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Environmental Protection
Agency

Economic Analysis for the Final Lead and Copper Rule Revisions

Office of Water (4607M)
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List of Acronyms

µg/L	micrograms per liter
AALM	All Ages Lead model
ACS	American Community Survey
ADF	Average daily flow
ADHD	Attention-deficit/hyperactivity disorder
AFQT	Armed Forces Qualifying Test
AHHS	American Healthy Homes Survey
AIC	Akaike's Information Criterion
AL	Action level
ALE	Action level exceedance
ALM	Adult lead methodology
ALS	Amyotrophic lateral sclerosis
AMA	American Medical Association
ANSI	American National Standards Institute
ASCE	American Society of Civil Engineers
ASDWA	Association of State Drinking Water Administrators
ASVAB	Armed Services Vocational Aptitude Battery
ATSDR	Agency for Toxic Substances and Disease Registry
AWIA	America's Water Infrastructure Act
AWWA	American Water Works Association
BAEP	Brainstem auditory evoked potential
BIC	Bayesian information criterion
BLL	Blood lead level
BLS	Bureau of Labor Statistics
BMD	Benchmark dose
BMI	Body mass index
BMR	Benchmark response
BP	Blood pressure
CCR	Consumer Confidence Report
CCT	Corrosion control treatment
CDBG	Community development block grant
CDC	Centers for Disease Control and Prevention
CED	Committee for Economic Development
CFR	Code of Federal Regulations
CFSAN	Center for Food Safety and Applied Nutrition
CHAD	Consolidated Human Activity Database
CHD	Coronary heart disease
CI	Confidence interval
CND	Canada
CPI	Consumer price index
CRF	Concentration-response functions
CRP	c-reactive protein

CVD	Cardiovascular disease
CWS	Community water system
CWSS	Community Water System Survey
DBP	Diastolic blood pressure
DF	Design flow
DHS	Department of Homeland Security
DISC	Diagnostic Interview Schedule for Children
DMR	Discharge monitoring report
DSM	Diagnostic and Statistical Manual of Mental Disorders
DTH	Delayed-type hypersensitivity
DWINSA	Drinking Water Infrastructure Needs Survey and Assessment
DWM	Department of Water Management
DWSRF	Drinking water state revolving fund
EA	Economic analysis
ECI	Employment cost index
ECTT	Error code tracking tool
EDF	Environmental Defense Fund
EGLE	Environment, Great Lakes, and Energy
EKG	Electrocardiogram
EO	Executive order
EOG	End-of-grade
EP	Entry point
EPA	United States Environmental Protection Agency
FDA	Food and Drug Administration
FIML	Full-information maximum likelihood
FOIA	Freedom of Information Act
FR	Federal Register
FRFA	Final Regulatory Flexibility Analysis
FRN	Federal Register Notice
FSIQ	Full scale intelligence quotient
FTE	Full-time equivalent
GAO	Government Accountability Office
GCI	General cognitive index
GCWW	Greater Cincinnati Water Works
GFR	Glomerular filtration rate
GI	Gastro-intestinal
GIS	Geographic information system
GM	Geometric mean
GUA	Ground water under the influence of surface water active
GW	Ground water
GWA	Ground water active
GWR	Ground Water Rule
GWUDI	Ground water under the direct influence of surface water
HAB	Harmful algal blooms
HH	Households

HHFKA	Healthy Hunger-Free Kids Act
HHS	Department of Health and Human Services
HMR	Heavy metals registry
HR	Hazard ratio
HUD	U.S. Department of Housing and Urban Development
IARC	International Agency for Research on Cancer
ICC	Indian childhood cirrhosis
ICD	International Classification of Diseases
ICR	Information collection request
ICT	Idiopathic copper toxicosis
IESWTR	Interim Enhanced Surface Water Treatment Rule
IEUBK	Integrated exposure uptake biokinetic
IPC	Internal plumbing code
IQ	Intelligence quotient
ISA	Integrated Science Assessment for Lead
LCCA	Lead Contamination Control Act
LCR	Lead and Copper Rule
LCRMR	Lead and Copper Rule Minor Revisions
LCRR	Lead and Copper Rule Revisions
LCRWG	Lead and Copper Rule Working Group
LGAC	Local government advisory committee
LIS	Lead information survey
LOAEL	Low-observed-adverse-effect-level
LOD	Limit of detection
LSL	Lead service line
LSLR	Lead service line replacement
MCL	Maximum contaminant level
MCLG	Maximum contaminant level goal
MDI	Mental development index
MDL	Method detection limit
MFR	Multi-family residence
MGD	Million gallons per day
MHP	Mobile home park
MMSE	Mini-mental state examination
MRDL	Maximum disinfectant residual level
MRL	Minimal risk level
NAAQS	National Ambient Air Quality Standards
NACCHO	National Association of County and City Health Officials
NAICS	North American Industry Classification System
NARA	National Association for Regulatory Administration
NCCIC	National Child Care Information and Technical Assistance Center
NCES	National Center for Education Statistics
NDDIC	National Digestive Diseases Clearinghouse
NDWAC	National Drinking Water Advisory Council
NHANES	National Health and Nutrition Examination Survey

NHEXAS	National Human Exposure Assessment Survey
NIDDK	National Institute of Diabetes and Digestive and Kidney Diseases
NLSY	National Longitudinal Survey of Youth
NOAEL	No adverse effect level
NPDES	National Pollutant Discharge Elimination System
NPDWR	National primary drinking water regulation
NRDC	Natural Resources Defense Council
NSF	NSF International
NTNCWS	Non-transient non-community water system
NTP	National Toxicology Program
NTTAA	National Technology Transfer and Advancement Act
OCCT	Optimal corrosion control treatment
OES	Occupational employment survey
OGWDW	Office of Ground Water and Drinking Water
OMB	Office of Management and Budget
OWQP	Optimal water quality parameter
P90	Lead 90th percentile level
PE	Public education
PN	Public notice
POE	Point-of-entry
POU	Point-of-Use
PQL	Practical quantitation limit
PRA	Paperwork Reduction Act
PSA	Public service announcement
PUMS	Public use microdata sample
PVC	Polyvinyl chloride
PWD	Philadelphia water department
PWS	Public water system
PWSID	Public water system identification number
PWSS	Public water system supervision
QA	Quality assurance
QC	Quality control
RDA	Recommended daily allowance
REML	Restricted maximum likelihood
RFA	Regulatory Flexibility Act
RIA	Regulatory impact assessment
RLDWA	Reduction of Lead in Drinking Water Act
RTCR	Revised Total Coliform Rule
RTOC	Regional Tribal Operations Committee
SAB	Science Advisory Board
SAT	Standard assessment test
SBA	Small Business Administration
SBAR	Small Business Advocacy Review
SBP	Systolic blood pressure
SBREFA	Small Business Regulatory Enforcement Fairness Act

SD	Standard deviation
SDWA	Safe Drinking Water Act
SDWIS	Safe Drinking Water Information System
SDWIS/FED	Safe Drinking Water Information System/Federal version
SE	Standard error
SFS	Single family structure
SHEDS	Stochastic Human Exposure and Dose Simulation
SISNOSE	Significant economic impact on a substantial number of small entities
SRF	State revolving fund
SS	Sums of squares
SSA	Social Security Administration
SW	Surface water
SWDIS	Safe Drinking Water Information System
TCR	Total Coliform Rule
TDS	Total Diet Study 2007-2013
TL	Trigger level
TLE	Trigger level exceedance
TP	Total phosphorous
TV	Television
UK	United Kingdom
UL	Upper intake levels
UMRA	Unfunded mandates reform act
USA	United States of America
USDA	United States Department of Agriculture
USEPA	Unites States Environmental Protection Agency
USGS	United States Geological Survey
VLS	Very large system
WBS	Work breakdown structure
WIC	Women, infants and children
WIFIA	Water Infrastructure Finance and Innovation Act
WIIN	Water Infrastructure Improvements for the Nation
WISC	Wechsler intelligence scale for children
WLL	Water lead level
WPCA	Water Pollution Control Authority
WQP	Water quality parameter
WQTC	Water Quality Technology Conference
WWTP	Wastewater treatment plant

1 Introduction

The United States has made tremendous progress in lowering children's blood lead levels. As a result of multiple federal laws and regulations, including the 1973 phase out of lead in automobile gasoline, the 1978 ban on lead paint for residential and consumer use, the 1986 beginning of banning the use of leaded pipe and solder in water supplies, the 1991 Lead and Copper Rule (LCR), and the 1995 ban on lead in solder in food cans, the median concentration of lead in the blood of children aged 1 to 5 years dropped from 15 micrograms per deciliter in 1976–1980 to 0.7 micrograms per deciliter in 2015-2016, a decrease of 95 percent (USEPA, 2019a).

Data evaluated by the National Toxicology Program (NTP, 2012) demonstrates that there is sufficient evidence to conclude that there are adverse health effects associated with low-level lead exposure. Sources of lead include lead-based paint, drinking water, and soil contaminated by historical sources. The Federal Action Plan (Action Plan) to Reduce Childhood Lead Exposures and Associated Health Impacts, issued in December 2018, provides a blueprint for reducing further lead exposure and associated harm through collaboration among federal agencies and with a range of stakeholders, including states, tribes, and local communities, along with businesses, property owners, and parents. The Action Plan is the product of the President's Task Force on Environmental Health Risks and Safety Risks to Children (Task Force, 2018). The Task Force is comprised of 17 federal departments and offices including the Department of Health and Human Services and the Department of Housing and Urban Development, which co-chaired the development of the Action Plan with the United States Environmental Protection Agency (EPA).

Through this plan, EPA committed to reducing lead exposures from multiple sources including paint, ambient air, and soil and dust contamination, especially to children who are among the most vulnerable to the effects of lead. On June 21, 2019, EPA announced new, tighter standards for lead in dust on floors and windowsills to protect children from the harmful effects of lead exposure (84 FR 32632; USEPA, 2019b). The standards were lowered from 40 µg of lead in dust per square foot (ft^2) on floors and 250 µg of lead in dust per ft^2 on interior windowsills, to 10 µg/ft^2 and 100 µg/ ft^2, respectively. The lead hazard standards help property owners, lead paint professionals, and government agencies identify lead hazards in residential paint, dust and soil. On June 19, 2020 EPA released a proposal to lower the clearance levels for lead in dust on floors and windowsills after lead removal activities from 40 µg/ft^2 to 10 µg/ft^2 for floor dust and from 250 µg/ft^2 to 100 µg/ft^2 for windowsill dust (85 FR 37810; USEPA, 2020a). The dust lead clearance levels are used to demonstrate that abatement activities effectively and permanently eliminate those hazards. They apply in most pre-1978 housing and child-occupied facilities. The proposed, tighter standards would increase the effectiveness of abatement in pre-1978 homes and child care facilities.

To address lead in soil, EPA will continue to remove, remediate, and take corrective actions at contaminated sites, including Superfund, Resource Conservation and Recovery Act Corrective Action, and other cleanup sites. EPA will also continue to work with state and tribal air agencies to help nonattainment areas meet the National Ambient Air Quality Standards. EPA is also focused on conducting critical research and improving public awareness by consolidating and streamlining federal messaging.

Lead and copper enter drinking water mainly from corrosion of plumbing materials containing lead and copper. Lead was widely used in plumbing materials until Congress prohibited the use or introduction into commerce of pipes and pipe fittings and fixtures that contained more than eight percent lead and solder or flux that contained more than 0.2 percent lead in 1986. On September 1, 2020, EPA published the final rule: *Use of Lead Free Pipes, Fittings, Fixtures, Solder, and Flux for Drinking Water* (USEPA, 2020b). The Lead-Free final rule significantly limits the lead content allowed in plumbing materials (e.g., pipes, fittings, and fixtures) used in new construction and replacement of existing plumbing. Specifically, the Lead-Free rule reduces the percentage of lead content allowed in these materials from eight percent to 0.25 percent in accordance with the 2011 Reduction of Lead in Drinking Water Act.

Many buildings were constructed prior to the restrictions on using plumbing materials that contained lead. There are currently an estimated 6.3 to 9.3 million homes served by lead service lines (LSLs) in thousands of communities nationwide, in addition to millions of older buildings with lead solder and faucets that contain lead. See Chapter 4, Section 4.3.4.1 for additional information on the estimated number and location of LSLs. To reduce exposure to lead through drinking water, the Action Plan highlights several key actions, including EPA's commitment to making regulatory changes to implement the statutory definition of lead-free plumbing products and assisting schools and child cares with testing for lead in drinking water using the *3Ts for Reducing Lead in Drinking Water in Schools and Child Care Facilities: A Training, Testing, and Taking Action Approach (Revised Manual)* (USEPA, 2018). The Action Plan also highlights EPA's support to states and communities by identifying funding opportunities through the Drinking Water State Revolving Fund and the Water Infrastructure Finance and Innovation Act loan program for updating and replacing drinking water infrastructure. In addition, the Action Plan highlights three newly authorized grant programs under the Water Infrastructure Improvements for the Nation Act, to fund grants to small and disadvantaged communities for developing and maintaining infrastructure, for lead reduction projects, and to support the voluntary testing of drinking water in schools and child cares. The Action Plan also highlights the importance of preventing lead exposure from drinking water by working with states, tribes, and local stakeholders to share best practices and tools to better implement the National Primary Drinking Water Regulations for Lead and Copper. For more information about the Federal Lead Action Plan see https://www.epa.gov/sites/production/files/2018-12/documents/fedactionplan_lead_final.pdf.

To reduce exposure to lead through drinking water, EPA issued the LCR in 1991 (USEPA, 1991). Since its implementation, drinking water exposures have declined, resulting in major improvements in public health. For example, the number of the nation's large drinking water systems (i.e., serving more than 50,000 persons) that have exceeded the LCR action level (AL) of 15 micrograms per liter (µg/L) has decreased by over 90 percent, and over 95 percent of all water systems have not reported an action level exceedance (ALE) from 2017-2019 (USEPA, 2019c).

This economic analysis (EA) presents the evaluation of the benefits and costs of the final LCRR. The analysis is performed in compliance with Executive Order 12866, *Regulatory Planning and Review* (58 Federal Register [FR] 51735, October 4, 1993), and Executive Order 13563, *Improving Regulations and Review* (76 FR 3821, January 21, 2011). These executive orders require EPA to estimate the economic impact of rules that have an annual effect on the economy of over $100 million, make that analysis available to the public for comment prior to publication of the final rule, and consider ways to reduce regulatory burden and maintain flexibility for the public. In addition, the Safe Drinking Water Act (SDWA) requires the EPA Administrator to "publish and seek public comment on an analysis of the

health risk reduction benefits and costs likely to be experienced as the result of compliance with the treatment technique and alternative treatment techniques that are being considered . . ." (SDWA Section 1412(b)(3)(C)(ii)). EPA solicited public comment on all aspects of the data and analysis presented in this EA and associated Appendices.

This chapter provides a summary of the final LCRR in Section 1.1. Section 1.2, outlines the organization of this EA, and provides information regarding supporting calculations and citations in Section 1.3.

1.1 Summary of the Final LCRR

The final LCRR includes a suite of actions to address lead contamination in drinking water that, taken together, will improve the LCR and further reduce lead exposure in comparison with the previous LCR, resulting in an enduring positive public health impact. This approach focuses on six key areas:

1. Identifying Areas Most Impacted. To help identify areas with the greatest potential for lead contamination of drinking water and most in need of remediation, EPA's final rule requires that all water systems complete and maintain an LSL inventory and collect tap samples from a prescribed selection of homes with LSLs if present in the distribution system. To reduce elevated levels of lead in certain locations, EPA's final rule also requires water systems to engage in a "find-and-fix" process to identify the causes of these elevated levels as well as take potential actions to reduce lead levels.

2. Strengthening Treatment Requirements. EPA is finalizing expanded requirements for corrosion control treatment (CCT) based on tap sampling results. The final rule also establishes a new trigger level (TL) of 10 µg/L. At this TL, systems that currently treat for corrosion are required to re-optimize their existing treatment. Systems that do not currently treat for corrosion will be required to conduct a corrosion control study so that the system is prepared to respond quickly if the system exceeds the AL in a subsequent monitoring period. Flexibility is important for small systems so that they can protect public health by taking the treatment action that makes sense for their community. The LCRR provides new alternatives (i.e., small system flexibilities) to CCT for community water systems (CWSs) serving 10,000 or fewer people and all non-transient non-community water systems (NTNCWSs) including point-of-use (POU) treatment and replacement of lead bearing plumbing materials.

3. Systematically Replacing LSLs. The final LCRR requires water systems with high lead levels to initiate LSL removal, permanently reducing a significant source of lead in many communities. All water systems with LSLs or lead status unknown service lines must create a lead service line replacement (LSLR) plan by the rule compliance date. The more stringent sampling requirements in the final rule will better identify elevated lead levels, which will result in more systems replacing LSLs. Systems that are above the TL (greater than 10 µg/L) but at or below the lead AL (15 µg/L) must conduct replacements at a goal rate approved by the Primacy Agency,[1]

[1] EPA delegates primacy, which is primary enforcement responsibility to implement SDWA's Public Water System Supervision Program, for public water systems to states, territories, and Indian tribes if they meet special requirements. See Chapter 2, Section 2.3. All states (except for Wyoming) have primacy, as well as the Navajo

and, systems that are above the AL, must replace an average annual rate of three percent, calculated on a two-year rolling basis. The base number of service lines to which the mandatory rate of three percent, or rate otherwise specified in § 141.84(g)(9), is applied is equal to the number of known LSLs and galvanized requiring replacement service lines at the time the system first exceeds the lead AL plus the number of unknowns at the beginning of each year of the system's LSLR program. Systems cannot end their goal-based program until they demonstrate their lead 90th percentile levels are at or below the lead TL for two consecutive years. Systems can stop their mandatory replacement program once they demonstrate their lead 90th percentile levels are at or below the AL for two consecutive years and the cumulative percentage of LSLs replaced by the system is greater than or equal to three percent, or as otherwise specified in § 141.84(g)(9), times the number of years that elapsed between when the system most recently began mandatory LSLR and the date on which the system's 90th percentile lead levels are at or below the action level for two consecutive years. Only full LSL replacements will be counted towards the required goal-based and mandatory rate, not partial replacements and not replacement through testing. The final rule requires water systems to replace the water system-owned portion of an LSL when a customer chooses to replace their customer-owned portion of the line within 45 days, with the ability to have up to 180 days with notification of the Primacy Agency.

4. Increasing Sampling Reliability. EPA is changing the criteria for selecting homes at which to collect tap samples and the way in which those samples are collected. EPA is requiring tap sample site selection to focus on sites with LSLs (where present) and is requiring a new way to collect tap samples at these sites. Systems with LSLs must collect fifth liter samples that are representative of water that has been in the LSL for several hours, which will provide better information on the highest concentration of lead in drinking water. The final LCRR prohibits tap sampling instructions that call for pre-stagnation flushing or, the cleaning or removing of faucet aerators, and includes a requirement that tap samples be collected in bottles with a wide-mouth configuration. Collectively, these new more stringent sampling requirements will better identify elevated lead levels and result in more water systems taking required lead mitigation actions.

5. Improving Risk Communication. EPA is requiring systems to notify consumers of a system-wide lead ALE within 24 hours. For individual tap samples that exceed 15 µg/L, EPA is requiring systems to notify the individual consumer within three days. EPA is also requiring the consistent use of clear and concise language in public notifications and all public education materials including the consumer confidence report (CCR) on the health effects of exposure to lead in drinking water. The final rule increases the number, forms, and comprehensiveness of public education materials on lead in drinking water that are provided to the public. It also requires systems to conduct regular outreach to customers with LSLs. Systems must make their LSL inventory publicly available and must notify occupants of homes with known or potential LSLs every year about their LSL, drinking water exposure risks, and mitigation options, including

Nation, Puerto Rico, the United States Virgin Islands, American Samoa, Guam, and the Commonwealth of Northern Mariana Islands. These states, territories, and Indian tribes, are referred to as Primacy Agencies. As discussed in Chapter 5, for cost modeling purposes EPA also includes the District of Columbia as a Primacy Agency when assigning burden and costs of the rule although some of these costs are incurred by EPA.

removal. The final rule's requirements to provide understandable and consistent information about the levels of lead in drinking water, the sources of lead in a system, and the risks of lead in drinking water, will increase public actions to limit exposure to lead in drinking water.

6. Protecting Children in Schools. Since children are at the highest risk of significant harm from lead exposure (USEPA, 2013), EPA is requiring that CWSs test for lead in drinking water in school and child cares. Systems must conduct one round of drinking water sampling at each elementary school and each child care they serve over no more than five years, testing 20 percent of the facilities they serve each year. The system will be required to provide the results to the school or child care[2] and information on actions that can be taken by the school or child care to reduce lead in drinking water. The system will also be required to provide information to the school or child care facility on methods to communicate results to users of the facility and parents. CWSs are also required to provide testing on request to secondary schools and to elementary schools and child care facilities after the first round of mandatory testing. These requirements will provide schools and child cares with an understanding of how to create and manage a drinking water testing program that is customizable to their needs and an appreciation of the benefits of such a program.

Through strengthened treatment procedures, expanded sampling, and improved protocols for identifying lead, EPA's LCRR will require more water systems to progressively take more actions to reduce lead levels in drinking water. Additionally, by improving transparency and communication, the rule is expected to increase community awareness and accelerate the replacement of LSLs. By taking these collective actions EPA, Primacy Agencies, and water systems will be implementing a proactive holistic approach to more aggressively manage lead in drinking water.

Error! Reference source not found. provides a summary of the revisions to system requirements under the final rule by major rule component (e.g., lead and copper tap monitoring, LSLR). In this Exhibit and throughout this notice and supporting documents the requirements for the LCR that are in place prior to the compliance date of this rulemaking are referred to as the "previous LCR" and the requirements that will be in place on the compliance date of this rulemaking are referred to as the "final LCRR" or "final rule."

[2] CWSs are also required to submit the results to their Primacy Agency and to state and local health departments.

Exhibit 1-1: Summary of Revisions to System Requirements under the Final LCRR

Previous LCR	Final LCRR
AL and TL	
• 90th percentile (P90) level above lead AL of 15 µg/L or copper AL of 1.3 mg/L requires additional actions.	• 90th percentile (P90) level above lead AL of 15 µg/L or copper AL of 1.3 mg/L requires more actions than the previous rule. • Defines lead TL of 10 µg/L < P90 ≤ 15 µg/L that triggers additional planning, monitoring, and treatment requirements.
Lead and Copper Tap Monitoring	
Sample Site Selection • Prioritizes collection of samples from sites with sources of lead in contact with drinking water. • Highest priority given to sites served by copper pipes with lead solder installed after 1982 but before the state ban on lead pipes and/or LSLs. • Systems must collect 50 percent of samples from LSLs, if available.	**Sample Site Selection** • Changes priorities for collection of samples with a greater focus on LSLs. • Prioritizes collecting samples from sites served by LSLs – all samples must be collected from sites served by LSLs, if available. • No distinction in prioritization of copper pipes with lead solder by installation date. • Improved tap sample site selection tiering criteria.
Collection Procedure • Requires collection of the first-liter sample after water has sat stagnant for a minimum of 6 hours.	**Collection Procedure** • Requires collection of the fifth liter sample in homes with LSLs after water has sat stagnant for a minimum of 6 hours and maintains first-liter sampling protocol in homes without LSLs. • Adds requirement that samples must be collected in wide-mouth bottles. • Prohibits sampling instructions that include recommendations for aerator cleaning/removal and pre-stagnation flushing prior to sample collection.

Previous LCR	Final LCRR

Monitoring Frequency
• Samples are analyzed for both lead and copper.
• Systems must collect standard number of samples, based on population; semi-annually unless they qualify for reduced monitoring.
• Systems can qualify for annual or triennial monitoring at reduced number of sites. Schedule based on number of consecutive years meeting the following criteria:
  ○ Serves ≤ 50,000 people and ≤ lead & copper ALs.
  ○ Serves any population size, meets Primacy Agency-specified OWQPs, and ≤ lead AL.
• Triennial monitoring also applies to any system with lead and copper 90th percentile levels ≤ 0.005 mg/L and ≤ 0.65 mg/L, respectively, for 2 consecutive 6-month monitoring periods.
• 9-year monitoring waiver available to systems serving ≤ 3,300.
	Monitoring Frequency
	• Some samples may be analyzed for only lead when lead monitoring is conducted more frequently than copper.
	• Copper follows the same criteria as the previous rule.
	• Lead monitoring schedule is based on P90 level for all systems as follows:
	  ○ **P90 > 15 µg/L**: Semi-annually at the standard number of sites.
	  ○ **10 µg/L < P90 ≤ 15 µg/L**: Annually at the standard number of sites.
	  ○ **P90 ≤ 10 µg/L**:
	  ▪ Annually at the standard number of sites and triennially at reduced number of sites using same criteria as previous rule except copper 90th percentile level is not considered.
	  ▪ Every 9 years based on previous rule requirements for a 9-year monitoring waiver.

CCT and WQPs	

CCT
• Systems serving > 50,000 people were required to install treatment by January 1, 1997 with limited exception.
• Systems serving ≤ 50,000 that exceed lead and/or copper AL are subject to CCT requirements (e.g., CCT recommendation, study if required by Primacy Agency, CCT installation). They can discontinue CCT steps if no longer exceed both ALs for two consecutive 6-month monitoring periods.
• Systems must operate CCT to meet any Primacy Agency-designated OWQPs that define optimal CCT.
• There is no requirement for systems to re-optimize.
	CCT
	• Specifies CCT requirements for systems with P90 level 10 µg/L < P90 ≤ 15 µg/L:
	  ○ **No CCT:** must conduct a CCT study if required by Primacy Agency.
	  ○ **With CCT:** must follow the steps for re-optimizing CCT, as specified in the rule.
	• Systems with P90 level > 15 µg/L:
	  ○ **No CCT:** must complete CCT installation regardless of their subsequent P90 levels.
	  ○ **With CCT:** must re-optimize CCT.
	• CWSs serving ≤ 10,000 people and NTNCWSs can select an option other than CCT to address lead. ***See Small System Flexibility.***

CCT Options: Includes alkalinity and pH adjustment, calcium hardness adjustment, and phosphate or silicate-based corrosion inhibitor.	**CCT Options:** Removes calcium hardness as an option and specifies any phosphate inhibitor must be orthophosphate.

Previous LCR	Final LCRR
Regulated WQPs: • **No CCT**: pH, alkalinity, calcium, conductivity, temperature, orthophosphate (if phosphate-based inhibitor is used), silica (if silica-based inhibitor is used). • **With CCT**: pH, alkalinity, and based on type of CCT either orthophosphate, silica, or calcium.	**Regulated WQPs:** • Eliminates WQPs related to calcium hardness (i.e., calcium, conductivity, and temperature).
WQP Monitoring • Systems serving ≥ 50,000 people must conduct regular WQP monitoring at entry points and within the distribution system. • Systems serving ≤ 50,000 people conduct monitoring only in those periods > lead or copper AL. • Contains provisions to sample at reduced number of sites in distribution system less frequency for all systems meeting their OWQPs.	**WQP Monitoring** • Systems serving ≥ 50,000 people must conduct regular WQP monitoring at entry points and within the distribution system. • Systems serving ≤ 50,000 people must continue WQP monitoring until they no longer > lead and/or copper AL for two consecutive 6-month monitoring periods. • To qualify for reduced WQP distribution monitoring, P90 must be ≤ 10 µg/L and the system must meet its OWQPs.
Sanitary Survey Review: • Treatment must be reviewed during sanitary surveys; no specific requirement to assess CCT or WQPs.	**Sanitary Survey Review:** • CCT and WQP data must be reviewed during sanitary surveys against most recent CCT guidance issued by EPA.

Find-and-Fix:
• No required follow-up samples or additional actions if an individual sample exceeds 15 µg/L.
	Find-and-Fix:
	• If individual tap samples > 15 µg/L systems must:
	  ○ Collect tap sample of any liter or volume at the same tap sample site within 30 days.
	  ○ Conduct WQP monitoring at or near the site > 15 µg/L.
	  ○ Perform needed corrective action.
	  ○ Document customer refusal or nonresponse after 2 attempts.
	  ○ Provide information to state and local public health officials.

LSL Inventory and LSLR Plan	
Initial LSL Program Activities: • Systems were required to complete a materials evaluation by the time of initial sampling. No requirement to update materials evaluation. • No LSLR plan is required.	**Initial LSL Program Activities:** • All systems must develop an LSL inventory or demonstrate absence of LSLs within 3 years of final rule publication. • LSL inventory must be updated annually or triennially, based on their tap sampling frequency. • All systems with known or possible LSLs must develop an LSLR plan.

Previous LCR	Final LCRR

LSLR:
• Systems with LSLs with P90 > 15 µg/L after CCT installation must annually replace ≥7 percent of number of LSLs in their distribution system when the lead AL is first exceeded.
• Systems must replace the LSL portion they own and offer to replace the private portion at the owner's expense.
• Full LSLR, partial LSLR, and LSLs with lead sample results ≤15 µg/L ("test-outs") count toward the 7 percent replacement rate.
• Systems can discontinue LSLR after 2 consecutive 6-month monitoring periods ≤ lead AL.
	LSLR:
	• Rule specifies replacement programs based on P90 level for CWSs serving > 10,000 people:
	  ○ **If P90 > 15 µg/L:** Must fully replace 3 percent of LSLs per year based upon a 2 year rolling average (mandatory replacement) for at least 4 consecutive 6-month monitoring periods.
	  ○ **If 10 µg/L < P90 ≤ 15 µg/L:** Implement an LSLR program with replacement goals in consultation with the Primacy Agency for 2 consecutive 1-year monitoring periods.
	• Small CWSs and NTNCWSs that LSLR as their approved compliance option must complete LSLR within 15 years if P90 > 15 µg/L. ***See Small System Flexibility.***
	• Annual LSLR rate is based on number of LSLs and galvanized requiring replacement service lines when the system first exceeds the AL plus the current number of lead status unknown.
	• Only full LSLR (both customer-owned and system-owned portion) count toward mandatory rate or goal-based rate.
	• All systems must replace their portion of an LSL if notified by consumer of private side replacement within 45 days of notification or within 180 days after notification to the Primacy Agency.
	• Following each LSLR, systems must:
	  ○ Provide pitcher filters or POU devices, and cartridges to each customer for 6 months after replacement. Provide pitcher filters/cartridges within 24 hours for full and partial LSLRs.
	  ○ Collect a lead tap sample at locations served by replaced line within 3 to 6 months after replacement.
	• Systems must replace galvanized service lines that are or ever were downstream of an LSL.

Previous LCR	Final LCRR

LSL-Related Outreach:
• When water system plans to replace the portion it owns, it must offer to replace customer-owned portion at owner's expense.
• System replacing its portion only must:
  ○ Provide notification to affected residences within 45 days prior to replacement on possible elevated short-term lead levels and measures to minimize exposure.
  ○ Include offer to collect lead tap sample within 72 hours of replacement.
  ○ Provide test results within 3 business days after receiving results.
	LSL-Related Outreach:
	• Inform consumers annually that they are served by LSL or lead status unknown service line.
	• Systems subject to goal-based program must:
	  ○ Conduct targeted outreach that encourages consumers with LSLs to participate in the LSLR program.
	  ○ Conduct an additional outreach activity if they fail to meet their goal.
	• Systems subject to mandatory LSLR include information on LSLR program in PE materials that are provided in response to P90 > AL.

Small System Flexibility	
No provisions for systems to elect an alternative treatment approach but sets specific requirements for CCT and LSLR.	• Allows CWSs serving ≤ 10,000 people and all NTNCWSs with P90 > 10 µg/L to select their approach to address lead with Primacy Agency approval. • Systems can choose CCT, LSLR, provision and maintenance of POU devices, or replace all lead-bearing plumbing materials.
Public Education and Outreach	

• All CWSs must provide education material in the annual CCR.
• Systems with P90 > AL must provide PE to customers about lead sources, health effects, measures to reduce lead exposure, and additional information sources.
• Systems must provide lead consumer notice to individuals served at tested taps within 30 days of learning results.
• Customers can contact the CWS to get PE materials translated in other languages.
	• CWSs must provide updated health effects language in all PE materials and the CCR.
	• Customers can contact the CWS to get PE materials translated in other languages.
	• All CWSs must include information on how to access service line inventory information and how to access the results of all tap sampling in the CCR.
	• If P90 > AL:
	  ○ Previous rule PE requirements apply.
	  ○ Systems must notify consumers of P90 > AL within 24 hours.
	• In addition, CWSs must:
	  ○ Deliver notice and educational materials to consumers during water-related work that could disturb LSLs.
	  ○ Provide increased information to local and state health agencies.
	  ○ Provide lead consumer notice to consumers whose individual tap sample is > 15 µg/L as soon as practicable but no later than 3 days.
	Also see LSL-Related Outreach section of table.

Previous LCR	Final LCRR
Change in Source or Treatment	
Systems on a **reduced** tap monitoring schedule must obtain prior Primacy Agency approval before changing their source or treatment.	Systems on **any** tap monitoring schedule must obtain prior Primacy Agency approval before changing their source or treatment. These systems must also conduct tap monitoring semi-annually.
Source Water Monitoring and Treatment	
• Periodic source water monitoring is required for systems with: ○ Source water treatment; or ○ P90 > AL and no source water treatment.	• Primacy Agencies can waive continued source water monitoring if: ○ The system has already conducted source water monitoring for a previous P90 > AL; ○ Primacy Agencies have determined that source water treatment is not required; ***and*** ○ The system has not added any new water sources.
Lead in Drinking Water at Schools and Child cares	
• Does not include separate testing and education program for CWSs at schools and child cares. • Schools and child cares that are classified as NTNCWSs must sample for lead and copper.	• CWS must conduct sampling at 20% of elementary schools and 20% of child cares per year and conduct sampling at secondary schools on request over 5 years and conduct sampling on request of all schools and child care facilities thereafter. • Sample results and PE must be provided to each sampled school/child care, Primacy Agency and local or state health department. • Excludes facilities built or replaced all plumbing after January 1, 2014.
Primacy Agency Reporting	
Primacy Agencies must report information to EPA that includes but is not limited to: • All P90 levels for systems serving > 3,300 people, and only levels > 15 µg/L for smaller systems. • Systems that are required to initiate LSLR and the date replacement must begin. • Systems for which OCCT has been designated.	Expands previous rule requirements to include: • All P90 values for all system sizes. • The current number of LSLs and lead status unknown service lines for every water system. • OCCT status of all systems including Primacy Agency-specified OWQPs.

Acronyms: AL = action level; ALE = action level exceedance; CCR = consumer confidence report; CCT = corrosion control treatment; CWS = community water system; LCR = Lead and Copper Rule; LCRR = Lead and Copper Rule revisions; LSL = lead service line; LSLR = lead service line replacement; NTNCWS = non-transient non-community water system; OCCT = optimal corrosion control treatment; OWQP = optimal water quality parameter; P90 = lead 90th percentile; PE = public education; POU = point-of use; TL = trigger level; TLE = trigger level exceedance; WQP = water quality parameter.

1.2 Document Organization

The remainder of this EA is organized into the following chapters:

- **Chapter 2: Need for the Rule** summarizes the goal of the LCRR, why EPA revised the rule, and the regulatory history. It also explains the statutory authority for the final LCRR and the economic rationale for the regulatory approach.
- **Chapter 3**: **Regulatory Revisions** provides a description of the regulatory revisions included in the final LCRR and the rationale for the change.
- **Chapter 4: Baseline Drinking Water System Characteristics** describes systems subject to the final LCRR including the population they serve and CCT status, lead and copper tap water concentration levels, the extent of LSLs in the United States, the proportion of systems on reduced monitoring under the previous LCR, and the rate of historical source and treatment changes to characterize the baseline before EPA models estimated changes that result from complying with the final LCRR requirements.
- **Chapter 5: Economic Impact and Cost Analysis of the Final Lead and Copper Rule Revisions** provides an estimate of the potential health benefits of the final LCRR options relative to the baseline, including quantification and monetization where possible.
- **Chapter 6: Benefits Resulting from the Lead and Copper Rule Revisions** provides a description of the estimated costs for the final regulatory changes affecting systems and Primacy Agencies and focuses on the incremental costs between the previous LCR and the final LCRR requirements.
- **Chapter 7: Comparison of Costs to Benefits** provides a summary of costs and benefits associated with the provisions of the previous LCR and the final LCRR requirements.
- **Chapter 0: United States Environmental Protection** Agency (USEPA). 2013. *Integrated Science Assessment for Lead*. July 2013. Office of Research and Development. EPA/600/R-10/075F.
- Statutory and Administrative Requirements discusses distributional analyses performed to evaluate the effects of the final LCRR options on different segments of the population in accordance with 13 federal mandates and statutory reviews, including but not limited to the Regulatory Flexibility Act, Unfunded Mandates Reform Act, and Executive Order 12898 on, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations.
- **Chapter 0: .**

- **Other Options** Considered presents other alternatives EPA evaluated when developing the final LCRR for which EPA took public comment during the proposed rule comment period. These include public education and sampling at schools and child cares, modifications to the tap sample collection protocol for systems with LSLs, and information to be made publicly available regarding the location of LSLs and galvanized requiring replacement.

1.3 Calculations and Citations

This EA involves numerous detailed and complex analyses, and the following are provided to help the reader understand how those analyses were conducted and their underlying data and assumptions:

- Appendices containing supporting spreadsheets and analyses:
    - Appendix A: LSLR Unit Costs
    - Appendix B: Modeling Costs in the SafeWater LCR Model and Economic Impact and Analysis of the Previous Rule
    - Appendix C: Detailed Costs Results
    - Appendix D: Adverse Health Effects Associated with Lead Exposures
    - Appendix E: Adverse Health Effects Associated with Copper Exposures
    - Appendix F: Water Lead Level Analysis and Simulation
    - Appendix G: Sensitivity Analysis for Blood Lead and IQ Benefits in Children
    - Appendix H: Alternative Approaches to Estimating Changes in Blood Lead Levels in Adults
    - Appendix I: Discussion of Additional Potentially Reduced Adverse Health Endpoints in Children
    - Appendix J: Detailed Summaries of Studies That May Potentially Inform Concentration-Response Functions
    - Appendix K: Estimating Value of an IQ Point
- Tabular exhibits, most of which include a row with the formulas used to calculate the contents of each column and information sources for values that are not calculated in the exhibits.
- Exhibits that illustrate methodologies of analyses as well as final LCRR requirements.
- Supporting report and electronic spreadsheet files, as explained in Exhibit 1-2 below.

Exhibit 1-2: Supporting Report and Spreadsheet Files

File Name	Description
CWS Inventory Characteristics_Final Rule.xlsx	Provides inventory, milestone, violation, and treatment information from the SDWIS/Fed third quarter 2016 "frozen" dataset for 50,067 CWSs and how these data are used to provide baseline system characteristics described in Chapter 4 and Appendix B.
Derivation of Administrative Burden and Costs_Final Rule.xlsx	Provides one-time and ongoing administrative burden and costs associated with the previous and final rules for water systems and Primacy Agencies.
Derivation of Baseline CCT Characteristics_Final Rule.xlsx	Provides the number of entry points per system, baseline orthophosphate and baseline pH levels under the previous rule.
Derivation of CCT Study and Review Costs_Final Rule.xlsx	Provides EPA's assumptions regarding which systems will be required to conduct a CCT study and if applicable, if the study will be a desktop or demonstration study, and the estimated costs of these studies under the previous rule. Also, provides Primacy Agency CCT review-related activities for the previous and final rules.
Technologies and Costs for Corrosion Control to Reduce Lead in Drinking Water.pdf	Provides CCT costs for the final rule.
Derivation of Estimated Driving Distances_Final Rule.xlsx	Outlines EPA's approach for estimating the distance a water system would drive to a customer's home for lead sampling, site investigation, or other reasons.
Derivation of Failure to Meet LSLR Goals_Final Rule.xlsx	Calculates the burden and costs for CWSs serving > 10,000 people with a TLE to conduct outreach activities if they fail to meet their annual LSLR goal.
Derivation of Initial P90 Categorization_Baseline_Final Rule.xlsx	Assigns CWSs to one of three P90 categories using two approaches: A low estimate based on their lowest P90 level and high estimate based on their highest P90 level. These estimates represent the baseline condition before systems implement the requirements of the final LCRR.
Derivation of Initial P90 Categorization_CWS_NTNCWS Compare_Final Rule.xlsx	Assigns CWSs and NTNCWSs to one of three categories using two approaches: A low estimate based on their lowest P90 level and high estimate based on their highest P90 level. Compares the estimates of baseline conditions of CWSs to NTNCWs.
Derivation of Initial P90 Categorization_Final Rule.xlsx	Assigns CWSs to one of three categories using two approaches: A low estimate based on their lowest P90 level and high estimate based on their highest P90 level. For the systems with known LSLs, adjusts the P90 levels to simulate the requirement under the final LCRR for these systems to collect all samples from sites served by LSLs versus 50 percent as previously required and to collect a fifth liter sample in lieu of a first-draw sample.
Derivation of Initial P90 Categorization_ First Liter Option.xlsx	Assigns CWSs to one of three P90 categories using two approaches: A low estimate based on their lowest P90 level and high estimate based on their highest P90 level. For the systems with known LSLs, adjusts the P90 levels to simulate the requirements under the first-liter option in which systems with LSLs collect all first-liter samples from sites served by LSLs versus 50 percent as previously required.

File Name	Description
Derivation of Lead Analytical Burden and Costs_Final Rule.xlsx	Provides estimated burden and costs for lead sample collection, analysis, and reporting as well as assumptions and data sources for each estimate.
Derivation of LSL Number_CWS_Final Rule.xlsx	Calculates the number and percent of CWSs with LSLs, the average number of LSLs per system, the percent of service connections that are lead, and the total number of LSLs.
Derivation of LSLR Ancillary Costs_Final Rule.xlsx	Provides the derivation of costs associated with LSLR other than physical replacement including inventory, planning, and "paper replacements."
Derivation of LSLR Costs_Final Rule.xlsx	Provides the derivation of the LSL physical replacement costs, including detailed results from four surveys of LSLR costs as well as individual utility estimates. Also includes percentages for different replacement types.
Derivation of LSLR_Time_Span_Analysis_CWS_Final Rule.xlsx	Estimates the average length of time a CWS that is triggered into LSLR replaces LSLs under the previous LCR. The results of this analysis are also used for NTNCWSs.
Derivation of Pb Schedules_CWS_Final Rule.xlsx	Estimates baseline lead tap sampling schedules for CWSs using the SDWIS/Fed 3rd quarter 2016 "frozen" dataset starting in Year 4 of the 35-year analysis period and for the final LCRR starting in Year 5 for systems with P90 ≤ 15 µg/L.
Derivation of Pb Schedules_NTNCWSs_Final Rule.xlsx	Estimates baseline lead tap sampling schedules for NTNCWSs using the SDWIS/Fed 3rd quarter 2016 "frozen" dataset starting in Year 4 of the 35-year analysis period and for the final LCRR starting in Year 5 for systems with P90 ≤ 15 µg/L.
Derivation of POU Inputs_Final Rule.xlsx	Provides costing inputs for small CWSs and those NTNCWSs that select POU devices as their compliance option. Includes estimated number of required POU devices, development of a POU process, annual reporting, and Primacy Agency review.
Derivation of Probability_Sample_Above_15_First Liter Option.xlsx	Provides estimates of the likelihood of an individual tap sample being > 15 µg/L based on system size, LSL status, and P90 classification under the first-liter option, as described in Chapter 9. Also includes estimated burden and costs for response to samples > 15 µg/L.
Derivation of Probability_Sample_Above_15_Final Rule.xlsx	Provides estimates of the likelihood of an individual tap sample being > 15 µg/L based on system size, LSL status, and P90 classification under the final LCRR.
Derivation of Probability_SourceChange_Final Rule.xlsx	Provides the estimated likelihood that a CWS or NTNCWS will add a new source or change its primary source. Also includes reporting, review, and Primacy Agency consultation associated with this change.
Derivation of Probability_TreatmentChange_Final Rule.xlsx	Provides the estimated likelihood that a CWS or NTNCWS will add a new treatment. Also includes reporting, review, and Primacy Agency consultation associated with this change.
Derivation of Public Education Inputs_CWS_Final Rule.xlsx	Provides the derivation of the inputs used to estimate public education burden and costs under the previous rule and final LCRR for CWSs.

File Name	Description
Derivation of Public Education Inputs_NTNCWS_Final Rule.xlsx	Provides the derivation of the inputs used to estimate public education burden and costs under the previous rule and final LCRR for NTNCWSs.
Derivation of School_Child Care Inputs_Final Rule.xlsx	Provides the derivation of the inputs used to estimate the burden and costs for CWSs to conduct a lead in drinking water testing program at schools and licensed child cares.
Derivation of State LSL Status_Final Rule.xlsx	Provides system-specific information for the subset of CWSs with known LSL status (either presence or absence of LSLs) based on data submitted by several Primacy Agencies and web searches. Also includes the geographic representativeness of states with known LSL status.
Derivation of WQP Analytical Burden and Costs_Final Rule.xlsx	Provides the derivation of the inputs used to estimate burden and costs for system WQP sample collection, analysis, and reporting and Primacy Agency review.
Derivation of WQP Schedules_CWS_Baseline_Final Rule.xlsx	Estimates the initial WQP distribution system monitoring schedules under the previous rule for CWSs using the SDWIS/Fed 3rd quarter 2016 "frozen" dataset.
Derivation of WQP Schedules_CWS_Final Rule.xlsx	Estimates the initial WQP distribution system monitoring schedules under the final LCRR for CWSs using the SDWIS/Fed 3rd quarter 2016 "frozen" dataset.
Derivation of WQP Schedules_NTNCWS_Baseline_Final Rule.xlsx	Estimates the initial WQP distribution system monitoring schedules under the previous rule for CWSs using the SDWIS/Fed 3rd quarter 2016 "frozen" dataset.
Derivation of WQP Schedules_NTNCWS_Final Rule.xlsx	Estimates WQP distribution system monitoring schedules for NTNCWSs under the final LCRR using the SDWIS/Fed 3rd quarter 2016 "frozen" dataset.
Extent of P90 Data_Final Rule.xlsx	Provides the estimated percentage of CWSs with at least one reported P90 value during 2007 – 2015 and the percentage with known LSL status for three system size categories to determine if systems serving ≤ 3,300 people were underrepresented.
Final CoSTS 2-6-20.xlsx	Provides ASDWA's estimated increase burden estimates for Primacy Agencies to oversee the requirements of the LCRR as proposed.
General Cost Model Inputs_Final Rule.xlsx	Provides general costing inputs that include system and Primacy Agency labor costs, postage, paper, and envelopes.
NTNCWS Inventory Characteristics_Final Rule.xlsx	Provides inventory, milestone, violation, and treatment information from the SDWIS/Fed third quarter 2016 "frozen" dataset for 17,589 NTNCWS and how these data are used to provide baseline system characteristics described in Chapter 4 and Appendix B.
P90_Unknown LSL vs. LSL Known Status CWSs_Final Rule.xlsx	Compares the P90 data for the subset of systems with known LSLs status and reported P90 values to the larger set of CWSs with at least one reported P90 value (but unknown LSL status) in SDWIS/Fed for 2007 – 2015 to determine the representativeness of the subset.
VLS system-provided data tables for appendix.xlsx	Provides a summary of system-level data compiled by EPA for LSL estimates for systems serving more than 1 million people.

Acronyms: ASDWA = Association of State Drinking Water Administrators; CCT = corrosion control treatment; CoSTS = Costs of State Transactions Study; CWS = community water system; LCR = Lead and Copper Rule; LCRR = Lead

and Copper Rule revisions; LSL = lead service line; LSLR = lead service line replacement; NTNCWS = non-transient non-community water system; P90 = lead 90th percentile level; POU = point-of use; SDWIS/Fed: Safe Drinking Water Information System/Federal Version; TLE = trigger level exceedance; VLS = very large system; WQP = water quality parameter.
Notes: These documents are available in the docket for the final rule under docket number EPA-HQ-OW-2017-0300 at https://www.regulations.gov.

1.4 References

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2 Need for the Rule

Lead and copper enter drinking water primarily through the corrosion of distribution system and household plumbing materials that contain these metals. The goal of the Lead and Copper Rule (LCR) is to protect public health by reducing exposure to lead and copper in drinking water and the associated health risks from this exposure. The LCR accomplishes this primarily by controlling water corrosivity, thereby minimizing the leaching of these metals from household plumbing and drinking water distribution system components. The United States Environmental Protection Agency (EPA) has revised the LCR to strengthen the rule's implementation in the following areas: corrosion control treatment (CCT), lead service line replacement (LSLR), monitoring, public education (PE), and improved access to information.

The LCR was first promulgated in 1991 (USEPA, 1991). Since then, the LCR has undergone several revisions. In 2000, EPA published revisions pertaining to implementation issues to streamline monitoring and reporting requirements and reduce implementation burden (USEPA, 2000). In early 2004, EPA began a wide-ranging national review of LCR implementation, hereafter referred to as the "2004 National Review," to determine if there were continuing challenges related to elevated levels of lead in drinking water (see Section 2.1.5). The review identified several areas where there was confusion about implementation of the existing regulations. In October 2007, EPA promulgated the *Short-Term Regulatory Revisions to the Lead and Copper Rule,* hereafter referred to as the "LCR Short-Term Revisions" (USEPA, 2007). These revisions addressed several of the issues identified during the 2004 National Review. However, several issues remained that required additional data collection, research, analysis, and additional stakeholder involvement to support regulatory decisions. These issues have been addressed in the Lead and Copper Rule revisions (LCRR) regulatory process. The purpose of this document is to provide additional technical information on the final LCRR.[3]

In addition to the 2004 National Review, several additional activities and sources of information and input have contributed to the development of the final LCRR, including but not limited to LCR stakeholder meetings held by EPA; input from the Science Advisory Board (SAB); recommendations made by the National Drinking Water Advisory Council (NDWAC) and its Lead and Copper Rule Working Group (LCRWG); comments received in response to consultations with state, local, and tribal governments and intergovernmental organizations in 2018 and in prior years; and comments received from the public in response to the November 13, 2019 proposed LCRR. These activities and sources of input are described further in Section 2.2 and collectively contributed to the development of the final LCRR as summarized in Chapter 1 and detailed in Chapter 3.

The remainder of this chapter is organized as follows:

- **Section 2.1** provides the statutory requirements, a chronology of the regulatory actions, and initiatives affecting lead and copper in drinking water prior to the publication of the final LCRR.

[3] EPA is required to adhere to the Administrative Procedure Act during the process of developing and issuing regulations: https://www.archives.gov/federal-register/laws/administrative-procedure.

- **Section 2.2** provides a description of the activities following the LCR Short-Term Revisions that have informed development of the final LCRR.
- **Section 2.3** discusses regulatory authority for the regulation.
- **Section 2.4** discusses the economic rationale for the regulation.

2.1 Statutory Requirements, Regulatory Actions and National EPA Initiatives Affecting Lead and Copper in Drinking Water

This section provides a chronology of regulatory actions and initiatives affecting lead and copper in drinking water prior to the publication of the final LCRR.

2.1.1 Safe Drinking Water Act (SDWA) Requirements and Drinking Water Regulations Addressing Lead Prior to 1991

The SDWA (Public Law 93-523) was passed in 1974. The Act authorized EPA to establish National Primary Drinking Water Regulations (NPDWRs) for public water systems (PWSs). EPA published national interim primary drinking water regulations on December 24, 1975. Included among those regulations was a maximum contaminant level (MCL) of 0.05 mg/L for lead. The monitoring requirements for lead under these interim regulations focused on limiting the lead levels of drinking water entering the distribution system. The supporting materials for these interim regulations (USEPA, 1976) recognized to some degree that elevated lead levels were due to corrosion problems in the distribution system and household plumbing, however the regulation did not address this source of contamination.

Amendments to the SDWA in 1986 (Public Law 99-339) required the use of "lead free" materials in the installation or repair of pipes, fixtures, solders, and fluxes in any facility that provides water for human consumption. As defined in Section 1417(d), "lead free" solders and fluxes may not contain more than 0.2 percent lead, and "lead free" pipes, pipe fittings, and well pumps could not at the time contain more than 8.0 percent lead. All Primacy Agencies were required to implement the "lead ban" by August 6, 1988 (USEPA, 1987).

To limit children's exposure to lead, one of the most sensitive populations, Congress passed the Lead Contamination Control Act (LCCA) (Public Law 100-572) in 1988 that further amended the SDWA. The LCCA is aimed at the identification and reduction of lead in drinking water at schools and child care centers, including the recall of drinking water coolers with lead lined tanks and the publication of a list of drinking water coolers that were not "lead free." It required EPA to provide guidance to states and localities to test for and remedy lead contamination in drinking water at schools and child care centers.[4] In addition, the LCCA required testing, recall, repair, and/or replacement of water coolers with lead-lined storage tanks or with other parts containing lead. One section of the LCCA that required states to establish program to conduct testing and remedial actions has since been repealed as part of the Water Infrastructure Improvements for the Nation Act (WIIN Act) (Public Law 114-322, Dec. 16, 2016; United

[4] In response to the LCCA, EPA developed the guidance document, "Lead in Drinking Water in Schools and Non-residential Buildings in April 1994." Some states have initiated their own testing efforts, which may be dictated by state-specific regulations. See Chapter 4, Section 4.3.9.2 for more information on states with lead testing programs in schools and child cares.

States, 2016). Prior to the WIIN Act repeal of that section of the LCCA, in 1996, the U.S. Court of Appeals for the 5th Circuit held that this now-repealed provision requiring States to establish programs for testing and remediating lead was unconstitutional under the Tenth Amendment because it directly compelled states to enact and enforce a federal regulatory program and provided no options for the states to decline.[5] Since that time, EPA developed and revised its voluntary program for states, schools, and child cares to address lead in drinking water (USEPA, 2018). In 2016, the WIIN Act replaced the repealed version of Section 1464(d) of the SDWA with a new provision establishing a voluntary school and childcare lead testing grant program. 42 US.C. § 300j-24(d). Many states have also enacted their own testing programs.[6]

2.1.2 Lead and Copper Rule (1991)

The 1986 SDWA Amendments directed EPA to revise the regulations for lead and copper in drinking water. In response to this directive, the Agency proposed revisions in 1988. On June 7, 1991, EPA promulgated the LCR (USEPA, 1991), and established a maximum contaminant level goal (MCLG) of zero for lead and 1.3 mg/L for copper. The LCR established treatment technique requirements instead of an MCL. Section 1412(b)(7)(A) of the SDWA authorizes EPA to "promulgate a national primary drinking water regulation that requires the use of a treatment technique in lieu of establishing an MCL, if the Administrator makes a finding that it is not economically or technologically feasible to ascertain the level of the contaminant." EPA's decision to promulgate a treatment technique rule for lead instead of an MCL in 1991 has been upheld by the United States Court of Appeals for the District of Columbia Circuit. American Water Works Association (AWWA) v. EPA, 40 F.3d 1266, 1270-71 (D.C Cir. 1994).

In establishing treatment technique requirements, the Administrator is required to identify those treatment techniques "which in the Administrator's judgment, would prevent known or anticipated adverse effects on the health of persons to the extent feasible." 42 U.S.C. § 300g-1(b)(7)(A). "Feasible" is defined in Section 1412(b)(4)(D) of the SDWA as "feasible with the use of the best technology, treatment techniques and other means which the Administrator finds after examination for efficacy under field conditions and not solely under laboratory conditions, are available (taking cost into consideration)." The 1991 LCR established requirements for PWSs to conduct tap sampling at households with plumbing materials containing lead and copper. The1991 LCR set an action level (AL) of 0.015 mg/L (or 15 µg/L) for lead and 1.3 mg/L (or 1,300 µg/L) for copper. The AL is exceeded if the concentration in more than ten percent of water samples (i.e., the 90th percentile level) collected at interior taps during any monitoring period is greater than 0.015 mg/L for lead or 1.3 mg/L for copper.

[5] No. 94-30714 (81 F.3d 1387) (5th Cir. April 22, 1996). For more information about this case, see: https://caselaw.findlaw.com/us-5th-circuit/1340297.html.

[6] EPA assessed existing state level requirements for school and child care lead in drinking water testing. Currently 35 states have some requirements for school testing. Ten state programs have similar requirements to those indicated in the LCRR for mandatory sampling and an additional 11 have requirements that would meet those specified for on-request sampling under the final rule. A total of 17 states have some requirements for testing at child cares. Eight states have requirements that are comparable to the LCRR's final rule mandatory testing criteria. Six additional state programs meet the on-request requirements of the LCRR. See Chapter 4, Section 4.3.9.2 for additional detail on EPA's assessment of current state school and child care testing requirements and how they compare with the LCRR requirements. (AWWA, 2005; Cradock et al. 2019; 120 Water Audit, 2019).

Water systems that exceed the AL are not in violation of the LCR but these systems are required to take actions to reduce drinking water lead and copper exposure including CCT,[7] PE, and LSLR.

2.1.3 SDWA Amendments (1996)

The 1996 Amendments to the SDWA added that "lead free" plumbing fittings and fixtures must meet standards established under Section 1417(e) (42 U.S.C. 300g–6(e)). Section 1417(e) of the SDWA required EPA to accept a voluntary standard within a year or issue a regulation within two years. Furthermore, for the voluntary standard to be accepted, the Administrator must provide technical assistance to a qualified third-party in the development of the voluntary standard and associated testing protocols for examining lead leaching from new plumbing fittings and fixtures.

In 1996, the National Sanitation Foundation (NSF) developed National Sanitation Foundation/American National Standards Institute (NSF/ANSI) Standard 61, Section 9, which limits the amount of lead that can be leached from endpoint devices for water intended for human consumption (NSF, 2019). EPA published, in the *Federal Register (FR)* (USEPA, 1997), its view that NSF 61, Section 9 satisfied the requirement of Section 1417(e) . Specifically, EPA found that NSF 61, Section 9 is an established voluntary standard. Therefore, the obligation to issue a new regulation was not triggered. As a result, from August 1997 to January 2014, only those plumbing fixtures and fittings that had a maximum lead content of eight percent and were NSF/ANSI Standard 61, Section 9 certified could be defined as "lead free" per the SDWA.

2.1.4 Lead and Copper Rule Minor Revisions (2000)

On January 12, 2000, EPA published the final Lead and Copper Rule Minor Revisions (USEPA, 2000). The goals of the revisions were to streamline requirements, promote consistent national implementation, and in many cases, reduce the burden for community water systems (CWSs) and non-transient non-community water systems (NTNCWSs). The changes affected the following rule requirements: demonstration of optimal corrosion control, LSLR, PE, monitoring, analytical methods, reporting and recordkeeping, and special primacy considerations.

2.1.5 2004 National Review of the LCR Leading up to the LCR Short-Term Revisions of 2007

In early 2004, EPA began a wide-ranging review of the implementation of the LCR in response to high profile action level exceedances (ALEs) experienced by the District of Columbia Water and Sewer Authority (DC Water, formerly known as DC Water and Sewer Authority). The purpose of the 2004 National Review was to answer the following questions regarding lead in drinking water:

- Is this a national problem? Does a large percentage of the population receive water that exceeds the lead AL? Do many systems fail to meet the lead AL?

[7] The LCR required PWSs serving more than 50,000 people including those at or below their ALs to install CCT unless they: 1) had completed treatment steps that are equivalent to those described in the 1991 LCR prior to December 7, 1992 or 2) could demonstrate they had very low levels of lead and copper in the distribution system (i.e., qualified as a "b3" system).

- How well has the rule worked to reduce lead levels in systems over the past 12 years, particularly in systems that had demonstrated high lead levels in the initial rounds of sampling?
- Is the rule effectively implemented, particularly with respect to monitoring and PE requirements?

The comprehensive review consisted of the following elements:

1. A series of workshops to identify issues and gather comments and suggestions from stakeholders on particular topics,
2. A review of data (i.e., reported 90th percentile levels) and LCR implementation by Primacy Agencies and utilities to evaluate the effectiveness of the rule, and
3. A series of NDWAC meetings to address concerns related to PE requirements.

2.1.5.1 ***Elements of the Comprehensive Review***

The following sections provide more detail regarding elements included in the comprehensive review of the LCR that contributed to the development of the LCR Short-Term Revisions. Workshop and meeting summaries mentioned in these sections are available in the docket for the proposed rule under EPA-HQ-OW-2017-0300 at https://www.regulations.gov.

2.1.5.1.1 Review of Data to Evaluate the Effectiveness of the Rule (2004)

In 2004, EPA reviewed implementation of LCR requirements by Primacy Agencies. EPA asked Primacy Agency managers and staff, who have primary oversight responsibility, questions regarding implementation of various aspects of the LCR. The questions were centered on the following broad categories: sampling issues, calculation of the 90th percentile value, treatment issues, LSLR, PE, and enforcement (USEPA, 2005a).

Generally, the Primacy Agencies indicated they were following the minimum Primacy Agency requirements of the LCR. However, the information provided to EPA indicated that many could have taken additional steps to oversee implementation of the rule. Also, the Primacy Agencies' responses highlighted a few areas in which there was some confusion about the requirements of the rule as well as areas in which some Primacy Agencies were going above and beyond the minimum requirements.

Also, in 2004, EPA reviewed the lead levels in CWSs and NTNCWSs serving more than 3,300 people as reported in the Safe Drinking Water Information System/Federal Version (SDWIS/Fed). Since 2002, EPA has required Primacy Agencies to report to SDWIS/Fed all lead 90th percentile levels for CWSs and NTNCWSs serving more than 3,300. Prior to 2002, Primacy Agencies were required to report only those lead 90th percentile levels that were above the AL of 15 µg/L. At the start of the review, SDWIS/Fed contained data for only 23 percent of systems serving more than 3,300 people. EPA worked with Primacy Agencies to expedite entry of the 90th percentile lead data. When EPA evaluated the completeness of the data as of June 1, 2004, lead 90th percentile data had been reported for 97 percent of systems serving more than 50,000 people and 91 percent of systems serving 3,301 to 50,000 people. Based on the June 1, 2004 data, EPA also determined that 95.8 percent of CWSs and NTNCWSs serving more than 3,300 people with reported 90th percentile levels were below the lead AL. This percentage rose slightly to 96.9 percent based on 90th percentile data reported to SDWIS/Fed as of January 27,

2005. Based on the data collected in 2004, EPA concluded that: "There does not appear to be a widespread problem with elevated lead levels across the country comparable to that currently being observed in the District of Columbia" (USEPA, 2004).

EPA also compared the 90th percentile levels for a set of 166 systems serving more than 50,000 people that had exceeded the lead AL immediately after the adoption of the LCR in 1992-1993 to their respective 90th percentile levels during 2000–2004. EPA found that only 15 systems continued to exceed the lead AL during 2000–2004, "... demonstrating that corrosion control efforts taken by the utilities have largely been effective in controlling lead levels" (USEPA, 2007).

2.1.5.1.2 Workshops on Lead in Drinking Water (2004–2005)

EPA held five workshops in 2004 and 2005 to identify issues and gather suggestions from stakeholders on diverse topics related to lead in drinking water including:

- Simultaneous Compliance, May 2004, St. Louis, MO: Expert participants from utilities, academia, state governments, and other stakeholder groups identified issues, proposed solutions, and identified information gaps with respect to simultaneous compliance with the LCR and other rules such as the Total Coliform Rule, the Surface Water Treatment Rules, and the Disinfection Byproducts Rules. Generally, the group of experts determined that information gaps existed on the impacts of treatment changes under various water quality conditions/chemistries and additional guidance was needed on a variety of topics. Specifically, issues and suggestions were developed for four topic areas: coagulation impacts on corrosion control; impacts of disinfectant changes on corrosion control; corrosion inhibitors; and distribution system management.

- Sampling Protocols, May 2004, St. Louis, MO: Expert participants from utilities, academia, state governments, and other stakeholder groups identified issues and information gaps, and proposed solutions with respect to monitoring and sampling under the LCR. Topic areas included sampling frequency and triggers; sampling site selection/location; sampling protocol; and sampling of water quality parameters (WQPs). The workshop participants discussed sampling after treatment changes and ALEs and re-examined tap sample flushing instructions.

- Public Education, September 2004, Philadelphia, PA: Expert participants from utilities, governments, consumer and environmental groups, and other stakeholder groups discussed the PE requirements under the LCR, drinking water risk communication, and effective communication with the public. Participants suggested ways to improve risk communication to the public through establishing partnerships with health departments and other groups, refining the message content, improving delivery of the message, and spending more time planning and evaluating the effectiveness of the risk communication.

- Lead Service Line Replacement, October 2004, Atlanta, GA: Expert participants from utilities, academia, state governments, and other stakeholder groups discussed the challenges and problems encountered in implementing LSLR, as well as strategies and solutions for overcoming those difficulties. Specific topic areas included monitoring, customer communications, replacement technologies, and managing inventory. Continued sampling after LSLR and the need to notify customers of testing results were also mentioned during the discussions.

- Lead in Plumbing, July 2005, Washington, D.C.: Expert participants from utilities, academia, state governments, and other stakeholder groups discussed lead in plumbing fittings and fixtures. Topic areas included NSF standards and testing protocols, alternative materials, and national/state/local/industry/consumer practices.

2.1.5.1.3 National Drinking Water Advisory Committee Working Group Meetings (2005 – 2006)

As part of the review of the LCR, EPA identified several issues relating to PE requirements. To address these concerns, the NDWAC formed a working group to consider possible revisions to the PE requirements. The charge to the NDWAC Working Group was to: 1) review the current PE requirements for lead in drinking water and make recommendations for improvements; 2) develop recommended revised language for communicating to the public the risk of lead in drinking water and how affected persons should respond; and 3) review and make recommendations for changes to the means of delivery of lead information to the public (USEPA, 2005b).

The NDWAC Working Group met in person four times between October 2005 and April 2006. The NDWAC Working Group included 16 individuals representing an array of backgrounds and perspectives. Collectively, these individuals brought into the discussion the perspectives of state drinking water agencies, environmental and consumer groups, drinking water utilities, small system advocates, state health officials, and risk communication experts. The recommendations from the NDWAC Working Group form the basis of the regulatory changes regarding PE that were promulgated under the LCR Short-Term Revisions (e.g., allow systems to tailor the PE message to their community and situation, and require wider distribution of PE materials to better reach at-risk populations).

2.1.5.2 *Development of the Drinking Water Lead Reduction Plan and LCR Short-Term Revisions*

EPA concluded as a result of the 2004 National Review that the LCR's then-current approach had been effective in reducing drinking water lead levels in the nation's systems and that high lead levels in drinking water do not appear to be a widespread problem. Furthermore, the Agency determined that opportunities did exist to improve and clarify specific areas of the LCR and guidance materials. EPA identified these areas for rule revisions, and other actions to reduce lead, in its March 2005 *Drinking Water Lead Reduction Plan* (USEPA, 2005c). Several of these targeted areas were addressed in the LCR Short-Term Revisions and are described in more detail in Section 2.1.6. EPA also identified issues that required longer term consideration to be addressed as part of the LCRR. These additional issues included revision of the mandatory PE language, monitoring, and LSLR requirements. In many cases, these issues required additional data collection, research, and analysis to fill critical data gaps. Also, some issues required more extensive stakeholder involvement to support decisions.

2.1.6 Lead and Copper Rule Short-Term Revisions and Clarifications (2007)

The LCR Short-Term Revisions were published in the *FR* on October 10, 2007 (USEPA, 2007). This rulemaking contained additional requirements to improve the implementation of the LCR. Specifically, the rule made the following revisions:

- Clarified the required minimum number of lead and copper tap samples for small systems.

- Clarified the terms “compliance period” and “monitoring period.”
- Increased the stringency of the reduced lead and copper tap monitoring criteria.
- Required water systems that conduct lead and copper tap monitoring less frequently than semi-annually to notify and obtain approval from their Primacy Agency in advance of long-term treatment or source changes.
- Required systems to provide a lead consumer notice to individuals at sites used for lead and copper tap compliance purposes.
- Enhanced PE requirements to modify the message content, delivery mechanism and time frame, to better reach at-risk populations, and to update the lead language in the consumer confidence report (CCR).
- Required systems to update their inventory to include those lead service lines (LSLs) that were replaced through testing (i.e., tested-out) in a previous round of LSLR if a system is re-triggered into LSLR.[8]

2.1.7 Additional Actions to Reduce Lead in Plumbing Materials (2008-present)

An annex to the NSF/ANSI Standard 61 was developed in 2008 that established a standard to determine product compliance with the lead content requirements of California's Health and Safety Code Section 116875 (commonly known as California Assembly Bill 1953 [AB 1953]), which specifies a maximum weighted average lead content of 0.25 percent calculated across the wetted surface of most plumbing pipe, fittings, and fixtures. Further, more stringent requirements under NSF/ANSI Standard 61 leaching standard (effective July 2012) include lowering the leaching standard from 11 µg/L to 3 µg/L under Section 9 for supply stops, flexible plumbing, connectors, and miscellaneous components, and from 11 µg/L to 5 µg/L for all other Section 9 devices (NSF, 2019).

Congress enacted the Reduction of Lead in Drinking Water Act (RLDWA) (Public Law 111-380) on January 4, 2011 to amend Section 1417 of the SDWA to revise the definition of “lead free” in solder, flux, pipe, and fixtures. The law reduced the level of permissible lead in drinking water plumbing fixtures from a maximum of 8 percent to 0.2 percent lead in solder and flux and specifies a maximum weighted average of 0.25 for wetted surfaces of most pipes, fittings, and fixtures. The RLDWA became effective on January 4, 2014. The Community Fire Safety Act of 2013 (Public Law 113-64) further amended Section 1417 to exempt fire hydrants from having to meet the “lead free” requirements under the RLDWA. EPA announced the final rule titled “Use of Lead Free Pipes, Fittings, Fixtures, Solder, and Flux for Drinking Water “on July 29, 2020 (USEPA, 2020a). This rule codified the requirements of the RLDWA and established certification requirements for demonstrating compliance.

[8] Under the previous rule, systems could count an LSL toward their replacement rate if a sample from the LSL was at or below the lead AL. The LCR Minor Revisions required systems to add these “tested-out” lines back into their inventory if they subsequently exceeded the lead AL and were again triggered into further LSLRs.

2.2 Outreach, Consultation, Workgroup Activities, and Other Events Contributing to the Lead and Copper Rule Revisions

The goal for the LCRR is to improve public health protection provided by the LCR by making substantive changes to the rule based on issues identified through EPA's 2004 National Review and as described in the March 2005 Drinking Water Lead Reduction Plan (USEPA, 2005c). To help EPA better define these changes, the Agency:

- Held various stakeholder meetings and consultations.
- Charged the SAB to evaluate the effectiveness of partial LSLRs.
- Solicited input from small business stakeholders.
- Continued to consult with NDWAC, whose LCRWG was convened in 2014 and met during 2014 - 2015.
- Consulted with tribal governments.
- Held a public meeting on environmental justice.
- Consulted with state, local government organizations, and PWSs.
- Convened a meeting of high-level staff from EPA, state, PWS, and non-government organizations (NGOs).

Outreach activities and other events that impacted the final LCRR are discussed in more detail in Sections 2.2.1 through 2.2.9, and summaries or presentation materials from meetings and consultations are available in the docket for the rule under EPA-HQ-OW-2017-0300 at https://www.regulations.gov.

2.2.1 Stakeholder Meetings

In October 2008, EPA held a two-day stakeholder meeting at the Carnegie Institution for Science in Washington, D.C. The purpose of this meeting was to gather stakeholder input on actions that could be taken on revisions to the LCR. Stakeholders present at the meeting included state drinking water regulators, members of city level water departments, regional water companies, state health departments, and smaller water testing groups. Discussion topics included changes to the tiering criteria for lead and copper sample site selection LSLR requirements, particulate lead in tap water samples, optimal water quality parameters (OWQPs), tap sampling issues, and CCT technologies. EPA presented summaries of the scientific data that the Agency had compiled on these issues. EPA also requested stakeholder input and feedback on these and other issues EPA could consider for potential future action on the LCR.

In November 2010, EPA held a one-day stakeholder meeting in Philadelphia, PA. Expert participants from utilities, academia, state governments, and other stakeholder groups met to discuss three areas that EPA considered for revision: tiering criteria for lead and copper sample site selection, LSLR requirements, and potential requirements for testing of lead in drinking water at schools.

2.2.2 Input from Small Business Stakeholders

In July 2012, EPA solicited input from the Small Business Administration, the Office of Management and Budget (OMB), and nine potentially affected small entity representatives (SERs) on the LCRR, pursuant to the Regulatory Flexibility Act (see Section 8.4). On August 14, 2012, EPA convened a Small Business Advocacy Review (SBAR) Panel and provided the Panel with input from the SERs. The SBAR Panel submitted its report to EPA in October 2012, which incorporated additional input from the SERs. The report provided the number and type of small entities that may be affected by the proposed rule; a recommendation to consider CCT techniques other than orthophosphate due to possible conflicts with National Pollutant Discharge Elimination System permit limits for phosphorus; and alternatives that would minimize any significant economic impact of the proposed rule on small entities. Specifically, the Panel submitted recommendations regarding the sample site selection criteria, PE for copper, the process for re-evaluating and revising CCT, copper monitoring waivers for systems that can demonstrate their water is non-aggressive toward copper; point-of-use (POU) treatment units in lieu of CCT for NTNCWSs serving 10,000 or fewer people; the sampling protocol at sites served by LSLs; and mandatory LSLR requirements.

2.2.3 Input from SAB and NDWAC

Throughout the LCRR rulemaking process, EPA consulted with the SAB and the NDWAC. Sections 2.2.3.1 and 2.2.3.2 provide a summary of EPA's consultations with the SAB and with the NDWAC, respectively.

2.2.3.1 *SAB Review*

The SAB provides scientific advice to the EPA Administrator including reviewing the quality and relevance of the scientific and technical information being used by the EPA or proposed as the basis for Agency regulations. This section describes consultations with the SAB during 2011 and 2020.

2.2.3.1.1 2011 SAB Consultation

EPA formally charged the SAB to review and provide advice regarding studies examining the effectiveness of partial LSLRs. The SAB held a public meeting on this review on March 30 and 31, 2011 in Washington, D.C. with a follow up conference call on May 16, 2011. SAB's final report, entitled "SAB Evaluation of the Effectiveness of Partial Lead Service Line Replacements" was transmitted along with a memorandum to EPA Administrator on September 28, 2011 (USEPA, 2011a). Refer to Chapter 3, Section 3.5.2.3 for more information on the SAB's charge and findings related to partial LSLRs.

2.2.3.1.2 2020 SAB Review of the Proposed LCRR

Following the LCRR proposal, the SAB elected to review the scientific and technical basis of the proposed rule, on March 30, 2020. The drinking water sub workgroup took the lead in the SAB deliberations on this topic at a public teleconference held on May 11, 2020. The SAB provided advice and comments in its June 12, 2020 report (USEPA, 2020b). SAB comments were similar to those raised by public commenters. A copy of the report is included in the docket for the rule.

2.2.3.2 ***NDWAC Meetings***

The NDWAC is a Federal Advisory Committee that supports EPA in performing its duties and responsibilities related to the national drinking water program and was created through a provision in the SDWA in 1974. In accordance with Section 1412(d) and (e) of the SDWA, EPA consulted with the NDWAC on efforts to develop revisions to the LCR. These consultations are further described in this section.

2.2.3.2.1 2011 NDWAC Consultation

On November 18, 2011, EPA held a public teleconference with NDWAC to discuss a study completed by the Centers for Disease Control and Prevention as well as to address the SAB evaluations regarding partial LSLR. In December 2011, the NDWAC held a 2-day public meeting to address various issues associated with drinking water protection including actions to assist small water systems. The NDWAC provided EPA with recommendations on the potential LCR regulatory revisions, which are outlined in a letter dated December 23, 2011 (NDWAC, 2011).

2.2.3.2.2 2013 NDWAC Consultation

In December 2013, EPA met with the NDWAC in Washington, D.C. to provide a national drinking water program update (USEPA, 2013). EPA provided background on the LCRR and highlighted for the Council five areas where EPA was considering a range of regulatory revisions and seeking detailed stakeholder input. The five areas were: 1) sample site selection criteria for tap monitoring, 2) lead sampling protocol, 3) copper PE, 4) measure to ensure optimal corrosion control treatment (OCCT), and 5) LSLR. The public also had an opportunity to provide information to the NDWAC on issues with which they were concerned and wanted to be considered in the rule revisions. During this meeting, EPA formally requested that the NDWAC form a working group to support EPA in the development of the LCRR. The NDWAC unanimously voted on forming this working group. A summary of these LCRWG meetings are provided in the next section.

2.2.3.2.3 2014 – 2015 NDWAC LCRWG Meetings

The NDWAC formed the LCRWG to provide additional advice to EPA on potential options for the LCRR. The 15-member LCRWG consisted of representatives from states, water systems, health agencies, and public interest groups. The LCRWG held seven in-person meetings from March 2014 through June 2015, participated in multiple conference calls, and spent time outside these meetings to provide input to the NDWAC on the five key issues that EPA identified during the December 2013 NDWAC meeting. The LCRWG also provided additional recommendations on other areas such as expanded lead education and outreach and the need to engage other stakeholders that include the health community.

The LCRWG provided their final report, including recommendations, to the larger NDWAC committee in August 2015 (NDWAC, 2015a) and presented their recommendations to the NDWAC in November 2015. The NDWAC accepted the LCRWG recommendations and submitted their recommendation via letter to EPA on December 15, 2015 (NDWAC, 2015b).

In the report, the NDWAC acknowledged that reducing lead exposure is a shared responsibility among consumers, PWSs, building owners, public health officials, and others. In addition, they recognized that creative financing is necessary to reach the LSL removal goals, especially for disparate and vulnerable communities. The NDWAC advised EPA to maintain the LCR as a treatment technique rule but with

enhanced improvements. The NDWAC qualitatively considered costs before finalizing its recommendations, emphasizing that PWSs and states should focus efforts where the greatest public health protection can be achieved and incorporating their anticipated costs in their capital improvement program or the requests for Drinking Water State Revolving Funds. The LCRWG outlined an extensive list of recommendations for the LCRR including establishing a goal-based LSLR program, strengthening CCT requirements, and tailoring WQPs to the specific CCT plan for each water system.

The report the NDWAC provided for EPA also included recommendations for renewed collaborative commitments between all levels of government and the public while recognizing EPA's leadership role in this area. These complementary actions as well as a detailed description of the provisions for NDWAC's recommendations for the proposed rule can be found in the "Report of the Lead and Copper Rule Working Group to the National Drinking Water Advisory Council" (NDWAC, 2015a). One member of the NDWAC working group provided a dissenting opinion (Parents for Nontoxic Alternatives, 2015). EPA took into consideration the NDWAC's recommendations and the dissenting opinion when developing the final revisions to the LCR.

2.2.3.2.4 2019 NDWAC Consultation

On December 4-5, 2019, EPA held a NDWAC meeting in Washington, D.C. where EPA presented the proposed LCRR. In the presentation, the major LCR revisions were highlighted (e.g., the LSL inventory, the new trigger level of 10 µg/L, and new sampling protocols). The presentation focused on six key areas: identifying areas most impacted, strengthening treatment requirements, replacing LSLs, increasing sampling reliability, improving risk communication, and protecting children in schools. EPA reiterated the LCRR was developed with extensive consultation from state, local, and tribal partners to identify opportunities that would reduce elevated levels of lead in drinking water. EPA reaffirmed its commitment to transparency and improved communication to the public.

2.2.4 Consultation with Tribal Governments

Consistent with EPA Policy on Consultation and Coordination with Indian Tribes (May 4, 2011), EPA consulted with tribal officials during the development of the LCRR to gain an understanding of tribal views of potential revisions to key areas of the LCR (USEPA, 2011b). EPA coordinated and consulted with federally-recognized Indian tribes on the LCR proposed regulatory revisions, pursuant to Executive Order 13175, *Consultation and Coordination With Indian Tribal Governments* (65 FR 67249, November 9, 2000) (see Chapter 0, Section 8.7). Any revisions to the LCR will impact a tribal government that operates a PWS or that has primary enforcement authority for PWSs on tribal lands. EPA requested input from tribal governments on how the Agency should revise the LCR while maintaining or improving public health protection. EPA held tribal consultations, beginning with a national tribal consultation teleconference on December 1, 2011 to obtain input from tribal governments on the proposed LCRR and to determine which revisions would assist tribal governments in implementing and complying with the rule while maintaining or improving public health.

More recently, EPA held a consultation with federally-recognized Indian tribes from January 16 to March 16, 2018. EPA sent a consultation invitation letter to all 567 federally-recognized tribes along with a consultation and coordination plan, a link to written technical background information, and an invitation to two national webinars for tribes. The first national webinar was held January 31, 2018, and a second national webinar was held February 15, 2018. A total of 48 tribal representatives participated in the two

webinars. Updates on the consultation process were provided to the National Tribal Water Council, upon request, at regularly scheduled monthly meetings during the consultation process. Also, upon request, informational webinars were provided to the National Tribal Toxics Council's Lead Subcommittee on January 30, 2018, and EPA Region 9's Regional Tribal Operations Committee on February 8, 2018. The information presented included key challenges to the previous LCR and potential revisions regarding LSLR, CCT, tap sampling, PE and transparency, and copper requirements.

Five tribes or tribal organizations (Navajo Tribal Utility Authority, National Tribal Water Council, United South and Eastern Tribes Sovereignty Protection Fund, Yukon River Inter-Tribal Watershed Council, and Indian Health Service – Sanitation Facilities Construction, Seattle Office) submitted written consultation comments to EPA.[9] A summary report of the views expressed during tribal consultations is available in the docket (EPA-HQ-OW-2017-0300) at www.regulations.gov.

2.2.5 Public Meeting on Environmental Justice

During March 2011, EPA held a public meeting to discuss and solicit input on environmental justice considerations related to several upcoming regulatory efforts that included the LCRR. The meeting was attended in-person and remotely by a diverse group including advocacy groups, water systems, state agencies and trade associations, and private corporations. LSLR was a main area of discussion during this meeting. EPA provided information on the LCR and rule revisions that the Agency was considering to alleviate disproportionate impacts. EPA also solicited input from the public regarding ways in which the Agency could further consider environmental justice concerns in the LCR revision process.

2.2.6 Consultation with State and Local Government Organizations

This section provides information on EPA's 2011 and 2018 federal consultations and interactions with the Association of State Drinking Water Administrators (ASDWA) on development of the LCRR.

2.2.6.1 *November 2011 Federalism Consultation*

On November 15, 2011, EPA held a Federalism consultation with representatives from state and local government organizations to solicit feedback on potential regulatory revisions to the LCR, pursuant to Executive Order 13132, *Federalism* (64 FR 43255, August 10, 1999) (see Chapter 0, Section 8.6).

In its capacity as an advisory committee to EPA, the Local Government Advisory Committee periodically makes recommendations and comments to the Agency on issues impacting local governments. EPA received comments that addressed sample site collection criteria and lead sampling protocol at LSL sites.

2.2.6.2 *ASDWA Questionnaire to States on Possible LCRR Requirements*

In 2016, ASDWA developed a state questionnaire regarding potential LCRR requirements. The purpose of the questionnaire was to obtain labor and cost estimates associated with some of the previous LCR and potential requirements under the proposed LCRR to include in the economic analysis for the proposed LCRR. States were questioned about previous rule oversight activities and additional

[9] More information on LCR-specific tribal consultation is available at EPA's LCR website: http://water.epa.gov/lawsregs/rulesregs/sdwa/lcr/index.cfm.

implementation (i.e., sampling invalidation, WQP monitoring, CCT re-assessment, changes in source or treatment, and LSLR). In terms of possible LCRR oversight activities, states were asked about burden and costs associated with lead sampling instructions, updating the materials inventory, annual review of lead information, discussion of sampling data during sanitary surveys, water aggressiveness to copper determinations, drinking water treatment process control charting, periodic review of updated CCT guidance, and how systems could demonstrate they had no LSLs. Two states (Indiana and North Carolina) responded to the questionnaire.

2.2.6.3 ***Questionnaire to States on LSL Inventory and Other LSL-Related Information***

In 2017, EPA disseminated a questionnaire to nine states regarding the burden and cost associated with NDWAC's recommendation to require all systems to develop a comprehensive LSL inventory and to expand the definition of an LSL to include lead connectors even if the service line is not made of lead. The questionnaire asked states how they would manage the LSL inventory requirement and their estimates for costs associated with reviewing PWS inventory documentation. The nine states were selected based on geographic diversity, high incidence of LSLs, and knowledge of existing LSLR programs. Seven states (Illinois, Michigan, New Jersey, Ohio, Rhode Island, Washington, and Wisconsin) out of the nine states responded to the questionnaire.

2.2.6.4 ***January 2018 Federalism Consultation***

Pursuant to Executive Order 13132, *Federalism*, EPA held an initial Federalism meeting on January 8, 2018 in Washington, D.C. with 17 intergovernmental associations and several associations representing state and local governments.[10] EPA provided the associations' membership an opportunity to provide input during follow-up meetings. EPA also held five follow-up briefings between January 8 and March 8, 2018. A total of 82 state and local governments and related associations provided input during the meetings and within 60 days after the initial meeting. EPA received comments from 24 municipal water utilities, 21 local government agencies, 20 intergovernmental associations, 15 state agencies, and two Members of the United States House of Representatives. Common issues discussed included LSLR, CCT, transparency and PE, tap sampling, and copper.

A summary report of the views expressed during Federalism consultations is available in the docket (EPA-HQ-OW-2017-0300) at www.regulations.gov.

2.2.6.5 ***Meetings with ASDWA***

This section describes EPA's meetings with ASDWA during August 2018 to further discuss their Federalism comments and March 2020 on projected Primacy Agency costs to implement the possible revisions to the LCR.

2.2.6.5.1 August 2018 Meeting

EPA met with ASDWA in August 2018 to further discuss ASDWA's comments provided during the Federalism consultation period discussed above. EPA gave an abbreviated version of the federalism

[10] For more information regarding the LCR Federalism Consultation, refer to: https://www.epa.gov/dwstandardsregulations/lcr-federalism-consultation.

presentation for the ASDWA members, highlighting the major topics EPA was contemplating for revision for the LCR. ASDWA presented preliminary estimates of state costs for CCT-related activities, including state review of CCT and find-and-fix activities. ASDWA noted that they planned to continue to refine their estimates and analysis and to eventually conduct a survey of their members. EPA and ASDWA also discussed LSLR, CCT, transparency and PE, tap sampling, and copper.

2.2.6.5.2 March 2020 Meeting

EPA met with ASDWA during March 2020 to discuss revisions to their 2018 Costs of State Transactions Study (CoSTS) (ASDWA, 2018). The model projected the increase in the Primacy Agencies' workload from the anticipated revisions to the LCR. ASDWA submitted the 2018 version of the model during the Federalism consultation and submitted a revised version to EPA during the public comment period for the proposed rule. As discussed throughout Chapter 5, EPA revised several of its costing inputs used for the proposed rule to reflect information provided in ASDWA's 2020 version of CoSTS (ASDWA, 2020). The file, "Final CoSTS 2-6-20.xlsx" is available in the LCRR docket at EPA-HQ-OW-2017-0300 at www.regulations.gov.

2.2.7 Public Water Systems

The lead in drinking water crisis in Flint, MI[11] brought increased attention to lead in drinking water and to the need to improve the previous rule. It underscored significant challenges in the implementation of the previous rule, including a rule structure that for many systems only compels protective actions after public health threats have been identified (USEPA, 2016a). EPA has taken into account the experience in Flint, MI in developing the final LCRR. In addition, EPA solicited input from other PWSs across the country regarding burden and costs of potential revisions to consider in the development of the LCRR. A summary of the input from PWSs (through the dissemination of surveys and questionnaires) is discussed in Section 2.2.7.1.

2.2.7.1 *Input from PWSs*

EPA sought input from PWSs regarding the cost and burden of potential provisions in the LCRR. Specifically, EPA issued questionnaires to the New York City Department of Environmental Protection and the Chicago Department of Water Management about their free lead in drinking water testing program and to nine systems regarding their LSL inventories. EPA also met with systems by phone to obtain information. EPA met with Greater Cincinnati Water Works (GCWW) about their school testing program for lead in drinking water and with the Philadelphia Water Department (PWD) regarding their protocol to address high lead levels at individual households. Each of these is discussed in more detail in the following sections.

[11] See, https://www.epa.gov/flint for additional information on EPA's Flint drinking water response along with website links to additional information. Also see, https://www.cdc.gov/nceh/lead/programs/flint-registry.htm, the Centers for Decease Control and Preventions' voluntary Flint lead exposure registry website.

2.2.7.1.1 New York City Department of Environmental Protection and Chicago Department of Water Management

EPA sent a questionnaire in 2016 to the New York City Department of Environmental Protection and the Chicago Department of Water Management regarding their free testing programs for lead in drinking water. The purpose of this questionnaire was to give EPA a sense of the burden and cost associated with implementing such a program. In particular, the questionnaire asked about when these programs were started, methods of advertising and communication, how many customers requested sampling per year, percentage of sample results that exceeded the lead AL, public accessibility of the lead results, and other types of testing and analyses offered to customers.

2.2.7.1.2 LSL Inventory and LSLR Questionnaire

EPA sent a questionnaire to nine PWSs with active LSLR programs. The questionnaire was designed to obtain information about the activities and costs needed to develop a comprehensive LSL inventory, how systems have achieved successful LSLR programs, and the cost associated with LSLR. Fort Worth was the only PWS to respond to the questionnaire.

2.2.7.1.3 Greater Cincinnati Water Works

On May 25, 2018, EPA met with GCWW to discuss their proactive school testing program for lead in drinking water. Representatives from GCWW provided an overview of the program and discussed the services offered to schools, the roles of other agencies in the program, and the integration of child cares into the program. GCWW also provided EPA with an Excel spreadsheet that outlined the steps taken to sample at a school, average time it takes to complete each step, and the average cost per school.

2.2.7.1.4 Philadelphia Water Department

EPA met with PWD on November 2, 2018 to discuss how the system addresses high lead levels at individual residences. PWD served on the NDWAC LCRWG and indicated that PWD conducts find-and-fix steps when LCR compliance sampling yields high lead results. During this meeting, PWD discussed its free lead tap sampling program for customers who request testing. PWD also provided EPA with some of its lead PE materials.

2.2.8 EPA Letter to Governors and State Environment and Public Health Commissions and Tribal Leaders

In 2016, EPA sent letters to Governors, State Environment and Public Health Commissioners, and Tribal Leaders regarding the LCR.[12] The intent of the letters was to ensure that the LCR was being properly implemented. In the letter, EPA explained their immediate effort to oversee state implementation of the LCR and to work with states to identify ways to strengthen implementation and ultimately improve public health protection. The letter also asked these parties to take action to improve public transparency and accountability in the implementation of the rule.

[12] For templates of these letters and stakeholder responses, refer to: https://www.epa.gov/dwreginfo/epa-letter-governors-and-state-environment-and-public-health-commissioners.

2.2.9 Administrator's Meeting with States, PWS, and Non-Government Organizations

In May and June of 2016, the Administrator and other high-ranking EPA officials conducted meetings with state officials, water system officials, and NGOs. Sixteen state officials and 16 PWS officials met with EPA on May 26 and June 1, 2016, respectively. EPA met with 15 NGOs on June 2, 2016. During each meeting, EPA and stakeholder officials discussed critical needs and key opportunities for addressing drinking water challenges and four priority issues including the LCR with the goal of strengthening implementation of the previous LCR and improving public health protection through updates to the rule. The results of these meetings informed EPA's Drinking Water Action Plan, published in November 2016 (USEPA, 2016b).

2.2.10 Public Comments on the Proposed LCRR

Following publication of the proposed LCRR, EPA accepted public comments for 90 days. EPA received comments from over 79,000 individuals and organizations representing a wide range of stakeholders, including PWSs, states, tribes, other organizations, and private citizens. Each unique comment was read and considered in determining the final rule requirements. A record of the comments received on the proposal, as well as EPA's responses to these comments, can be found in the "Public Comment and Response Document for the Final Lead and Copper Rule Revisions" (USEPA, 2020c). Copies of unique individual comments are also available as part of the public record and can be accessed through EPA's docket (EPA-HQ-OW-2017-0300 at www.regulations.gov).

2.3 Statutory Authority for Promulgating the Rule

EPA derives its statutory authority to regulate contaminants in drinking water through the SDWA. The SDWA requires EPA to establish MCLGs and NPDWRs for contaminants that may have an adverse effect on the health of persons and may occur in systems at a frequency and level of public concern and for which, in the sole judgment of the Administrator, regulation of the contaminant would present a meaningful opportunity for health risk reduction for persons served by PWSs (SDWA Section 1412(b)(1)(A)). The 1986 amendments to the SDWA established a list of 83 contaminants for which EPA is to develop MCLGs and NPDWRs, which included lead and copper. The 1991 NPDWR for Lead and Copper (USEPA, 1991) fulfilled the requirements of the 1986 SDWA amendments with respect to lead and copper.

EPA is finalizing revisions to the LCR under the authority of the following sections of the SDWA: 1412, 1413, 1414, 1417, 1445, and 1450 (42 U.S.C. §§ 300f et seq.).

Section 1412(b)(7)(A) of the SDWA authorizes EPA to promulgate a treatment technique "which in the Administrator's judgement, would prevent known or anticipated adverse effects on the health of persons to the extent feasible." (42 U.S.C. § 300g-1(b)(7)(A)). Section 1412(b)(9) provides that "[T]he Administrator shall, not less often than every 6 years, review and revise, as appropriate, each national primary drinking water regulation promulgated under this subchapter. Any revision of a national primary drinking water regulation shall be promulgated in accordance with this section, except that each revision shall maintain, or provide for greater, protection of the health of persons." (42 U.S.C. § 300g-1(b)(9)). In promulgating a revised NPDWR, EPA follows the applicable procedures and requirements described in Section 1412, including those related to 1) the use of the best available, peer-reviewed

science and supporting studies; 2) presentation of information on public health effects; and 3) a health risk reduction and cost analysis of the rule (42 U.S.C. § 300g-1(b)(3)(A)-(C)).

Section 1413(a)(1) of the SDWA allows EPA to grant a state primary enforcement responsibility ("primacy") for NPDWRs when EPA has determined that the state has adopted regulations that are no less stringent than EPA's regulations (42 U.S.C. § 300g-2(a)(1)). To obtain primacy for this rule, states must adopt comparable regulations within two years of EPA's promulgation of the final rule, unless EPA grants the state a two-year extension. State primacy requires, among other things, adequate enforcement (including monitoring and inspections) and reporting. EPA must approve or deny state primacy applications within 90 days of submission to EPA (42 U.S.C. § 300g-2(b)(2)). In some cases, a state submitting revisions to adopt an NPDWR has primary enforcement authority for the new regulation while EPA's decision on the revision is pending (42 U.S.C. § 300g-2(c)).

Section 1414(c) of the SDWA, as amended by the WIIN Act, requires PWSs to provide notice to the public if the water system exceeds the lead action level (42 U.S.C. § 300g-3(c)). Section 1414(c)(2) provides that the Administrator "shall, by regulation … prescribe the manner, frequency, form, and content for giving notice" (42 U.S.C. § 300g-3(c)(2)). Section 1414(c)(2)(C) specifies additional requirements for those regulations related to public notification of a lead ALE "that has the potential to have serious adverse effects on human health as a result of short-term exposure," including requirements for providing notification to EPA.

Section 1417(a)(2) of the SDWA provides that PWSs "shall identify and provide notice to persons that may be affected by lead contamination of their drinking water where such contamination results from the lead content of the construction materials of the public water distribution system and/or corrosivity of the water supply sufficient to cause leaching of lead" (42 U.S.C. § 300g-6(a)(2)(A)(i) and (ii)). The notice "shall be provided notwithstanding the absence of a violation of any national drinking water standard" (42 U.S.C. § 300g-6(a)(2)(A)).

Section 1445(a) of the SDWA authorizes the Administrator to establish monitoring, recordkeeping, and reporting regulations, to assist the Administrator in establishing regulations under the SDWA, determining compliance with the SDWA, and in advising the public of the risks of unregulated contaminants (42 U.S.C. § 300j-4(a)). In requiring a PWS to monitor under Section 1445(a), the Administrator may take into consideration the water system size and the contaminants likely to be found in the system's drinking water (42 U.S.C. § 300j-4(a)). Section 1445(a)(1)(C) of the SDWA provides that "every person who is subject to a national primary drinking water regulation" must provide such information as the Administrator may reasonably require to assist the Administrator in establishing regulations under Section 1412 (42 U.S.C § 300j-4(a)(1)(C)).

Section 1450 of the SDWA authorizes the Administrator to prescribe such regulations as are necessary or appropriate to carry out his or her functions under the Act (42 U.S.C § 300j-9).

2.4 Economic Rationale

This section addresses the economic rationale, as described in Executive Order 12866, *Regulatory Planning and Review* (58 FR 51735, October 4, 1993), for choosing a regulatory approach to regulate

lead and copper levels in drinking water supplies rather than nonregulatory alternatives. Executive Order 12866 states the following:

> [E]ach agency shall identify the problem that it intends to address (including, where applicable, the failures of the private markets or public institutions that warrant new agency action) as well as assess the significance of that problem (Section 1, b(1)).

In addition, OMB Circular A-4, dated September 17, 2003, states that

> "… [the analyst] should try to explain whether the action is intended to address a significant market failure or to meet some other compelling public need such as improving governmental processes or promoting intangible values such as distributional fairness or privacy" (USOMB, 2003).

In the case of the final LCRR, several properties of public water suppliers do not satisfy the conditions for a perfectly competitive market and thus lead to market failures that require regulation. In a perfectly competitive market, prices and quantities are determined solely by the aggregated decisions of buyers and sellers. Such a market occurs when many producers of a product are selling to many buyers, and where both producers and consumers have perfect information on the characteristics and prices of each firm's products. Barriers to entry in the industry cannot exist, and individual buyers and sellers must be "price takers" (i.e., their individual decisions cannot affect the price).

Many systems are natural monopolies. A natural monopoly exists when it is impossible for more than one entity in each area to recover the costs of production and survive. For PWSs, there are high fixed costs associated with reservoirs and wells, transmission and distribution systems, treatment plants, and other facilities. For other potential suppliers to enter the market, they would need to provide the same extensive infrastructure to realize similar economies of scale and be competitive. A splitting of the market with increased fixed costs (e.g., two supplier networks in a single market) usually makes this situation unprofitable. The result is a market suitable for a single supplier and hostile to alternative suppliers. In such natural monopolies, suppliers have fewer incentives for providing quality services or maintaining competitive prices. In these situations, governments often intervene to help protect the public interest. Consumers may purchase bottled water, but this option can be much more expensive due to the inefficiencies of bottling and transporting bottled water. Consumers may also install and operate home treatment systems, but this can also be considerably more expensive because they do not have the economies of scale of large centralized water systems and home treatment systems potentially can lead to increased health risks when not regularly maintained by the consumer.

For example, because systems are legal, as well as natural monopolies, they are often subject to price controls if not outright public ownership. Although customers may demand improvements in water quality, the regulatory structure may not facilitate the transmission of that demand to the water supplier or allow the supplier to raise its price to recover the cost of the improvements. If consumers do not believe that their drinking water is safe enough, they cannot simply switch to another water utility. Other options for obtaining safe drinking water (e.g., buying bottled water or installing POU filtration) most often represent a higher water cost to consumers than purchasing from systems. Therefore, the water supplier may have little incentive to improve water quality.

The public may also not understand the health and safety issues associated with poor drinking water quality, resulting in the existence of inadequate or asymmetric information. Understanding the health risks posed by trace quantities of drinking water contaminants involves analysis and synthesis of complex toxicological and health sciences data. Therefore, the public may not be aware of the risks it faces. EPA has implemented a CCR Rule (USEPA, 1998) that makes water quality information more easily available to consumers. This rule requires CWSs to publish an annual report on local drinking water quality. Consumers, however, still need to analyze this information for its health risk implications. Furthermore, even if informed consumers can engage systems in a dialogue about health issues, the transaction costs of such interaction (measured in personal time and monetary outlays) present another significant impediment to consumer expression of risk reduction preferences.

Several of the rule changes under the final LCRR specifically compensate for inadequate or asymmetric information. For example, the final LCRR greatly expands the PE and outreach requirements to provide consumer notice to individuals with a lead test result above the lead AL as soon as practicable but no later than 3 days, and educational materials to those served by LSLs, and those potentially impacted by disturbances to a known or potential service line containing lead. The requirements also extend beyond the customer base to state and local health agencies and require greater public accessibility to information on lead-related information, such as LSL locations and lead tap sample results. The more robust PE will provide consumers will more timely and useful information to make more informed decisions and subsequently reduce their exposure to lead.

Overall, the SDWA regulations are intended to provide health protection from exposure to drinking water contaminants. The regulations set minimum safety standards to protect consumers from exposure to contaminants in drinking water supplies. The SDWA regulations are not intended to restructure market mechanisms or establish competition in supply; rather, they establish the level of service to be provided that best reflects public preference for safety. Federal regulations reduce the high information and transaction costs by acting on behalf of consumers in balancing risk reduction and the social costs of achieving this risk reduction.

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3 Regulatory Revisions

3.1 Introduction

This chapter describes the regulatory revisions for the final Lead and Copper Rule revisions (LCRR) that are evaluated as part of this economic analysis (EA). The United States Environmental Protection Agency (EPA) considered the input from the National Drinking Water Advisory Council (NDWAC); state, local and tribal governments; the Science Advisory Board (SAB); and input received during the proposed rule comment period. See Chapter 2 for additional information on the rule development process.

The LCRR provides greater and more effective protection of public health by reducing exposure to lead and copper in drinking water. The rule will better identify high levels of lead, improve the reliability of lead tap sampling results, strengthen corrosion control treatment (CCT) requirements, expand consumer awareness, and improve risk communication. This final rule requires, for the first time, community water systems (CWSs) to conduct lead-in-drinking-water testing and public education (PE) in schools and child cares. In addition, the rule will accelerate lead service line replacements (LSLRs) by closing existing regulatory loopholes, propelling early action, and strengthening replacement requirements.

The remainder of this chapter presents each rule revision and is organized as follows:

- **Section 3.2** – Action Level, Trigger Level, and Small System Flexibilities.
- **Section 0** – Lead and Copper Tap Sampling.
- **Section 3.4** – Corrosion Control Treatment and Water Quality Parameter Monitoring.
- **Section 3.5** – Lead Service Line Inventory and Replacement.
- **Section 3.6** – Point-of-Use Treatment.
- **Section 3.7** – Replacement of Lead-Bearing Plumbing Materials.
- **Section 3.8** – Lead Public Education and Outreach.
- **Section 3.9** – Change in Source or Treatment.
- **Section 3.10** – Source Water Monitoring and Treatment.
- **Section 3.11** – Public Education and Sampling at Schools and Child Cares.
- **Section 3.12** – Other Proposed Rule Changes.
- **Section 3.13** – Primacy Agency Reporting and Recordkeeping Requirements and Special Primacy Conditions.

Sections 3.2 through 3.11 provide a description of the previous rule requirements, the regulatory changes, and rationale for the changes. Section 3.12 presents other changes to rule language including removal of obsolete terms and dates. Section 3.13 includes Primacy Agency reporting and recordkeeping requirements and special primacy conditions under the final LCRR.

3.2 Action Level, Trigger Level, and Small System Flexibilities

3.2.1 Additional Requirements Related to the Action Level and New Trigger Level

3.2.1.1 *Previous Rule*

The previous rule set an action level (AL) of 15 µg/L for lead and an AL of 1.3 mg/L for copper. If a system exceeded the AL in more than ten percent of tap water samples collected during any monitoring period (i.e., if the 90th percentile level was greater than the AL) the system had not violated the rule but was required to take certain actions. These actions included CCT steps, water quality parameter (WQP) monitoring, PE, source water monitoring, and source water treatment (if needed). Systems that exceeded the lead AL after CCT is in place were required to replace lead service lines (LSLs).

3.2.1.2 *Description of Final Regulatory Change*

The final LCRR triggers certain requirements according to the system's lead 90th percentile level. The final LCRR establishes a new lead trigger level (TL) of 10 µg/L in addition to the AL of 15 µg/L established under the previous rule. The LCRR requires actions based on whether a system's 90th percentile lead level exceeds the TL and AL:

- **No Trigger Level Exceedance/Action Level Exceedance (TLE/ALE):** Lead 90th percentile level is at or below the TL of 10 µg/L.
- **TLE:** Lead 90th percentile level exceeds the TL but is at or below the lead AL of 15 µg/L.
- **ALE:** Lead 90th percentile level is above the AL of 15 µg/L.

Exhibit 3-1 includes the lead 90th percentile ranges for no TLE or ALE, TLE, and ALE.

Exhibit 3-1: Lead 90th Percentile Level Categories

No TLE/ALE	TLE	ALE
P90: ≤ 10 µg/L	10 µg/L < P90 ≤ 15 µg/L	P90: > 15 µg/L

Acronyms: ALE = action level exceedance; P90 = lead 90th percentile level; TLE = trigger level exceedance.

Final requirements affected by lead 90th percentile levels are related to lead tap samples, lead CCT, LSLR, PE, and small CWS and non-transient non-community water system (NTNCWS) compliance alternatives to lead CCT and LSLR. Exhibit 3-2 outlines LCRR requirements that are dependent on a system's lead 90th percentile level and provides the section in this chapter in which each requirement is discussed.

Exhibit 3-2: Final LCRR Requirements Dependent on 90th Percentile Level[1]

Category	Requirement	Section
Lead Tap Sampling	Tiering and sample protocol requirements	3.3.1
	Sampling frequency and number of samples	3.3.3

Category	Requirement	Section
WQP	Continued WQP monitoring for systems serving ≤ 50,000 people with an ALE	3.4.1
CCT	CCT steps	3.4.2
LSLR	Full LSLR	3.5.2
	Targeted PE to LSL consumers	3.5.3
Compliance Alternative: POU Provision	POU provision and maintenance for CWSs serving ≤ 10,000 people and all NTNCWSs	3.6.1
Compliance Alternative: Replacement of Lead-Bearing Plumbing Materials	Replacement of lead-bearing plumbing materials for CWSs serving ≤ 10,000 people and all NTNCWSs	3.7.1
PN	Notice of lead ALE within 24 hours	3.8.1

Acronyms: ALE = action level exceedance; CCT = corrosion control treatment; LSLR = lead service line replacement; NTNCWS = non-transient non-community water system; PN = public notice; POU = point-of-use; WQP = water quality parameter.

Notes:

[1] This table does not include requirements under the previous rule that remain unchanged by the final LCRR (e.g., those pertaining to copper, PE after a lead ALE).

Final rule requirements for systems that are at or below the lead TL are similar to the previous rule requirements for systems at or below the AL. Systems with a TLE must conduct planning steps to help address lead in the event that a system has an ALE in the future. Systems with a TLE that also have LSLs and CCT are subject to additional requirements. In addition, the final LCRR requires more stringent actions in the areas of CCT, WQP, and LSLR compared to the previous rule for systems with an ALE. The final LCRR is also codifying the statutory requirement for Tier 1 public notice (PN)[13] in response to a lead ALE.

A system without LSLs can use grandfathered data that meets the tap sampling protocol and revised tiering criteria under the final rule to determine its initial lead 90th percentile level. This level will be used to establish many of the system's initial requirements under the final LCRR. Systems without LSLs and with lead 90th percentile levels at or below 10 µg/L can remain on their current monitoring schedule. Because some requirements are based on a system's lead 90th percentile level, a system can become subject to a different set of requirements based on one tap sampling monitoring period[14] or two consecutive tap sampling monitoring periods if a system is on semi-annual monitoring. Note that some requirements that were initiated when the system had a lead TLE or ALE must be completed or

[13] In 2016, Section 2106 of the Water Infrastructure Improvements for the Nation Act (WIIN Act) expanded Section 1414 of the Safe Drinking Water Act (SDWA) to include lead ALEs as a Tier 1 PN. See Section 3.8.1 for more information.

[14] For improved clarity, the final rule defines two new terms related to the timing of when a tap sample must be collected. The term "tap sampling monitoring period" pertains to the frequency with which a system must conduct tap monitoring, i.e., semi-annually, annually, triennially, or every 9 years. The term "tap sampling period" indicates when within the tap sampling monitoring period systems on reduced monitoring must collect the sample. The final LCRR retains the previous rule's specifications of June through September or an alternate consecutive 4-month period designated in writing by the Primacy Agency.

continued regardless of whether the system no longer has a lead TLE or ALE. See Section 3.3.3 for more information about tap monitoring requirements.

The final LCRR does not modify any copper requirements under the previous rule. This includes no modification to the copper AL or actions required in response to a copper ALE.

3.2.1.3 *Rationale for Final Regulatory Change*

The use of a trigger level of 10 µg/L in the implementation of the LCRR provides a reasonable concentration, one that is below the AL and above the practical quantitation limit (PQL) for lead of 5 µg/L specified in 40 CFR141.89(a)(1)(ii)(A) at which to require water systems to take a progressive set of actions to reduce lead levels prior to an ALE and to have a plan in place to rapidly respond if there is an ALE. EPA has found that a significant number of benefits accrue from systems being required to take mitigation activities as a result of TLEs (see Chapter 6, Section 6.4.6 for additional information). EPA also examined the costs and found that it is feasible for systems to take the actions required when there is a TLE. Requiring these actions when a system's lead levels are high, but not exceeding the AL, will help both systems and Primacy Agencies to engage in a methodical process to reduce lead levels in drinking water so that they remain at or below the lead AL. Accordingly, inclusion of the TL in the final rule will provide for "greater protection of the health of persons" consistent with the statutory authority in Section 1412(b)(9) of the Safe Drinking Water Act (SDWA) for revising existing drinking water standards. Additionally, this proactive approach to lead contamination in response to a TL will reduce the likelihood that a water system will exceed the AL in the future or be faced with the need to implement emergency measures such as the distribution of water filters or bottled water in response to a lead crisis.

This regulatory framework is similar to other National Primary Drinking Water Regulations (NPDWRs), such as the Long-Term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR), which requires increasing levels of remedial action based on the concentration of the contaminant (USEPA, 2006a). The LCRR sets the fewest requirements for systems at or below the TL and the most stringent requirements for systems above the lead AL. In addition, the new intermediate requirements for systems with a TLE (i.e., above the TL but below or equal to the AL) accomplish two goals. Specifically, they require systems to: 1) take certain immediate actions to protect public health, and 2) take preparatory actions that will allow them to more quickly address elevated lead levels if they have an ALE in the future. These immediate and preparatory actions are related to CCT (see Section 3.4.2), LSLR (see Section 3.5.2), point-of-use (POU) devices (see Section 3.6.1), and replacement of lead-bearing plumbing materials (see Section 3.7.1).

3.2.2 **Small System Flexibilities**

3.2.2.1 *Previous Rule*

The previous rule required small and medium systems (i.e., systems serving 50,000 people or fewer people) without CCT to commence CCT steps after a lead ALE. In 1998, EPA designated CCT as an affordable compliance technology for all categories of small systems in accordance with the SDWA Section 1412(b)(4)(E)(iii) (USEPA, 1998a). There were no other additional flexibilities incorporated into the previous rule for small systems when they exceeded the lead AL.

3.2.2.2 *Description of Final Regulatory Change*

The final LCRR provides ***flexibility for small CWSs and all NTNCWSs*** to select the compliance options that best protects public health, recognizing the unique nature of these systems. Small CWSs include CWSs serving 10,000 or fewer people. This flexibility applies to small CWSs and all NTNCWSs that exceed the TL or AL. Compliance options for these systems after a TLE or ALE include CCT; provision, monitoring, and maintenance of POU devices; LSLR; and replacement of lead-bearing materials. A small CWS or any NTNCWS that exceeds the TL must collect WQPs to assist with the selection of their compliance option and submit a recommendation to the Primacy Agency for approval within six months from the end of the tap sampling monitoring period in which it exceeded the TL. The Primacy Agency has six months to approve the recommendation or designate an alternative approach. If the system has a subsequent ALE, it must implement the compliance option approved by the Primacy Agency. Exhibit 3-3 provides a summary of small system flexibility requirements and provides subsequent sections where each option is discussed in more detail.

Exhibit 3-3: Summary of Requirements for Small CWSs and All NTNCWSs that have a TLE/ALE by Compliance Option

Compliance Option	Other System Restrictions	After a TLE, the system must:	After an ALE, the system must:[1]
Install or re-optimize CCT (see Section 3.4.2)	Systems without CCT must install CCT, and systems with CCT must re-optimize CCT	Collect WQPs and submit a recommendation to the Primacy Agency for approval within six months and conduct a CCT study (if required)	Install and maintain or re-optimize CCT based on a schedule approved by the Primacy Agency
LSLR[2] *(see Section 3.5.2)*	Systems with LSLs must ensure they have authority or consent to remove the customer-owned portion of every LSL in the distribution system or obtain refusals/non-response from customers	Collect WQPs and submit a recommendation to the Primacy Agency for approval within six months	Implement full LSLR program on a schedule specified by the Primacy Agency, but not to exceed 15 years
POU provision, monitoring, and maintenance[2] *(see Section 3.6.1)*	Systems must be able to access homes of the residents and non-residential structures served by the system	Collect WQPs and submit a recommendation to the Primacy Agency for approval within 6 months	Install POUs on a schedule specified by the Primacy Agency, but not to exceed one year; provide PE on use of POU devices; provide ongoing maintenance; and collect tap samples at 1/3 of sites with POUs annually
Replacement of lead-bearing plumbing materials (see Section 3.7.1)	Systems without LSLs that have control over premise plumbing in all buildings served	Collect WQPs and submit recommendation to the Primacy Agency for approval within 6 months	Replace all lead-bearing plumbing on a schedule specified by the Primacy Agency, but not to exceed one year

Acronyms: ALE = action level exceedance; CCT = corrosion control treatment; LSL = lead service line; LSLR = lead service line replacement; PE = public education; POU = point-of-use; TLE = trigger level exceedance; WQPs = water quality parameters.

Notes:

[1] The recommendation must be approved by the Primacy Agency before a system implements its selected compliance option. Systems that did not have a TLE prior to an ALE must submit a recommendation to the Primacy Agency within six months from the end of the tap sampling period in which it exceeded the lead AL. The Primacy Agency has six months to approve the recommendation or designate an alternative approach. The system must implement the compliance option approved by the Primacy Agency on a schedule specified by the Primacy Agency .

[2] If a system no longer exceeds the lead AL, it must complete implementation of the option approved by the Primacy Agency unless another option is specified by the Primacy Agency.

3.2.2.3 *Rationale for Final Regulatory Change*

To address concerns that small CWSs and NTNCWSs tend to have more limited technical, financial, and managerial capacity to implement complex treatment technique rules such as the LCR (USEPA, 2011a), EPA incorporated flexibility into the final LCRR by allowing CWSs serving 10,000 or fewer people and NTNCWSs that have a TLE or ALE to choose among different compliance approaches to reduce lead levels. Small CWSs and all NTNCWSs can choose CCT, LSLR, POU devices, or replacement of all lead-bearing plumbing materials. These other options are discussed in subsequent sections: CCT (Sections 3.4.2 and 3.4.3), LSLR (Section 3.5.2), POU devices (Section 3.6.1), and replacement of lead-bearing plumbing materials (Section 3.7.1). This flexibility will allow individual systems to find the most appropriate and feasible approach to reducing lead.

EPA determined that the appropriate threshold to provide flexibility to small CWSs is 10,000 or fewer persons served because these systems typically do not have the capacity to implement multiple measures such as CCT and LSLR programs simultaneously. Small CWSs serving 10,000 or fewer people and NTNCWSs tend to have more limited technical, financial, and managerial capacity to implement complex treatment technique rules such as the LCR (USEPA, 2011a). Many small PWSs face challenges in reliably providing safe drinking water to their customers and consistently meeting the requirements of the SDWA and the NPDWRs (USEPA, 2011a). The Agency determined the compliance flexibility options would be most appropriate for small water systems that serve 10,000 or fewer persons, as they are most frequently the systems that are struggling to maintain compliance with the previous LCR and/or do not have the capacity to operate CCT in conjunction with other complex treatment technique requirements. Small water systems serving 10,000 or fewer persons have more monitoring and reporting (M&R) violations and account for approximately 90 percent of all M&R violations for all NPDWRs. The number of violations decreases as system size increases (USEPA, 2011a). Recurring M&R violations can obscure more important water quality problems because maximum contaminant level (MCL) and maximum residual disinfectant level (MRDL) violations may not be discovered if a system fails to conduct routine monitoring. M&R requirements are often the simplest compliance requirements and systems that cannot complete these procedures may have other technical, managerial, or financial issues (USEPA, 2011a).

Small system flexibilities provide alternatives to chemical treatment as it is difficult for many small systems to find operators that have the more advanced skills necessary to implement and maintain such treatment, particularly given the limited financial and programmatic capacity of many small utilities

(Kane and Tomer, 2018). EPA has concluded that these small systems will work with their state to identify the single most cost-effective measure from this list of affordable and feasible compliance options. Selection of a compliance option will depend upon the characteristics of the small system including the number of service connections, the number of LSLs and the technical capacity of the system's operators.

EPA requested comment on whether small system flexibility is needed by systems serving between 3,301 and 10,000 persons and whether a different threshold is more appropriate. EPA recognizes that while small systems serving between 3,301 and 10,000 persons may have greater technical, managerial and financial capacity than smaller systems, they still face capacity limitations. EPA has determined that it is not feasible for systems serving 10,000 or fewer persons to implement the multiple treatment technique actions of optimized CCT, PE and LSLR due to more limited financial, managerial and technical capacity. The systems serving 10,000 or fewer persons have less professional staff than the smaller systems; these systems have an average of 0.4 to 2.4 full time operators and 0.5 to 2.4 managers per system, which is 2 to 11 times less than the average number of operators in larger systems Average revenues for systems serving 10,000 or fewer people are about 4 to 170 times smaller than average revenues for larger systems (USEPA, 2009).

3.3 Lead and Copper Tap Sampling

EPA is requiring the following changes related to lead tap sampling under the LCRR:

- Require systems with known or possible LSLs to re-evaluate tap sample sites based on an LSL inventory that must be updated annually to reflect any LSLRs or changes in service line classification;[15]
- Revise tiering criteria for tap sample sites, including a new Tier 3, requiring monitoring of locations served by galvanized service lines impacted by upstream lead sources;
- Require systems with LSLs to:
    - Initially conduct monitoring under the LCRR on a semi-annual frequency including any systems previously defined as "b3" systems[16]
    - Collect all samples needed to meet minimum sampling requirements from sites served by LSLs, if available
    - Collect a fifth liter sample for lead and first liter sample for copper from sites served by LSLs

[15] Service line classifications are discussed in Section 3.5.1.2.

[16] Under the previous rule, the criteria in 40 CFR 141.81(b)(3) were met if for two consecutive six-month tap sampling monitoring periods, the system's: 1) 90th percentile lead level minus the highest source water level was < 0.005 mg/L; or 2) Source water lead levels were below the method detection limit (MDL) and the 90th percentile lead level was < 0.005 mg/L. These systems were on triennial tap monitoring. Under the final LCRR, "b3" systems must demonstrate their lead 90th percentile levels are ≤ practical quantitation limit of 0.005 mg/L and copper 90th percentile levels are ≤ 1.3 mg/L for two consecutive tap sampling monitoring periods.

- Calculate their lead 90th percentile level using only tap samples from locations with LSLs, if a system has a large enough LSL sampling pool to obtain the required minimum number of tap samples;

- Require sampling instructions to specify the use of wide mouth one-liter bottles and to prohibit sampling instructions that instructed samplers to perform flushing prior to the stagnation period or aerator removal and cleaning prior to sampling;
- Use a system's lead 90th percentile as a criterion to determine monitoring requirements (i.e., frequency of tap sampling and number of required samples); and
- Require systems to make their tap sampling results used in their 90th percentile calculation publicly available within 60 days of the end of the applicable tap sampling monitoring period. See Section 3.8.2.2.2 for additional detail.

As a result of changes to the sampling requirements based on the lead 90th percentile, the sampling schedule and number of samples required for lead and copper may be different for systems with lead 90th percentile levels with a TLE or ALE. For example, a system may be on a semi-annual schedule for lead but a triennial schedule for copper. The final regulatory changes are discussed in more detail in Sections 3.3.1 through 3.3.3. Exhibit 3-4 provides a summary of final revisions to lead and copper tap sampling requirements and indicates to which systems the requirements apply.

Exhibit 3-4: Summary of Lead and Copper Tap Sampling Requirements under the Final LCRR

Final Revisions	Applies to:	Based on the Following P90 Levels:		
		No TLE/ALE P90: ≤10 µg/L	**TLE** 10 µg/L < P90 ≤ 15 µg/L	**ALE** P90: >15 µg/L
Lead and Copper Tap Sampling[1]				
Re-evaluate LCR tap sample sites based on LSL inventory and revised tiering requirements.	All CWSs and NTNCWSs	X	X	X
Conduct sampling that is consistent with EPA's February 29, 2016 guidance.[2]		X	X	X
Conduct monitoring annually at the standard number of sites, or triennially or every 9 years at the reduced number of sites.[3]		X		
Conduct monitoring annually at the standard number of sites.			X	
Conduct monitoring semi-annually at the standard number of sites.				X
Make lead sampling data publicly available.		X	X	X

Final Revisions	Applies to:	Based on the Following P90 Levels:		
		No TLE/ALE P90: ≤10 µg/L	**TLE** 10 µg/L < P90 ≤ 15 µg/L	**ALE** P90: >15 µg/L
Re-evaluate LCR tap sample sites based on updated LSL inventory.	CWSs and NTNCWSs with LSLs[4]	X	X	X
Conduct initial tap sampling semi-annually.		X	X	X
Collect 100 percent of tap samples from sites served by LSLs.[5]		X	X	X
Collect fifth liter sample for lead from sites served by LSLs.		X	X	X
Calculate 90th percentile based on LSL sites only.[5] Include lower tiers only when sites from higher tiers are unavailable.		X	X	X

Acronyms: ALE = action level exceedance; CWS = community water system; LSL = lead service line; NTNCWS = non-transient non-community water system; P90 = lead 90th percentile level; TLE = trigger level exceedance.

Notes:

[1] A system without LSLs can use data collected under the previous rule to initially determine which level of requirements apply (i.e., no TLE/ALE, TLE, or ALE) as long as it meets the sampling requirements described in Note 2 below. A system's lead 90th percentile level must be reassessed each year based on the previous calendar year's compliance monitoring. As a result, certain requirements to which a system is subject can change when the lead 90th percentile is reassessed. However, there are some requirements that a system must complete (e.g., LSLR for CWSs serving 10,000 or fewer people and NTNCWSs) or continue (e.g., CCT operation) even if the system no longer exceeds the TL and/or AL. See Section 3.3.3.2 for additional details.

[2] EPA is codifying the requirements in the Agency's February 29, 2016 memo, Clarification of Recommended Tap Sampling Procedures for Purposes of the Lead and Copper Rule, which address aerators, pre-stagnation flushing, and bottle configuration (USEPA, 2016a).

[3] The LCR specified the minimum number of tap samples for systems on routine (or standard) and reduced monitoring. These requirements have not been modified under the LCRR. In general, the reduced number of samples is half that required under routine monitoring (see Exhibit 5-13 in Chapter 5 for additional detail).

[4] Systems documented as non-LSL systems that discover an LSL must inform the Primacy Agency and will become subject to the requirements of an LSL system.

[5] LSL systems that are unable to collect all their samples from sites served by LSLs must use only the highest lead values from non-LSL sites needed to meet minimum sampling requirements in their 90th percentile calculation but must still report all sample results to the Primacy Agency.

3.3.1 Re-evaluation of Tap Sample Sites Based on LSL Inventory and Revised Tiering Criteria

3.3.1.1 *Previous Rule*

The previous rule (40 CFR 141.86(a)) established a tiering system for prioritizing the selection of sampling sites based on the likelihood of finding the highest lead levels. Systems were required to conduct a one-time materials evaluation of their distribution system prior to the commencement of monitoring to identify tap sample sites that meet the tiering criteria. EPA established three tiers for CWSs and two for NTNCWSs, with Tier 1 being the highest priority (see Exhibit 3-5). Under the previous

rule, systems were required to use all Tier 1 sites if available. If systems could not identify enough Tier 1 sites to meet their minimum sampling requirements, they had to select Tier 2 sites, followed by Tier 3 sites, and then representative sites. Public water systems (PWSs) with known LSLs were required to collect at least 50 percent of their tap samples at known LSL sites. Further, any additional monitoring above the minimum tap monitoring requirements had to be used in calculating the lead and copper 90th percentile levels (40 CFR 141.86(e)).

Exhibit 3-5: Previous Lead and Copper Site Selection Criteria

Tier	CWSs	NTNCWSs
Tier 1	Collect samples from SFSs*: • with copper pipe and lead solder installed after 1982 *(but before the effective date of the state's lead ban)*, or with lead pipes; and/or • served by LSLs. *Tier 1 samples can be collected from MFRs if they represent at least 20 percent of structures served by the water system.	Collect samples from buildings: • with copper pipe and lead solder installed after 1982 *(but before the effective date of the state's lead ban)*, and/or • served by LSLs.
Tier 2	Collect samples from buildings and MFRs: • with copper pipe and lead solder installed after 1982, or with lead pipes; and/ or • served by LSLs.	Collect samples from buildings with copper pipe and lead solder installed before 1983.
Tier 3	Collect samples from SFSs with copper pipes with lead solder installed before 1983.	N/A
	Representative sample where the plumbing is similar to that used at other sites served.	Representative sample where the plumbing is similar to that used at other sites served.

Acronyms: CWS = community water system; LSL = lead service line; MFR = multi-family residence; N/A = not applicable; NTNCWS = non-transient non-community water system; SFS = single family structure.

3.3.1.2 *Description of Final Regulatory Change*

Under the final LCRR, all CWSs and NTNCWSs regardless of their lead 90th percentile level must re-evaluate Lead and Copper Rule (LCR) sample sites based on an LSL inventory, which is discussed further in Section 3.5.1. The revised site sample plan must be submitted to the Primacy Agency prior to the compliance date of the rule. If any changes are made to tap sampling locations, these changes must be reflected in the site sample plan before they are implemented by the system. The final LCRR also requires systems to provide in their sampling plan a list of all tap WQP sampling sites. See Section 3.4 for a detailed discussion of WQP requirements including new WQP requirements for systems with CCT that have a single sample above 15 µg/L. EPA is also revising and simplifying the tap sample site tiering criteria to emphasize sampling from LSL sites and to recategorize all copper pipe with lead solder sites regardless of age (i.e., installed after 1982/before 1983) into a single tier. For CWSs, Tier 1 and 2 sites are LSLs sites served by a single family structure or multi-family residences, respectively. For NTNCWSs, Tier 1 sites are buildings served by LSLs. There are no Tier 2 sites for NTNCWSs. Tier 3 sites are single family structures for CWSs or buildings for NTNCWSs, respectively, with galvanized service lines that are currently or were previously downstream from an LSL or lead connector. For CWSs, Tier 4 sites are

copper pipes with lead solder installed before the effective date of the state's lead ban. There are no Tier 4 sites for NTNCWSs. EPA is not modifying the definition of a "representative site" but is referring to it as a "Tier 5" site. The final LCRR also retain the requirement for systems to collect samples from these locations if they have an insufficient number of available Tier 1 - 4 sites for CWSs or Tier 1 or 3 sites for NTNCWSs. Exhibit 3-6 provides a summary of the revised site selection criteria.

Exhibit 3-6: Revised Lead and Copper Site Selection Criteria under the Final Rule

Tier	CWSs	NTNCWSs
Tier 1	Collect samples from SFSs served by LSLs.* *Tier 1 samples can be collected from MFRs if they represent at least 20 percent of structures served by the water system.	Collect samples from buildings served by LSLs.
Tier 2	Collect samples from buildings and MFRs served by LSLs.	N/A.
Tier 3	Collect samples from SFSs with galvanized service lines downstream of an LSL, currently or in the past or known to be downstream of a lead connector.	Collect samples from buildings with galvanized service lines downstream of an LSL, currently or in the past or known to be downstream of a lead connector.
Tier 4	Collect samples from SFSs with copper pipes with lead solder installed before *the effective date of the state's lead ban*.	N/A.
Tier 5	Representative sample where the plumbing is similar to that used at other sites served.	Representative sample where the plumbing is similar to that used at other sites served.

Acronyms: CWS = community water system; LSL = lead service line; MFR = multi-family residence; N/A = not applicable; NTNCWS = non-transient non-community water system; SFS = single family structure.

Systems with LSLs must collect all tap samples from sites served by LSLs, if available. However, systems with LSLs that have an insufficient number of LSL sites must collect samples from every LSL site and collect the remaining samples from non-LSL sites (Tier 3 through Tier 5). In calculating the lead and copper 90th percentiles, systems must use all sample results from LSL sites and the highest lead and copper values from non-LSL sites (to meet the minimum number of required samples). This clarification is intended to prevent "diluting" the lead 90th percentile level. For example, an LSL system that is required to collect a minimum of 100 samples from LSL sites but only has 80 of these sites available and collects 25 samples from non-LSL sites must use only the 20 highest non-LSL samples in its 90th percentile calculation. In addition, systems with LSLs that have an insufficient number of LSL sites are required to report in the site sample plan why they cannot complete their sampling pool with LSL sites.

A system collecting more than the minimum number of required samples from LSL sites (Tier 1 and/or Tier 2 sites) must use all samples in the 90th percentile calculations. Non-LSL systems must continue to use all samples that meet the sampling criteria in their lead and copper 90th percentile calculations. Similarly, all systems must use all samples that meet the sampling criteria in their copper 90th percentile calculations.

The final rule also clarifies that systems that have a customer-requested testing program[17] may include any samples in the 90th percentile calculations that meet the tiering and sampling protocol requirements. For LSL systems, this includes fifth liter samples collected from Tier 1 and 2 sites for CWSs and Tier 1 sites for NTNCWSs. For non-LSL sites, this includes any first liter sample that meets the sampling protocol described in Section 3.3.2.2. EPA also clarified that lead testing results from follow-up samples collected under the find-and-fix provisions (see Section 3.4.5) or after an LSLR (see Section 3.5.2.2) are not included in the 90th percentile calculation but must be submitted to the Primacy Agency.

Systems must report to the Primacy Agency all tap samples including those above the minimum requirement that were excluded from the 90th percentile calculation. This reporting requirement will allow the Primacy Agency to confirm that the system used the highest lead samples from non-LSL sites in its lead 90th percentile calculation. In addition, systems with LSLs that do not have a sufficient number of LSLs in their sampling pool must provide documentation that supports this conclusion to their Primacy Agency.

3.3.1.3 *Rationale for Final Regulatory Change*

Under the final LCRR, LSL systems must select tap sampling sites based on up-to-date service line inventory information and collect samples from the locations in the system that are with the greatest likelihood of having high lead levels. The requirement for systems with LSLs to evaluate sample sites compared to an updated inventory will ensure that samples will be collected from sites that are most likely to yield higher lead results. Systems with documentation that they have no LSLs would not be required to update tap sample sites based on the inventory data. See Section 3.5.1 for additional information on the LSL inventory requirements.

The previous rule required CWSs to collect samples at taps from residences that have lead pipes and/or are served by an LSL, and/or from sites that have copper pipes with lead solder installed after 1982 (but before the effective date of the state's lead ban). The rationale for the previous rule tiering criteria was to prioritize sites with the greatest likelihood of having the highest lead levels at that time. The lead solder date requirement was based on a study in which lead leaching from solder was found to decline after five years (USEPA, 1990a).[18] At the time the previous rule was developed, samples collected from more recently soldered copper pipes would have been expected to have higher lead results. More than thirty years have passed since lead solder was banned in all jurisdictions. As a result, there have been no newly added sites with lead solder, and old sites with lead solder would be less likely to yield high lead levels. Current scientific evidence supports the prioritization of LSLs as Tier 1 and Tier 2 sites (Giani et al., 2005; Sandvig et al., 2008; Muylwyk et al., 2009; HDR Engineering, 2011; Kempic, 2011; McFadden et al., 2011). Sites with copper pipe and lead solder are still part of the tiering criteria, but they are now Tier 4 sites for CWSs to emphasize that systems with LSLs must prioritize sampling at LSL sites (i.e., Tier 1 and 2 sites), where high lead levels are most likely to occur.

The requirement for LSL systems to collect all samples from sites with LSLs if possible, reflects research showing that when present, LSLs represent the largest source of lead in tap water (Sandvig et al., 2008). Systems should assess their 90th percentile level and, where applicable, operate their CCT based on

[17] Some water systems offer free testing programs to their customers.

[18] Based on first-draw samples collected from homes with a construction age ranging from less than one year to more than 20 years (USEPA, 1990a).

sampling results from all high-risk LSL sites. As a result, EPA is requiring LSL systems that collect more than the minimum number of required samples from LSL sites to use all samples in the 90th percentile calculation. EPA also recognizes that some systems with LSLs may not have access to a sufficient number of LSL sites and in some instances will need to use non-LSL sites. The previous rule (40 CFR 141.86(e)) required systems to include all samples that meet the monitoring specifications in 40 CFR 141.86 in the 90th percentile calculation. However, the final LCRR specifies that LSL systems that include non-LSL sites must only include the highest lead sampling results from the non-LSL sites to meet the minimum sampling requirements. This will help minimize a situation in which inclusion of additional non-LSL sites lowers the lead 90th percentile level to at or below the TL or AL and results in a system's not being required to take additional actions to address lead. LSL systems that use non-LSL sites in the lead 90th percentile calculations would also be required to report all collected samples to the Primacy Agency so that the Primacy Agency can confirm that the system used the correct sampling sites in their 90th percentile calculation.

Commenters on the proposed rule raised concerns about water systems with few or no LSLs, but that have galvanized service lines impacted by lead, or lead goosenecks, pigtails, or connectors in their distribution system. EPA agrees that galvanized service lines impacted by lead, or lead goosenecks, pigtails or connectors should be considered in the tiering criteria for selecting tap samples and has modified the final rule to reflect this. EPA revised the tap sampling criteria to include five tiers. EPA added Tier 3 for galvanized service lines impacted by lead, or lead goosenecks, pigtails, or connectors for sites. This revision ensures that priority is given to highest risk lead sources in the absence of LSLs. Galvanized lines that are or were downstream of a lead source such as an LSL can contribute to lead in drinking water. These lines have zinc coating containing lead that can leach into drinking water when corroded, and they also can capture lead from upstream lead sources and release lead if water quality changes or these pipes are disturbed. In this way, these materials are prioritized in tap sampling site selection and will be sampled for non-LSL systems.

EPA clarified in the final LCRR that systems with a customer-requested sampling program must include customer-requested sample results in the 90th percentile calculations only if they were collected from the appropriate tiered sites, i.e., LSL sites for systems with LSLs, and in accordance with tap sampling requirements in the final LCRR. Including these results provides a more representative 90th percentile calculation. Customer-requested samples that do not follow these requirements must not be included in the 90th percentile calculations. EPA also clarified that "find-and-fix" follow-up tap samples are not included in the system's 90th percentile calculations because multiple investigatory samples at locations with high lead levels would bias results. In addition, the sample volumes and protocols may not be consistent with the tap monitoring requirements.

3.3.2 Tap Sampling Collection Procedures

3.3.2.1 *Previous Rule*

The tap sample collection requirements specified that each tap sample must be a one-liter sample with a minimum stagnation time of 6 hours. Samples collected from residences were required to be from the cold-water kitchen or bathroom sink tap, and those from nonresidential building to be from an interior tap from which water is typically used for consumption. A one-liter first-draw sample was collected for both lead and copper analysis.

3.3.2.2 *Description of Final Regulatory Change*

The final LCRR specifies a new protocol for the collection of a sample from an LSL site. The tap sampling protocol must include instructions for correctly collecting a first-draw sample for sites without LSLs and a first-draw and a fifth liter sample for sites with LSLs. For sample sites without LSLs, the first-draw sample must be analyzed for both lead and copper. For sample sites with LSLs, the sampler uses five one-liter bottles in which the first-draw sample is returned for copper analysis based on the system's copper monitoring schedule[19] and the fifth liter is used for lead analysis. See Section 3.3.3.2 for a discussion of lead and copper monitoring schedules.

The final LCRR also codifies the tap monitoring procedures outlined in EPA February 29, 2016 guidance, "Clarification of Recommended Tap Sampling Procedures for Purposes of the Lead" (USEPA, 2016). Specifically, the final LCRR:

- Prohibits systems from including recommendations in the sampling instructions provided to consumers or sample collectors to remove and clean aerators or to conduct pre-stagnation flushing prior to the start of the required stagnation period. Systems must supply samplers/consumers with wide-mouth bottles to collect a tap sample. The final rule also defines a wide-mouth bottles to those "configured with a mouth that is at least 55 mm wide that are one liter in size."
- Requires systems to submit to the Primacy Agency a copy of the tap sampling instructions (for both first-draw and fifth liter sampling) that they plan to provide to consumers for prior review and approval. Systems must submit a certification with their monitoring results that they have not revised their Primacy Agency-approved sampling instructions. Water systems that modify the tap sampling protocol must submit the updated version of the protocol to the Primacy Agency for review and approval no later than 60 days prior to use.

3.3.2.3 *Rationale for Final Regulatory Change*

EPA is finalizing changes to the sampling procedures for collection of LCRR tap samples to better reflect the state of knowledge regarding the fate and transport of lead in distribution systems and to help ensure that collection procedures do not potentially result in tap samples that erroneously reflect lower lead concentrations. Specifically,

- <u>Requiring a fifth liter sample from LSL sites:</u> EPA has determined the fifth liter is the most appropriate sample for sites served by an LSL and will better target areas with the greatest potential for lead contamination of drinking water and most in need of remediation. Numerous studies have evaluated the contribution of lead in drinking water from different sources (e.g., service lines, faucets, meters). A study published by American Water Works Association (AWWA) Water Research Foundation (2008) ''Contributions of Service Line and Plumbing Fixtures to Lead and Copper Rule Compliance Issues'' (Sandvig et al., 2008) estimates that 50

[19] Given the sampling results in past monitoring periods a system may be required to sample for copper and lead at different frequencies. For example, a system on triennial monitoring for both lead and copper may have a lead ALE but no copper ALE in a specific monitoring period. This system would then be required to sample for lead on a semi-annual basis but remain on a triennial frequency for copper monitoring. In this case samples at LSL locations will be tested for lead each semi-annual period while the copper samples will only be assessed every three years.

percent to 75 percent of lead in drinking water comes from LSLs. Thus, when present, LSLs are the greatest contributor of lead in a home's drinking water. Research using sequential tap sample collection techniques on homes with LSLs indicates that a first-draw sample may not represent the significant contributions of LSLs to a home's drinking water lead levels (Lytle et al., 2019). Therefore, relying on first liter samples for lead could allow for a situation in which there may be high lead levels in a system but a 90th percentile concentration at or below the trigger level or action level.

EPA reviewed the sampling data in the Sandvig et al., 2008; Del Toral, 2013; and Lytle et al, 2019 studies to determine the liter in any given sequential sampling profile that was most likely to contain the water that remained stagnant within a customer-owned LSL. Based on this information, EPA selected the fifth liter as the most likely to capture this water and any elevated levels of lead. Additionally, the fifth liter is more likely capture the water from the customer-owned portion of the service line, which may remain in place from partial LSLRs conducted by systems under the previous rule. The first-draw sample represents water that has traveled through the service line but that has sat in contact with the plumbing materials inside the home prior to the tap for the stagnation period. The first-draw is an effective sampling technique to identify lead corrosion from taps, solder, pipes and fittings within the home but is not an effective sampling approach to capture corrosion from LSLs. Therefore, the final LCRR requires systems to collect fifth liter samples at LSL sites because the data gathered from fifth liter samples to calculate the 90th percentile is a better indicator of the effectiveness of CCT in a system.

Requiring the fifth liter sample for tap sampling would be more representative of lead concentrations in service lines than the first liter sample, which will provide better information on the highest concentration of lead in the system's drinking water. This better information will more appropriately identify the need for required actions designed to reduce lead and copper exposure by ensuring effective CCT and re-optimization of CCT when water quality declines; enhancing WQP monitoring; implementing a "find-and-fix" process to evaluate and remediate elevated lead at a site where the individual tap sample exceeds 15 µg/L; and making consumers aware of the presence of a LSL, if applicable, to facilitate replacement of LSLs.

- Prohibiting the removal and cleaning of aerators prior to sample collection: This revision will ensure that the sample collected is representative of water in the distribution system. Removing and cleaning aerators prior to sample collection may misrepresent their contribution to lead in tap water and may result in lower lead sample results.

- Prohibiting pre-stagnation flushing prior to sample collection: Pre-stagnation flushing removes water that may have been in contact with the LSL for extended periods, which is when lead typically leaches into drinking water. This may misrepresent the range of lead concentrations that consumers are exposed to in tap water.

- Requiring use a of wide-mouth bottles: Use of a wide-mouth bottles allow for a higher flow rate during sample collection, which is more representative of the typical flow rate a consumer may use and may result in higher release of particulate/colloidal lead from pipes, compared to a narrow-necked bottle.

3.3.3 Sampling Frequency and Number of Samples Based on Lead 90th Percentile Level

3.3.3.1 *Previous Rule*

Under the previous rule, all CWSs and NTNCWSs must conduct tap sampling at a standard number of sites based on the population they serve every six months unless they qualify for reduced monitoring. Systems on reduced monitoring must collect samples during the four-month period (June – September) that represents the time of year in which the highest lead levels are expected. The Primacy Agency can approve a different four-month period during the same calendar year as may be needed for some NTNCWSs that are closed during the summer. The tap sample is analyzed for both lead and copper.

3.3.3.2 *Description of Final Regulatory Change*

Under the final LCRR, a system may be on a different monitoring schedule for lead and copper. For lead, the frequency of tap sampling and number of required samples depends on a system's lead 90th percentile level and whether or not it exceeds the copper AL as follows:

- **Systems with a lead or copper ALE** must monitor for lead every six months at the standard number of sample sites.
- **Systems with a lead TLE** must monitor annually at the standard number of sample sites.
- **Systems without a lead TLE or lead or copper ALE** are eligible to collect samples at the reduced number of sites on a triennial or nine-year monitoring and based on system size.

Lead and copper tap sampling is also affected by the use of POU devices. Small CWSs serving 10,000 or fewer people and all NTNCWSs that elect to use POU device installation and maintenance as their compliance option must monitor for lead on a different schedule (see Section 3.6.1 for additional detail).

The copper monitoring requirements are similar to those under the previous rule, which are based on the system's copper 90th percentile level and compliance with a system's optimal water quality parameter (OWQP) specifications. One difference is that a system's lead 90th percentile level is not always a factor in determining the system's copper monitoring requirements.

For both lead and copper, the final LCRR retains the requirement that systems sampling annually or less frequently must collect samples during the summer months or Primacy-approved alternate four-month period. In addition, the final LCRR does not modify the required number of samples under standard and reduced monitoring from the previous rule.

Exhibit 3-7 provides a comparison of the criteria for reduced and increased lead and copper tap sampling under the previous rule and the separate criteria under the final LCRR for lead and copper tap sampling. This exhibit does not apply to CWSs serving 10,000 or fewer people or NTNCWSs implementing the POU program (see Section 3.6.1 for additional detail).

Exhibit 3-7: Criteria for Increased and Reduced Tap Sample Monitoring

Frequency and # of Samples	Previous Rule Criteria for Lead and Copper	Final Rule Criteria for Lead	Final Rule Criteria for Copper
Semi-Annually at Routine Number of Sites	• P90 is > 15 µg/L and/or Cu90 is > 1.3 mg/L during any tap sampling monitoring period; and/or • Has an OWQP excursion[1] for more than 9 days in a 6month period.	• ALE: P90 is > 15 µg/L during any tap sampling monitoring period. • After Primacy Agency sets OWQPs following CCT installation or re-optimization • Lead ALE or has an OWQP excursion[1] for more than 9 days in a 6-month period. • New water systems that begin operation after effective date. • Initial monitoring: Systems with LSLs optimized under 40 CFR 141.81(b)(3).[2]	• Cu90 is > 1.3 mg/L during any tap monitoring period; and/or • Has an OWQP excursion[1] for more than 9 days in a 6-month period.
Annually at Routine Number of Sites	• N/A under the previous rule.	• No TLE/ALE: P90 is ≤ 10 µg/L, Cu90 is ≤ 1.3 mg/L, and meets OWQP specifications (if applicable) for 2 consecutive 6-month tap sampling monitoring periods. • TLE: 10 µg/L < P90 ≤ 15 µg/L, Cu90 is ≤ 1.3 mg/L, and meets OWQP specifications (if applicable) for 2 consecutive 6-month tap sampling monitoring periods.	• TLE: 10 µg/L < P90 ≤ 15 µg/L and Cu90 is ≤ 1.3 mg/L for 3 consecutive years of monitoring.
Annually at Reduced Number of Sites	• Served ≤ 50,000 people: No lead or copper ALE for 2 consecutive 6-month tap sampling monitoring periods. • All sizes: No lead ALE and met OWQP specifications (if applicable) for 2 consecutive 6-month tap sampling monitoring periods.	• N/A under the Final Rule.	• Cu90 is ≤ 1.3 mg/L and meets OWQP specifications (if applicable) for 2 consecutive 6-month tap sampling monitoring periods.

Frequency and # of Samples	Previous Rule Criteria for Lead and Copper	Final Rule Criteria for Lead	Final Rule Criteria for Copper
Triennially at Reduced Number of Sites	• Served ≤ 50,000 people: No lead or copper ALE for 3 consecutive years. • All sizes: ○ No lead ALE and met OWQP specifications for 3 consecutive years; or ○ Met 40 CFR 141.81(b)(3);[2] or ○ P90 was ≤ 0.005 mg/L and Cu90 was ≤ 0.65 mg/L for 2 consecutive 6-month tap sampling monitoring periods.	• Serves ≤ 50,000 people: No TLE/ALE: P90 is ≤ 10 µg/L, Cu90 is ≤ 1.3 mg/L and meets OWQP specifications (if applicable) for ≥ 3 consecutive years.[3] • All sizes: P90 level is ≤ 5 µg/L and Cu90 is ≤ 0.65 mg/L for 2 consecutive 6-month tap sampling monitoring periods.	• Serves ≤ 50,000 people: Cu90 is ≤ 1.3 mg/L and meets OWQP specifications for 3 consecutive years. • All sizes: ○ Meets 40 CFR 141.81(b)(3) criteria[2] and OWQP specifications (if applicable); or ○ Cu90 is ≤ 0.65 mg/L and meets OWQP specifications (if applicable) for 2 consecutive 6-month tap sampling monitoring periods.
Every Nine Years at Reduced Number of Sites	Serves ≤ 3,300 people: Lead and copper 90th percentile levels are ≤ 5 µg/L and ≤ 0.65 mg/L, respectively, and all plumbing materials are free of lead- and copper-containing materials including those in buildings and residences served by the system.		

Acronyms: ALE = action level exceedance; CCT = corrosion control treatment; Cu90 = copper 90th percentile level; LSL = lead service line; MDL = method detection limit; OWQP = optimal water quality parameter; P90 = lead 90th percentile level; TLE = trigger level exceedance; WQP = water quality parameter.

Notes:

General: System size refers to the population served.

[1] OWQPs are measured to determine whether a system is operating its CCT at a level that most effectively minimizes the lead and copper concentrations at users' taps. An excursion occurs when the daily value of a WQP is below the minimum value or outside the OWQP range set by the Primacy Agency.

[2] Under the previous rule, a system met the criteria in 40 CFR 141.81(b)(3) if for two consecutive 6-month monitoring periods, the system P90 level minus its highest source water level was < 5 µg/L or its source water lead was less than the lead method detection limit and its P90 was ≤ 5 µg/L. The final rule modifies these criteria to specify they are met if for two consecutive six-month tap sampling monitoring periods, the system's lead 90th level is ≤ the practical quantitation limit of 0.005 mg/L. Also under the final LCRR, systems with LSLs need to reaffirm they meet the criteria.

[3] A system without LSLs can use grandfathered data that meets the sampling protocol under the final rule to determine its initial lead 90th percentile level. This level will be used to establish many of the system's initial requirements under the final rule. Systems with lead 90th percentile levels at or below 10 µg/L remain on their current monitoring schedule. Systems with LSLs that are optimized under 40 CFR 141.81(b)(3) are not allowed to use data and must initially monitor for lead and copper semi-annually. In addition, standard monitoring completed during both six-month periods of a calendar year can count as the first year of monitoring.

3.3.3.2.1 Initial Lead Sampling Requirements

Systems without LSLs can use their most recent monitoring round(s) conducted within three years after rule publication (i.e., "grandfathered" data) to determine their lead 90th percentile level if the system meets the monitoring requirements in Sections 3.3.1.2 and 3.3.2.2. Systems on semi-annual monitoring

must use the higher of the two lead 90th percentile levels to determine their initial level. Systems without LSLs that do not have grandfathered data and all LSL systems, including those that are optimized according to 40 CFR 141.81(b)(3), must monitor semi-annually at first and use the lead 90th percentile results from the first year of monitoring under the final LCRR (between the final rule publication and compliance date that is three years later). The initial lead 90th percentile level will be used to establish many of the system's requirements under the final LCRR. Systems without LSLs with lead 90th percentile levels at or below 10 µg/L can remain on their current monitoring schedule.

3.3.3.2.2 Reassessment of Lead 90th Percentile Levels

Under the final rule, a system will assess its lead 90th percentile levels each calendar year in which it conducts lead tap sampling to determine if its levels place it in a different lead 90th percentile category as outlined in Exhibit 3-8 below.

Exhibit 3-8: Criteria for Moving Lead 90th Percentile Categories under the Final Rule

Change from P90 Category of:	To P90 Category of:	If P90 Level in the Prior Tap Sampling Monitoring Period Is:
ALE	TLE	• > 10 but ≤ 15 µg/L for two consecutive 6-month tap sampling monitoring periods, ***or*** • > 10 but ≤ 15 µg/L for one of the 6-month monitoring periods and ≤ 10 µg/L for the other.
ALE	No TLE or ALE	≤ 10 µg/L for two 6-month tap sampling monitoring periods.
TLE	ALE	> 15 µg/L in the prior tap sampling monitoring period.
TLE	No TLE or ALE	≤ 10 µg/L in the prior tap sampling monitoring period.
No TLE/ALE	ALE	> 15 µg/L in the prior tap sampling monitoring period.[1]
No TLE/ALE	TLE	> 10 but ≤ 15 µg/L in the prior tap sampling monitoring period.[1]

Acronyms: ALE = action level exceedance; TLE = trigger level exceedance; P90 = lead 90th percentile level.
Notes:
[1]Systems without a TLE/ALE can be on annual, triennial, or 9-year monitoring frequency.

Systems that have a lead 90th percentile level that places them into a different lead 90th percentile category must begin complying with the requirements of the new category at the start of the next calendar year. For example, if a system that previously had an ALE conducts monitoring in year 5 that meets the specifications of a system with a TLE, the system must begin complying with the requirements for systems with a TLE in year 6.

It is important to note that systems that no longer have a TLE or ALE (e.g., lead 90th percentile levels decreased) must continue or complete certain requirements. Requirements that must be completed by systems that no longer have a TLE are listed in Exhibit 3-9. Requirements that must be completed by systems that no longer have an ALE are listed in Exhibit 3-10.

Exhibit 3-9: Final LCRR Requirements that Must Be Completed or Continued if a System No Longer Exceeds the TL

Applies To:	Requirement to be Completed/Continued	Section
• CWSs serving 10,001 to 50,000 • CWSs serving ≤ 10,000 and NTNCWSs in which CCT is their approved compliance option	Submit a recommendation for OCCT or re-optimized OCCT	3.4.2
• CWSs serving > 10,000 • CWSs serving ≤ 10,000 and all NTNCWSs in which CCT is their approved compliance option	Conduct a CCT study to determine re-optimized OCCT[1]	3.4.2
• CWSs serving > 10,000 with CCT • CWSs serving ≤ 10,000 and all NTNCWSs with CCT in which CCT as their approved compliance option	Re-optimize CCT	3.4.2
CWSs serving > 10,000 with LSLs	Meet annual replacement goal and any additional needed outreach	3.5.2
CWSs serving ≤ 10,000 and all NTNCWSs with LSLR as their approved compliance option	Submit a recommendation to the Primacy Agency	3.5.2
CWSs serving ≤ 10,000 and all NTNCWSs that select the POU as their approved compliance option	Submit a recommendation to the Primacy Agency	3.6.1
CWSs serving ≤ 10,000 and all NTNCWSs that select the lead-bearing compliance option: • With no LSLs • That replaced all LSLs but remain above the lead AL	Submit a recommendation to the Primacy Agency	3.7.1

Acronyms: AL = action level; CCT = corrosion control treatment; CWS = community water system; LSLs = lead service lines; NTNCWS = non-transient non-community water system; OCCT = optimal corrosion control treatment; POU = point-of-use.

Note:

See Section 3.4.2 for situations in which a Primacy Agency may waive the study requirement.

Exhibit 3-10: Final LCRR Requirements that Must be Completed or Continued if a System No Longer Exceeds the Lead AL

Applies To:	Requirement to be Completed/Continued	Section
CWSs serving 50,000 or fewer	Conduct WQP monitoring until system no longer has an ALE for two consecutive 6-month periods	3.4.1
• PWSs with LSLs	Construct pipe loops from harvested pipe and operate loops and conduct a study to determine re-optimized OCCT using these pipe loops	3.4.2
• CWSs serving > 10,000 without CCT or LSLs • CWSs serving ≤ 10,000 and all NTNCWSs without CCT or LSLs for which CCT is their approved compliance option	Conduct a study to determine re-optimized OCCT[1]	3.4.2
• CWSs serving > 10,000 without CCT • CWSs serving ≤ 10,000 and all NTNCWSs without CCT for which CCT is their approved compliance option	Install CCT	3.4.2
• CWSs serving > 10,000 with CCT • CWSs serving ≤ 10,000 and all NTNCWSs with CCT for which CCT is their approved compliance option	Re-optimize CCT	3.4.2
• CWSs serving > 10,000	Meet annual mandatory rate[2]	3.5.2
• CWSs serving ≤ 10,000 and all NTNCWSs with LSLs with LSLR as their approved compliance option	Replace all LSLs not to exceed 15 years	3.5.2
CWSs serving ≤ 10,000 and all NTNCWSs with POU installation, monitoring, and maintenance as their approved compliance option	Install and maintain POU devices	3.6.1
CWSs serving ≤ 10,000 and all NTNCWSs with no LSLs for which lead-bearing plumbing replacement is their approved compliance option	Replace all lead-bearing plumbing materials	3.7.1

Acronyms: AL = action level; CCT = corrosion control treatment; CWS = community water system; LSLs = lead service lines; LSLR = lead service line replacement; NTNCWS = non-transient non-community water system; OCCT = optimal corrosion control treatment; POU = point-of-use; WQP = water quality parameter.

Notes:

[1] See Section 3.4.2 for situations in which a Primacy Agency may waive the study requirement.

[2] See Section 3.5.2 for criteria a system must meet to stop mandatory LSLR.

3.3.3.3 *Rationale for Final Regulatory Change*

As discussed in Section 3.2.1.2, a system's lead tap sampling requirements are primarily determined by its lead 90th percentile. The intent of this is to target systems with higher lead levels and to apply increasingly stringent requirements to address lead and promote consumer awareness. For tap sampling, this means that systems with an ALE will conduct more frequent monitoring than systems

with a TLE or with no TLE or ALE. In addition, those systems with a TLE or ALE must conduct sampling at the standard number of sites and cannot qualify for reduced tap sampling sites. This increased sampling will allow a system with high lead levels to monitor its lead issue closely while performing other treatment techniques to protect public health that include CCT, PE, and LSLR.

3.4 Corrosion Control Treatment and Water Quality Parameter Monitoring

EPA made the following changes related to CCT and WQP monitoring:

- Remove calcium carbonate stabilization as a treatment technique and calcium as a regulated WQP.
- Require systems serving more than 50,000 people without CCT to conduct WQPs during the first two 6-month tap sampling periods if their lead 90th percentile level exceeds the lead PQL of 5 µg/L. Also required for systems without CCT that increases in size to serve more than 50,000 people.
- Require additional WQP monitoring for systems serving 50,000 or fewer people as follows:
  - Those that have a lead or copper ALE must continue WQP monitoring until they no longer exceed either AL for two consecutive six-month tap sampling monitoring periods as opposed to limiting monitoring to periods with an ALE. If the system has CCT and OWQPs, they also must be in compliance with their OWQPs for two consecutive six-month monitoring periods.
  - Those that have CCT but no OWQPs and have a TLE must monitor for 2 consecutive six-month monitoring periods starting in the month following the end of the tap sampling monitoring period with the exceedance.
- Specify that systems should evaluate an orthophosphate-based inhibitor (measured as PO_4) as CCT (instead of a phosphate-based inhibitor) as part of the CCT study.
- Require all systems with LSLs that exceed the lead ALE to conduct harvested pipe loop studies.
- Establish additional specifications when Primacy Agencies are setting OWQPs.
- Increase the stringency of the reduced WQP monitoring criteria to require systems to meet the TL in addition to their OWQPs and no longer allow triennial WQP distribution tap monitoring.
- Require all systems to conduct “find-and-fix” activities when a lead tap sample exceeds 15 µg/L.
- Revise sanitary survey requirements for water systems to include CCT review and WQP assessment, including relevant updated guidance that has been issued by EPA.
- Require systems to conduct CCT steps based on lead 90th percentile levels and system size.

The final regulatory changes to CCT and WQP requirements are discussed in greater detail in Sections 3.4.1 through Section 3.4.6. The final rule also requires CWSs serving 10,000 or fewer people and NTNCWSs with a TLE to conduct one round of WQP monitoring as part of the small system flexibility requirements described in Section 3.2.2. Apart from this requirement and the changes listed above, all

other WQP requirements of the previous rule apply to the final LCRR. Exhibit 3-11 summarizes final revisions to CCT and WQP requirements.

Exhibit 3-11: Summary of CCT Requirements under the Final LCRR

Final Revisions	Applies to:	No TLE/ALE P90: ≤10 µg/L	TLE 10 µg/L < P90 ≤ 15 µg/L	ALE P90: >15 µg/L
Corrosion Control Treatment and Water Quality Parameter Monitoring				
Remove calcium carbonate as an eligible CCT and calcium as a regulated WQP.	All CWSs and NTNCWSs	X	X	X
Implement "find-and-fix" approach when lead tap sample is > 15 µg/L.		X	X	X
Require systems serving > 50,000 without CCT with P90 levels > 5 µg/L (PQL) to monitor during the first two six-month tap monitoring periods.[1]	All CWSs and NTNCWSs > 50,000 without CCT	X	X	X
No longer allow serving ≤ 50,000 people to discontinue WQP monitoring unless they no longer have an ALE for two consecutive 6-month tap sampling monitoring periods.[2]	All CWSs and NTNCWSs serving ≤ 50,000	X	X	
Require systems with CCT but not Primacy-set OWQPs with a TLE to monitor for two consecutive six-month monitoring periods.	CWSs and NTNCWSs serving ≤ 50,000 with CCT		X	
Require systems with a TLE to conduct one round of WQP monitoring to inform the small system compliance recommendation.	CWSs and NTNCWSs serving ≤ 10,000		X	
Allow systems that have P90 levels ≤ TL and meet OWQP specifications to qualify for reduced WQP monitoring, but no longer allow triennial distribution system monitoring frequency.	All CWSs and NTNCWSs with CCT	X		
Require Primacy Agencies to review treatment and assess WQPs during sanitary survey.		X	X	X

Final Revisions	Applies to:	No TLE/ALE P90: ≤10 µg/L	TLE 10 µg/L < P90 ≤ 15 µg/L	ALE P90: >15 µg/L
Require systems to submit a recommendation for OCCT.	• CWSs serving 10,001 to 50,000 without CCT • CWSs serving ≤ 10,000 and all NTNCWS without CCT choosing CCT option[3]		X	X
Require a study prior to CCT installation.[4]	PWS serving > 50,000	X[4]		
	• CWSs serving 10,001 to 50,000 without CCT • CWSs serving ≤ 10,000 and all NTNCWS without CCT choosing CCT option[3]		X	X
	All systems with LSLs			X
Require systems to install and maintain CCT.	All CWSs and NTNCWSs without CCT			X
Require systems to submit and re-optimize CCT.	• CWSs serving 10,001 to 50,000 with CCT • CWSs serving ≤ 10,000 and all NTNCWS with CCT choosing CCT option[3]		X	X
Require systems to conduct a study prior to CCT re-optimization.	CWSs and NTNCWSs serving > 50,000	X[5]	X	X
	• CWSs serving > 10,000 without LSLs • CWSs serving ≤ 10,000 and all NTNCWS choosing CCT option without LSLs		X	
	All systems with LSLs			X
Require systems to install and maintain re-optimized CCT.	All CWSs and NTNCWSs with CCT		X	X

Acronyms: ALE = action level exceedance; CCT = corrosion control treatment; CWS = community water system; LSL = lead service line; LSLR = lead service line replacement; NTNCWS = non-transient non-community water system; OCCT = optimal corrosion control treatment; OWQP = optimal water quality parameter; P90 = lead 90th percentile level; PE = public education; POU = point-of-use; PQL = practical quantitation limit; TLE = trigger level exceedance; WQP = water quality parameter.

Notes:

[1] This requirement also applies to systems without CCT that increase in size to serve more than 50,000 people that exceed the lead PQL of 5 µg/L.

[2] WQP monitoring requirements are dependent on a system size, CCT status, and lead 90th percentile level. WQP monitoring requirements are discussed in Section 3.4.1.
[3] As discussed in Section 3.2.2, CWSs serving 10,000 or fewer people and NTNCWSs have the flexibility to select their approach for addressing lead that includes CCT, LSLR, POU maintenance and provision, and replacement of lead-bearing materials. For these systems, this requirement applies to those that with CCT as their approved compliance option.
[4] See Section 3.4.2.2 for a more detailed discussion of the applicability of each CCT installation steps and re-optimization steps. See Section 3.4.3.2 for specific details on the scope of the CCT studies.
[5] Systems serving more than 50,000 people without CCT with a lead 90th percentile level above the PQL of 5 µg/L must conduct a study. The Primacy Agency may request those with CCT and no LSLs that have a lead 90th percentile level above the PQL but at or below the TL to conduct a study prior to CCT re-optimization.

3.4.1 Regulated WQPs and Applicability

3.4.1.1 *Previous Rule*

Under the previous rule, WQP monitoring was required for all systems serving more than 50,000 people (except systems that meet the criteria in 40 CFR 141.81(b)(3)[20] or "b3" systems) and all water systems serving 50,000 or fewer people that exceeded the lead or copper AL. Systems serving 50,000 or fewer people could discontinue WQP if they no longer exceed the lead or copper AL.

WQP samples were collected at representative taps throughout the distribution system (e.g., at approved coliform sites) and at each entry point to the distribution system.

Systems were required to conduct WQP monitoring prior to the installation of CCT and after CCT installation. Systems analyzed samples for WQPs, including pH, alkalinity, calcium, conductivity, and water temperature prior to the installation of CCT. Systems that used a corrosion inhibitor also analyzed samples for orthophosphate or silica depending on the corrosion inhibitor used. After CCT installation, systems were required to conduct WQP monitoring at taps for pH, alkalinity, orthophosphate, or silica (depending on the type of inhibitor used), and calcium (if a calcium carbonate stabilization is used). Systems were also required to conduct WQP monitoring at entry points for pH, alkalinity, inhibitor dosage rate, and orthophosphate or silicate concentration (depending on the type of inhibitor used). See Exhibit 3-12 for a summary of WQP monitoring requirements.

The Primacy Agency designated OWQPs after the installation of CCT. Systems with CCT had to continue to maintain WQPs at or above minimum values or within OWQP ranges designated by the Primacy Agency.

[20] See footnote 16 for the criteria in 40 CFR 141.81(b)(3).

Exhibit 3-12: WQP Monitoring Requirements under the Previous Rule

Monitoring period	Location	Frequency	WQPs
Prior to CCT Installation	Tap	Collect 2 samples within the same 6-month tap sampling monitoring period in which the AL was exceeded (systems serving ≤ 50,000 without CCT).	pH, alkalinity, calcium, conductivity, temperature, and if applicable: • orthophosphate concentration, or • silica concentration.
	Entry Point		Same WQPs as those collected at WQP taps.
After CCT Installation[1]	Tap	Every 6 months.	pH, alkalinity, orthophosphate or silica, calcium (if applicable).
	Entry point	Every 2 weeks.	pH & alkalinity, and if applicable: • dosage rate of any chemical used to adjust alkalinity, • orthophosphate concentration, or • silica concentration.

Acronyms: CCT = corrosion control treatment; WQPs = water quality parameters.
Notes:
[1] WQP monitoring after CCT installation applies to systems serving more than 50,000 people. Systems with CCT that serve 50,000 or fewer people were required to conduct WQP monitoring when they exceed the lead or copper AL.

3.4.1.2 *Description of Final Regulatory Change*

The final LCRR eliminates the monitoring of WQPs that are related to calcium hardness – calcium, conductivity, and water temperature. In addition, EPA is requiring additional monitoring for systems serving 50,000 or fewer as follows:

- Those that have a lead or copper ALE must continue WQP monitoring until they no longer have a lead and/or copper ALE for two consecutive six-month tap sampling monitoring periods as opposed to limiting monitoring to periods with an ALE. If the system has CCT and OWQPs, they also must be in compliance with their OWQPs for two consecutive six-month monitoring periods.
- Those that have CCT but no OWQPs and have a TLE must monitor for two consecutive six-month monitoring periods starting in the month following the end of the tap sampling monitoring period with the exceedance.

The final rule also specifies requirements for systems serving more than 50,000 people without CCT to conduct WQPs during the first two six-month tap sampling periods if their lead 90th percentile level exceeds the lead PQL of 5 µg/L. This requirement also applies to systems without CCT that increase in size to serve more than 50,000 people.

All other WQP monitoring requirements pertaining to the number of samples and required parameters remain the same under the final LCRR as the previous rule with the exception of additional WQP monitoring when any lead tap sample exceeds 15 µg/L (see Section 3.4.5).

3.4.1.3 *Rationale for Final Regulatory Change*

As will be discussed in greater detail in Section 3.4.3, the final LCRR no longer requires calcium carbonate stabilization to be evaluated as a possible CCT. Thus, EPA is eliminating the three WQPs that are used to evaluate calcium carbonate stabilization – calcium, conductivity, and temperature.

EPA is also requiring additional WQP monitoring for systems serving 50,000 or fewer people with an ALE. These systems must continue WQP monitoring until they have two consecutive six-month tap sampling monitoring periods without a lead or copper ALE. Under the previous rule, these systems could discontinue WQP monitoring at the end of a tap sampling monitoring period in which they no longer had an ALE even though the system might continue to exceed in the next tap sampling monitoring period. The system would only resume WQP monitoring after an ALE in the next tap sampling monitoring period, which can make it difficult to evaluate the CCT due to data gaps. In addition, EPA is also requiring systems serving 50,000 or fewer people without CCT or Primacy Agency set OWQPs to monitor for two consecutive six-month monitoring periods if they have a TLE. This monitoring must start in the month following the end of the tap sampling monitoring period with the exceedance. Additional WQP monitoring and review of other distribution system data would provide information to evaluate and reoptimize CCT after a lead ALE or TLE.

In addition, EPA is requiring a system serving 50,000 or fewer that qualified as a "b3" system under the previous rule (40 CFR 141.83(b)(3))[21] and thus, were not required to install CCT to conduct WQPs during the first two 6-month tap sampling periods if the system does not meet the b3 criteria under the final rule because its lead 90th percentile level exceeds the lead PQL of 5 µg/L. These systems will be subject to CCT steps as described in Section 3.4.2. EPA has also clarified in the final rule that any system that increases in size to more than 50,000 people are subject to these WQP and CCT requirements.

3.4.2 CCT Installation and Re-optimization Based on Lead 90th Percentile

3.4.2.1 *Previous Rule*

CCT requirements under the previous rule differed depending on the system size (i.e., population served). Most systems serving more than 50,000 people were required to meet a series of deadlines beginning in 1993 to determine optimal corrosion control treatment (OCCT) [22] and install treatment by January 1, 1997. Exceptions were those that were deemed to have optimized CCT under 40 CFR 141.81(b)(2) or (b)(3).[23]

Systems serving 50,000 or fewer people were not required to conduct CCT steps under the LCR unless they exceeded the lead and/or copper AL. As per 40 CFR 141.81(e), systems serving 50,000 or fewer people that exceeded the lead/copper AL were required to install CCT after making an OCCT recommendation to the Primacy Agency and, if required, to conduct a CCT study (see Section 3.4.3).

[21] See footnote 16 for the criteria in 40 CFR 141.81(b)(3).
[22] Section 141.2 defines OCCT as "… the corrosion control treatment that minimizes the lead and copper concentrations at users' taps while ensuring that the treatment does not cause the water system to violate any national primary drinking water regulations."
[23] Under the previous rule, a system was deemed optimized according to 40 CFR 141.81(b)(2) if the system demonstrated to the Primacy Agency that it had conducted activities equivalent to the CCT steps. See footnote 16 for the criteria in 40 CFR 141.81(b)(3).

However, systems could discontinue these steps whenever their 90th percentile levels were at or below both ALs for two consecutive six-month tap sampling monitoring periods. If these systems then exceeded the lead or copper AL again, they had to recommence completion of the CCT steps.

Systems with CCT under the previous rule were required to continue to operate and maintain OCCT, including maintaining WQPs at or above minimum values or within OWQP ranges designated by the Primacy Agency. Primacy Agencies could modify their determination of OCCT and OWQPs under 40 CFR 141.82(h) on their own initiative or in response to a request by a water system or other interested party. The previous rule, however, did not explicitly require systems to make adjustments to their CCT (i.e., re-optimize CCT) in response to a subsequent lead or copper ALE or when the system failed to meet its OWQPs.

3.4.2.2 *Description of Final Regulatory Change*

The final rule sets additional CCT requirements based on a system's lead 90th percentile level, system type, system size, CCT status, and LSL status. Additional requirements under the final rule for systems without and with CCT are summarized in Exhibit 3-13.

Exhibit 3-13: Additional CCT Step Requirements for Systems under the Final LCRR

Requirement	System Size	Required If the System	Deadline
Systems without CCT			
Recommend OCCT *(Systems constructing pipe loops below skip the OCCT recommendation)*	CWSs serving 10,001 to 50,000	Exceeds the lead TL or copper AL	Within 6 months after the end of the tap sampling period with lead TLE or copper ALE
	CWSs serving ≤ 10,000 and all NTNCWSs choosing CCT option for lead[1]	Exceeds the lead TL	
	CWSs serving ≤ 10,000 and all NTNCWSs	Exceeds the copper AL	
Construct pipe loops from harvested lead pipes and operate loops	PWSs serving > 50,000 with LSLs	Exceeds the PQL of 5 µg/L[3]	Within 1 year after end of tap sampling in which the PQL or lead AL was exceeded
	All PWSs serving ≤ 50,000 with LSLs[2]	Exceeds the lead AL	
Conduct a study based on harvested lead pipe loops	PWSs serving > 50,000 with LSLs	Exceeds the PQL of 5 µg/L[3]	Within 30 months after end of tap sampling period in which the PQL or lead AL was exceeded
	All PWSs serving ≤ 50,000 with LSLs[2]	Exceeds the lead AL	
Conduct a study from a rule-specified menu	PWSs serving > 50,000 without LSLs	Exceeds the PQL of 5 µg/L[3]	Within 18 months after end of tap sampling period in which the PQL was exceeded
Conduct study if required by Primacy Agency from a rule-specified menu	• CWSs serving 10,001 to 50,000 without LSLs • CWSs serving ≤ 3,300 and all NTNCWSs choosing CCT option without LSLs[1]	Exceeds the lead or copper AL	Within 18 months after Primacy Agency provides written notification of the requirement

Requirement	System Size	Required If the System	Deadline
Install CCT	• CWSs serving > 10,000 • CWSs serving ≤ 10,000 and all NTNCWSs choosing CCT option[1]	Exceeds the lead or copper AL or exceeds the PQL for CWSs serving > 50,000	Within 24 months after Primacy Agency designated OCCT
Systems with CCT			
Recommend re-optimized OCCT *(Systems constructing pipe loops below skip the OCCT recommendation)*	CWSs serving 10,001 to 50,000	Exceeds the lead TL or copper AL	Within 6 months after the end of the tap sampling period with lead TLE or copper ALE *(Systems that exceed the lead TL but not the lead or copper AL can recommend re-optimization of existing CCT w/o study)*
	CWSs serving ≤ 10,000 and all NTNCWSs choosing CCT option for lead[1]	Exceeds the lead TL	
	CWSs serving ≤ 10,000 and all NTNCWSs	Exceeds the copper AL	
Construct pipe loops from harvested lead pipes and operate loops	All sizes with LSLs	Exceeds the lead AL	Within 1 year after the end of tap sampling period end with lead ALE
Conduct a study based on harvested lead pipe loops	All sizes with LSLs	Exceeds the lead AL	Within 30 months after end of tap sampling period in which the lead AL was exceeded
Conduct a re-optimization study from a rule-specified menu	PWSs serving > 50,000 without LSLs	Exceeds the lead AL	Within 18 months after Primacy Agency written notification of the requirement
Conduct study if required by Primacy Agency from a rule-specified menu	PWSs serving > 50,000 without LSLs	Exceeds the PQL of 5 µg/L but not the TL or lead or copper AL[3]	
	• CWSs serving > 10,000 without LSLs • CWSs serving ≤ 10,000 and all NTNCWS choosing CCT option without LSLs[1]	Exceeds the lead TL but not the lead or copper AL[4]	
Re-optimize existing CCT for systems not required to conduct a study	• CWSs serving > 50,000 • CWSs serving ≤ 10,000 and all NTNCWSs choosing CCT option[1]	Exceeds the TL but not the lead or copper AL	Within 6 months of Primacy Agency designation of re-optimized CCT[5]
Re-optimize existing CCT for systems conducting a study	• CWSs serving > 50,000 • CWSs serving ≤ 10,000 and all NTNCWSs choosing CCT option[1]	Exceeds the lead or copper AL	Within 12 months after Primacy Agency designated OCCT

Acronyms: AL = action level; ALE = action level exceedance; CCT = corrosion control treatment; CWS = community water system; NTNCWS = non-transient non-community water system; OCCT = optimal corrosion control treatment; OWQP = optimal water quality parameter; PQL = practical quantitation limit; TL = trigger level.

Notes:
[1] CWSs serving 10,000 or fewer and all NTNCWSs have flexibility to recommend their compliance pathway that includes CCT, LSLR, POU provision and maintenance, and replacement of lead-bearing materials.
[2] EPA expects that small systems will use the flexibility granted in the rule to elect a less costly option.
[3] All large systems serving more than 50,000 people were required to install CCT except those that met the "b3 criteria." This requirement is limited to those large systems that no longer qualify as a b3 system because their 90th lead level is above the PQL of 5 µg/L or medium systems without CCT that grow to become large systems.
[4] The Primacy Agency can waive the requirement for systems with a TLE and no LSLs to conduct a study before re-optimizing CCT.
[5] States may approve modifications of the existing CCT without a study for systems that exceed the lead TL, but do not exceed the lead or copper AL.

The final LCRR includes more stringent requirements for systems serving more than 50,000 people as well as those with LSLs and/or a TLE or ALE.

Systems *without CCT and no LSLs are subject to the following requirements*:

- CWSs serving more than 50,000 people with a lead 90th percentile level above the PQL of 5 µg/L no longer qualify as a "b3" system and must conduct a study to identify OCCT within 18 months after the end of the tap sampling period in which the exceedance occurred. They must install CCT within 24 months after the Primacy Agency designates OCCT.
- CWSs serving 10,001 to 50,000 people and CWSs serving 10,000 and fewer people and NTNCWSs of any size with CCT as their approved compliance option for lead or need CCT for a copper ALE:
    - With a lead 90th percentile level above the lead TL and/or above the copper AL must recommend OCCT within 6 months after the end of tap sampling period in which the TLE or copper ALE occurred.
    - With a lead or copper ALE must conduct a CCT study within 18 months from the time the Primacy Agency notifies the system of this requirement. Similar to the previous rule, the Primacy Agency can waive this requirement and designate OCCT based on available information provided by the system. The system must install CCT within 24 months of Primacy Agency CCT designation, which is the same as the previous rule. Once the Primacy Agency has designated OCCT and a system has installed treatment, the Primacy Agency must set OWQPs. The LCRR specifies minimum pH and orthophosphate levels for OWQPs for optimization and re-optimization.
    - Are not required to complete the study or install CCT if they no longer exceed the lead or copper AL for two consecutive 6-month tap sampling monitoring periods prior to completing the study or installing CCT. However, if they exceed either again in the future, they cannot cease the steps a second time and must complete the applicable treatment steps beginning with the first treatment step that was not previously completed in its entirety or repeat a step if required by the Primacy Agency.

Systems *without CCT that have LSLs are subject to the following requirements*:

- CWSs serving more than 50,000 people that exceed the PQL must construct pipe loops from harvested lead pipes from their distribution system and operate the loops with finished water within one year after the end of the tap sampling period in which they exceeded the PQL. The study must be completed within 30 months from the end of the tap sampling period in which they exceeded the PQL. These systems have 24 months to install CCT from the date the Primacy Agency specifies OCCT.
- CWSs serving 10,001 to 50,000 people and CWSs serving 10,000 and fewer people and NTNCWSs of any size with CCT as their approved compliance option for lead or need CCT for a copper ALE:
    - With a lead 90th percentile level above the TL but at or below the lead AL or above the copper AL must recommend OCCT within 6 months after end of tap period in which the system exceeded the TL or copper AL.
    - With a lead ALE are subject to harvested pipe loop study requirement described above. System must install CCT within 24 months of the Primacy Agency OCCT designation and operate in compliance with Primacy set OWQPs.
    - Primacy Agencies cannot waive the study requirement for systems with LSLs and systems must complete this study regardless of whether the system no longer exceeds the lead or copper AL for 2 consecutive 6-month monitoring periods. However, they are not required to install CCT if they no longer exceed the lead or copper AL for two consecutive 6-month tap sampling monitoring periods prior to completing CCT installation. Systems must complete CCT installation if they subsequently exceed either AL.

All systems with CCT that exceed the lead TL or copper AL must re-optimize treatment (i.e., adjust CCT to enhanced levels). This includes systems serving more than 10,000 people and CWSs serving 10,000 and fewer people and NTNCWSs of any size with CCT as their approved compliance option. Primacy Agencies have discretion to require systems serving more than 50,000 people with a lead 90th percentile level above the lead PQL to re-optimize CCT. The Primacy Agency can waive the study for any system that has a TLE but does not exceed the lead or copper AL. In this event, the system must modify their CCT within 6 months of when the Primacy Agency designates re-optimized CCT. The Primacy Agency can also waive the study for any system serving 50,000 or fewer people without LSLs that exceeds the lead AL. Systems with LSLs that exceed the lead AL are subject to the harvested pipe loop study requirement described above, except for small systems with a compliance option other than CCT. Systems have 12 months to install the Primacy Agency designated treatment.

For a detailed discussion of the CCT study requirements, see Section 3.4.3.2.

3.4.2.3 ***Rationale for Final Regulatory Change***

CCT is one of the main requirements affected by a system's lead 90th percentile level and the new structure introduced under the final LCRR. Section 3.2.1.3 provides the rationale of the final LCRR structure based on lead 90th percentile levels in greater detail. The intent of this is to target systems with

higher lead levels and to apply increasingly stringent requirements to address lead and consumer awareness.

For CCT, this means that systems with an ALE must install or re-optimize CCT because of their elevated lead levels. This ensures that systems with CCT that continue to have high lead levels re-evaluate CCT and that systems without CCT that continue to have high lead levels install CCT. The previous rule allows systems serving 50,000 or fewer that no longer have a lead or copper ALE for two consecutive six-month tap sampling monitoring periods to stop CCT steps. Thus, some of these systems that had intermittent exceedances never installed CCT. Based on public comment, the final rule re-defines the optimization and re-optimization process to provide more flexibility on factors such as presence of LSLs, system size, 90th percentile lead concentration, and existing CCT. The new classifications provide more bins for optimization and re-optimization for any system without CCT and gives Primacy Agencies the ability to approve existing CCT modifications if smaller systems meet the guidelines set forth in the rule, which several commenters suggested could help make the rule more comprehensive. In addition, based on public comment, the final rule allows Primacy Agencies to approve modifications of the system's existing CCT for systems that are between the TL and AL without first requiring a corrosion control study. For some systems lead reductions can be achieved quickly with slight modifications of the existing CCT and should not be delayed potentially by two years for the results of the corrosion control study. To clarify which systems that are not eligible for this flexibility, EPA added a definition of "systems without corrosion control treatment" that includes a public water system that does not have, or purchases all of its water from a system that does not have: 1) an optimal corrosion control treatment approved by the Primacy Agency; or 2) any pH adjustment, alkalinity adjustment, and or corrosion inhibitor addition resulting from other water quality adjustments as part of its treatment train infrastructure.

EPA is requiring harvested pipe loops for systems with LSLs that exceed the lead AL and to the extent that there are any large systems without CCT with LSLs that exceed the PQL. EPA believes that the CCT changes needed for systems above the AL merit a thorough investigation of the impacts of the options on the existing pipe scale. Public commenters noted that the construction of harvested flow-through pipe loops and the stabilization of those loops can take six months to one year before options can be evaluated. Therefore, the final rule directs these systems to start constructing and operating the flow-through pipe loops after the ALE in place of the initial treatment recommendation step, since the pipe loop study will be the basis for their treatment recommendation.

3.4.3 Performance of Corrosion Control Treatment Study

3.4.3.1 *Previous Rule*

Under the previous rule, systems installing CCT could use the three types of CCT listed below or a combination of these treatments:

- Alkalinity and pH adjustment;
- Calcium hardness adjustment; and
- The addition of a phosphate- or silicate-based corrosion inhibitor at a concentration sufficient to maintain an effective residual concentration in all test tap samples.

Systems performing CCT studies had to evaluate the effectiveness of each of the treatments listed above and, if applicable, combinations of those treatments.

3.4.3.2 ***Description of Final Regulatory Change***

The final LCRR removes the use of calcium carbonate as an eligible CCT[24] but retains the other types of CCT included in the previous rule. In addition, the final rule removes the requirement for systems to evaluate the effectiveness of calcium hardness adjustment as part of the CCT study.

EPA is also revising the CCT study requirements for systems without CCT to specify that systems must evaluate:

- An orthophosphate-based inhibitor versus a phosphate-based inhibitor.
- Specify three sets of orthophosphate residuals concentrations that must be maintained in all tested taps:
    - The addition of an orthophosphate- or silicate-based corrosion inhibitor at a concentration sufficient to maintain an effective residual concentration in all test tap samples;
    - The addition of an orthophosphate-based corrosion inhibitor at a concentration sufficient to maintain an orthophosphate residual concentration of 1 mg/L (as PO_4) in all test samples; and
    - The addition of an orthophosphate-based corrosion inhibitor at a concentration sufficient to maintain an orthophosphate residual concentration of 3 mg/L (as PO_4) in all test samples.

These sets of requirements are in addition to an assessment of alkalinity and pH adjustment, as currently required.

Systems with CCT that are required to re-optimize treatment would have to conduct a re-optimization CCT study.

Systems with pH and alkalinity CCT must evaluate:

- Additional alkalinity and/or pH adjustment;
- The addition of an orthophosphate- or silicate-based corrosion inhibitor at a concentration sufficient to maintain an effective residual concentration in all test tap samples;
- The addition of an orthophosphate-based corrosion inhibitor at a concentration sufficient to maintain an orthophosphate residual concentration of 1 mg/L (as PO_4) in all test samples; and
- The addition of an orthophosphate-based corrosion inhibitor at a concentration sufficient to maintain an orthophosphate residual concentration of 3 mg/L (as PO_4) in all test samples.

[24] EPA has removed calcium carbonate stabilization and its associated unique water quality parameters from the final rule as options for systems that are optimizing or re-optimizing CCT. However, EPA is not requiring systems that have previously been deemed optimized using this treatment approach to change their treatment as long as their lead 90th percentile levels are at or below the TL. EPA is retaining the key WQPs of pH and alkalinity and Primacy Agencies have the discretion to designate additional WQPs to reflect OCCT.

Systems with an inhibitor CCT process must evaluate:

- Alkalinity and/or pH adjustment;
- The addition of an orthophosphate-based corrosion inhibitor at a concentration sufficient to maintain an orthophosphate residual concentration of 1 mg/L (as PO_4) in all test samples unless the current inhibitor process already meets this residual; and
- The addition of an orthophosphate-based corrosion inhibitor at a concentration sufficient to maintain an orthophosphate residual concentration of 3 mg/L (as PO_4) in all test samples unless the current inhibitor process already meets this residual.

Systems with and without CCT must evaluate each of the control treatments using either pipe rig/loop tests, metal coupon tests, partial-system tests, or analyses based on documented analogous treatments with other systems of similar size, water chemistry, and distribution system configurations. All systems with LSLs that exceed the lead AL must conduct harvested pipe rig/loop studies to assess the effectiveness of CCTs options on the existing pipe scale. For these systems, metal coupon tests can be used as a screen to reduce the number of options that are evaluated using pipe rig/loops to the current conditions and two options.

Systems must also identify all chemical or physical constraints that limit or prohibit the use of a particular CCT and document the constraints and evaluate the effect of the chemicals used for CCT on other drinking water quality treatment processes. On the basis of the analysis of the data generated during each evaluation, the system must recommend to the Primacy Agency in writing the treatment option that the corrosion control studies indicate constitutes OCCT for that system.

3.4.3.3 *Rationale for Final Regulatory Change*

Research has shown that calcium carbonate films only rarely form on lead and copper pipe and are not considered an effective form of corrosion control (AwwaRF and DVGW-Technologiezentrum Wasser, 1996; Schock and Lytle, 2011; Hill and Cantor, 2011)[25]. Since the promulgation of the original LCR, research has confirmed that the most effective treatments for optimization of corrosion control are pH/alkalinity adjustment and the use of orthophosphate (USEPA, 2003; Wilczak et al., 2010; Schock and Lytle, 2011). The inefficacy of calcium hardness adjustment as CCT was noted in EPA's most recent technical recommendations document regarding OCCT (USEPA, 2019a). Consequently, EPA is eliminating the requirement for systems to include calcium carbonate stabilization as a potential option for optimizing corrosion control, along with the associated WQP monitoring for calcium, conductivity, and water temperature (see Section 3.4.1).

EPA is also requiring water systems to evaluate two additional options for orthophosphate-based corrosion control. The existing requirement for evaluating orthophosphate-based corrosion inhibitor specifies that systems must evaluate maintaining an "effective residual concentration in all test

[25] AwwaRF and DVGW-Technologiezentrum Wasser (1996) included studies of the physical properties of calcium carbonate scales on lead, copper, and iron pipe surfaces. These studies confirm that calcium carbonate scale cannot prevent uniform corrosion. Moreover, studies in this reference showed a lack of correlation between the Langelier Index, which has been used predict calcium carbonate scaling, and the concentration of metals in water (Hill and Cantor, 2011).

samples." EPA has determined based upon experience in implementing these requirements that systems may not be evaluating a full range of orthophosphate residual concentrations to achieve OCCT. Therefore, EPA is adding two new treatment options for systems conducting corrosion control studies to evaluate: maintaining a 1 mg/L orthophosphate residual concentration and maintaining a 3 mg/L orthophosphate residual concentration.

EPA is also referring to orthophosphate-based inhibitors instead of phosphate-based inhibitors and clarifying that the dosage is expressed as PO_4. Orthophosphate is commonly used for lead and copper control. Polyphosphates are used to control iron and manganese, but they can increase exposure to lead and copper in water by sequestering them (USEPA, 2019a). EPA is specifying orthophosphate in the final LCRR to prevent systems from using polyphosphates as CCT.

In the final rule, harvested pipe loops are required for systems with LSLs that exceed the lead AL. EPA believes that the CCT changes needed for systems above the AL merit a thorough investigation of the impacts of the options on the existing pipe scale. Public comments to the proposed rule noted that the construction of harvested flow-through pipe loops and the stabilization of those loops can take six months to one year before options can be evaluated. EPA agrees that more time is needed to construct pipe loops from harvested pipes and therefore as discussed in Section 3.4.2.3 is removing the requirement for initial treatment recommendations in the final rule for large and medium systems. For systems with LSLs, Step 1 of the optimization or re-optimization process is the construction and operation of the flow-through pipe loops after the ALE, which must be completed within one year of the exceedance, since the pipe loop study will be the basis for their treatment recommendation. The final rule includes requirements to allow coupon studies to be the basis for a treatment recommendation tool for other systems that do not have a lead ALE and LSLs.

3.4.4 Criteria for Reduced WQP Monitoring

3.4.4.1 *Previous Rule*

Under the previous rule, systems could qualify for reduced WQP tap monitoring after the Primacy Agency set OWQPs. Systems on reduced monitoring were required to collect two samples at a reduced number of sites on a semi-annual, annual, or triennial frequency. Reduced monitoring for WQPs at the entry point (at a frequency less than every two weeks) was not allowed. The criteria for reduced WQP tap monitoring under the previous rule are provided in Exhibit 3-14.

Exhibit 3-14: Previous Rule Reduced WQP Tap Monitoring Criteria

Criteria[1] *(Required time period in which system is in compliance with its OWQP specifications)*	**Monitoring Frequency** *(Samples are collected at reduced number of sites)*
Two consecutive 6-month periods.	Every 6 months
Three consecutive years (equals six, six-month periods).	Annual

Criteria[1] *(Required time period in which system is in compliance with its OWQP specifications)*	Monitoring Frequency *(Samples are collected at reduced number of sites)*
Three consecutive years of annual monitoring.[2]	Triennial
Two consecutive tap sampling monitoring periods in which all the following are met: 1. 90th percentile lead level < 0.005 mg/L, 2. 90th percentile copper level < 0.65 mg/L, and 3. In compliance with OWQP specifications.	

Acronyms: OWQP = optimal water quality parameter.
Notes:
[1] Compliance with OWQPs must occur in consecutive periods in order for a system to qualify for reduced monitoring.
[2] Unlike lead and copper tap monitoring, semi-annual monitoring cannot count as the first year toward the triennial monitoring criteria. A system must be in compliance with its OWQP specifications for three years in which it collects WQP tap samples at the annual frequency before qualifying for triennial monitoring.

3.4.4.2 *Description of Final Regulatory Change*

The final rule continues to include provisions for water systems to qualify for reduced WQP tap monitoring only. To qualify, the water system's lead 90th percentile level must be at or below the TL of 10 µg/L in addition to the previous rule requirements shown in Exhibit 3-14 above. EPA is also eliminating the allowance for systems to monitor at triennial frequency. Exhibit 3-15 provides a summary of the revised reduced monitoring criteria under the final LCRR.

Exhibit 3-15: Final Rule Revised Reduced WQP Tap Monitoring Criteria

Criteria[1] *(Required time period in which system is in compliance with its OWQP specifications and P90 is ≤10 µg/L)*	Monitoring Frequency *(Samples are collected at reduced number of sites)*
Two consecutive 6-month periods.	Every 6 months
Minimum of three consecutive years (equals six, six-month periods).	Annual
Two consecutive monitoring periods in which all the following are met: [2] 1. 90th percentile lead level < 0.005 mg/L, 2. 90th percentile copper level < 0.65 mg/L, and 3. In compliance with OWQP specifications.	

Acronyms: OWQP = optimal water quality parameter; P90 = lead 90th percentile level.
Notes:
[1] Compliance with OWQPs must occur in consecutive periods in order for a system to qualify for reduced monitoring.
[2] As shown in Exhibit 3-14, under the previous rule systems meeting these criteria were allowed to monitor annually at the reduced number of sites.

3.4.4.3 *Rationale for the Final Regulatory Change*

EPA is increasing the stringency of the reduced WQP tap monitoring requirements to ensure water systems are not able to reduce the number of sites or frequency of WQP monitoring when they have a lead 90th percentile level that exceeds 10 µg/L. This helps ensure that required WQP monitoring continues when water systems have high lead levels. EPA also is no longer allowing WQP distribution monitoring on a triennial schedule. Several commenters stressed that the final rule should require all systems to conduct regular monitoring of the OWQPs. EPA agrees with these commenters that triennial monitoring does not provide enough data on water quality in the distribution system. Significant changes in distribution system water quality can occur over a three-year period and water systems need to conduct more frequent WQP sampling to assure CCT is being effectively maintained.

3.4.5 Actions in Response to a Lead Tap Sample Result Exceeding 15 µg/L – "Find-and-Fix"

3.4.5.1 *Previous Rule*

The previous rule required systems to provide lead consumer notice to all individuals served at tested tap sample sites that were used for compliance purposes. The notice consisted of individual lead results at the tested tap, an explanation of the health effects of lead, steps consumers can take to reduce exposure to lead in drinking water, and the lead maximum contaminant level goal (MCLG) and AL and definitions for these two terms. However, systems were not required to take additional action if an individual tap sample exceeded 15 µg/L.

3.4.5.2 *Description of Final Regulatory Change*

The final LCRR requires all CWSs and NTNCWSs to conduct a corrosion control assessment step in which WQP sampling must be done within five days of the system's receiving the tap sample results exceeding 15 µg/L, except for CWSs serving 10,000 or fewer people without CCT and NTNCWSs without CCT that may perform the sampling within 14 days. The sampling is to replicate as closely as possible the water quality conditions at the time when the tap exceeded 15 µg/L. The WQP sampling location must be within the same pressure zone, on the same size main and within a half-mile from the tap sample site with the sample result above 15 µg/L.

If a system with CCT has a subsequent sample above 15 µg/L and no appropriate WQP sample location, the system must continue to add another site until the system has twice the minimum number of standard WQP distribution sites shown in Exhibit 3-16. When a system exceeds this upper threshold for the number of sites, for example, 50 sites for systems serving more than 100,000 people, the Primacy Agency has discretion to switch out sites that have been added if the newer site can better assess the effectiveness of the CCT and to remove sites during the sanitary survey evaluation of OCCT (see Section 3.4.6.2).

Exhibit 3-16: Final Rule Minimum Number of WQP Tap Sites and Maximum Number of Additional Sites Added under Find-and-Fix

System Size (Population Served)	Minimum No. of Sites under Standard Monitoring	Maximum Number of WQP Sites Added under Find-and-Fix
	A	B = A*2
≤100	1	2
101 – 500	1	2
501 – 3,300	2	4
3,301 – 10,000	3	6
10,001 – 100,000	10	20
>100,000	25	50

Note:
A: Specified in the rule at 40 CFR 141.87(a)(2)(i).

The final LCRR requires CWSs and NTNCWSs to conduct the following additional actions as part of the CCT find-and-fix approach:

- **Collect a follow-up lead tap sample:** Systems must collect a follow-up lead tap sample at each monitoring site that yielded a lead result above 15 µg/L within 30 days of learning the results. The system is not required to collect a 1-liter, first-draw sample but should use a sample volume and sampling protocol that is appropriate to assess the source of lead (e.g., a 125 or 250 mL first-draw sample volume to assess lead contribution from a faucet, service line sample to assess the LSL site). Systems are not required to collect a follow-up sample if the occupant(s) are non-responsive or decline the follow up sampling. The sampling results and information pertaining to customer refusals or non-response are due to the Primacy Agency within the first 10 days following the end of the applicable tap sampling period in which an individual sample exceeded 15 µg/L. The follow-up lead results are not included in lead 90th percentile calculations.
- **Conduct a Site Assessment**: Water systems must conduct follow-up sampling at each tap sampling site that yielded a lead result above 15 µg/L within 30 days of learning the result. The final rule allows tap sample collection of a different volume or using a different protocol (if needed to better identify the source of lead) than samples collected under the tap monitoring and therefore the sample is not included in the 90th percentile calculation. Systems are not required to collect a follow-up sample if the occupant(s) are non-responsive or decline the follow up sampling. The sampling results and information pertaining to customer refusals or non-response are due to the Primacy Agency within the first 10 days following the end of the applicable tap sampling period in which an individual sample exceeded 15 µg/L. Water systems must note the cause of the elevated lead level, if known from the site assessment.
- **Evaluate the monitoring results:** Systems must evaluate the WQP and follow-up tap results to determine if the cause of the lead tap sample above 15 µg/L is due to a source of lead at the sampling location, to corrosive WQPs, or is unknown. If the water system determines the cause of the elevated level of lead is solely due to a source of lead at the sampling location, or is unknown, the system is not required to recommend an action to fix the cause of the elevated lead. If the water system finds that corrosive WQPs are the cause, the system must determine if

distribution system management changes such as flushing to reduce water age or adjustment of the CCT are necessary to restore optimal water quality parameters in that portion of the system. Adjustment of CCT could include changing the feed rates for the corrosion inhibitor for a portion of the distribution system or for the entire system to ensure that OWQPs are maintained for optimal corrosion control. Systems must submit a recommendation to the Primacy Agency for approval within six months of the end of the tap sampling monitoring period in which the site(s) exceeded 15 µg/L.[26] The Primacy Agency has six months to approve the recommendation or specify a different approach. A water system that recommends optimizing CCT or re-optimization must follow the steps discussed in Section 3.4.2.2.

- **Report Information to state and local health officials**: Systems must also report the results of tap sampling and WQP monitoring, any distribution system management actions or CCT adjustments made to fix the cause of sample results above 15 µg/L to their Primacy Agency to state and local health departments (see Section 0) along with lead outreach and lead in drinking water sample results at schools and child cares (see Section 3.11.1.2).

3.4.5.3 *Rationale for Final Regulatory Change*

The previous rule included systemwide responses to lead ALEs, but beyond notifying consumers at tested locations of their sampling results, did not require additional or immediate action when individual tap samples were greater than the lead AL. This means that potentially up to 10 percent of consumers' tap water could be above 15 µg/L, and some consumers could be exposed to lead levels well above this level. NDWAC raised concerns about this potential threat to public health in their final report to EPA (NDWAC, 2015).

The follow-up WQP sample for systems will help the system determine if CCT is needed or optimized, if additional WQP sites are needed, and/or its OWQPs set by the Primacy Agency are being met in that part of the distribution system (see Section 3.4.2), or if parameters such as pH or orthophosphate are outside of the target range. For example, a pH sample could indicate if there are potential water quality issues in that part of the distribution system, such as decreased pH due to water age. This step will help water systems determine if they have a localized or systemwide problem with their CCT so that they may take the appropriate corrective action (e.g., spot flushing, localized treatment, systemwide treatment change). A follow-up lead sample at the tap will help water systems and consumers evaluate potential causes of the high lead result and to identify the source of the lead, such as the service line, brass faucet, lead solder, and/or gooseneck/pigtails.

3.4.6 Review of CCT and WQPs During Sanitary Survey

3.4.6.1 *Previous Rule*

Under 40 CFR 141.723 of the Interim Enhanced Surface Water Treatment Rule (IESWTR), a sanitary survey is described as "an onsite review of the water source (identifying sources of contamination by using results of source water assessments where available), facilities, equipment, operation, maintenance, and monitoring compliance of a PWS to evaluate the adequacy of the PWS, its sources

[26] A system that is in the process of optimizing or re-optimizing CCT does not need to submit a recommendation for find-and-fix.

and operations, and the distribution of safe drinking water" (USEPA, 1998b). The preamble to the IESWTR indicates that sanitary surveys for surface water and ground water under the direct influence of surface water (GWUDI) systems must address eight elements initially introduced in the 1995 EPA/State Joint Guidance on Sanitary Surveys.[27] These eight elements include: source (protection, physical components, and condition); treatment; distribution system; finished water storage; pumps, pump facilities, and controls; monitoring, reporting, and data verification; system management and operation; and operator compliance with state requirements (USEPA, 1999). Under 40 CFR 141.401 of the Ground Water Rule (GWR), sanitary surveys for ground water systems must include an evaluation of the same eight elements (USEPA, 2006b). Regulations related to sanitary surveys do not include requirements specific to reviewing CCT and WQPs, and the LCR does not include any additional requirements for sanitary surveys to address the periodic review of CCT and related WQP data.

3.4.6.2 *Description of Final Regulatory Change*

The final LCRR requires Primacy Agencies to specifically review CCT and assess WQPs and tap sampling results during sanitary surveys for systems with CCT to ensure the system is maintaining the OCCT and to assess if there should be modifications to the CCT to further reduce lead and copper levels in tap samples. The review must address applicable recommendations in any new CCT guidance that is issued by EPA prior to the sanitary survey.

3.4.6.3 *Rationale for Final Regulatory Change*

NDWAC recognized that treatment technologies for corrosion control are continuing to evolve as a result of ongoing and new research. In their 2015 report to EPA, NDWAC recommended that systems should review their existing CCT with their Primacy Agency to ensure that CCT and WQPs reflect the most current science (NDWAC, 2015). This periodic review, as well as regular updates to CCT guidance to reflect current science, will help systems and Primacy Agency respond to problems with CCT and also to anticipate challenges, particularly with new sources or changes in treatment. EPA agrees and is responding to these recommendations by requiring Primacy Agencies and systems to review updated CCT guidance during the sanitary survey.

EPA's guidance for sanitary surveys of surface water systems (USEPA, 1999) includes a recommendation that a system's corrosion control program should be reviewed as part of the distribution system component of the survey but does not specifically refer to WQPs in relation to the LCR. However, it indicates that WQPs (e.g., turbidity, temperature, conductivity, and pH) should be reviewed as a part of the source, monitoring, reporting, and data verification components of the survey. EPA guidance for sanitary surveys of ground water systems (USEPA, 2008) states that Primacy Agencies should review WQP data to determine compliance with OWQP minimums or ranges. The guidance refers surveyors directly to LCR regulatory requirements to determine compliance with OCCT requirements. It also recommends reviewing the system's LCR tap sampling program.

Although Primacy Agencies may already be reviewing CCT and WQPs according to EPA guidance during the sanitary survey, the final requirement will promote consistent national implementation of this review. Furthermore, incorporating the review into an existing process where the Primacy Agency is

[27] The 1995 EPA/State Joint Guidance on Sanitary Surveys is included as an appendix to EPA guidance for sanitary surveys of surface water systems (USEPA, 1999).

already on-site and reviewing treatment processes, operating data, and water quality data, will promote efficiency. EPA also recognizes the importance of disseminating the most current corrosion control science to help systems refine their treatment, respond to problem situations, and anticipate challenges as new water sources and treatments are brought online.

3.5 Lead Service Line Inventory and Replacement

EPA is revising several of the LSLR provisions. The final LCRR requires systems to:

- Prepare an initial service line materials inventory (within three years of rule publication) that categorizes the water system and customer portions of each service line into rule-specified categories.
- Update the inventory annually or triennially to reflect any LSLs discovered or removed, unknowns that are investigated, or any other material classification changes. Report the updated inventory to the state and the public annually or triennially, based on their tap sampling monitoring schedule.
- Develop an LSLR plan that describes how the system would develop the inventory, implement and fund an LSLR program, and recommend a goal LSLR rate to the Primacy Agency should the system exceed the TL.
- Promote full LSLRs at locations by:
    - Requiring mandatory full LSLR, in response to a lead ALE, at an average annual rate of at least three percent, calculated on a two-year rolling basis. The base number of service lines to which three percent is applied is equal to the number of known LSLs and galvanized requiring replacement service lines at the time the system first exceeds the lead action level plus the number of unknowns at the beginning of each year of the system's LSLR program. In response to a lead TLE, implementing a full LSLR program including a goal-based replacement rate approved by the Primacy Agency.
    - Prohibiting systems from counting partial LSLRs toward their mandatory rate or replacement goal.
    - Eliminating the "tested out" provision (i.e., systems will no longer be allowed to count an LSL as "replaced" through testing, but not actual removal).
    - Requiring replacement of lead connectors as they are encountered but emphasizing full LSLR by not counting connector replacement toward the mandatory or goal-based program.
    - Requiring systems to replace their portion of the LSL if they are made aware that the customer intends to or has replaced his/her portion.
- Implement lead exposure mitigation methods after replacement of an LSL, lead connector, or other actions that can result in disturbances of that could release lead.

Conduct lead outreach to consumers with LSLs and in the event of a TLE to encourage them to participate in the LSLR program.

Exhibit 3-17 summarizes final revisions to LSLR requirements. The final regulatory changes to LSLR requirements are discussed in greater detail in Sections 3.5.1 through 3.5.3.

Exhibit 3-17: Summary of LSLR Requirements under the Final LCRR

Final Revisions	Applies to:	Based on the Following P90 Levels:		
		No TLE/ALE P90: ≤10 µg/L	**TLE** 10 µg/L < P90 ≤ 15 µg/L	**ALE** P90: >15 µg/L
Lead Service Line Testing and Replacement				
Develop initial service line materials inventory of system and customer's portions.	All CWSs and NTNCWSs	X	X	X
Replace lead goosenecks, pigtails, and connectors as they are encountered.	All CWSs and NTNCWSs	X	X	X
Update the materials inventory based on tap monitoring schedule.	All CWSs and NTNCWSs with known or possible LSLs[2]	X	X	X
Develop an LSLR plan.[1]	All CWSs and NTNCWSs with known or possible LSLs[2]	X	X	X
Collect one follow-up lead tap sample 3 to 6 months after LSLR.	All CWSs and NTNCWSs with known or possible LSLs[2]	X	X	X
Replace system's portion of an LSL when customer initiates replacement of his/her portion.	All CWSs and NTNCWSs with known or possible LSLs[2]	X	X	X
Inform consumers annually if they have an LSL, lead health effects, ways to reduce lead exposure in drinking water, and opportunities for LSLR.	All CWSs and NTNCWSs with known or possible LSLs[2]	X	X	X
Conduct targeted outreach that encourages consumers with LSLs to participate in the LSLR program.	CWSs serving > 10,000 people[2]		X	
Fully replace at least an average annual 3 percent of LSL/year based on a 2-year rolling average.[3,4]	CWSs serving > 10,000 people[2]			X

Final Revisions	Applies to:	Based on the Following P90 Levels:		
		No TLE/ALE P90: ≤10 µg/L	**TLE** 10 µg/L < P90 ≤ 15 µg/L	**ALE** P90: >15 µg/L
Fully replace all LSLs within 15 years. [3,4]	CWSs serving ≤ 10,000 people & NTNCWSs:[2] • With CCT in which P90 remain above > 15 µg/L after re-optimization. • Without CCT with LSLR as their approved compliance option.			X
Implement full LSLR program with replacement goals set in consultation with Primacy Agency.	CWSs serving > 10,000 people[2]		X	
Implement lead mitigation methods following a partial or full LSLR or other disturbances that include an ANSI-certified pitcher filter or POU for lead removal, 6 months of replacement cartridges, and use instructions.	All CWSs[2]	X	X	X

Acronyms: ALE = action level exceedance; ANSI = American National Standards Institute; CCT = corrosion control treatment; CWS = community water system; LSL = lead service line; LSLR = lead service line replacement; NTNCWS = non-transient non-community water system; P90 = lead 90th percentile level; PE = public education; POU = point-of-use; TLE = trigger level exceedance.

Notes:

[1] The plan includes a recommended goal for CWSs serving > 10,000 people should they be required to replace LSLs under a goal-based program following a lead TLE.

[2] Apply to the subset of systems with lead, galvanized requiring replacement, or lead status unknown service lines. These terms are defined in Section 3.5.1.2.

[3] CWSs that cannot meet the mandatory replacement rate are in compliance if they have no remaining lead status unknown service lines and can provide documentation they made two good faith attempts to reach all customers served by an LSL or galvanized requiring replacement that resulted in a signed or verbal refusal or non-response.

[4] Primacy Agencies must require mandatory replacement on an accelerated schedule where a faster replacement schedule is feasible. CWSs serving ≤ 10,000 people and NTNCWSs must complete this replacement even if future 90th percentiles levels are at or below the AL.

3.5.1 Develop Comprehensive Service Line Materials Inventory and LSLR Plan

3.5.1.1 *Previous Rule*

Under the previous rule, systems must have completed a materials evaluation prior to the commencement of initial tap sampling, which occurred in 1992 or 1993 depending on the system's size. The purpose of the materials evaluation was to identify a pool of targeted sampling sites that met the tiering requirements for lead and copper tap sampling discussed in Section **Error! Reference source not**

found.. Systems were to use information collected pursuant to 40 CFR 141.42(d) of the previous rule (i.e., whether lead and/or copper is present in the distribution system and/or home plumbing) and supplement that information with applicable plumbing and distribution system documents (e.g., plumbing codes, permits, inspections) and all existing water quality information. Only systems that were triggered into LSLR were required to submit the materials evaluation to the Primacy Agency along with the initial number of LSLs and a schedule for replacing seven percent of the initial number of LSLs annually (40 CFR 141.90(e)(1)).

Systems triggered into LSLR were required to replace seven percent of LSLs each year based on the number of LSLs identified in the materials evaluation. However, the previous rule did not require systems to regularly update their materials evaluation.

3.5.1.2 *Description of Final Regulatory Change*

The final LCRR requires all CWSs and NTNCWSs to prepare an initial service line inventory that categorizes the water system and customer portions of each service line into the following categories:

- **Lead** if the service line is made of lead. The final rule also defines an LSL as a "portion of pipe that is made of lead which connects the water main to the building inlet. A lead service line may be owned by the water system, owned by the property owner, or both."
- **Galvanized requiring replacement** if the galvanized service line is or was at any time downstream of an LSL, or is currently downstream of a "lead status unknown service line". The final rule also defines a galvanized service line as "iron or steel piping that has been dipped in zinc to prevent corrosion and rusting."
- **Non-lead** if the service line is known not to be lead or galvanized requiring replacement.
- **Lead status unknown service line** that is defined as "a service line that has not been demonstrated to meet or not meet the SDWA 1417 definition of lead free."

To develop the inventory, systems must review existing records and use other information or methods required by the Primacy Agency. The rule also includes these specifications for systems:

- Must presume there was an upstream LSL unless they can demonstrate that the galvanized service line was never downstream of an LSL.
- Does not need to physically verify the material composition to classify a service line as "non-lead." For example, a system can use records demonstrating the service line was installed after a municipal, state, or federal lead ban) and is not a "galvanized requiring replacement" service line.

The initial inventory must be completed within three years of rule publication. Systems must annually or triennially update the inventory to reflect any replaced or newly discovered LSLs or service line material classification changes. Systems are required to report the updated inventory to their Primacy Agency based on their tap sampling monitoring schedule such that those on semi-annual and annual tap sampling monitoring schedule would report the inventory annually and those on a triennial schedule would report the updated information every three years. Systems must make the inventory publicly accessible and indicate how to access it their Consumer Confidence Report (CCR) (see Section 3.8.2.2.1).

Systems serving more than 50,000 people must make it available on-line. Systems serving 50,000 or fewer persons have the option to make the inventory available to the public online or upon request. Online inventories may be hosted by the water system's or Primacy Agency's website or public social media page. Systems must include a location identifier for each LSL and galvanized requiring replacement service lines, such as a street address, block, intersection, or landmark.

Systems whose inventories contain only non-LSLs must have a statement available to the public that the system has no LSLs and is not required to provide inventory updates to the Primacy Agency or to the public. However, if they later discover an LSL, they would become an LSL system, be required to prepare an LSL inventory on a Primacy Agency-established schedule, and be subject to all other requirements for LSL systems.

In addition to the inventory, all systems with lead, galvanized requiring replacement, or lead status unknown service lines must develop a plan for LSLR regardless of their lead 90th percentile level.

The plan must include:

- A strategy for determining the composition of lead status unknown service lines in its inventory.
- Procedures for conducting full LSLR.
- A strategy for informing customers before a full or partial LSLR.
- A funding strategy for conducting LSLR that includes ways to accommodate customers that are unable to pay to replace the portion they own. (Water systems are only responsible for paying for replacement of the system-owned portion of the LSL.)
- A procedure for customers to flush service lines and premise plumbing of particulate lead.
- A LSLR prioritization strategy based on factors such as targeting disadvantaged consumers and populations most sensitive to the effects of lead.

For CWSs serving more than 10,000 people, the plan must also include a recommended goal-based LSLR rate in the event the system exceeds the TL.

3.5.1.3 *Rationale for Final Regulatory Change*

A comprehensive inventory of service line materials for all systems supports many goals of the final LCRR. The Agency determined it is practicable and feasible for water systems to prepare the initial inventory by the rule compliance date, as not every service line composition need be determined and may be identified as lead status unknown. It is important that water systems complete the initial LSL inventory within three years of publication of the final rule to facilitate selection of tap sampling sites under new tiering criteria (see Section 3.3.1 for additional details of this new tap sampling requirement). An accurate inventory is also a necessary starting point for Primacy Agencies to ensure that systems are meeting their goals/requirements for LSLR. Lastly, an updated inventory is needed for systems to meet the enhanced PE and outreach requirements under the final LCRR that target customers with known or potential LSLs (see Section 3.5.3.2). Based on public comment, the final LCRR updates inventory terminology such as "galvanized requiring replacement" and "lead status unknown service lines." The

rule also incorporates commenters' suggestions to match the inventory update submission frequency with the system's tap sampling monitoring period.

Because water systems may not have complete records to enable them to identify the material for every service line, the rule requires water systems to identify those lines as unknown, and then update the inventory on an annual basis to reflect more precise information about those lines. EPA determined that such an approach strikes an appropriate balance between a voluntary and mandatory requirement to conduct an accurate and complete inventory of the service line materials in the distribution system. It provides significant flexibility that would not be available if the rule required an accurate and complete inventory by a fixed date; on the other hand, by structuring the replacement requirements so as to incentivize systems to verify the materials of unknown service lines, completion of an accurate inventory is more than an aspirational goal. Including unknown service lines in the inventory will demonstrate transparency, build trust, and present an opportunity for customer engagement, all of which should mitigate any potential alarm experienced by customers with unknown service lines. Exclusion of lead status unknown service lines from the LSL inventory would likely cause significantly more confusion and alarm to the consumers at locations that are excluded from the inventory entirely.

Under the final LCRR, CWSs and NTNCWSs may, but are not required to make the addresses of identified LSLs and galvanized requiring replacement service lines publicly available. If addresses are not used, the LSL and galvanized requiring replacement service lines must be associated with another locational identifier (e.g., a street intersection, block, or landmark). An inventory that is publicly available with locational information provides all water system users and potential users an indication of where there are potential sources of lead in the drinking water. All persons served by an LSL, galvanized line requiring replacement, or lead status unknown line will be notified of their service line material classification under 40 CFR 141.85(e) after the water system conducts its initial inventory and annually or triennially thereafter. However, that notice does not reach everyone who may consume water at the location. A publicly available inventory fills that gap. Even though it will not include specific address level information, persons who may be affected by the potential in drinking water at a location can access the inventory and inquire further of the person who would have received the notice. The inventory will also provide communities with updated information regarding the total number of LSLs, galvanized, unknown, and non-LSLs, as well as the general areas where LSLs and galvanized requiring replacement service lines are most numerous. Making this information publicly available allows the community to track LSLR and material composition verification progress. In addition, prospective homebuyers could use the publicly accessible inventory to determine whether and how to work with the homeowner, real estate agent, or home inspector to identify the service line's material composition.

Requiring an LSLR plan would ensure operating procedures are in place that would ready the water system to perform the technical, financial, and other aspects of LSLR. While there is some upfront burden associated with creating an LSLR plan, the plan could significantly reduce future burden for water systems and will reduce the response time if LSLR is needed. For CWSs serving 10,000 or fewer people and all NTNCWSs, plan components like the strategy to investigate material of lead status unknown service lines, identify potential funding, and have procedures established for LSLR have the potential to significantly reduce the investigation burden that these systems choosing an LSLR compliance path would face after exceeding the lead AL and will ensure faster implementation. Investigating unknowns will also benefit public health by providing customers with information about their service line material.

The final rule adds a new LSLR plan component for water systems to include a strategy for accommodating customers who wish to replace the LSL but are unable to pay the cost of replacing the portion they own. Nothing in this provision obligates the water system to pay for replacement of a customer-owned LSL. EPA notes potential environmental justice concerns associated with full LSLR when the customer is expected to pay the entire cost to replace the customer-owned portion of the LSL. EPA believes that these impacts can be mitigated by water systems' developing a financial assistance strategy ahead of time. In recent years, EPA has become aware of water systems around the country that have successfully adopted one or more approaches for facilitating full LSLR (USEPA, 2019b). As part of their plan, water systems could investigate whether rate revenue can contribute to customer-owned LSLR or identify external LSLR funding, such as Federal or state grants or loans, that could be used to finance a customer's LSLR. EPA maintains a list of some funding sources that can be used for lead in drinking water reduction activities which can be reached at https://www.epa.gov/ground-water-and-drinking-water/funding-lead-service-line-replacement. EPA is also requiring that the LSLR plan must include a replacement prioritization strategy, which will inform how a water system will execute their LSLR program.

3.5.2 Promote Full LSLR

3.5.2.1 *Previous Rule*

The previous rule required water systems with LSLs that continue to exceed the lead AL after the installation of CCT to annually replace at least seven percent of the number of LSLs in their distribution system when the AL is first exceeded. The Primacy Agency could require systems that do not install required treatment to also initiate LSLR and/or to replace LSLs at a faster replacement rate. Three types of actions, or replacements can count toward replacement requirements: full LSLR, partial LSLR, and "tested-out" LSLs.

- **Full LSLR:** Under the previous rule, an LSL was defined as "a service line made of lead which connects the water main to the building inlet and any lead pigtail, gooseneck or other fitting which is connected to such lead line" (40 CFR 141.2). Full LSLR included replacement of the water system-owned portion and consumer-owned portion (if applicable) of the LSL as well as the connector (e.g., goosenecks and pigtails) if it is leaded. Full LSLRs were sometimes difficult to accomplish when there is partial customer ownership of the LSL.
- **Partial LSLR:** The previous rule only required systems to replace the portion of the LSL that they own. Often, the system's ownership stops at the homeowner's property line, and the homeowner's portion was not required to be replaced. This is discussed in further detail below.
- **"Tested-out" LSLs:** An LSL could "test out" (i.e., be considered replaced) if a sample taken from the LSL was at or below the lead AL. "Tested-out" LSLs did not have to be physically replaced.

Systems were required to replace the portion of the LSL that they own. When the system did not own the entire LSL, it had to offer to replace the customer's portion at his or her expense. If the customer elected not to have his or her portion replaced, the system was not required to replace the customer-owned portion and still received LSLR credit for replacing the system portion only. In addition, systems were not required to replace the customer-owned portion of the line where doing so was precluded by state, local, or common law.

In those instances where a system only replaced its portion of the LSL (i.e., partial LSLR), it was required to:

- Provide notification to affected residents 45 days prior to the partial LSLR that included information on possible elevated short-term lead levels and measures to minimize exposure. The notification also informed the resident(s) that within 72 hours of the replacement, the system would collect a sample at its expense from each partially-replaced LSL that is representative of the water in the service line for analysis of lead content.
- Collect a representative LSL sample for lead analysis at each residence that requested it within 72 hours of the replacement.
- Notify owners and residents of the LSL sample results within 3 business days of receiving the results.

3.5.2.2 ***Description of Final Regulatory Change***

Under the final LCRR, EPA is accelerating full LSLR through new requirements based on the system's 90th percentile lead concentration and adding new requirements for all systems with LSLs. They include a mandatory LSLR program for systems with a lead ALE, a goal-based program for systems with a lead TLE, elimination of incentives to conduct partial LSLRs, elimination of the test out provision, requirements to complete LSLR when customers initiate replacement of their portion, and mitigation methods following LSLR or other disturbances that may cause lead release. These requirements are discussed in more detail in Sections 3.5.2.2.1 through 3.5.2.2.5. Systems are also required to provide enhanced outreach to consumers that are served by LSLs, galvanized service lines requiring replacement, or by a service line of lead status unknown service line. These public outreach requirements are discussed in detail in Section 3.5.3.

3.5.2.2.1 Mandatory LSLR for Systems with a Lead ALE

The final LCRR requires systems that have a lead ALE to begin mandatory LSLR. The final LCRR requires CWSs serving more than 10,000 people to conduct full replacement at an average annual rate of three percent of their LSLs, calculated on a two-year rolling average. The Primacy Agency must require a faster schedule if feasible and must notify the system of this requirement within 6 months after the system initiates LSLR. In the first year of replacement, the rate is applied to the sum of known lead, galvanized requiring replacement, and lead status unknown service lines in the initial inventory when the system first exceeds the lead AL. The number of service lines requiring replacement must be updated annually to subtract the number of lead status unknown service lines that were discovered to be non-lead and to add any non-LSLs that were discovered to be an LSL or a galvanized requiring replacement service line. Only replacements that result in the removal of the entire LSL count as a replaced LSL. Specifically, the following do not count toward the replacement rate: 1) partial replacements, 2) the verification of a lead status unknown service line as non-lead in the inventory, or 3) the replacement of a lead connector. The system must, however, replace any lead gooseneck, pigtail, or connector it owns when encountered during planned or unplanned water system infrastructure work, including during LSLR, and offer to replace those owned by the customer at the owner's expense. CWSs that cannot meet the mandatory replacement rate remain in compliance and can discontinue mandatory LSLR if they have no remaining lead status unknown service lines and can certify that they made two good faith attempts to reach all

customers served by an LSL or galvanized requiring replacement that resulted in a signed or verbal refusal or non-response. Systems must provide this certification that includes the number of refusals and non-response and the accuracy of this information within 30 days after the end of each tap sampling period.

Systems can also discontinue the mandatory replacement program when the water system's 90th percentile lead levels are at or below the action level for 2 years (four consecutive six-month tap sampling monitoring periods) and the cumulative percentage of LSLs replaced by the system is greater than or equal to 3 percent times the number of years that elapsed between when the system most recently began mandatory LSLR and the date on which the system's 90th percentile lead levels are at or below the action level for 2 years. If the water system exceeds the lead AL again, it must:

- Recommence mandatory lead service line replacement at the same two-year rolling average rate, unless the Primacy Agency has designated an alternate replacement rate.
- Provide the Primacy Agency with its schedule for replacing an average annual rate of at least three percent of their LSLs, calculated on a two- year rolling average, using a base number equal to the initial number of LSLs and galvanized lines requiring replacement (at the time of the system's first ALE), and lead status unknown service lines (at the time of each required annual cycle of LSLR) in its distribution system no later than 12 months after the end of the tap sampling period in which it exceeded the lead AL.
- Contact any customers served by a full or partial LSL or galvanized requiring replacement with an offer to replace the customer-owned portion.

Mandatory LSLR also applies to CWSs serving 10,000 or fewer people and NTNCWSs with LSLs that elect LSLR as their compliance option (see Section 3.2.2.2 for more information about ***flexibility for small CWSs and all NTNCWSs***). These requirements are similar to those for larger CWSs. However, CWSs serving 10,000 or fewer people and all NTNCWSs must ensure complete replacement of all LSLs, including those owned by customers, on a schedule specified by the Primacy Agency, not to exceed 15 years from the end of the monitoring period in which the ALE occurred. In addition, they must complete replacement even if they no longer exceed the lead AL.

3.5.2.2.2 Goal-Based LSLR for Systems with a Lead TLE

Under the final LCRR, CWSs serving more than 10,000 people that exceed the TL but not the lead AL must begin implementing goal-based LSLR program with a goal replacement rate that has been approved by the Primacy Agency. Similar to the mandatory LSLR program, under the goal-based program:

- Eligible for replacement under the approved rate are known lead and galvanized requiring replacement service lines.
- The system must also make the same annual adjustment to the inventory as described above.
- Only full LSLRs count toward the system's annual replacement goal.

If systems fail to meet their LSLR goal, they must conduct additional outreach activities to LSL consumers to promote LSLR and encourage consumers to participate in the replacement program. In the first year, the system must select at least one of the following outreach activities:

- Sending certified mail to consumers with lead, galvanized requiring replacement, or lead status unknown service lines to inform them about the system's goal-based LSLR program and opportunities for replacement of the service line;
- Conducting a town hall meeting;
- Participating in a community event to provide information about the system's LSLR program and distributing PE materials that describe the health effect of lead, sources of lead, and steps consumers can take to reduce exposure to lead in drinking water;
- Contacting customers by phone, text message, email, or door hanger; or
- Using another Primacy Agency-approved method to discuss the LSLR program and opportunities for LSLR.

For each additional concurrent year in which the system fails to meet its goal, the system must conduct one of the activities listed above and two additional activities from the following list:

- Conducting a social media campaign;
- Conducting outreach via newspaper, television, or radio;
- Contacting organizations representing plumbers and contractors by mail to provide information about lead in drinking water including health effects, sources of lead, and the importance of using lead free plumbing materials; or
- Visiting targeted customers to discuss the LSLR program and opportunities for replacement.

A system must continue the outreach annually until: 1) the goal is met or 2) the system is at or below the TL for two consecutive one-year tap sampling monitoring periods.

Annually by July 1, the water system must demonstrate to the Primacy Agency that it met its outreach requirements when failing to meet the LSLR goal for the previous calendar year and include a copy of the outreach materials.

EPA is providing flexibility for CWSs serving 10,000 or fewer and all NTNCWSs. CWSs serving 10,000 people or fewer and all NTNCWSs with LSLs that exceed the TL have the ability to recommend to their Primacy Agency an approach to control lead (see Section 3.2.2.2). If these systems recommend LSLR as their compliance option and the Primacy Agency approves it, they would be required to replace all of their LSLs within 15 years from the end of the monitoring period in which the ALE occurred or on a schedule specified by the Primacy Agency if they have a subsequent lead ALE.

3.5.2.2.3 Limited Allowance for Partial LSLRs and Removal of Test Out Provision

Under the final rule, systems can still replace only their portion of the LSL so long as risk mitigation procedures in the final rule are taken (see Section 3.5.2.2.5); however, partial replacements no longer count as an LSLR for the goal-based and mandatory LSLR programs. In addition, systems can no longer

replace an LSL through the "tested-out" procedures. Only those replacements that result in the replacement of the entire LSL count toward a system's replacement goal or mandatory replacement rate.

3.5.2.2.4 Customer-Initiated LSLR

CWSs that are notified by the customer that he or she will replace his/her portion of an LSL must make a good faith effort to coordinate simultaneous replacement of their portion. If simultaneous replacement cannot be conducted, the system has 45 days to replace its portion of the line from the date the customer replaces his/her portion. The replacement timeframe can be extended up to 180 days if the system notifies the Primacy Agency within 30 days of failing to meet the 45-day deadline. If the system is notified or otherwise learns that the customer replaced his or her portion within the previous six months, the CWSs has 45 days to replace the system-owned portion or up to 180 days if the system notifies the Primacy Agency within 30 days of learning about the customer-side replacement. A system that is subject to the goal-based or mandatory LSLR program may count these replacements toward the replacement rates. A system is not required to replace the system-owned portion if it learns of the customer-owned replacement six months or more after it has occurred. However, the system-owned portion must be considered for any future replacement under the goal-based or mandatory LSLR program.

3.5.2.2.5 Mitigation Methods Following LSLR or Other Lead Disturbances

The final LCRR specifies lead mitigation methods that systems must follow after partial or full LSLR and other activities that may cause lead disturbances.

For any partial or full LSLR the system must:

- Provide notice to the owner of the LSLR, or the owner's authorized agent, as well as any non-owner resident(s) served by the LSL that consumers may experience a temporary increase of lead levels in their drinking water due to the replacement, information about the health effects of lead, and actions consumers can take to minimize their exposure to lead in drinking water. The notice is due within 24 hours of completion of the replacement for full LSLRs or before the affected service line is returned to service for emergency or partial replacements.
- Provide information about service line flushing.
- Provide the consumer with a pitcher filter or POU device certified by an American National Standards Institute (ANSI) accredited certifier to reduce lead and six months of replacement cartridges, and instructions for its use at the time of the replacement or for replacements in which the customer has replaced his/her LSL, within 24 hours of learning of the replacement.
- Offer to collect a lead tap sample at these residences between three and six months after replacement. Systems must provide the consumers with their results within 30 days of learning of the result unless the sample is above 15 µg/L. In that event, the results must be provided as soon as practicable but no later than 3 calendar days. Water systems that choose to mail the notification must assure those letters are postmarked within three days.

For disturbances to lead, galvanized requiring replacement, or lead status unknown service line without a partial or full LSLR must undertake the following actions before the affected service line is returned to service:

- Systems that shut off or bypass an individual service line (e.g., when operating a valve on a service line or meter setter) must provide the person served by the water system at the service connection with information about the potential for elevated lead levels in drinking water as a result of the disturbance as well as a flushing procedure to remove particulate lead.
- Systems that replace an inline water meter; a water meter setter; or gooseneck, pigtail, or connector must provide the person served by the water system at the service connection with information about the potential for elevated lead levels in drinking water as a result of the disturbance, lead PE, a pitcher filter or POU device certified by an ANSI-accredited certifier to reduce lead, instructions to use the filter, and six months of filter replacement cartridges.

3.5.2.3 ***Rationale for Final Regulatory Change***

3.5.2.3.1 Mandatory LSLR for Systems with a Lead ALE

The final LCRR is consistent with the previous rule in that it sets a mandatory replacement rate when there is a lead ALE. In the final LCRR, EPA is requiring a full mandatory annual average replacement rate of at least three percent of a system's LSLs, calculated on a two-year rolling average compared to the previous rate of seven percent which included partial LSLR and situations where a line could be tested out. The previous LCR did not require full replacement of LSLs and the required seven percent replacement rate is rarely occurring since there are provisions in the previous rule that allowed systems to discontinue LSLR. In addition, under the final LCRR systems that implement a mandatory replacement program (see Section 3.5.2.3.1) or goal-based program (see Section 3.5.2.3.2) are also prohibited from counting "tested out" LSLs and partial LSLRs toward their replacement rate or goal, which are not proven to increase public health protection. Additionally, very few water systems were actually required to replace LSLs under the previous rule after exceeding the lead AL. Water systems without CCT can take up to 48 months to study and install CCT following an ALE. If during that period a system has two rounds of tap sampling 90th percentile result at or below the lead and copper AL, the system could discontinue CCT installation. Under the previous rule, a system was not required to begin LSLR unless it exceeded the lead AL after the system installed CCT. EPA has found that very few systems that exceeded the lead AL were required to conduct LSLR likely because they had never been required to install CCT. The Agency finds that a rolling average construct associated with the replacement rate is appropriate for the final rule. A water system may receive heightened customer interest in LSLR immediately following a lead ALE. Replacing more than 3 percent of LSLs in the first year of an LSLR program under a rolling average rate will result in earlier reductions in drinking water lead exposure for those households served by systems that are able to obtain resources for a short-term expedited replacement program. This would remove a potential unintended incentive under a fixed rate of 3 percent to replace the minimum number of LSLs in the first year to ensure there is sufficient customer participation to achieve 3 percent in the second year. EPA notes that while the final rule requires states to set the mandatory LSLR rate higher than 3 percent where feasible, the short-term ability of a water system to replace more than 3 percent immediately following a lead ALE when customer interest is highest is not necessarily indicative of long-term feasibility. EPA also notes that a rolling average approach could provide flexibility to water

systems that experience delays in initiating LSLR programs. Some systems may not immediately have access to LSLR financing following a lead ALE, and therefore would face increased challenges to meet the mandatory 3 percent LSLR in the first year. These challenges could be compounded where the water system experiences delays securing financing and then faces construction moratoriums in the winter months, which commenters mentioned in the context of customer-initiated replacement. The rolling average approach could alleviate these challenges. EPA recommends that water systems begin LSLR as quickly as possible following an ALE to assure that the system achieves the required 3% rolling annual average by the end of the second year following the ALE. EPA notes that by having the LSLR plan prepared in advance as required by the rule, systems should be positioned to avoid delays and have timely implementation of their LSLR program. EPA recognizes that potential funding or scheduling delays that may impede a water system's ability to achieve the LSLR rate or circumstances such as higher than average customer interest that may expedite a water system's ability to achieve the LSLR rate may occur throughout implementation of the LSLR program. Therefore, EPA has constructed the rolling average approach for the duration of the LSLR. The rolling average approach is not intended to address delays caused by customer refusals, as the final rule includes a mechanism for a water system to cease LSLR after it shows no unknowns in its inventory and has received replacement refusals from all customers served by an LSL or galvanized requiring replacement service line.

EPA has determined that the revisions to the LCR, as a whole, maintain or provide for greater public health protection. Because a treatment technique rule is not centered on a single compliance level, but rather on an integrated set of actions designed to reduce the level of exposure to a contaminant, the backsliding analysis for a treatment technique rule should be based on an assessment of public health protection as a result of implementation of the rule as a whole, rather than a comparison of numerical benchmarks within the treatment technique rule. Even when the LSL removal rates are compared directly, this rule results in a greater rate of removal. Improvements in the final rule will result in a 5 to 73 fold increase in full LSLR investments by closing loopholes, improving sampling and monitoring requirements, compelling early action, and strengthening replacement requirements. See Chapter 5 Section 5.3.4 for additional information. LSLR programs are required to be initiated at systems that exceed the lead TL of 10 µg/L versus the 15 µg/L AL in the previous LCR. The requirement for an LSLR plan for all systems with LSLs, galvanized requiring replacement, or lead status unknown service lines will avoid delays in initiating LSLR that have hampered progress under the previous rule. Furthermore, the more stringent sampling requirements in the final rule will better identify elevated lead levels associated with LSLs, which will result in more systems that exceed the lead TL and AL and are thus required to replace LSLs.

The revised LSLR requirements will assure that these full LSLRs reduce the drinking water lead exposure to the residents of the homes that are served. As in the previous LCR, for circumstances in which a faster replacement schedule is feasible, Primacy Agencies must require systems to replace LSLs on a faster schedule (i.e., a higher annual percentage than required under the federal rule), taking into account the number of LSLs in the system. By requiring full LSLR, the final rule will require that water systems engage with their customers to obtain their agreement to replace the customer-owned portion of the line and possibly to gain access to the customers property because the final LCRR requires full LSLR to count towards mandatory and goal rate annual LSLR. The water system may also need to make arrangements with the customer to pay the cost of replacing the customer-owned portion of the service line.

Similar to CCT requirements under the final LCRR, EPA is including small CWS and NTNCWS flexibility in LSLR requirements. The final LCRR provides all NTNCWSs and CWSs that serve 10,000 or fewer people compliance alternatives in evaluating the best treatment technique to control lead and to implement their chosen approach based on Primacy Agency approval. See Section 3.2.2 and Exhibit 3-3 above for additional information of the small system compliance alternatives. LSLR is a resource-intensive process and may not be the most feasible solution for some systems. Under the final LCRR, CWSs serving 10,000 or fewer people and all NTNCWSs can choose the approach (i.e., CCT, LSLR, POU devices, or replacement of lead-bearing plumbing materials) that would be the most appropriate. For these systems that choose LSLR, EPA is requiring replacement of all LSLs and galvanized requiring replacement service lines on a schedule approved by the Primacy Agency, not to exceed 15 years. Once the LSLR commences, the final rule does not allow it to stop until all the lines are removed.

3.5.2.3.2 Goal-Based LSLR for Systems with a Lead TLE

The final LCRR increases public health protection by requiring systems that have a TLE to implement a goal-based LSLR program. The goal-based LSLR program is intended to reflect the specific water system's priorities and community characteristics, including the pace of existing capital improvement schedules and other programs water systems may have for achieving faster replacements.

EPA is requiring CWSs serving more than 10,000 persons that fail to meet their annual LSLR goal to conduct additional public outreach activities. Failure to meet the LSLR goal will not be a violation; however, failure to conduct public outreach activities will result in a treatment technique violation. To increase customer awareness of the potential higher exposure to lead from an LSL and advance customer interest in participating in the goal-based LSLR program, water systems must conduct annual public outreach activities until the water system meets its replacement goal or a water system is no longer required to perform a goal-based LSLR program. To enhance community engagement and allow water system flexibility as suggested by the NDWAC, EPA is providing options to meet this requirement, so water systems can conduct effective community engagement. The options provided for annual outreach activities in the final rule are intended to be inclusive and not exclude some segments of the population. For example, a social media campaign may be an option but must be accompanied by at least two other forms of outreach to ensure that water systems reach individuals who may not use social media. Based on public comments, EPA also included additional options that CWSs may select if they continue to fail to meet their goal.

3.5.2.3.3 Limited Allowance for Partial LSLRs and Removal of Test Out Provision

Partial LSLR has been associated with elevated lead levels at the tap (Sandvig et al., 2008). These elevations in lead levels can last days, weeks, months or longer. EPA asked the SAB to evaluate the current scientific data regarding the effectiveness of partial LSLR, specifically: 1) associations between partial LSLR and blood lead levels in children; 2) lead tap water sampling data before and after partial LSLR; 3) comparisons between partial and full LSLRs; 4) partial LSLR techniques; and 5) the impact of galvanic corrosion. The SAB deliberated and sought input from the public at meetings held on March 30 and 31, 2011 and during a public conference call on May 16, 2011. SAB's final report, entitled "SAB Evaluation of the Effectiveness of Partial Lead Service Line Replacements" (USEPA, 2011b) was transmitted along with a memorandum to EPA Administrator on September 28, 2011.

The SAB found that the quantity and quality of the available data are inadequate to fully determine the effectiveness of partial LSLR in reducing drinking water lead concentrations. The small number of studies available had significant limitations (small number of samples, limited follow-up sampling, lack of information about the sampling data, limited comparability between studies, etc.) for fully evaluating partial LSLR efficacy. Nevertheless, despite these limitations, the SAB concluded that partial LSLRs have not been shown to reliably reduce drinking water lead levels in the short-term, ranging from days to months, and potentially even longer, suggesting the potential for harm rather than benefit during that time period. The available data suggest that the elevated tap water lead levels tend to gradually stabilize over time following partial LSLR, sometimes at levels below and sometimes at levels similar to those observed prior to partial LSLR. In summary, the SAB found the available information is broadly suggestive that partial LSLR may pose a risk to the population due to the short-term elevations in drinking water lead concentrations. The SAB found that full LSLR appears generally effective in reliably achieving long-term reductions in drinking water lead levels. However, based on the studies reviewed, full LSLR also results in elevated lead levels for a variable period of time after replacement.

Partial LSLRs cannot be fully prohibited since they may be unavoidable in certain situations, such as during main breaks and emergency service line repairs. These final requirements eliminate the previous rule's incentives to conduct partial LSLRs, with the intention of significantly reducing the occurrence of partial LSLRs to protect public health. In those instances where partial LSLRs occur, systems must act more quickly to provide the customer with risk mitigation measures that include flushing instructions and a pitcher filter or POU device certified by an ANSI-accredited certifier to remove lead with six months of replacement cartridges and instructions for use to the consumer within 24 hours of the replacement.

3.5.2.3.4 Customer-Initiated LSLR

The final rule requires that water systems complete customer-initiated LSLR within 45 days, with the possibility of an extension to 180 days after notification to the state. EPA encourages water systems to establish a process for customer-initiated LSLRs that would allow for upfront coordination on timing and would avoid the need for a reactionary replacement of the water system portion of the LSL. To mitigate potential lead exposure associated with a partial LSLR until the system completes the full replacement, the water system must provide the consumer with a pitcher filter or POU device (see Section 3.5.2.2) with six months of replacement cartridges and use instructions to consumers until the replacement is completed. Because of the potential for partial LSLR to contribute higher levels of lead into drinking water, water systems must also provide the above mitigation materials within 24 hours of learning of a customer replacement that leaves in place a system-owned LSL and that occurred within the past six months. This new requirement will ensure customers are protected from the effects of partial LSLR, regardless of who owns the remaining LSL portion.

3.5.2.3.5 Mitigation Methods Following LSLR or Other Lead Disturbances

EPA is also mandating risk mitigation best practices following LSLR and other actions that can cause lead disturbance to protect consumers from possible temporary increases in lead levels. These include requirements for water systems to provide consumer notification, flushing instructions, a ANSI-certified pitcher filter or POU device for lead removal with six months of replacement cartridges and use instructions, and an offer to collect a lead tap sample between three and six months after replacement. EPA agrees with public commenters that providing notification and risk mitigation before the consumer

uses the water is of primary importance and has revised the requirement for notification and risk communication to be prior to returning the affected service line to service.

3.5.3 LSL Notification and Targeted Outreach to LSL Consumers

3.5.3.1 *Previous Rule*

Under the previous rule, a system was required to notify the owner of the LSL, or the owner's authorized agent, that the system would replace the portion of the service line that it owns and replace the owner's portion of the line at the owner's expense. In those instances in which the system only replaced its portion of the LSL, the system was required to provide written notification to affected residents at least 45 days prior to the partial LSLR.[28] The notification had to include information on possible elevated short-term lead levels and measures to minimize exposure, and an offer for the system to collect a sample within 72 hours of the replacement and analyze it for lead at the system's expense.

3.5.3.2 *Description of Final Regulatory Change*

All CWSs and NTNCWSs must provide a notice to consumers that are served by lead, galvanized requiring replacement, or by lead status unknown service lines within 30 days of completing the LSL inventory by mail or other Primacy Agency-approved method. The notice must indicate the service line is lead, galvanized requirement replacement, or unknown but may be lead, and include an explanation of the health effects of lead, steps consumers can take to reduce exposure to lead in drinking water, information about opportunities to replace LSLs, and contact information for the water utility. This notice must be repeated annually until the entire service connection is no longer a lead, galvanized requiring replacement, or lead status unknown service. This notice is delivered to new consumers at the time of service initiation.

CWSs serving more than 10,000 people that exceed the lead TL but not the lead AL must provide information regarding the system's LSLR program and opportunities for replacement of LSLs to customers with lead, galvanized requiring replacement, or lead status unknown service line material. The outreach also must include an explanation of how to access the service line inventory so the consumer can find out if they have an LSL and information on the presence of LSLs in the community, information on programs that provide financing solutions to assist property owners with replacement of their portion of an LSL, and a statement that the water system is required to replace its portion of an LSL when the property owner notifies them they are replacing their portion of the LSL. Systems must provide this notice within 30 days of the end of the tap sampling period in which the TLE occurred using mail or other Primacy-approved method. Systems with a lead ALE must follow PE requirements that are consistent with the previous rule as discussed in Section 3.8.1.

3.5.3.3 *Rationale for Final Regulatory Change*

Under the previous rule, PE to consumers was required when a system has a lead ALE. In addition, systems required to conduct LSLR had to contact LSL customers prior to the replacement. The final LCRR

[28] The Primacy Agency can allow a shorter timeframe when the replacement is done in conjunction with emergency repairs.

includes an enhanced outreach program to provide LSL consumers with more frequent and robust information about lead in drinking water. The goal of this targeted outreach is to inform consumers about the health effects and sources of lead including LSLs and to encourage them to participate in the system's LSLR program. By requiring notification to encourage consumers to replace their portion of the line, EPA expects that more LSLs will be fully replaced and residents at these locations will have reduced lead exposure. This revision draws on the "shared responsibility" of the LCR (NDWAC, 2015). In their recommendations to EPA, NDWAC noted: "Effective elimination of leaded materials in contact with water and minimization of exposure to lead in drinking water is a shared responsibility. PWSs, consumers, building owners, public health officials and others each have important roles to play" (NDWAC, 2015). Part of this shared responsibility is ensuring that the public is well-informed.

EPA decided to include PE to homes with lead status unknown service lines because it will provide these consumers with necessary information to aid them in decision making and increase transparency and trust in the water system. Consumers served by lead status unknown service lines may decide to take steps to determine the material of their service line and/or take measures to reduce their potential exposure to lead in drinking water.

3.6 Point-of-Use Treatment

EPA is allowing CWSs serving 10,000 or fewer people and all NTNCWSs the flexibility to use POU devices to address high lead levels based on Primacy Agency approval. The final regulatory requirements for POU devices are discussed in greater detail in Section 3.6.1 and summarized in Exhibit 3-18.

Exhibit 3-18: Summary of the POU Alternative to CCT and LSLR under the Final LCRR

Final Revisions	Applies to:	Based on the Following P90 Levels:		
		No TLE/ALE P90: ≤10 µg/L	**TLE** 10 µg/L < P90 ≤ 15 µg/L	**ALE** P90: >15 µg/L
POU Provision and Maintenance				
Submit a recommendation to the Primacy Agency.[1, 2]	CWSs ≤ 10,000 and all NTNCWSs that select this option.		X	X
Provide and maintain one POU device at all homes served by the system.[3, 4]	CWSs ≤ 10,000 approved for this option.			X
Provide and maintain POU devices at all taps used for drinking water consumption.[3, 4]	All NTNCWSs approved for this option.			X
Collect a tap sample at one-third of sites that have installed POUs annually.[4]	CWS ≤ 10,000 and all NTNCWSs .	X	X	X

Acronyms: ALE = action level exceedance; CWS = community water system; NTNCWS = non-transient non-community water system; P90 = lead 90th percentile level; POU = point-of-use; TLE = trigger level exceedance.
Notes:

General: CWSs serving ≤ 10,000 people that have access to all homes they serve and all NTNCWSs have the flexibility to choose POU provision and maintenance as their compliance option based on Primacy Agency approval.
[1] This requirement also applies to systems that choose this option and have an ALE without a prior TLE. Systems must obtain Primacy Agency approval before implementing a POU program.
[2] Those with a TLE that choose the POU compliance option must submit a recommendation to the Primacy Agency for approval.
[3] CWSs serving ≤ 10,000 people and all NTNCWSs that have an ALE must implement their POU program.
[4] Systems must continue these requirements regardless of their subsequent lead 90th percentile levels unless the Primacy Agency approves another compliance measure.

3.6.1 POU Provision and Maintenance

3.6.1.1 *Previous Rule*

The previous rule did not include provisions for systems to install, continuously operate, and maintain POU treatment in lieu of complying with CCT requirements in response to a lead or copper ALE. However, Primacy Agencies may grant a variance or exemption to CCT requirements for small systems (Section 1412(b)(4)(E)(ii) of the SDWA; USEPA, 2006c). According to 40 CFR 142.62(f), "The State may require a public water system to use bottled water and point-of-use devices or other means, *but not point-of-entry devices*, as a condition for granting an exemption from corrosion control treatment requirements for lead and copper in §§141.81 and 141.82 to avoid an unreasonable risk to health." These are intended to be short-term solutions for the interim period before the system implements a longer-term solution.

3.6.1.2 *Description of Final Regulatory Change*

Under the final LCRR, CWSs serving 10,000 or fewer people that have access to all homes and non-residential buildings they serve and all NTNCWSs can use POU devices to address high levels of lead in lieu of CCT or LSLR with Primacy Agency approval. POU devices must be certified by an ANSI-accredited certifier to reduce lead and be equipped with mechanical warnings to notify users of the need for filter cartridge replacement or operational problems. The POU requirements vary by a system's lead 90th percentile. Specifically, systems with a TLE that elect this option must submit a recommendation to the Primacy Agency within six months after the end of the tap sampling period in which they exceeded the TL. The Primacy Agency must approve a system's compliance choice or require an alternative approach within six months of receipt of the system's recommendation.

Systems with a lead ALE that have received Primacy approval for the POU compliance option must implement a POU program on a schedule specified by the Primacy Agency not to exceed one year. Specifically:

- CWSs must install and maintain a minimum of one POU device per household and at every tap used for human drinking or cooking in non-residential buildings served by the system, provide PE on the proper use of POU device, and collect lead tap samples at one-third of the POU sites annually to assess performance.

- NTNCWSs must provide and maintain POU devices at all taps used for drinking water consumption, provide PE regarding the POU program, and collect lead tap samples at one-third of POU devices annually.
- POU device must be equipped with mechanical warnings to ensure that customers are automatically notified of operational problems.
- CWSs and NTNCWSs must report tap sampling results no later than 10 days after the end of the tap sampling monitoring period.
- If a tap sample result exceeds 10 µg/L, CWSs and NTNCWSs must:
    - notify the homeowner and/or building management no later than 24 hours of receiving the tap sample result.
    - complete corrective actions within 30 days or provide documentation to the Primacy Agency within 30 days explaining why they were unable to correct the issue.
- Systems must also submit documentation that certifies the maintenance of the POU devices if requested by the Primacy Agency.

Systems that select this option must continue to operate and maintain the POU devices regardless of the subsequent 90th percentile results, unless they receive Primacy Agency approval to select one of the other small system compliance flexibility options.

Note that copper monitoring still applies to systems implementing a POU program. These sites are considered representative sites and the criteria for determining a system's number of samples and monitoring schedule is the same as the previous rule (see Exhibit 3-7 in Section 3.3.3).

3.6.1.3 ***Rationale for Final Regulatory Change***

CWSs serving 10,000 or fewer people and NTNCWSs may not have the technical expertise to evaluate, install, and maintain CCT. POU treatment units offer systems a potentially simpler remediation option than the installation of CCT or LSLR. EPA is therefore allowing the use of POU treatment units as an alternative path to compliance. Section 1412(b)(4)(E) of the SDWA requires PWSs using POU treatment units to own, control, and maintain the treatment units to ensure proper operation and maintenance and compliance with the treatment technique. It also requires that the POUs be equipped with mechanical warning devices to ensure that customers are automatically notified of operational problems.

EPA believes that some small water systems can cost effectively install and maintain POU devices in their customer's homes. Most NTNCWSs own and control all the outlets in their system and can ensure proper operation and maintenance of installed units. In addition, small CWSs have fewer households at which they would need to provide POU devices compared to larger CWSs. As a result, EPA is limiting the use of POU devices to CWSs that serve 10,000 or fewer people and all NTNCWSs, as this would not be a feasible treatment strategy for larger CWSs.

EPA is also requiring certain measures to help ensure the proper maintenance and early detection of any issues. All POU devices must be certified by an ANSI accredited certifier to reduce lead and be equipped

with mechanical warnings to notify users of the need for cartridge replacement or operational problems. In addition, systems must provide PE to consumers on how to properly use the units to maximize the units' effectiveness in reducing lead levels in drinking water. This requirement is consistent with EPA's 2006 guidance regarding POU/point-of-entry (POE) devices for small systems that recommends systems invest in PE when implementing POU/POE devices to maintain consumer participation and satisfaction (USEPA, 2006c). Also, systems must annually sample one-third of these devices to ensure that they are operating properly and report results from the tap sampling to their Primacy Agency no later than 10 days after the end of the tap sampling monitoring period. In addition, systems must certify maintenance of the POU device to their Primacy Agency unless it waives this certification requirement.

The LCRR also requires systems to take additional action in the event that a sample exceeds the TL of 1 µg/L. Systems must report any sample results above the TL to the homeowner or building manager, and take corrective action within 30 days or document to the Primacy Agency why the deadline could not be met. In addition, the LCRR requires systems to operate and maintain the POU devices until the system receives approval from the Primacy Agency to select one of the other compliance flexibility options and implements it.

As discussed in Section 3.2.2.2, CWSs serving 10,000 or fewer people and NTNCWSs can choose the most appropriate approach for addressing high lead levels under the final rule. This flexibility has been built into the final rule so that small CWSs and NTNCWSs are not overburdened with the installation of CCT and/or LSLR. The installation and maintenance of POU devices may be the preferred and less burdensome treatment option for some NTNCWSs and small CWSs compared to CCT, LSLR, or the replacement of lead-bearing plumbing materials.

3.7 Replacement of Lead-Bearing Plumbing Materials

EPA is allowing CWSs serving 10,000 or fewer people and all NTNCWSs that do not have LSLs the ***flexibility to choose*** replacement of lead-bearing plumbing materials to address elevated lead levels within the system with Primacy Agency approval. Water systems approved for this option must also have control over all plumbing in their buildings. Exhibit 3-19 summarizes the final requirements for replacement of lead-bearing plumbing materials. The final requirements are discussed in greater detail in Section 3.7.1.2.

Exhibit 3-19: Summary of Replacement of Lead-Bearing Plumbing Materials Requirements under the Final LCRR

Final Revisions	Applies to:	Based on the Following P90 Levels:		
		No TLE/ALE P90: ≤10 µg/L	**TLE** 10 µg/L < P90 ≤ 15 µg/L	**ALE** P90: >15 µg/L
Replacement of Lead-Bearing Plumbing Materials				
Submit a recommendation to the Primacy Agency.[1]	CWSs serving ≤ 10,000 people and NTNCWSs without LSLs that elect this option		X	X[3]

Final Revisions	Applies to:	Based on the Following P90 Levels:		
		No TLE/ALE P90: ≤10 µg/L	**TLE** 10 µg/L < P90 ≤ 15 µg/L	**ALE** P90: >15 µg/L
Replace all lead-bearing plumbing materials.[2]	CWSs serving ≤ 10,000 people and NTNCWSs without LSLs approved for this option			X[3]

Acronyms: ALE = action level exceedance; CCT = corrosion control treatment; NTNCWS = non-transient non-community water system; P90 = lead 90th percentile level; TLE = trigger level exceedance.

Notes:

General: CWSs serving ≤ 10,000 people and NTNCWSs without LSLs can select replacement of lead-bearing plumbing materials as their compliance option for addressing lead if they have control over the plumbing in all buildings they serve and based on Primacy Agency approval.

[1] Those with a TLE must submit a recommendation for replacing all lead-bearing plumbing materials to the Primacy Agency for approval.

[2] Systems that receive approval for this option and have an ALE must replace all lead-bearing plumbing materials on a schedule established by the Primacy Agency but not to exceed one year.

[3] Also applies to CWSs serving ≤ 10,000 people and NTNCWSs that receive approval for this option but did not have a TLE prior to having an ALE.

3.7.1 Replacement of Lead-Bearing Plumbing Materials

3.7.1.1 *Previous Rule*

In the preamble to the LCR Short-Term Revisions, EPA noted that there was sufficient flexibility under the previous rule for small NTNCWSs that control 100 percent of plumbing fixtures and components to replace them in lieu of CCT and/or LSLR (USEPA, 2007). A system that replaces plumbing fixtures and components was considered optimized once the system was at or below the AL for two consecutive six-month tap sampling monitoring periods.

3.7.1.2 *Description of Final Regulatory Change*

Under the final LCRR, replacement of all lead-bearing plumbing materials is an additional small system compliance option for CWSs serving 10,000 or fewer people and all NTNCWSs if they have control over all plumbing in their buildings and no unknown, galvanized, or LSLs. Systems with a TLE that elect this option must submit a recommendation to the Primacy Agency within six months after the end of the tap sampling monitoring period in which they exceeded the TL. The Primacy Agency must approve the systems compliance choice or require an alternative approach within six months of receipt of the system's recommendation. Systems with a lead ALE that have received Primacy Agency approval to replace lead-bearing materials must replace them within one year or on a faster schedule if specified by the Primacy Agency and provide certification of the replacement to the Primacy Agency within one year of designation of this option.

Note that any system with a lead ALE approved by the Primacy Agency to replace lead-bearing plumbing materials must complete their replacement even if its lead 90th percentile level drops such that it no longer has a lead ALE.

3.7.1.3 *Rationale for Final Regulatory Change*

Small CWSs and NTNCWSs may not have the technical expertise to evaluate, install, and maintain CCT. Replacement of lead-bearing plumbing materials may be a viable and less burdensome treatment option for some small CWSs and NTNCWSs compared to CCT and the use of POU devices. As explained by a commenter in the public comment process for the proposed rule,[29] this option may especially be more feasible for small CWSs that do not wish to operate OCCT or install POU devices in perpetuity but have control over all lead-bearing plumbing materials, such as small CWSs that are assisted living facilities, boarding schools, prisons, and apartment buildings.

EPA is limiting this option to those that have control over all of their plumbing because otherwise consumers could change the plumbing without the system's knowledge. Also, fixture replacement may not be successful if some lead sources remain in the plumbing system (USEPA, 2007).

As discussed above, CWSs serving 10,000 or fewer people and all NTNCWSs can choose the most appropriate approach for addressing high lead levels under the final rule. This flexibility has been built into the final rule so that small CWSs and NTNCWSs are not overburdened with the installation of CCT.

3.8 Lead Public Education and Outreach

EPA is retaining the previous rule PE requirements when systems exceed the lead AL. EPA is also codifying the statutory requirement for Tier 1 Public Notification (PN) in response to a lead ALE. Further, the final LCRR includes several revisions to strengthen the lead PE and outreach provisions of the previous rule based on NDWAC's recommendations (NDWAC, 2015). The final LCRR provides a more sustained and open approach to communication. Most of the final PE requirements apply to systems regardless of their lead 90th percentile levels. The revisions require consumer notification of an individual lead tap sampling result that exceeds 15 µg/L within 3 calendar days of systems receiving the result. The revisions also include additional outreach to those potentially impacted by disturbances to lead, galvanized requiring replacement, or lead status unknown service lines. Revisions also increase information available to state and local public health agencies and the public and require updated lead health effects language in all lead PE materials, in the PN materials, and in the CCR. The final regulatory changes to PE requirements are discussed in greater detail in Sections 3.8.1 through 3.8.2 and summarized in Exhibit 3-20.

The final LCRR also requires systems with LSLs to perform general outreach to consumers with lead, galvanized requiring replacement, and lead status unknown service lines and targeted outreach to these consumers when the system exceeds the TL. Also, small CWSs and NTNCWSs that are providing and maintaining POU devices must provide educational materials to consumers. These requirements are listed in Exhibit 3-20 to provide a complete listing of all final rule PE and outreach requirements. However, the detailed discussion of these requirements are provided in Section 3.5.3 for the general and targeted outreach required for LSL systems and in Section 3.6.1 for the POU requirements.

[29] Refer to EPA's "Public Comment and Response Document for the Final Lead and Copper Rule Revisions" for public comments and EPA's responses. The document is available in the docket under EPA-HQ-OW-2017-0300 at https://www.regulations.gov.

Exhibit 3-20: Summary of PE and Outreach Requirements under the Final LCRR

Final Revisions	Applies to:	Based on the Following P90 Levels:		
		No TLE/ALE P90: ≤10 µg/L	**TLE** 10 µg/L < P90 ≤ 15 µg/L	**ALE** P90: >15 µg/L
Public Education and Outreach				
Follow same protocol for lead ALE as prescribed in the previous rule.	All CWSs and NTNCWSs			X
Provide PN for lead ALE within 24 hours based on the WIIN Act and provide updated health effects language.				X
Provide updated mandatory health effects language in PE materials.				X
Provide lead consumer notice to customers whose individual tap sample is > 15 µg/L within 3 calendar days after receiving the lead sample results.		X	X	X
Provide improved public access to lead information including LSL locations.		X	X	X
Provide updated health effects statement in CCR.	All CWSs	X	X	X
Provide annual information to state and local public health agencies.		X	X	X
Deliver PE resulting from disturbances to lead, galvanized requiring replacement, or lead status unknown service lines.	All CWSs with lead, galvanized requiring replacement, or lead status unknown service lines	X	X	X
Deliver general outreach that informs consumer of service line material, lead health effects information, lead exposure mitigation steps, and opportunities to replace LSLs.[1]		X	X	X
Conduct targeted outreach that encourages consumers with LSLs to participate in the LSLR program.[1]	CWSs serving > 10,000 people with known or possible LSLs		X	
Provide PE on use of POU devices.[2]	CWSs serving ≤ 10,000 people and NTNCWSs implementing a POU program			X

Acronyms: ALE = action level exceedance; CCR = consumer confidence report; CWS = community water system; LSL = lead service line; NTNCWS = non-transient non-community water system; P90 = lead 90th percentile level; PE = public education; POU = point-of-use; TLE = trigger level exceedance; WIIN Act = Water Infrastructure Improvements for the Nation Act.

Note:
[1] See Section 3.5.3 for additional information.
[2] See Section 3.6.1 for additional information.

3.8.1 Lead PE and PN after an ALE

3.8.1.1 *Previous Rule*

The previous rule required systems with lead ALEs to deliver PE materials that informed consumers of sources of lead, health effects of lead, measures they can take to reduce their lead exposure, measures the system is taking to reduce their lead levels, contact information, and sources for additional information for as long as they continued to exceed the lead AL. Materials were required to be submitted to consumers within 60 days after the end of the tap sampling monitoring period in which the lead AL was exceeded (if the system is not already delivering PE). The previous rule did not require more immediate notification of the lead ALE. Requirements pertaining to delivery of PE varied for CWSs and NTNCWSs. CWS were also required to:

- Target at-risk populations (i.e., pregnant women, infants, and children) by delivering printed materials annually, for as long as the system has a lead ALE to:
    - Local public health agencies, including those outside the system's service area, as well as additional community-based organizations identified by local health agencies that serve target populations.
    - Public and private schools or school boards; women, infants and children (WIC) and Head Start programs; public and private hospitals and medical clinics; pediatricians; family planning clinics; and local welfare agencies.
    - Licensed child care centers, public and private pre-schools, and obstetricians-gynecologists and midwives.
- Deliver printed materials (pamphlets and brochures) to all bill paying consumers annually and put mandatory language on or in water bills quarterly.
- Submit press releases to local media outlets semi-annually.
- Post information to their websites for those serving more than 100,000 people.
- Conduct additional PE activities from a list specified in the rule in consultation with the Primacy Agency annually.

NTNCWSs were required to post and distribute PE to all consumers annually. PE distribution for NTNCWSs could be electronic with the Primacy Agency's approval. CWSs and NTNCWSs were required to provide written certification to the Primacy Agency that they properly completed their PE requirements after each PE delivery period. CWSs had to continue to deliver PE at the frequency described above and NTNCWSs annually for as long as they exceeded the lead AL.

3.8.1.2 *Description of Final Regulatory Change*

The final LCRR retains the previous rule requirements for systems with a lead ALE. The LCRR also requires systems with a lead ALE to update the mandatory health effects language (shown below) in all PE materials.

> *Exposure to lead in drinking water can cause serious health effects in all age groups. Infants and children can have decreases in IQ and attention span and increases in learning and behavior problems. The children of women who are exposed to lead before or during pregnancy can have increased risk. Adults can have increased risk of heart disease, high blood pressure, kidney or nervous system problems.*

In addition, Section 1414 of the SDWA requires PWSs to notify consumers within 24 hours of any violation that potentially could cause serious health effects. In 2016, Section 2106 of the Water Infrastructure Improvements for the Nation Act (WIIN Act) expanded Section 1414 of the SDWA to include lead ALEs as a Tier 1 PN. This change now requires PWSs to notify consumers, the Primacy Agency, and EPA of a lead ALE within 24 hours of learning of the ALE. EPA modified the PN requirements in Table 1 of 40 CFR 141.201 and Appendix A to Subpart Q to incorporate this requirement. Further, EPA revised the mandatory health effects language in Appendix B to Subpart Q (Standard health effects language for public notification) to include the same consistent messaging shown above for PE in response to a lead ALE.

3.8.1.3 *Rationale for Final Regulatory Change*

EPA is requiring systems with a lead ALE to update their mandatory health effects language to provide clearer messaging that lead is harmful for all age groups.

Prior to the WIIN Act, CWSs and NTNCWSs were not required to issue PN in response to a lead ALE because an ALE is not a violation. Consumers served by the water system may not have learned about a lead ALE until they received PE materials, which could be up to 60 days after the end of the tap sampling monitoring period or less frequently for systems with continuing lead ALEs. This requirement under the WIIN Act allows consumers to be informed immediately of an ALE and to take precautions if necessary.

3.8.2 **Additional Lead PE and Outreach**

3.8.2.1 *Previous Rule*

In addition to PE after a lead ALE, CWSs and NTNCWSs had to provide a consumer notice of lead tap sampling results, and CWSs had to include lead information in their annual CCR.

3.8.2.1.1 Lead Consumer Notice

The previous rule required all water systems to provide lead consumer notice to all individuals served at tap sample sites that were used for compliance purposes. The notice consisted of individual lead results at the tested tap, an explanation of the health effects of lead, steps consumers can take to reduce exposure to lead in drinking water, and the lead MCLG and AL and definitions for these two terms. The system was required to provide the consumer notice as soon as practical but no later than 30 days of learning of the tap monitoring results.

3.8.2.1.2 Consumer Confidence Report

Under the CCR Rule (40 CFR 141 Subpart O), all CWSs, regardless of lead levels, must provide lead educational material in the annual CCR. The CCR must contain the lead and copper 90th percentile and the number of tap samples that exceeded the AL. In addition, systems must include an informational statement about the impact of lead on children using the language in 40 CFR 141.154(d)(1) or develop their own language in consultation with the Primacy Agency. Further, systems in violation of their treatment technique requirements must include mandatory health effects language provided in Appendix A to Subpart O. NTNCWSs are not subject to the CCR requirements.

3.8.2.2 ***Description of Final Regulatory Change***

EPA is including several enhancements to PE requirements for systems regardless of their lead 90th percentile levels. Specifically, CWSs under the final LCRR must provide revised lead health effects language in the CCR, lead consumer notice, and other PE materials, new consumer outreach, increased public access to lead information, outreach to state and local health departments, and expedited lead consumer notice when a sample result exceeds 15 µg/L. In addition, CWSs with LSLs must provide PE to people they serve in areas with LSLs, galvanized requiring replacement, or service lines of unknown material that have been disturbed. These revisions are described in more detail below in Sections 3.8.2.2.1 through 3.8.2.2.5.

3.8.2.2.1 Revised CCR Lead Language

Under the final rule, CWSs must continue to report the system's 90th percentile lead level and the number of samples above the lead AL in the CCR. EPA is retaining the requirement for systems to report the lead and copper 90th percentile and the number of tap samples above the AL and is also modifying the CCR content requirements in Section 141 Subpart O at 40 CFR 141.153 to require systems to report the range of tap sample results from the most recent round(s) of sampling for both lead and copper. In addition, EPA is revising the mandatory health informational statement about lead in drinking water at 40 CFR 141.154(d)(1) to include the same health effects messaging required for PE and PN in response to a lead ALE and the following informational statement about lead in drinking water and its effect on children:

> *Lead can cause serious health problems, especially for pregnant women and young children. Lead in drinking water is primarily from materials and components associated with service lines and home plumbing. [NAME OF UTILITY] is responsible for providing high quality drinking water and removing lead pipes, but cannot control the variety of materials used in plumbing components in your home. You share the responsibility for protecting yourself and your family from the lead in your home plumbing. You can take responsibility by identifying and removing lead materials within your home plumbing and taking steps to reduce your family's risk. Before drinking tap water, flush your pipes for several minutes by running your tap, taking a shower, doing laundry or a load of dishes. You can also use a filter certified by an American National Standards Institute accredited certifier to reduce lead from drinking water. If you are concerned about lead in your water and wish to have your water tested, contact [NAME OF UTILITY and CONTACT INFORMATION]. Information on lead in drinking water, testing methods, and steps you can take to minimize exposure is available at http://www.epa.gov/safewater/lead.*

In addition, all CWSs must notify consumers that lead tap sampling data are available and must include information on how to access the data in the CCR. CWSs must also include a statement in the CCR explaining that a service line inventory has been prepared and is available to the public on the water system's website or at the water system's office. CWSs that have neither lead nor lead status unknown service lines in their inventories must include a statement in the CCR declaring that the system has no LSLs and explaining the methods used to make that determination.

3.8.2.2.2 Improving Public Access to Lead Information

All water systems must improve public access to data related to lead. Specifically, all systems must make results of all tap water results used to calculate 90th percentile values publicly available within 60 days of the end of the tap sampling monitoring period. Water systems will not be required to list the addresses of the sites where the tap samples were collected. Systems serving more than 50,000 people must post the monitoring results summary in a publicly available digital format. Systems serving 50,000 or fewer people must post the monitoring results summary in either a written or digital format. In addition, systems must make their LSL inventories publicly available including a location identifier such as the street, intersection, or landmark. Large systems, serving greater than 50,000 persons must post the inventory to a publicly-accessible site on the Internet. Note that EPA considered in the proposed rule to require an exact address of locations with LSLs. See Chapter 9, Section 0 for additional information.

CWSs must provide the LSL inventory information to those who request it (e.g., homeowners, residents, realtors, home inspectors, and potential home buyers). CWSs may include a disclaimer that the accuracy of this information is based on information available to the system.

3.8.2.2.3 State and Local Health Agencies

CWSs must provide lead information PE materials to local and state health agencies annually. For tribal systems, this would be the Indian Health Service Area, Division of Environmental Health Services program, or applicable tribal program if administered through self-determination contracts or compacts under the Indian Self-Determination and Education Assistance Act. This PE must include information about find-and-fix activities, school and child care testing results (see Section 3.11.1.2), and general outreach on lead. For find-and-fix activities, CWSs must provide information including the location of each tap sample site that exceeded 15 µg/L, the result of the initial tap sample, the result of the follow up tap sample, the result of WQP monitoring, and any distribution system management actions or CCT adjustments made. The lead outreach must explain the sources of lead in drinking water, discuss health effects of lead, discuss the steps consumers can take to reduce exposure to lead in drinking water, and include additional contact information for the water system. CWSs are expected to use this as an opportunity to collaborate with local and state health agencies on joint communication efforts and PE programs. PE must be delivered annually by July 1 and include information about actions conducted in the previous calendar year.

3.8.2.2.4 Customers with Tap Samples Above 15 µg/L

The final LCRR requires CWSs and NTNCWSs to provide lead consumer notice on an expedited schedule if any lead tap sample exceeds 15 µg/L. Specifically, CWSs must contact the customer with tap sample results above 15 µg/L as soon as practicable but no later than three calendar days after receiving the lead sample results to notify the customer of the high lead result, provide information on how they can mitigate their exposure, and to arrange a time to collect a follow-up lead sample. The system must

contact consumers electronically, via phone, hand delivery, mail, or some other Primacy Agency - approved method. NTNCWSs with one or more samples above 15 µg/L may post the results on a bulletin board in the facility to allow users to review the information. Refer to Section 3.4.5 for actions a system must take in response to a lead tap sample above 15 µg/L.

If there are no sample results that exceed 15 µg/L, the LCRR retains the previous rule requirement to notify the consumer or users within 30 days of learning of the result. Similar to the previous rule, CWSs and NTNCWSs regardless of sample results must mail a copy of the consumer notification with sample results to the Primacy Agency along with certification that the notification was distributed in a timely manner and consistent with the rule requirements.

3.8.2.2.5 Disturbance to a Known or Potential Service Line Containing Lead

The final LCRR adds a requirement for CWSs with lead, galvanized requiring replacement, or lead status unknown service line to provide notice and educational materials to consumers if there is a disturbance to such a service line. If the disturbance of such a line is the result of:

- Shutting off or bypassing the line without conducting LSLR, the water system must provide individuals impacted by the disturbances with information about the potential for elevated lead levels in drinking water as a result of the disturbance as well as instructions for a flushing procedure to remove particulate lead.
- Replacement of an inline water meter, a water meter setter, or gooseneck, pigtail, or connector, the water system must provide affected individuals with information about the potential for elevated lead levels in drinking water as a result of the disturbance PE materials that meet the content requirements in 40 CFR 141.85(a) and mitigation measures described in the regulation.

The water system must comply with the requirements before the affected service line is returned to service. In addition, water systems conducting full or partial LSLRs must also provide outreach and ANSI-certified pitcher filters or POU devices for lead removal, use instructions, and six months of replacement cartridges, as explained in Section 3.5.2.2.

3.8.2.3 ***Rationale for Final Regulatory Change***

Most of the final PE requirements discussed in the preceding section are based on NDWAC's recommendations (NDWAC, 2015). The intent is to strengthen the PE requirements by acting on the shared responsibility nature of the LCR to notify and educate the public about lead in drinking water and reducing risks. NDWAC encouraged EPA to focus PE programs on consumer understanding of:

- The risks of lead in drinking water,
- The likelihood that the water in one's home may contain lead,
- The LCR as a "shared responsibility" rule, and
- The availability of additional resources that consumers can use to better minimize their exposure to lead.

In general, NDWAC recommended that PE programs include a more sustained and open approach to communication that involves a partnership with the public. The rationale for each requirement is further discussed in Sections 3.8.2.3.1 through 3.8.2.3.5.

3.8.2.3.1 Revised CCR Lead Language

The final LCRR updates and strengthens the information in the CCR pertaining to lead based on NDWAC's recommendations (NDWAC, 2015). EPA consulted with risk communication experts to revise the mandatory health effects language and the informational statement about lead in drinking water in the CCR. EPA revised the mandatory health effects language further based on public comments to the proposed rule. These revisions provide better risk communication and improve accuracy and clarity. The resulting health effects language in the final rule conveys a more concise message and includes simpler sentence structure for clearer communication. The revised mandatory health effects statement is intended to inform consumers that lead is harmful for all age groups. CWSs must also include additional sampling data (i.e., lead and copper 90th percentile levels, range of lead and copper sample results) and provide information on how to access the results of all tap sampling. CWSs with LSLs also must include information on how to access the LSL inventory and CWSs with only non-lead service lines must include a statement that they do not have any LSLs and the means the system demonstrated it has no LSLs. The updated health effects statement in the CCR reflects the current science on lead. The increased information on lead tap sampling and LSL locations can help a consumer to understand the likelihood that the water in one's home may contain lead.

3.8.2.3.2 Improved Public Access to Lead-Related Information

NDWAC emphasized the importance of increasing public access to lead information (NDWAC, 2015). Previously, CWSs were only required to provide information on their lead 90th percentile levels and the number of samples above the 15 µg/L threshold in the CCR. Also, previously systems with LSLs were not required to make their inventory publicly available. Some systems have elected to make their sampling data and/or LSL information available publicly; however, previously this practice was not required nationally. Under the final LCRR, all systems must make their lead sampling results publicly available. Those serving more than 50,000 people must post their monitoring results summary in a digital format; those serving 50,000 or fewer have options to use a written or digital format. In addition, systems with LSLs, and galvanized requiring replacement must make their inventories publicly available including a locational identifier such as the street, intersection, or landmark. Systems serving more than 50,000 people must post the inventory to a publicly-accessible site on the Internet.

3.8.2.3.3 State and Local Public Health Agencies

In its report to EPA, NDWAC recommended that water systems participate in joint communication efforts led by state health departments, state lead poisoning prevention agencies, and state drinking water primacy agencies (NDWAC, 2015). NDWAC stressed that by working together, water systems and health agencies can help ensure that caregivers and health care providers hear and respond appropriately to information about lead in drinking water (NDWAC, 2015). The intent of the outreach under the final rule requirements is to raise the awareness of state and local public health agencies about sources of lead in drinking water and to enlist their support in providing effective lead education. By working together, CWSs and health agencies can help ensure that caregivers, health care providers, and communities they serve hear and respond appropriately to information about lead in drinking

water. This provides an opportunity for CWSs to explore collaborative efforts with local and state health agencies to work together on PE programs. This collaboration is another way in which CWSs may reach consumers who may be affected by lead in their drinking water and so that, in return, these consumers can take measures to reduce their exposure. EPA is also requiring that systems submit as part of their outreach any find-and-fix activities taken when a tap sample exceeds 15 µg/L (see Section 3.4.5) and the results of testing at schools and child cares (see Section 3.11) by July 1 for the prior calendar year. State and local health agencies may evaluate this information along with other data they may have such as blood lead levels and take steps to investigate other potential sources of lead in the communities they serve. In addition, the July 1 deadline is consistent with the CCR reporting deadline and is also consistent with the requirement under the final LCRR to notify local and state health agencies of school sampling and find-and-fix results. CWSs may send one letter that covers both find-and-fix activities and school sampling results to local and state health agencies, or separate letters, as they choose.

3.8.2.3.4 Customers with Tap Samples Above 15 µg/L

Previously, systems were required to notify all consumers of their individual tap sample results within 30 days of learning the results. Although some systems provide more timely notification and take additional follow-up actions if the lead sample result is high, neither was required under the previous rule. Under the final LCRR, accelerating the notification of potential exposure to high lead levels, above 15 µg/L, to within three calendar days allows consumers to act quickly to minimize their exposure. The final LCRR also requires systems to take additional actions that include a follow-up sample at the site above 15 µg/L and other possible actions under the find-and-fix approach discussed in Section 3.4.5.

In the proposed LCRR, notification to the customer was required within 24 hours of receiving the lead sample results. Some public comments noted that this may be difficult for water systems as lab results may be sent on Fridays and it takes additional time for water systems to validate the results. In the final LCRR, EPA decided to extend the deadline to three calendar days to accommodate these potential delays but require notification as soon as practicable. Once systems receive tap sample results that exceed 15 µg/L, they can choose from several options that make it feasible to provide the consumer notice within three days, including delivery electronically, by phone, hand delivery, mailing with a post mark within three days, or any other method approved by the Primacy Agency.

3.8.2.3.5 Disturbance to a Known or Potential Service Line Containing Lead

EPA's 2016 Technical Recommendations document regarding OCCT indicated that physical and hydraulic factors in addition to water quality can affect lead and copper levels at a consumer's tap (USEPA, 2019a). A recent study has shown that physical disturbances of LSLs related to infrastructure work can result in elevated lead levels due to lead particulate release. The Del Toral et al. 2013 study found that in the data the authors collected most of the lead tap sampling results above the lead AL were at sites with physical disturbances to LSLs. These elevated levels may have also resulted from low water usage at the disturbed sites. Physical disturbances that may cause release of particulate lead into drinking water include meter installation or replacement, auto-meter-reader installation, LSL repair, full or partial LSLR, significant street excavation, and repair or replacement of home plumbing fixtures or piping. Distributing PE during water-related work can inform consumers of these potential elevated levels of lead and how to mitigate their exposure.

In the final rule, EPA more clearly defines types of disturbances that increase lead levels to consumers served by lead, galvanized requiring replacement, or lead status unknown service lines and required mitigations procedures to minimize lead exposure to impacted consumers. For each type of disturbance, systems must provide PE about the potential for elevated lead levels. Other types of disturbances such as shutting off the water require the system to provide a flushing procedure to remove particulate lead. For more significant disturbances that may cause sustained elevated lead concentrations, systems must provide mitigation measures described in the regulation. The tailored risk mitigation best practices mandated in the final rule are intended to reduce consumer exposure to lead in drinking water when LSLR and other LSL disturbances occur.

3.9 Change in Source or Treatment

The final LCRR requires all CWSs and NTNCWSs regardless of lead 90th percentile levels and monitoring schedule to obtain Primacy Agency approval prior to making any long-term treatment changes or adding a new source. The revised rule also requires systems to consult with the Primacy Agency on possible additional source water, tap, and WQP sampling in response to a significant change in source or treatment. The final regulatory requirements to changes in source or treatment are discussed in greater detail in Section 3.9.1. Exhibit 3-21 summarizes final revisions to requirements related to a change in source or treatment.

Exhibit 3-21: Summary of Requirements for Change in Source or Treatment under the Final LCRR

Final Revisions	Applies to:	Based on the Following P90 Levels:		
		No TLE/ALE P90: ≤10 µg/L	**TLE** 10 µg/L < P90 ≤ 15 µg/L	**ALE** P90: >15 µg/L
Change in Source or Treatment				
Prior to making any long-term change in source or treatment notify and consult with Primacy Agency on required actions.	All CWSs and NTNCWSs	X	X	X
Conduct routine tap monitoring semi-annually if a new source is added or the treatment change is deemed significant by the Primacy Agency.	All CWSs and NTNCWSs	X	X	X

Acronyms: ALE = action level exceedance; CCT = corrosion control treatment; CWS = community water system; NTNCWS = non-transient non-community water system; P90 = lead 90th percentile level; TLE = trigger level exceedance; WQP = water quality parameter.

3.9.1 Reporting a Change in Source or Treatment and Follow-up Actions

3.9.1.1 *Previous Rule*

Under the previous rule, any system collecting lead and copper samples on an annual or less frequent schedule was required to obtain approval from their Primacy Agency before adding a new source or any long-term change in treatment.

These systems had to submit written documentation to the Primacy Agency that described the change or addition (40 CFR 141.90(a)(3)). The Primacy Agency could require additional monitoring or other actions it deemed appropriate to ensure systems maintained minimal levels of corrosion in the distribution system as per 40 CFR 141.81(b)(3)(iii), 40 CFR 141.86(d)(4)(vii), and 40 CFR 141.86(d)(4)(iii).

3.9.1.2 *Description of Final Regulatory Change*

Under the final LCRR, EPA is extending the scope of the previous rule provisions described in Section 3.9.1.1 to include all CWSs and NTNCWSs regardless of their monitoring schedule or lead 90th percentile levels. The final LCRR also requires CWSs and NTNCWSs to notify the Primacy Agency in writing of a new source or long-term change in treatment no later than six months prior to the addition of a new source or treatment change.

The Primacy Agency must review and approve the addition of a new source or long-term treatment change before it is implemented by the water system. The Primacy Agency may deem the new source or change in treatment significant. If deemed significant by the Primacy Agency, the water system must conduct tap sampling every six months after the addition of a new source or treatment change until tap sample results are at or below the lead TL and copper AL for two consecutive six-month tap sampling periods. If a water system's sample results are at or below the lead and copper ALs and/or lead TL for two consecutive six-month periods, then the system may reduce monitoring.

Similar to the previous rule, the Primacy Agency may also require a CWS or NTNCWS with a planned new source or treatment change to take additional steps, such as increased WQP monitoring or re-evaluation of CCT, given the potentially different water quality conditions of the source or treatment change.

3.9.1.3 *Rationale for Proposed Final Change*

EPA issued a memorandum in 2015 related to OCCT at larger systems and specifically discussed the importance of maintaining OCCT when there is a change in source or treatment (USEPA, 2015). The memorandum was in response to a change in source at the drinking water system in Flint, Michigan. This prompted an evaluation of LCR requirements pertaining to OCCT and changes in source or treatment. The memo highlighted the importance of the requirements under the previous rule to report any long-term changes in source or treatment to the Primacy Agency. The Primacy Agency must then review, approve, and modify OCCT determination and OWQPs, if necessary, before a change is implemented. In the memo, EPA recommended that systems not subject to the requirement, under the previous rule, also report changes in source or treatment to the Primacy Agency to help ensure that OCCT is maintained and public health is protected. Due to the unique characteristics of each system (e.g., source water source and quality characteristics, existing treatment processes, treated water WQPs, distribution system materials, the presence of LSLs) it is critical that PWSs, in conjunction with

their Primacy Agencies and, if necessary, outside technical consultants, evaluate and address potential impacts resulting from treatment and/or source water changes prior to making the change. The evaluation may include a systemwide assessment of source water or treatment modifications to identify existing or anticipated water quality, treatment or operational issues that may interfere with or limit the effectiveness of CCT optimization or re-optimization.

EPA determined the tap sampling monitoring frequency after a significant change in source or treatment based on public comments received for the proposed LCRR. After a full evaluation of these comments, EPA determined that a minimum tap sampling frequency of once every six months following a significant change in source water or treatment is appropriate. Deterioration in water quality or unintended consequences of source water or treatment changes will be more quickly identified and therefore addressed when tap sampling occurs every six months. Although the final rule continues to provide examples of what constitutes long-term changes, EPA designated authority to the Primacy Agency to determine what constitutes a significant change in source or treatment. Primacy Agencies have the expertise to determine which changes qualify as significant to warrant standard six-month monitoring.

3.10 Source Water Monitoring and Treatment

The final rule includes one revision to the source water monitoring requirements under the previous rule. Under the final LCRR, the source water monitoring requirements only apply to the first time in which a water system exceeds the lead or copper AL as long as the system is not currently treating its source water or has not added a new source since the system last monitored its source water in response to a lead or copper ALE. The final regulatory requirements to source water monitoring and treatment are discussed in greater detail in Section 3.10.1 and summarized in Exhibit 3-22.

Exhibit 3-22: Summary of Source Water Monitoring under the Final LCRR

Final Revisions	Applies to:	Based on the Following P90 Levels:		
		No TLE/ALE P90: ≤10 µg/L	**TLE** 10 µg/L < P90 ≤ 15 µg/L	**ALE** P90: >15 µg/L
Source Water Monitoring and Treatment				
Discontinue additional monitoring if the system: 1) has conducted source water monitoring for prior lead and/or copper ALE, 2) Primacy Agency has determined no source water treatment is required, and 3) the system has not added any new water source(s).	All CWSs and NTNCWSs			X

Final Revisions	Applies to:	Based on the Following P90 Levels:		
		No TLE/ALE P90: ≤10 µg/L	**TLE** 10 µg/L < P90 ≤ 15 µg/L	**ALE** P90: >15 µg/L
If a new source is added and a system is treating its source for lead and/or copper, sample source water until lead and copper levels are below the maximum permissible lead and copper levels set by the Primacy Agency.	All CWSs and NTNCWSs	X	X	X

Acronyms: ALE = action level exceedance; CWS = community water system; NTNCWS = non-transient non-community water system; P90 = lead 90th percentile level; TLE = trigger level exceedance.

3.10.1 Source Water Monitoring

3.10.1.1 *Previous Rule*

Under the previous rule, systems were required to conduct source water monitoring if they exceeded the lead or copper AL. An "initial" source water sample had to be collected at each entry point to the distribution system within six months of the tap sampling monitoring period in which the system had a lead or copper ALE and analyzed for both lead and copper. Systems that were required to install source water treatment had to conduct follow-up monitoring during two consecutive six-month monitoring periods after installing this treatment. Continued annual or triennial source water monitoring was required for surface water and ground water systems, respectively, that had source water treatment for lead and/or copper or for those without this treatment but had a lead and/or copper ALE. Systems that continued to have an ALE could qualify to conduct source water monitoring on a nine-year monitoring schedule if they met the following criteria for three consecutive monitoring periods:

1. The system did not exceed the maximum permissible lead and copper source water levels set by the Primacy Agency, or
2. The Primacy Agency determined that source water treatment was not needed and the system's source water lead and copper levels were ≤ 5 µg/L and ≤ 0.65 mg/L, respectively.

The previous rule also required systems that were seeking to qualify as b3 systems to conduct two rounds of source water monitoring (see Exhibit 3-7 for more information).

3.10.1.2 *Description of Final Regulatory Change*

The final LCRR no longer requires additional source water monitoring for CWSs and NTNCWSs that exceed the lead or copper AL if:

- The system has already conducted source water monitoring for a previous ALE,
- The Primacy Agency has determined that source water treatment is not required, and
- The system has not added any new water source(s).

However, if the system is treating its source water for lead and/or copper and adds a new source, it must collect an additional source water sample from each entry point to the distribution system until it demonstrates that finished drinking water entering the distribution system has been maintained below the maximum permissible source water lead and copper concentrations specified by the Primacy Agency.

3.10.1.3 *Rationale for the Final Regulatory Change*

Elevated lead or copper levels are typically caused by the contact of corrosive water with lead- and copper-containing plumbing materials. These metals are rarely present in source water in significant quantities (Chin and Karalekas, 1985; USEPA, 1988; USEPA, 1990b). For these reasons, EPA eliminated continued source water monitoring for systems without lead and copper source water treatment that meet the criteria listed in Section 3.10.1.2 because this monitoring is not needed to protect public health. For systems treating their source for lead and/or copper and that add a new source(s), the rule specifies that systems must conduct an additional source water sample from each entry point to the distribution system for lead and copper until the system can demonstrate it has met is Primacy-designated maximum permissible lead and copper concentrations.

3.11 Public Education and Sampling for Lead at Schools and Child Cares

EPA is requiring CWSs to conduct lead in drinking water sampling and PE at schools and child cares constructed prior to January 1, 2014 or those built before the date of state-adopted standards that meet the definition of lead free in accordance with Section 1417 of the SDWA. The previous rule did not require school or child care testing unless the facility was classified as a NTNCWS. Requirements for lead testing in schools are discussed in Section 3.11.1. Exhibit 3-23 summarizes requirements for sampling drinking water for lead in schools and licensed child cares under the final LCRR. Primacy Agencies may waive sampling and PE requirements at any school and/or child care under certain conditions.

Exhibit 3-23: Summary of Lead in Drinking Water Sampling Program at Schools and Child Cares under the Final LCRR

Final Revisions	Applies to:	Based on the Following P90 Levels:		
		No TLE/ALE P90: ≤10 µg/L	**TLE** 10 µg/L < P90 ≤ 15 µg/L	**ALE** P90: >15 µg/L
Lead in Drinking Water Sampling Program at Schools and Licensed Child Cares				
Conduct lead in drinking water sampling at elementary schools and child cares, and "on-request"[1] sampling at secondary schools during the first 5 years. Conduct "on request" at all schools and child cares thereafter.	All CWSs	X	X	X
Provide annual PE about health risks from lead in drinking water and the system's lead sampling program to schools and child cares.		X	X	X
Provide sample results and PE to each sampled school/child care, Primacy Agency, and local and state health departments.		X	X	X
Provide an annual report to the Primacy Agency.		X	X	X

Acronyms: ALE = action level exceedance; CWS = community water system; P90 = lead 90th percentile level; PE = public education; TLE = trigger level exceedance.

Note:

[1] The on request program, requires that CWS must continue to distribute annual information on the health risks of lead in drinking water and provide annual information to schools and child care facilities about the opportunity to request sampling. Only these targeted facilities may request sampling.

3.11.1 Sampling for Lead in Schools and Child Cares

3.11.1.1 *Previous Rule*

Under the previous rule, most PWSs did not include schools or child cares in their sampling plans because the rule prioritized sampling at single family dwellings (see Section 3.3.1 for more information regarding tiering criteria). In addition, there is no federal law requiring schools or child cares to test for lead in drinking water, except for schools or child cares that are regulated under the SDWA as NTNCWSs. Under the Lead Contamination Control Act (LCCA) of 1988, Congress established a program that aimed to identify and reduce lead in drinking water at schools and child cares by requiring states to develop and implement their own school testing initiatives and requiring the replacement of drinking water fixtures that contributed to excessive levels of lead. Some states and local jurisdictions have established their own programs for testing drinking water lead levels in schools.

In accordance with the LCCA, EPA developed a protocol and detailed guidance for conducting a testing program in schools and child cares. This was updated and is outlined in the 3Ts for Reducing Lead in Drinking Water in Schools and Child Care Facilities Toolkit: A Training, Testing, and Taking Action Approach (Revised Manual) (USEPA, 2018), hereafter referred to as the "3Ts." EPA recommends a different sampling protocol for lead tap monitoring for schools from the protocol required for CWSs and NTNCWSs. In the 3Ts, EPA recommends that schools collect 250 mL, first-draw samples after an 8- to 18-hour stagnation period from all water fountains and other outlets used for consumption. The stagnation period is representative of daily water use within these facilities. This sample is smaller than the 1-liter sample collected for CWSs and NTNCWSs because it is more representative of water per serving consumed by a child. The school sampling protocol helps the school pinpoint specific fountains and outlets that require remediation. The first-draw samples would serve as a preliminary screen for lead risks within the facility and are not necessarily representative of lead levels in other outlets.

3.11.1.2 *Description of Final Regulatory Change*

Under the final LCRR, all CWSs must sample for lead in the elementary schools and child care facilities they serve once during the first five years after the compliance date for the final rule, and sample lead in the secondary schools they serve on request. After all elementary schools and child care facilities are tested once, CWSs must conduct sampling at all the schools and child care facilities they serve only when requested by a facility. This requirement only applies to schools and child care facilities constructed before January 1, 2014 or built before the date of state-adopted standards that meet the definition of lead free in accordance with Section 1417 of the SDWA, as amended by the Reduction of Lead in Drinking Water Act, to account for localities that adopted lead free standards earlier than 2014. Specific details that include frequency, number of samples, and sampling location are summarized in **Error! Reference source not found.** below.

Exhibit 3-24: Monitoring Program Details for Schools and Child Cares under the Final LCRR

<table>
<tr><th>Facility Type</th><th>Frequency</th><th>Number of Samples[1]</th><th>Protocol[2]</th><th>Location [3,4]</th></tr>
<tr><td>Child Cares</td><td>Mandatory testing: 20 percent each year for first 5 years, then on request</td><td>2</td><td rowspan="3">250-mL samples after an 8- to 8-hours stagnation period</td><td>• 1 drinking water fountain, and
• 1 of either kitchen faucet used for food or drink preparation, or 1 classroom faucet.</td></tr>
<tr><td>Schools (Elementary)</td><td>Mandatory testing: 20 percent each year for first 5 years, then on request</td><td rowspan="2">5</td><td rowspan="2">• 2 drinking water fountains,
• 1 kitchen faucet used for food or drink preparation,
• 1 classroom faucet used for drinking, and
• 1 nurse's office faucet, as available.</td></tr>
<tr><td>Schools (Secondary</td><td>On request only</td></tr>
</table>

Note:

[1] If any facility has fewer than the required number of outlets, the CWS must collect samples from all outlets used for consumption.

[2] Samples must be collected from cold water taps. This sampling protocol is consistent with the 3Ts (USEPA, 2018). Samples must be analyzed using acidification and corresponding analytical methods prescribed in the final rule.
[3] If any facility does not contain the type of location listed above, the CWS must collect a sample from another outlet typically used for consumption as identified by the facility.
[4] Outlets sampled must not have POU devices. However, the CWS may sample at outlets with POU devices if a facility has POU devices installed on all outlets typically used for consumption.

CWSs must compile a list of schools and licensed child care facilities served by the system to conduct PE and sampling. During the first five years after the rule compliance date, CWSs must contact elementary schools and child care facilities identified and provide them information about health risks of lead in drinking water at least annually, schedule sampling, and provide the EPA's 3Ts (USEPA, 2018) or subsequent EPA guidance). CWSs must also contact the secondary schools identified in the list at least annually and provide them with health information, and information on how to request sampling. CWSs must submit an updated list of schools and child cares if there are any changes at least once every 5 years.

CWSs must sample 20 percent of elementary schools and 20 percent of child care facilities per year or on a Primacy-approved schedule until all have been sampled or declined to participate. Non-responses and refusals may be accounted for in the 20 percent testing rate. CWSs are also required to sample secondary schools at the request of the facility starting in the first year after rule implementation. If a CWS receives requests from more than 20 percent of the secondary schools it serves during any the years in which it is also conducting mandatory testing for elementary and secondary schools, the CWS can defer the secondary school sampling to the next year.

Once a CWS has completed the requirements for all elementary schools and child care facilities once, it must sample both elementary and secondary schools and child care facilities on request. As part of the on request program, CWS must continue to distribute annual information on the health risks of lead in drinking water and provide annual information to schools and child care facilities about the opportunity to request sampling. At least 30 days prior to sampling, the CWS must provide instructions to facilities on how to identify outlets for sampling. If the CWS receives requests from more than 20 percent of the schools and 20 percent of the child care facilities it serves in a given year, the CWS may defer additional requests to the following year. The CWS is also not required to sample any individual school or child care facility more than once every five years. While not required, EPA recommends that CWSs consider factors such as age of students, building construction date, socioeconomic indicators, presence of LSLs, and federal funding through Title 1 (20 USC 6301 et seq.) and Head Start (42 USC 9801 et seq.) to prioritize sampling in facilities that serve vulnerable or disadvantaged populations.

Primacy Agencies can waive school and/or child care sampling requirements for individual CWSs to avoid duplication under the following conditions:

- The state or locality has an existing program or facility, or district has a policy that meets all of the requirement in the final rule,
- The state or locality has an existing program or facility or district has a policy that meets all of the requirement in the final rule except its program uses a different sample volume for testing or stagnation time but requires remediation actions in response to a high lead level (e.g., disconnecting or replacing affected fixtures and installation of POU devices),

- The state or locality has an existing program or facility, or district has a policy that meets all the requirements in the final rule except its program samples less frequently than once every five years but requires remediation actions in response to a high lead level, or
- Sampling was conducted under the WIIN Act Grant Program for Lead Testing in School and Child Care Program Drinking Water and therefore was consistent with the grant requirements. Note that CWS sampling and PE waivers will only be effective during the time period covered by the grant program and expire at the end of any 12-month period during which sampling was not conducted at the required number of schools or child cares. In addition, the Primacy Agency may issue a partial waiver if the grant program only covers a subset of schools and child cares served by the CWS.

The Primacy Agency can issue a partial waiver if a program is limited to a subset of schools and child care facilities.

CWSs must provide sample results to schools and child care facilities along with remediation options from the 3Ts (USEPA, 2018) within 30 days of receipt of results. CWSs must also report all results to their Primacy Agency and to the local and state health departments annually. The CWS is also required to annually report and certify to the Primacy Agency that it met the notification and sampling requirements as detailed in Exhibit 3-25. The report is due by July 1 of each year for the previous calendar year's activity.

Exhibit 3-25: Contents of Annual Report for CWSs PE and Sampling Programs in Schools and Child Cares under the Final LCRR

- Certification that CWS made a good faith effort to identify all schools and child cares in service area
- Certification that CWS delivered information about health risks from lead in drinking water
- Certification that CWS completed the notification and sampling requirements at a minimum of 20 percent of elementary schools and 20 percent of child cares:
  - Number of schools and child cares served by the CWS
  - Number of schools and child cares sampled in the calendar year
  - Number of schools and child cares that have refused sampling*
  - Documentation of outreach attempts to schools and child cares with no response*
  - Analytical results for schools and child cares sampled in the calendar year
- Certification that CWS sent sampling results to schools, child cares, and local and state health departments

**Applies only to mandatory testing conducted at elementary schools and child cares during the first five years after the compliance date for the final rule.*

3.11.1.3 ***Rationale for Final Regulatory Change***

EPA is requiring CWSs to conduct targeted PE and sampling at schools and child cares that they serve. The requirements are part of a targeted PE effort to educate schools and child cares and their users of the risks from lead in premise plumbing and the importance of testing for lead in drinking water. The PE and water system sampling will provide schools and child cares with assurance in the process and benefits of managing a drinking water testing program and the information necessary for them to take actions to reduce lead risk. The requirement for CWSs to conduct sampling and PE for this vulnerable

subset of consumers is within EPA's authority to promulgate a treatment technique rule to "prevent known or anticipated adverse effects on the health of persons to the extent feasible" (the SDWA Section 1412(b)(7)(A)). School and child care sampling contributes to increased public awareness of the potential for elevated levels of lead in premise plumbing independent of a water system's lead 90th percentile value. EPA also anticipates that increased familiarity with the 3Ts (USEPA, 2018) will assist facilities in taking steps to reduce lead risks to vulnerable populations.

EPA evaluated two options for the CWS lead in drinking water sampling program in schools and child cares for the proposed rule; sampling at 20 percent of facilities every five years on an on-going basis or an on request only program. These options are discussed in Section 9.2 of Chapter 9. EPA collected public comments on the two options. Based on public comments received, EPA has decided to combine the proposed and alternative options by incorporating both mandatory and on request sampling into the final rule. CWSs will conduct sampling in elementary schools and child care facilities as described in the proposed requirements for one sampling cycle (5 years) and will offer sampling to secondary schools on request. After the first cycle is complete, CWSs will continue to conduct outreach to elementary schools and child care facilities but will only sample at the request of a facility. These requirements are intended to educate schools and child care facilities about the risks of lead in drinking water and inform them of ways to mitigate lead risks. The first cycle of sampling accompanied by continued lead in drinking water outreach will provide elementary schools and child care facilities with an understanding of how to create and manage a recurring drinking water testing program that is customizable to their needs and an appreciation of the benefits of such a program. The first cycle of sampling is intended to reinforce the importance and benefits of lead testing in schools and child cares. Children under the age of 7 are at the greatest risk of drinking water lead exposure, and prioritizing sampling in those facilities with the greatest risks will reduce burden on CWSs and will enable them to focus upon those schools and child care facilities with the most susceptible population. This construct will also allow CWSs, following the initial cycle of sampling, to focus resources on sampling in schools and child cares that request assistance. EPA anticipates that after the first cycle, elementary schools and child cares will better understand the process and benefits of lead testing and be more likely to implement their own 3Ts programs. However, facilities interested in further assistance will have the opportunity to be tested for lead by the CWS on request prompted through annual outreach. CWSs will not be required to sample more than 20 percent of the schools and child care facilities they serve in a given year.

EPA is requiring a program for schools and child cares because students and young children are especially vulnerable to lead exposure and spend a large portion of their day in schools and child care facilities. Lead in drinking water can be a significant contributor to overall exposure to lead, particularly for infants whose diets often include foods or formulas made with water from PWSs (i.e., baby food, juice, or formula). Young children and infants are particularly vulnerable to lead because the physical and behavioral effects of lead occur at lower exposure levels in children than in adults. In children, low levels of exposure have been linked to damage to the central and peripheral nervous system, learning disabilities, shorter stature, impaired hearing, and impaired formation and function of blood cells.

Some states and localities have established mandatory and voluntary programs to test for lead in schools and child care facilities. However, many schools and child care facilities have not been tested for lead. A 2018 survey by the Government Accountability Office (GAO) found that 41 percent of school districts had not tested for lead and an additional 16 percent did not know if they had been tested (GAO, 2018). In addition, children spend on average over six hours per day at school (NCES, 2009), with many

spending more time at on-site before- or after-school care or activities. Across the country, schools participating in the national school lunch program, served lunch to 29.6 million students in 2019. Schools also served breakfast to 14.8 million students in 2019 (USDA, 2020). The Healthy, Hunger-Free Kids Act of 2010, which authorizes funding and sets policy for United States Department of Agriculture's (USDA's) child nutrition programs requires schools participating in federally funded meal programs to make water available during meal periods at no cost to students (Section 202 of the Healthy Hunger-Free Kids Act (HHFKA) (42 U.S.C. 1758(a)(2)(A); United States 2010a). The Act also mandates that child cares provide free drinking water throughout the day (Section 221 of HHFKA (42 U.SC. 1766 (u)(2); United States, 2010b).

Furthermore, the requirement for CWSs to conduct sampling at schools and child cares provides an added measure of protection, above the other elements of the treatment technique rule, in light of the vulnerabilities of the population served and the potential variability of lead levels within the system and within a school or child care over time. Large buildings such as schools can have a higher potential for elevated lead levels because, even when served by a water system with well operated OCCT, there may be longer periods of stagnation due to complex premise plumbing systems and inconsistent water use patterns. In such situations, there may not be technical improvements that can be made to the OCCT. However, risk can be mitigated through public education and voluntary remediation actions such as replacement of premise plumbing.. Water systems have developed the technical capacity to do this work in operating their system and complying with drinking water standards.

Many states already implement mandatory and voluntary lead testing programs in schools and child cares (Refer to Chapter 4, Section 4.3.9.2 for states meeting waiver requirements). Requirements under the final LCRR may duplicate efforts in these states. Because of this, EPA has included both full and partial waiver eligibility requirements for CWSs that already meet certain school and child care testing requirements of the final LCRR. Recognizing that some aspects of state programs differ from the final rule, EPA built in flexibility for full and partial waiver eligibilities for CWSs in states with programs that are funded by WIIN Act grants, do not meet all requirements of the final LCRR but do require remediation, and only address a subset of schools and/or child cares.

EPA is not requiring CWSs to take remediation actions at facilities following the sampling and notification requirements. The managers of these facilities have established lines of communication with the occupants of these buildings (and their parents or guardians) and have control over routine maintenance and plumbing materials that may need to be addressed. The managers of the schools and child cares can use the sampling results and the 3Ts to make decisions about additional voluntary actions to reduce lead risks in their facilities, including implementing their own 3Ts program.

3.12 Other Rule Changes

The final LCRR includes some minor changes to the rule language to remove obsolete dates, terms, and provisions. The final revisions are described in more detail below.

3.12.1 Removal of Obsolete Dates

3.12.1.1 *Previous Rule*

The previous rule contained dates for conducting CCT steps for systems serving more than 50,000 people, the commencement of lead and copper tap monitoring, and system reporting requirements.

3.12.1.2 *Description of Final Regulatory Change*

EPA removed obsolete dates from the rule and instead specified schedules and timeframes in lieu of specific dates. For example, the previous rule language specified that the "initial" round of lead and copper monitoring must begin on January 1, 1992 for systems serving more than 50,000 people, on July 1, 1992 for those serving 3,301 to 50,000 people, and on July 1, 1993 for those serving 3,300 or fewer people.

Exhibit 3-26 below provides a list of obsolete dates that have been removed from the final LCRR.

Exhibit 3-26: List of Obsolete Dates Removed from the Final LCRR

Applicability of CCT	
40 CFR 141.81(b)(3)(ii)	Requires systems that have naturally non-corrosive water and that have not monitored for lead and copper at the tap since September 30, 1997 to complete one round of monitoring by September 30, 2000.
40 CFR 141.81(b)(3)(iv)	Specifies that systems serving more than 50,000 people that were "deemed to have optimized corrosion control" must implement CCT if they are above the copper AL as of July 12, 2001.
40 CFR 141.81(d)	Specifies deadlines for completing CCT steps from January 1, 1993 through January 1, 1998 for systems serving more than 50,000 people.
Monitoring requirements for lead and copper in tap water	
40 CFR 141.86(d)	Specifies when the first 6-month monitoring period for lead and copper must begin. Dates range from January 1, 1992 to July 1, 1993. The first two rounds are known as initial monitoring.
System Reporting Requirements	
40 CFR 141.90(a)(2)(i)	Allows Primacy Agencies to waive prior approval for NTNCWSs to use samples that have not stood motionless for a minimum of 6 hours for monitoring that begins after April 11, 2000.
40 CFR 141.90(a)(2)(iv)	Specifies documentation that must be provided by October 10, 2000 for systems serving 3,300 or fewer people that have been granted a monitoring waiver by April 11, 2000.
Primacy Agency Reporting Requirements	
40 CFR 142.15I(iv)(i)	Specifies reporting requirements provided to EPA prior to May 15, 2000.
40 CFR 142.15(c)(iv)(ii)	Specifies reporting requirements provided to EPA after May 14, 2000 and prior to January 14, 2002.
40 CFR 142.15(c)(iv)(i)	Specifies reporting requirements provided to EPA after January 14, 2002.

Acronyms: AL = action level; CCT = corrosion control treatment; NTNCWS = non-transient non-community water system

EPA also eliminated the criteria in 40 CFR 141.81(b)(2) that allowed water systems to demonstrate that their existing corrosion control was already optimized prior to the effective date of the rule and therefore, they would not be required to complete the CCT steps under the LCR.

3.12.1.3 *Rationale for Final Regulatory Change*

The final LCRR is intended to modernize the rule by eliminating obsolete dates, terms, and provisions. The changes will minimize confusion that could occur for new systems regarding their monitoring, reporting, and treatment requirements. The final LCRR will also help systems whose service area increases or decreases such that they move from one LCR size category to another. For example, the previous rule required systems serving more than 50,000 people (except those that have naturally non-corrosive water) to implement CCT steps, regardless of whether they exceed the lead or copper AL. Under the previous rule, water systems serving more than 50,000 people would have been required to conduct CCT steps during January 1, 1993 through January 1, 1998. Eliminating these obsolete dates in the rule will help minimize confusion regarding CCT requirements for a system whose population increases to more than 50,000 people or for new systems that serve more than 50,000 people.

EPA also removed the criteria in 40 CFR 141.81(b)(2). At the time the original LCR was promulgated in 1991, many systems already had CCT in place. Since the LCR required all systems to optimize corrosion control, the provision in 40 CFR 141.81(b)(2) was included as an allowance for systems to demonstrate that their existing corrosion control was optimized by meeting the criteria specified at 40 CFR 141.81(b)(2). Systems meeting the criteria would not be required to complete the CCT steps. This provision was a transitional provision which allowed systems to demonstrate that they already had OCCT in place when the original LCR became effective. It will be obsolete when the final LCRR takes effect, since the monitoring site selection criteria have changed, and all systems must demonstrate optimization of corrosion control based on the new tap sample site selection criteria.

3.13 Primacy Agency Reporting and Recordkeeping Requirements and Special Primacy Conditions

The final LCRR adds reporting, recordkeeping, and special primacy conditions for Primacy Agencies. These requirements are discussed in Sections 3.13.1 through 3.13.3.

3.13.1 **Reporting Requirements**

3.13.1.1 *Previous Rule*

Under the previous rule, Primacy Agencies were required to report the following 90th percentile information to EPA's database, the Safe Drinking Water Information System/federal version (SDWIS/Fed):

- For systems serving more than 3,300 people, all 90th percentile lead levels.
- For systems serving 3,300 or fewer people, 90th percentile lead levels for only those systems above the lead AL.
- For systems of all sizes, 90th percentile copper levels for only those systems above the AL.

The previous rule also required Primacy Agencies to report violation and milestone information that indicated initiation or completion of important Primacy Agency decisions or system requirements. One such milestone is the requirement for Primacy Agencies to report to SDWIS/Fed those systems with LSLs that must initiate LSLR and the date replacement must begin. Another example is the requirement for Primacy Agencies to report each water system for which OCCT has been designated. However, under the previous rule, Primacy Agencies were not required to report LSL locations and CCT status for all water systems.

3.13.1.2 *Description of Final Regulatory Change*

In addition to the reporting requirements in the previous rule, EPA is requiring Primacy Agencies to report for each system:

- All lead and copper 90th percentile values and the first and last days of the corresponding tap sampling monitoring period;
- For which the Primacy Agency has designated OWQPs or has deemed to be optimized, the date of the determination and the paragraph(s) under which the Primacy Agency made its determination, the CCT status of the water system, and the water system's OWQPs (for example, orthophosphate residual or target pH and alkalinity values);
- The number of lead, galvanized requiring replacement, and lead status unknown service lines in its distribution system, reported separately; and
- The goal or mandatory replacement rate and date the system must begin replacement for those systems that are required to begin LSLR.

3.13.1.3 *Rationale for Final Regulatory Change*

EPA has found that many Primacy Agencies already voluntarily report lead 90th percentile levels for water systems serving 3,300 or fewer people and all copper 90th percentile values. National information about the numbers of LSLs in PWSs will support EPA and other Federal Agencies in targeting programs to reduce lead exposure such as under the WIIN Act (United States, 2016) and America's Water Infrastructure Act (United States, 2018). The GAO in its report "Drinking Water: Additional Data and Statistical Analysis May Enhance EPA's Oversight of the Lead and Copper Rule," recommended EPA should require states to report available information about lead pipes to EPA's SDWIS (or a future redesign) database and should require states to report all 90th percentile sample results for small water systems (GAO, 2017). In the final rule, EPA increased the Primacy Agency reporting requirements compared to the previous rule, but this contributes to ensuring that public health will be better protected under the final LCRR.

3.13.2 **Record Keeping Requirements**

3.13.2.1 *Previous Rule*

Under the previous rule, Primacy Agencies were required to retain records of decisions, all supporting documentation, an explanation of the technical basis for the decision, and documentation submitted by the system, as specified in 40 CFR 142.14. Records had to be retained for a minimum of 12 years.

3.13.2.2 *Description of Final Regulatory Change*

In the final LCRR, EPA retained all record keeping requirements from the previous LCR and added new record keeping requirements pertaining to:

- Completed LSL inventories and annual or triennial updates to inventories;
- Determinations of the LSLR replacement goal and determinations as to whether a shorter replacement schedule is feasible for mandatory full LSLR;
- LSLR plans;
- Compliance tap sampling pools and any changes to tap sampling pools;
- Records of each system's currently applicable or most recently designated monitoring requirements;
- Evaluations and approvals[30] of water system source or treatment changes;
- Designations of OCCT and any simultaneous compliance considerations that factored into the designation;[31] and
- Identification of small CWSs and any NTNCWSs utilizing the small system flexibility compliance alternatives, the compliance alternative selected by the water system, and the compliance alternative approved by the Primacy Agency.

The final rule does not change the record retention period of 12 years.

3.13.2.3 *Rationale for Final Regulatory Change*

EPA is requiring Primacy Agencies to maintain a record of all PWS LSL inventories, as well as updates to their inventories as service line materials are verified and LSLs are replaced over time. This information is necessary for the Primacy Agency to calculate goal and mandatory LSLR rates and to verify correct tap sample site selection tiering. Primacy Agencies must also maintain records on LSLR plans, information on system's tap sampling pools, and system's tap monitoring requirements. Primacy Agencies must also maintain records on changes to source water or treatment and their evaluations and approvals, as these changes could affect the OCCT approved by the Primacy Agency. The final rule also specifies that in addition to maintaining records of their OCCT designations, Primacy Agencies must include records on any simultaneous compliance considerations that factored into these designations. In addition, the Primacy Agency must also maintain records regarding the required steps water systems must complete for find-and-fix when a system has any sample above 15 µg/L. Further, the Primacy Agency must maintain records of the compliance alternative they approved for CWSs serving 10,000 or fewer people and all NTNCWSs. This information will allow the Primacy Agency to track water systems' progress with

[30] The final LCRR clarifies that in addition to retaining records of their evaluations of source water treatment changes, as required under the previous rule, they also must retain records of their approvals.
[31] The previous rule required Primacy Agencies to maintain records of OCCT designations. The final LCRR adds the requirement for systems to also maintain any simultaneous compliance considerations that factored into the designation.

their chosen alternative of CCT, use of POU devices, LSLR, and/or replacement of leaded premise plumbing.

3.13.3 Special Primacy Requirements

Section 1413 of the SDWA establishes general requirements that primacy entities (states or Indian tribes) must meet to maintain primary enforcement responsibility (primacy) for its PWSs. These include: 1) adopting drinking water regulations that are no less stringent than federal NPDWRs in effect under Sections 1412(a) and 1412(b) of the Act, 2) adopting and implementing adequate procedures for enforcement, 3) keeping records and making reports available on activities that EPA requires by regulation, 4) issuing variances and exemptions (if allowed by the state) under conditions no less stringent than allowed by the SDWA Sections 1415 and 1416, and 5) adopting and being capable of implementing an adequate plan for the provision of safe drinking water under emergency situations.

40 CFR part 142 sets out the specific program implementation requirements for states to obtain primacy for the Public Water Supply Supervision Program, as authorized under Section 1413 of the SDWA. To begin implementing or continue to implement the LCR, states or other Primacy Agencies would be required to adopt revisions at least as stringent as the previous rule provisions. These include special primacy requirements that are unique to the LCR.

The final LCRR retains the special primacy conditions of the previous rule contained in 40 CFR 141.16 as well as establishes additional requirements pertaining to LSL inventories, the goal-based LSLR rate, lead in drinking water testing at schools and child cares, find-and-fix requirements, and changes in source water or treatment. Specifically, Primacy Agencies must:

- Describe methods for verifying service line material that water systems must use for development of the initial inventory or inventory updates,
- Require water systems whose inventories contain only non-LSLs and subsequently find an LSL to prepare an updated inventory on a schedule determined by the Primacy Agency,
- Approve water systems' LSLR goal rate or designate an alternative that CWSs serving more than 10,000 people must implement after a lead TLE,
- Determine if a greater mandatory LSLR rate is feasible, and notifying the system of the determination in writing.,
- Define a school or child care and determine if any existing lead in drinking water testing program at schools and/or child cares at the state or local level is at least as stringent as the testing program required by EPA (if applicable),
- Demonstrate how they will verify compliance with find-and-fix requirements. For example, the Primacy Agency must determine the acceptability of the water system's corrective actions and timeliness of the corrective action implementation, and
- Describe the approach for reviewing any change in source water or treatment at a water system that includes the approval process, establishment of additional requirements to ensure the system will operate and maintain OCCT, and an evaluation of how this change may impact other NPDWRs.

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4 Baseline Drinking Water System Characteristics

4.1 Introduction

In its *Guidelines for Preparing Economic Analyses*, the United States Environmental Protection Agency (EPA, or USEPA) characterizes the "baseline" as a reference point that reflects the world without the final regulation (USEPA, 2014). It is the starting point for estimating the potential benefits and costs.

This chapter presents a characterization of public water systems (PWSs) and their current operations (i.e., the baseline) before changes are made to meet the final Lead and Copper Rule revisions (LCRR). Section 4.2 identifies each major source used to develop the baseline. Section 4.3 explains the derivation of each baseline characteristic and presents results in detailed tables. Section 4.4 summarizes limitations of the major data sources and uncertainties in the baseline characterization (both quantified and unquantified) in table format.

Note that EPA uses the SafeWater Lead and Copper Rule (LCR) model to estimate national costs of the LCRR. See Chapter 5, Economic Impact and Cost Analysis, for an in-depth discussion of the SafeWater LCR model and how these data variables are used to estimate burden and costs for the final LCRR.

4.2 Data Sources

EPA used a variety of data sources to develop the baseline. Additional background on each of these data sources is provided in the following subsections:

- **Section 4.2.1** explains the relevant information provided in the federal version of the Safe Drinking Water Information System (SDWIS/Fed) and measures EPA has taken to verify the data.
- **Section 4.2.2** explains the purpose of the 2006 Community Water System Survey (CWSS) and the representativeness of the data.
- **Section 4.2.3** describes a key information source used to characterize corrosion control treatment (CCT) costs.
- **Sections 4.2.4 and 4.2.5** describe the two data sources used to develop EPA's estimated ranges for the number of community water systems (CWSs) with lead service lines (LSLs) and the average number of LSLs per CWS.
- **Section 4.2.6** provides an overview of the system compliance monitoring data voluntarily submitted to EPA by states from 2006 to 2011, data cleaning steps, and data representativeness.
- **Section 4.2.7** describes the State of Michigan lead tap monitoring dataset that included first and fifth liter compliance monitoring samples collected in 2019 and data cleaning steps.
- **Section 4.2.8** describes other information sources used to characterize a subset of the population served by CWSs that provide services to sensitive subpopulations (i.e., infants, children, and pregnant women). Note that EPA used several studies to characterize sensitive subpopulations affected by the rule. These studies are discussed in Chapter 6.

Exhibit 4-1 identifies each major data source detailed in Sections 4.2.1 through 4.2.7 and the baseline data element(s) derived from them.

Exhibit 4-1: Data Sources Used to Develop the Baseline for the Final LCRR

Data Source	Baseline Data Derived from the Source
SDWIS/Fed third quarter 2016 "frozen" dataset[1]	• PWS inventory, including population served, number of service connections, source water type, and water system type. Also used to identify NTNCWSs that are schools and child cares. • Status of CCT, including identification of water systems with CCT and the proportion of water systems serving ≤ 50,000 people that installed CCT in response to the previous LCR. • Analysis of lead 90th percentile concentrations to identify water systems at or below the TL of 10 µg/L, above the TL, and above the AL of 15 µg/L at the start of rule implementation by LSL status, i.e., presence or absence of LSLs for the previous rule and LCRR. Used in concert with data from Michigan described below for the LCRR.[2] • The proportion of water systems that are on various reduced monitoring schedules for lead tap and WQP monitoring. • The frequency of source and treatment changes and those source changes that can result in additional source water monitoring. • Length of time that water systems replace LSLs if required under the previous LCR.
2006 CWSS (USEPA, 2009)	• Number of distribution system entry points per system. • PWS labor rates.
Geometries and Characteristics of Public Water Systems (USEPA, 2000)	• Design and average daily flow per system.
1988 AWWA Lead Information Survey	• LSL inventory, including the number of systems with LSLs, and the average number of LSLs per water system, as reported in the 1991 LCR RIA (Weston and EES, 1990).
2011 and 2013 AWWA Surveys of Lead Service Line Occurrence (as summarized in Cornwell et al., 2016)	• LSL inventory, including the number of water systems with LSLs and the average number of LSLs per water system.
Six-Year Review 3 ICR Occurrence Dataset (2006-2011)	• Baseline distribution of pH for various CCT conditions. • Baseline orthophosphate dose for CCT.

Data Source	Baseline Data Derived from the Source
2019 State of Michigan Lead and Copper Compliance Monitoring Data (Michigan EGLE, 2019)	• Analysis of the ratio of fifth to first liter lead tap samples to estimate the increase in lead 90th percentile levels based on the use of fifth liter samples. Ratios are applied to SDWIS/Fed lead 90th percentile data to identify systems at or below the TL of 10 µg/L, above the TL, and above the AL of 15 µg/L under the final LCRR by LSL status. • Percent of individual samples exceeding 15 µg/L for the final LCRR.

Acronyms: AL = action level; AWWA = American Water Works Association; CCT = corrosion control treatment; CWSS = Community Water System Survey; ICR = Information Collection Request; LCR = Lead and Copper Rule; LCRR = Lead and Copper Rule revisions; LSL = lead service line; Michigan EGLE = Michigan Department of Environment, Great Lakes, and Energy; NTNCWS = non-transient non-community water system; public water system; RIA = regulatory impact assessment; SDWIS/Fed = Safe Drinking Water Information System/Federal version; TL = trigger level; WQP = water quality parameter; USEPA = United States Environmental Protection Agency.

Note:

[1] Contains information reported through June 30, 2016.

[2] As detailed in Chapter 3, a system's lead 90th percentile level is a key factor in determining a system's requirements under the previous rule and final LCRR.

4.2.1 SDWIS/Fed 2016

SDWIS/Fed is EPA's national regulatory compliance database for the drinking water program. It contains inventory, 90th percentile lead and copper levels, treatment facility information, violation, and enforcement information for PWSs as reported by Primacy Agencies, EPA Regions, and EPA Headquarters personnel. Primacy Agencies report data quarterly to EPA. The information presented in the Economic Analysis (EA) is based on the third quarter 2016 "frozen" dataset that contains information reported through June 30, 2016.

SDWIS/Fed contains information to characterize the United States inventory of PWSs, namely: system name and location; retail population served; source water type (i.e., ground water, surface water, or ground water under the direct influence of surface water (GWUDI)); and PWS type, as described in Section 4.2.1.1. SDWIS/Fed also includes 90th percentile lead and copper levels, milestones, violations, and enforcement actions, as detailed in Section 4.2.1.2. A description of the treatment facility information in SDWIS/Fed is in Section 4.2.1.3. Section 4.2.1.4 summarizes steps by EPA to verify SDWIS/Fed information.

4.2.1.1 *Classification of Systems Using SDWIS/Fed Data*

This section describes how EPA classified systems by type (Section 4.2.1.1.1), population served (Section 4.2.1.1.2, and source water using data from SDWIS/Fed (Section 4.2.1.1.3).

4.2.1.1.1 System Type

The Safe Drinking Water Act (SDWA) defines a system as one that provides water for human consumption through pipes or other constructed conveyances to at least 15 service connections or regularly serves an average of at least 25 individuals per day for at least 60 days per year. Systems are categorized as follows:

- Community water systems (CWSs) are systems that supply water to the same population year-round.
- Non-community water systems (NCWSs) are systems that supply water to a varying population or one that is served less than year-round. They are sub-categorized as follows:
    - Non-transient non-community water systems (NTNCWSs) are systems that are not CWSs and that regularly supply water to at least 25 of the same people at least six months per year, for example, schools.
    - Transient non-community water systems (TNCWSs) are NCWSs that provide water in places such as gas stations or seasonal campgrounds where people do not remain for long periods of time.

The LCRR does not apply to TNCWSs. Therefore, system inventories in this EA are classified into two categories, CWSs and NTNCWSs.

4.2.1.1.2 Population Served

Systems are also categorized by the number of people they serve.[32] The following nine categories of populations served by systems are used throughout this EA:

- ≤ 100
- 101–500
- 501–1,000
- 1,001–3,300
- 3,301–10,000
- 10,001–50,000
- 50,001–100,000
- 100,001–1,000,000 (1M)
- > 1M

EPA has developed these system size categorizes based on distinctions in the way systems operate as the amount of water supplied and number of service connections increases. Systems within each size category can be expected to face similar implementation and cost challenges when complying with the new regulatory requirements for the LCRR.

4.2.1.1.3 Source Water Type

SDWIS/Fed classifies system by source water using the following six categories:

1. Ground water

[32] SDWIS/Fed classifies systems according to "retail" population that does not include the population served by other systems that purchase water from them.

2. Ground water purchased
3. Ground water under the direct influence (GWUDI)[33]
4. Ground water under the direct influence purchased
5. Surface water
6. Surface water purchased

For this final LCRR analysis, EPA broadly categorized systems as surface water if any of their sources were surface water, surface water purchased, GWUDI, or purchased GWUDI. Systems were classified as ground water if they exclusively used ground water or purchased ground water. See Section 4.3.1 for EPA's approach for assigning a source type to the small number of CWSs and NTNCWSs without a reported source water type to develop the system inventory for this EA.

4.2.1.2 ***Lead and Copper Rule-Specific Data***

This section describes LCR-specific data that Primacy Agencies must report to EPA using SDWIS/Fed and is organized into the following subsections:

- 4.2.1.2.1: 90th Percentile Levels
- 4.2.1.2.2: Violations/Compliance Achieved
- 4.2.1.2.3: Discussion of Data Limitations and Uncertainty.

4.2.1.2.1 90th Percentile Levels

Systems are required to report all lead and copper tap sample results used to calculate their lead and copper 90th percentile levels to their Primacy Agency. Primacy Agencies are required to report to SDWIS/Fed all lead 90th percentile levels for systems serving more than 3,300 people[34] and levels above the action level (AL) of 15 µg/L for systems serving 3,300 or fewer. For all systems, Primacy Agencies are also required to report to SDWIS/Fed copper 90th percentile levels above the AL of 1.3 mg/L.

As previously discussed in Chapter 3, Section 3.2.1.1, a system has an action level exceedance (ALE) if more than ten percent of tap water samples collected during any monitoring period are found to be greater than 15 µg/L for lead or 1.3 mg/L for copper (i.e., if the 90th percentile level is greater than the AL). An ALE is not a violation but triggers additional actions. These actions include CCT steps, water quality parameter (WQP) monitoring, source water monitoring and source water treatment, if needed. A lead ALE also triggers lead service line replacement (LSLR) for systems with treatment in place for lead and public education (PE) for all systems with a lead ALE.

[33] 40 CFR section 141.2 defines GWUDI as "any water beneath the surface of the ground with significant occurrence of insects or other macro-organisms, algae, or large-diameter pathogens such as *Giardia lamblia* or *Cryptosporidium,* or significant and relatively rapid shifts in water characteristics such as turbidity, temperature, conductivity, or pH which closely correlate to climatological or surface water conditions."
[34] Prior to 2002, Primacy Agencies were not required to report lead 90th percentile levels that were at or below the lead AL for systems serving 3,300 or fewer people.

4.2.1.2.2 Violations/Compliance Achieved

Systems are in violation of the Lead and Copper Rule (LCR) if they do not meet the treatment technique requirements related to LSLR, CCT, source water treatment, PE, or monitoring and reporting requirements. Primacy Agencies are required to report to SDWIS/Fed, systems that are in violation of these requirements using specific codes that identify the type of violation and the action taken by the system or Primacy Agency to address these violations. As explained in Section 4.3.3, EPA used the following subset of violations to estimate the number of systems with CCT:

- **Violation code 58** denotes systems that failed to meet their CCT requirements. This includes failure to properly install or operate Primacy Agency-approved CCT, submit a certification that CCT is being properly installed and operated, or to demonstrate that optimal corrosion control treatment (OCCT) already exists in accordance with 40 CFR 141.81(b)(1)-(3) and 141.90(c)(1).[35]
- **Violation code 59** denotes systems that fail to meet the optimal water quality parameter (OWQP) values set by the Primacy Agency. OWQPs are set by the Primacy Agency after a system has collected WQP samples during two consecutive, six-month monitoring periods, following the installation of CCT. OWQPs are measured to determine whether a system is operating its CCT at a level that most effectively minimizes the lead and copper concentrations at users' taps.

Primacy Agencies are also required to report enforcement actions taken by the Primacy Agency or EPA in response to a violation, and to report when a system has achieved compliance. As discussed in Section 4.3.3, EPA enforcement action code for compliance achieved is "SOX" or "EOX." Systems that have returned to compliance with a type 58 violation are likely to have installed CCT.

See "Safe Drinking Water Information System Federal (SDWIS Fed) Data Reporting Requirements" for additional information on SDWIS/Fed reporting requirements (USEPA, 2016a).

4.2.1.2.3 Milestones

Primacy Agencies report milestone information to indicate the initiation or completion of key requirements under the previous rule. EPA used the following milestones data to characterize the baseline. Specifically, EPA used the "Deem" and "Done" milestones to help estimate the number of systems with CCT (see Section 4.3.3) and LSLR milestone to estimate the average number of years a system is required to replace LSLs under the previous rule (see Section 4.3.4).

- "**Deem"** represents the basis for the Primacy Agency's determination that a system is "deemed" to be optimized under the LCR. Systems with a reason code of "WQP" have installed CCT.
- **"Done"** indicates when a water system has completed all required steps to reduce lead and/or copper levels. Systems with a reason code of "WQP" have installed CCT.
- **"LSLR"** indicates water systems that are required to initiate LSLR; Primacy Agencies are also required to report when this replacement is scheduled to begin.

[35] Code 58 is also used to identify water systems that are in violation of the source water treatment installation requirements. However, very few water systems have high lead and/or copper source water levels and are required to install source water treatment.

4.2.1.3 *Treatment Facility Information*

Primacy Agencies report treatment information to SDWIS/Fed for each system's drinking water treatment facilities. Specifically, for each treatment plant, Primacy Agencies report 1) the treatment objective codes from a list of 13 available options and 2) treatment process codes from a list of 71 available options. For example, the treatment objective code of "C" denotes corrosion control and the treatment process code of 445 indicates orthophosphate inhibitor. Primacy Agencies can report multiple treatment objective codes for each plant, and multiple treatment process codes for each plant or for each objective code.

EPA uses treatment code information to help determine the percent of systems with CCT and which type of CCT they have in place (pH adjustment, orthophosphate, or both) as described in Sections 4.3.3 and Section 5.3.3 in Chapter 5, respectively. EPA also uses treatment information from SDWIS/Fed to evaluate changes in treatment over time to predict the percent of systems that would change treatment each year, as described in Section 4.3.8.

4.2.1.4 *Verification of SDWIS/Fed Data*

EPA routinely conducts Program Reviews to verify whether information in the Primacy Agencies' databases and files, such as inventory, 90th percentile data, and violations for all regulations are correctly represented in SDWIS/Fed. Between 2006 and 2016, EPA recorded the findings from these reviews in the national Error Code Tracking Tool (ECTT) (USEPA, 2007). The ECTT contains, as individual records, all actions assessed during each Program Review. EPA identifies records as confirmed actions (correct compliance determinations and correct reporting to SDWIS/Fed), compliance determination discrepancies (incorrect compliance determinations), or data flow discrepancies (correct compliance determination but incorrect reporting). This section presents data from the ECTT from Program Reviews conducted from 2006 to 2016 related to system inventory (Section 4.2.1.4.1) and LCR compliance data (Section 4.2.1.4.2).

It is important to note that treatment data (objective codes and process codes for plants in SDWIS) are not evaluated during program reviews and therefore have more uncertainty associated with the data as compared to inventory and compliance data.

4.2.1.4.1 System Inventory

From 2006 to 2016 EPA evaluated inventory data for a total of 2,180 systems. Prior to August 2007, the Program Reviews evaluated eight inventory fields: system type, system status, activity status, source type, population, service connection, administrative contact, and administrative address. Afterwards the reviews did not include administrative contact or address. In addition, in August 2007, the review policy changed so that discrepancies for inventory were only identified if they affected monitoring requirements (e.g., change in population that would increase or decrease the minimum number of required samples).

Of the inventory fields evaluated from 2006 to 2016, only 82 (<1 percent) inventory discrepancies were identified. Some of these discrepancies could be for things that do not impact the PWS baseline characterization such as administrative contact and address. The inventory data in ECTT indicate a high degree of completeness and accuracy in SDWIS/Fed, and that the information is largely representative of the systems in the United States.

4.2.1.4.2 LCR Compliance Monitoring Data

To assess the completeness and accuracy of the SDWIS/Fed LCR compliance monitoring data, which is reported to the Primacy Agency as the 90th percentile of tap monitoring results, EPA determined whether Primacy Agencies had reported the following:

- The correct 90th percentile levels to SDWIS/Fed by comparing it to the computed 90th percentile levels from the individual monitoring results submitted by systems.[36]
- All required 90th percentile levels.

File reviews conducted between 2006 and 2016 evaluated 2,180 systems for two rounds of lead sampling and evaluated 4,360 rounds of lead samples for 53 Primacy Agencies. Of these data, the 90th percentile level sample values were properly calculated and reported to SDWIS/State for 4,212 (87 percent) of the sample rounds. The file review also evaluated whether the samples were properly collected, including a sufficient number of samples, correct sampling procedure, collection during the correct monitoring period. The review determined that systems complied with these additional requirements for 87 percent of the sample rounds. The file reviews also determined that systems failed to take the required steps after a lead ALE, including PE, CCT study (when required), WQP sampling, or follow-up monitoring after installation of CCT in some instances.

4.2.2 **2006 Community Water System Survey**

EPA periodically conducts the CWSS to obtain data to support the Agency's development and evaluation of drinking water regulations. The 2006 CWSS is the most recent survey. For this EA, EPA analyzed the number of entry points per CWS for each size category from the 2006 CWSS Final Report (USEPA, 2009), Volume II, Table 13[37] to create a custom distribution for a system having 1 to 50 entry points. EPA applied CCT costs per-entry point rather than per-system to more accurately represent the number of treatment plants and their flow that would be impacted by the LCRR. In addition, the 2006 CWSS is the basis for the PWS labor rates used in this EA, as described in Section 4.3.10.1.

The CWSS was selected as a data source because it is based on a nationally representative sample of CWSs. The sample was drawn from SDWIS/Fed which includes approximately 50,000 systems in the 50 states and the District of Columbia (D.C.). The survey used a stratified random sample design to ensure the sample was representative. A survey sample of 2,210 systems was selected, including all systems serving populations of 100,000 or more. In the 2006 CWSS, EPA took additional steps to improve response rates, ensure accurate responses, and reduce the burden of the survey on systems, especially systems serving 3,300 or fewer persons. EPA sent water system experts to collect data from systems serving 3,300 or fewer persons. For systems serving more than 3,300 people, the Agency mailed the survey, made available a spreadsheet and Web-based version of the questionnaire, and provided extensive assistance through e-mail and a toll-free telephone hotline. The survey was designed to collect data for the year 2006. Full-scale data collection occurred from June to December 2007. The overall response rate was 59 percent with a total of 1,314 systems responding; 95 percent of selected systems

[36] This evaluation also assessed whether the 90th percentile level was reported for the correct monitoring period.
[37] EPA assumed that NTNCWSs have one entry point per system for all size categories because these systems tend to be simpler and limited in geographical area.

serving 3,300 or fewer persons (representing 571 of 600 systems sampled) participated in the survey (USEPA 2009a).

4.2.3 Geometries and Characteristics of Public Water Systems (2000)

An important factor in determining costs of CCT is average daily flow and design flow, in gallons per day or million gallons per day, at a treatment plant. EPA estimated the average daily flow and design flow for each entry point in the system based on the relationship between retail population and flow as derived in the document, *Geometries and Characteristics of Public Water Systems* (USEPA, 2000).[38]

Utilizing data from the 1995 CWSS, EPA conducted an extensive data cleaning process[39] to develop a dataset consisting of 1,734 records with paired responses for population and total average daily flow. These data were then weighted to account for non-responses to individual questions from the CWSS. This dataset was used to develop regression equations that predict average daily flow based on retail population served (for both publicly-owned and privately-owned systems). The data show a very good correlation as indicated by a high R value of 0.90. Additional information and background data are provided in Chapter 4 of the *Geometries and Characteristics of Public Water Systems* (USEPA, 2000) and in Section B1.4.2 of the *Drinking Water Baseline Handbook, Fourth Edition* (USEPA, 2003).

4.2.4 AWWA 1988 Lead Information Survey

The American Water Works Association (AWWA) Lead Information Survey (LIS) was used to estimate LSLR costs in the 1991 LCR Regulatory Impact Analysis (RIA) (USEPA, 1991). EPA continues to use the results of this survey to help inform the baseline inventory of LSLs in CWSs.

AWWA conducted the LIS in 1988. The original report detailing the 1988 survey could not be obtained for this analysis. However, basic information about the survey and its results are described in Weston and EES (1990), including a copy of the survey questionnaire in (Appendix A of Weston and EES). AWWA mailed approximately 3,700 questionnaires to its water utility members and received 1,006 responses. Of the 1,006 responses, 566 responded "yes" to having LSLs and/or lead goosenecks,[40] 439 responded "no," and one utility was not sure. Of the 566 utilities with LSLs and/or lead goosenecks, 386 provided an estimated number of one or both. It is important to note that not all respondents provided complete responses to all questions in the survey; thus, some of the assumptions used in the 1991 RIA were based on subsets of responses.

Survey responses were distributed geographically in all 10 EPA regions as shown in Exhibit 4-2. There was considerable variability in the regional percentages of responses of "yes" to having LSLs and/or lead connections, with utilities in the eastern half of the United States. (EPA Regions 1 – 5) tending to have more than those in the western half (EPA Regions 6 – 10). The number of responses AWWA received by system size category were as follows: 241 responses from systems serving 3,300 or fewer people; 251 responses from systems serving 3,301 to 10,000 people; 317 responses from systems serving 10,001 to

[38] The analysis was republished in the *Drinking Water Baseline Handbook*, Fourth Edition (USEPA, 2003).
[39] EPA adjusted the dataset to remove non-zero values; adjusted flow if needed to represent retail flow only removing wholesale water flow; and adjusted for reporting discrepancies in population, flow, or service connections.
[40] Lead connections from the water main to the service line are referred to as "pigtails" or "goosenecks" in this EA.

50,000 people; and 191 responses from systems serving more than 50,000 people (Weston and EES, 1990).[41] As part of the development of the 1991 RIA, EPA categorized individual survey results using 12 system size categories and found that an insufficient number of systems serving 500 or fewer people responded to the survey. This low response rate prevented the direct derivation of LSL information for the smallest size categories. Thus, for the 1991 RIA, EPA used results from systems serving 501 to 1,000 people to represent systems serving 500 or fewer people.

Exhibit 4-2: Geographic Distribution of Responses to the 1988 AWWA LIS

EPA Region	Total Responses	Responses of "Yes" to Lead Service Line and/or Lead Connections in their System	Percentage of Responses of "Yes" to Lead Service Line and/or Lead Connections in their System
1	40	26	65.0%
2	72	40	55.6%
3	87	37	42.5%
4	111	41	36.9%
5	244	156	63.9%
6	63	16	25.4%
7	81	56	69.0%
8	65	36	55.4%
9	152	17	11.2%
10	91	14	15.4%
Total	**1,006**	**439**	**43.6%**

Source: Weston and EES (1990), p. 2-6, available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov.

4.2.5 AWWA 2011 and 2013 Surveys of Lead Service Line Occurrence

EPA used information presented in the AWWA Journal article "National Survey of Lead Service Line Occurrence" to help inform the baseline numbers of LSLs in CWSs (Cornwell et al., 2016). The findings in Cornwell et al. (2016) combine the results from two surveys. The first is referenced as the 2011 survey, with preliminary results presented by Dixon and Via (2011). The 2011 survey was an online survey conducted in the spring and summer of 2011 and targeted all CWSs serving more than 500 people. AWWA identified qualifying systems from SDWIS and contacted them via postcard. Other recruitment efforts to increase survey responses are described in Cornwell et al. (2016), and included outreach to all AWWA utility members in the United States. The survey contained 12 questions including whether the water system had LSLs and requesting an estimate of the number of LSLs (total, utility-owned, and customer owned). Cornwell et al. 2016 note that "The questions were clear that the response for the number of LSLs should include full and partial LSLs and should include those owned by the utility or the homeowner." AWWA received responses from 774 CWSs in 49 states and D.C.

The second survey was conducted in the summer of 2013. This survey effort included an online survey and a telephone interview survey. The online survey was provided to all AWWA utility members in the

[41] A total of 1,000 systems were grouped by size in Weston and EES (1990). The reference does not indicate the reason for not including the remaining 6 responses from the survey in the analysis of system size representation.

United States.[42] The telephone interview was targeted to CWSs serving more than 250,000 people. AWWA received responses from 204 CWSs in 43 states and D.C.

Overall, the combined responses from both surveys represented 978 CWSs. Cornwell et al. (2016) provide detail on data cleaning including the approach for addressing 39 CWSs that responded to both surveys and resolving conflicts between responses.

Survey responses were received from CWSs in all states (except New Hampshire) and from D.C. The combined survey results consisted almost equally of systems that use ground water (485) and those that use surface water (493). Cornwell et al. (2016) divided the responses into three population size categories: 575 systems (59 percent) serving fewer than 10,000 people, 230 systems (24 percent) serving 10,000 to 50,000 people, and 173 (18 percent) serving more than 50,000 people.[43]

4.2.6 **Six-Year Review Data**

EPA used information from the Six-Year 3 Review Information Collection Request (ICR) Dataset (hereafter referred to as the "SYR3 ICR dataset") to characterize the pH of finished water and the distribution of orthophosphate dose.[44] The SYR3 ICR dataset contains more than 47 million records of water system compliance monitoring data for chemical, microbial, disinfection byproduct, and radionuclides collected from 2006 through 2011. The SYR3 ICR dataset is regarded as the largest and most comprehensive source of PWS compliance monitoring dataset ever compiled and analyzed by EPA's Drinking Water Program. The SYR3 ICR dataset and general quality assurance/quality control (QA/QC) procedures are further described in USEPA (2016b) and USEPA (2016c).

Forty-four states, D.C., American Samoa, and five EPA Regions submitted individual compliance monitoring sample result for lead.[45] A number of QA steps were applied to the SYR3 ICR dataset to identify water quality data on system pH and orthophosphate concentration records suitable for analyses. Data were excluded via the following QA steps:

- Records from non-public water systems.
- Records marked as not being for compliance.

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[42] Cornwell et al. (2016) did not provide the exact number of water utilities that were contacted but AWWA has over 4,300 water utility members according to their website (https://www.awwa.org/about-us#:~:text=Founded%20in%201881%2C%20the%20Association,half%20of%20the%20nation%27s%20wastewater).

[43] Cornwell et al. (2016) describe two source water categories for the 2011 survey: 1) those that used only groundwater and, 2) those that used at least one surface water source, GWUDI, or multiple ground water and surface water sources. For the 2013 survey, Cornwell et al. note two categories: those that reported using ground water and those that reported using surface water. EPA assumed that the surface water category in the 2013 is the same as the 2011 category of those that used at least one surface water source, GWUDI, or multiple ground water and surface water sources.

[44] In the proposed rule, the SYR3 dataset were also used to estimate the likelihood of an individual sample exceeding the AL (see Section 4.3.5.2). However, for the final rule, EPA obtained data from the State of Michigan that included first and fifth liter results. These data were ultimately considered to be more complete and appropriate for use in the estimates in support of the final rule for the likelihood of samples exceeding the AL because the SYR3 ICR dataset did not identify LSL systems or include fifth liter data. The data from Michigan include actual fifth liter sample results using a protocol that is consistent with the final rule.

[45] With the exception of the Navajo Nation, EPA Regions are the Primacy Agencies for tribal water systems.

- Records marked with a sample type code equal to something other than “RT” (routine) or “CO” (confirmation). For example, “RP” for “repeat” or “SP” for “special.”
- Records from outside of the Six-Year Review date range of 2006 – 2011.
- Records from systems that were missing inventory information such as the system’s population served or source water type.

4.2.7 State of Michigan Lead Compliance Monitoring Data

Lead and copper compliance monitoring data were provided by the State of Michigan through a Freedom of Information Act Request (FOIA) submitted by AWWA and forwarded to EPA in March 2020. The request was for reported compliance observations and associated data elements for submissions from all of the water systems for which data was collected under Michigan’s LCR in 2019 per the new rule’s requirements (Michigan EGLE, 2019). Michigan’s rule requires systems to collect a first and fifth liter sample at sites with an LSL (any portion of the service line containing lead) and to collect a first liter sample only for all other sites (service lines made of galvanized, copper, or plastic pipe). The data provided by Michigan included the LCR compliance monitoring data submitted to Michigan’s Department of Environment, Great Lakes, and Energy (EGLE) from January of 2019 through November 1, 2019 and included sampling from LSL and non-LSL sites. The data were used to assign LSL and non-LSL systems into one of three lead 90th percentile classifications under the previous rule and final LCRR (see Section 4.3.5.1) and to estimate the likelihood a single sample would exceed 15 µg/L (see Section 4.3.5.2) under the final LCRR. EPA recognizes the uncertainty introduced in using data from a single state that may not represent the values on a national level. However, the Michigan data represent actual compliance monitoring data collected recently from all systems within the state, as opposed to using historical sampling data from a smaller subset of systems that may have had lead issues (e.g., the “profile” data from five systems that was used for the proposed LCRR). Incorporation of the compliance data from Michigan has improved the analysis substantially.

A total of 29,520 lead and copper sample results were submitted by the 630 CWSs in Michigan that sampled during January through November of 2019. The following QA steps were applied to the data to identify records suitable for analyses:

- Excluded records collected for copper.
- Removed the phrase “FIRST LITER,” “FIFTH LITER,” “FIRST” or “FIFTH” from the Address field to enable pairing of the first and fifth liter results based on the Public Water System ID (PWSID), Collection Date, and Address.
- Updated the first liter designations for nine samples that appeared to be mislabeled as first liter samples but were actually fifth liter samples.
- If duplicate samples were identified (based on the same PWSID, address, collection date, and first/fifth liter designation), retained the higher of the two samples and excluded the other sample.
- Substituted 0.01 µg/L for all concentrations equal to zero in the original dataset.

- Excluded data from nine systems that were not included in the "CWS Inventory Characteristics_Final Rule.xlsx" file that contains the universe of CWSs used for the analyses in the final LCRR (for CCT, population served, and system size information).
- Classified systems as non-LSL systems if they collected only first liter samples and were listed in Michigan's preliminary distribution system materials inventory (Michigan EGLE, 2020) with 0 values for "known lead" service line materials, "unknown - likely lead" service line materials, and "unknown - No information" service line materials.
- Assumed systems that collected paired first and fifth liter samples had LSLs. Excluded data from one system with conflicting LSL information when compared to Michigan's preliminary distribution system materials inventory (Michigan EGLE, 2020). The Kalamazoo Lake Sewer and Water Authority (PWSID MI0003525) contained paired first and fifth liter data in the State of Michigan dataset, implying that the system had LSLs. However, the state's preliminary distribution system materials inventory online indicated that the system did not have any LSLs. Therefore, this system was excluded from the analysis.

4.2.8 Data Sources for Schools, Child Cares, Local Health Agencies, and Targeted Medical Providers

The LCR previously required, and the LCRR will continue to require, CWSs that exceed the lead AL to deliver PE materials to schools, child cares, community-based organizations, and medical providers that offer services to pregnant women, children, and infants to better reach these at-risk populations and their caregivers.[46] CWSs must also contact local health departments by phone or in person to request the health agency's support in disseminating information on lead in drinking water and the steps that vulnerable populations can take to reduce their exposure. In addition, the LCRR requires CWSs to conduct lead in drinking water testing in schools and child cares and provide additional PE (see Chapter 3, Section 3.11 for more detail). Sections 4.2.8.1 through 4.2.8.3 describe the data sources used to estimate the number of these facilities.

4.2.8.1 *Schools*

EPA primarily used information from the United States Department of Education's National Center for Education Statistics (NCES) to estimate the number of elementary and secondary schools, both public and private, for each state (including Washington, D.C.) and United States territories. For public schools, EPA used 2016-2017 data from *Table 216.70: Public elementary and secondary schools, by level, type, and state or jurisdiction: 1990-91, 2000-01, 2010-11, and 2016-17* (NCES, 2018a). For private schools, EPA used *Table 15: Number of private schools, students, full-time equivalent (FTE) teachers, and 2016-17 high school graduates, by state: United States, 2017–18* from the NCES Private School Universe Survey (NCES, 2018b). This source did not differentiate elementary vs. secondary schools, so EPA used the proportion of elementary to secondary public schools per state and United States territory to estimate

[46] The estimated facilities described in Sections 4.2.8.1 through 4.2.8.3 focus on schools, child care centers, pediatricians, and obstetricians/gynecologists. It does not explicitly include all groups that are required to receive PE, i.e., Women, Infants, and Children (WIC) and Head Start, and public and private hospitals and clinics, family planning centers, local welfare agencies. Note the omission of some of the organizations that receive PE will not impact the incremental costs of the LCRR because the requirements for PE when there is a lead ALE is the same under the previous rule and LCRR.

the proportion of elementary to secondary private schools. EPA supplemented the NCES data with other sources to estimate the number of public and private schools in the Navajo Nation and the number of private schools in United States territories (American Samoa, Guam, Northern Marianas, Puerto Rico, and the United States Virgin Islands). The estimated total number of schools (public and private, elementary and secondary in all states and territories) is 127,233. See the file "Derivation of Schools_Child Care Inputs_Final Rule.xlsx" for details.

The estimated number of schools was adjusted to remove the 3,632 public schools and 2,023 private schools reported in SDWIS/Fed as NTNCWSs, as of June 30, 2016. The adjusted number of schools is 121,578.

4.2.8.2 *Child Cares*

EPA used data from an updated 2019 Committee for Economic Development (CED) report analyzing the role of child cares in the economy (CED, 2019), namely *Figure 24: U.S. Child Care Industry Statistics* (2017). EPA supplemented CED data with additional web-based information on the number of child cares in the Navajo Nation and in United States territories. See the file "Derivation of Schools_Child Care Inputs_Final Rule.xlsx" for details.

EPA adjusted the estimated number of United States child cares (674,332) to remove the 1,148 child cares reported in SDWIS/Fed as NTNCWSs, as of June 30, 2016. The adjusted number of child cares is 673,184.

4.2.8.3 *Local Health Agencies and Targeted Medical Providers*

EPA used the following sources to estimate the number of local health agencies and medical providers that are obstetricians/gynecologists (ob/gyn) and pediatricians in the United States:

- National Association of County and City Health Officials (NACCHO) 2016 National Profile of Local Health Departments (NACCHO, 2017): This source estimated the number of local health agencies at 2,800.
- 2012 article published in Obstetrics and Gynecology (Rayburn et al., 2012): This article estimated 33,624 ob/gyn in the United States in 2010.
- American Medical Association (AMA) (AMA, 2013, as cited in American Academy of Pediatrics, 2019). This source indicated there were 91,915 pediatricians in the United States.

Using the sources listed above, EPA estimated that there are 128,339 local health agencies, ob/gyns, and pediatricians in the United States.

4.3 Drinking Water System Baseline

This section presents the following baseline characterizations for the purposes of estimating costs and benefits for the final LCRR:

- **Section 4.3.1** provides a characterization of the inventory of systems subject to the LCR, i.e., CWSs and NTNCWSs.

- **Section 4.3.2** includes the population served by CWSs and NTNCWSs and the number of households served by CWSs.
- **Section 4.3.3** includes the derivation of the number of CWSs and NTNCWSs with existing CCT from SDWIS/Fed data.
- **Section 4.3.4** provides the derivation of the number of CWSs and NTNCWSs with LSLs, the number of LSLs present in these systems, and the average number of years a system replaces LSLs under the previous rule.
- **Section 4.3.5** details how lead and copper 90th percentile data and individual lead sampling data were used to characterize water systems.
- **Section 4.3.6** provides treatment plant characteristics used to determine treatment costs.
- **Section 4.3.7** provides the derivation of lead and copper tap sampling and WQP monitoring schedules based on SDWIS/Fed data.
- **Section 4.3.8** provides the derivation of the percent of systems that annually add a new source or treatment from SDWIS/Fed data.
- **Section 4.3.9** details the derivation of the number of schools, child cares, and targeted medical providers as well as the estimated percent of systems already conducting a school and/or child care testing program that meets the minimum requirements of the final LCRR.
- **Section 4.3.10** describes the derivation of PWS and Primacy Agency labor rates.

Each section includes a characterization of the baseline for CWSs, followed by NTNCWSs, if applicable, and a characterization of data limitations and uncertainty.

With respect to CCT and LSL status, EPA contacted the 21 CWSs serving more than one million people for information. Whenever possible, EPA used this system-specific information instead of the estimated values presented in this section for systems serving greater than one million people in the cost and benefits analysis. See Chapter 5, Section 5.2.4.3 and Appendix B, Section B.2.1.1 for additional information on the data collected for systems serving greater than one million people.

4.3.1 Water System Inventory

A key component of the baseline is the inventory of systems subject to the LCR. As shown in Exhibit 4-3, more than 80 percent of all CWSs serve 3,300 or fewer people, and those serving 500 or fewer account for about 55 percent of all CWSs. CWSs serving 3,301 – 50,000 people comprise about 17 percent of all CWSs, and those serving 50,000 or more people account for only about 2 percent. Most CWSs (about 77 percent) use ground water as their primary source. However, most systems serving above 10,000 people are classified as surface water systems (about 64 percent).

Exhibit 4-3: Inventory of CWSs

System Size (Population Served)	CWSs		
	Ground Water	Surface Water	Total
	A	B	C = A + B
≤100	11,080	966	12,046
101–500	13,235	2,072	15,307
501–1,000	4,250	1,146	5,396
1,001–3,300	5,537	2,498	8,035
3,301–10,000	2,771	2,203	4,974
10,001–50,000	1,325	2,006	3,331
50,001–100,000	155	395	550
100,001–1M	66	341	407
> 1M	2	19	21
TOTAL	**38,421**	**11,646**	**50,067**

Sources: SDWIS/Fed third quarter 2016 "frozen" dataset that contains information reported through June 30, 2016. Includes all active CWSs. See Section 4.2.1.1 for detail on system classification (system type, source water type, and population served using SDWIS). Additional information can be found in "CWS Inventory Characteristics_Final Rule.xlsx," available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov.

Notes:

A, B: Includes 30 CWSs serving 10,000 or fewer people for which no primary source water type was reported to SDWIS/Fed. These systems were assigned to the source type of ground water or surface water based on the ratio of systems with known ground water to surface water source type for each size category. Based on this ratio, 27 systems were assigned to the source type of ground water and 3 to surface water. Note that the total number of ground water systems and surface water systems was listed as 38,420 and 11,647 in the corresponding exhibit in Chapter 4 of the proposed rule EA. For the final EA, the exhibit was updated to match the SafeWater LCR model.

As shown in Exhibit 4-4, more than 99 percent of all NTNCWSs serve 3,300 or fewer people. NTNCWSs serving 3,301 – 50,000 people account for less than 1 percent of all NTNCWSs. Only three NTNCWSs (0.02 percent) serve more than 50,000 people and none serve more than 1 million people. Most NTNCWSs (about 77 percent) use ground water as their primary source. Fifty percent of those serving 10,001 to 100,000 people use ground water versus surface water and the one system serving 100,001 to 1 million people is classified as a surface water system.

Exhibit 4-4: Inventory of NTNCWSs

System Size (Population Served)	NTNCWSs		
	Ground Water	Surface Water	Total
	A	B	C=A+B
≤100	8,178	251	8,429
101–500	6,253	261	6,514
501–1,000	1,526	82	1,608
1,001–3,300	765	102	867
3,301–10,000	99	49	148
10,001–50,000	10	10	20
50,001–100,000	1	1	2
100,001–1M	0	1	1
> 1M	0	0	0
TOTAL	**16,832**	**757**	**17,589**

Sources: SDWIS/Fed third quarter 2016 "frozen" dataset that contains information reported through June 30, 2016. Includes all active NTNCWSs. See Section 4.2.1.1 for detail on system classification (system type, source water type, and population served using SDWIS). Additional information can be found in "NTNCWS Inventory Characteristics_Final Rule.xlsx," available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov.

Notes:

A: Includes 15 NTNCWSs serving 3,300 or fewer people for which no primary source type was reported to SDWIS/Fed. These systems were assigned to the source water type of ground water or surface water based on the ratio of systems with known ground water to surface water source type for each size category. The majority of small NTNCWSs are ground water systems and based on these ratios, all 15 systems were assigned to the source type of ground water.

4.3.1.1 *Discussion of Data Limitations and Uncertainty*

As described in Section 4.2.1.4.1, EPA periodically performs program reviews to verify inventory information in SDWIS/Fed. From 2006 to 2016, EPA identified only 82 individual discrepancies (<1 percent), although some discrepancies in the reviews conducted prior to August 2007 could be unrelated to the population, source type, or system type, such as contact information or address, based on a detailed review of 2,180 systems, indicating a high level of completeness and accuracy.

There is uncertainty in the approach used to assign source water type to PWSs where no primary source type was reported to SDWIS/Fed. EPA assumed that the systems with an unknown source would have the same proportion of ground water to surface water source types as the overall population of PWSs. This could result in an under or overestimate of costs in those instances where the cost model inputs vary by source type, e.g., number of entry points per system; however, EPA expects the impact to be low because systems with no source type in SDWIS/Fed represent a small proportion of systems subject to the rule (30 (0.06 percent) of the total 50,067 CWSs and 15 (0.09 percent) of the total 17,589 NTNCWSs or 0.07 percent of all systems subject to the rule) and all serve fewer than 10,000 people.

4.3.2 **Population and Households Served**

An accurate characterization of the populations served by water systems is necessary when assessing the potential benefits of the final regulation. Population served is also used to estimate volume of water treated and associated CCT costs.

SDWIS/Fed tracks "retail" population served, meaning that it counts only the population that purchase water directly from the water system and does not include the population of a water system that purchase water from another system. Consecutive water systems are recorded in SDWIS/Fed as a separate system with a unique PWSID number.

Exhibit 4-5 and Exhibit 4-6 show the total population served and average population served per system by size category for both CWSs and NTNCWSs, respectively. Each exhibit is organized by source water type (surface water or ground water) and is based on SDWIS/Fed third quarter 2016 "frozen" dataset that contains information reported by Primacy Agencies through June 30, 2016.

Because systems often pass their costs onto customers in the form of rate increases, the LCRR cost analysis also includes analyses to assess the impact of the requirements on a household level. The number of households served by CWSs expected to be subject to the final LCRR requirements is estimated by dividing the population for each system size category by the average number of people per household. For CWSs, EPA assumed an average of 2.59 persons per household based on 2010 United States Census data (United States Census Bureau, 2010). This information is also included in Exhibit 4-5 by system size and source type. NTNCWSs do not serve households and thus, this information is not included in Exhibit 4-6.

As shown in Exhibit 4-5, although CWSs serving 3,300 or fewer account more than 80 percent of all CWSs, they serve fewer than 8 percent of the population and households that receive their water from a CWS. On the other hand, although CWSs serving more than 50,000 people account for only 2 percent of all CWSs, they serve more than half (59 percent) of the population and households that receive their water from a CWS.

Exhibit 4-5: Population and Number of Households Served by CWSs

System Size (Population Served)	Ground Water			Surface Water			TOTAL* (includes 30 CWSs with unspecified primary source)		
	Population Served	Average Population Per System	Number of Households Served	Population Served	Average Population Per System	Number of Households Served	Population Served	Average Population Per System	Number of Households Served
	A	B	C = A/2.59	D	E	F=D/2.59	G=A+D	H	I=G/2.59
≤100	672,437	61	259,628	50,352	52	19,441	723,487	60	279,339
101–500	3,292,950	249	1,271,409	589,004	285	227,415	3,884,780	254	1,499,915
501–1,000	3,127,989	736	1,207,718	860,236	751	332,137	3,989,089	739	1,540,189
1,001–3,300	10,297,561	1,860	3,975,892	5,013,869	2,007	1,935,857	15,312,930	1,906	5,912,328
3,301–10,000	15,692,304	5,665	6,058,805	13,371,843	6,070	5,162,874	29,070,747	5,844	11,224,227
10,001–50,000	27,286,028	20,593	10,535,146	45,584,177	22,724	17,600,068	72,870,205	21,876	28,135,214
50,001–100,000	10,347,353	66,757	3,995,117	27,786,667	70,346	10,728,443	38,134,020	69,335	14,723,560
100,001–1M	13,159,351	199,384	5,080,831	85,367,218	250,344	32,960,316	98,526,569	242,080	38,041,146
> 1M	3,400,000	1,700,000	1,312,741	38,643,440	2,033,865	14,920,247	42,043,440	2,002,069	16,232,988
TOTAL	**87,275,973**	**2,273**	**33,697,287**	**218,366,806**	**18,755**	**84,311,508**	**304,555,267**	**6,083**	**117,588,906**

Sources: A, B, D, and E: SDWIS/Fed third quarter 2016 "frozen" dataset that contains information reported through June 30, 2016. See file "CWS Inventory Characteristics_Final Rule.xlsx," available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov.

Notes:

B, E, and H: Derived by dividing the population served by the number of systems presented in Exhibit 4-3.

C, F, and I: The average of 2.59 persons per household is from 2010 Census data (Table AVG1. Average Number of People per Household, by Race and Hispanic Origin/1, Marital Status, Age, and Education of Householder: 2010).

G-I: CWSs with unreported primary source were not summarized individually, however they were included in the "TOTAL" columns. Thus, the "TOTAL" column reflects an additional 30 CWSs with unreported primary source type.

As previously discussed, NTNCWSs serving 3,300 or fewer account for more than 99 percent of all NTNCWSs. As shown in Exhibit 4-6, these systems serve approximately 75 percent of the population that receives their water from a NTNCWS. Those serving 3,301 to 50,000 people and more than 50,000 people serve approximately 20 percent and 5 percent of the population that receives water from a NTNCWS, respectively.

Exhibit 4-6: Population Served by NTNCWSs

System Size (Population Served)	Ground Water		Surface Water		TOTAL	
	Population Served	Average Population Per System	Population Served	Average Population Per System	Population Served	Average Population Per System
	A	B	D	E	F	G
≤100	457,766	56	12,897	51	471,225	56
101–500	1,565,659	250	66,071	253	1,632,090	251
501–1,000	1,096,208	719	61,883	755	1,158,991	721
1,001–3,300	1,283,281	1,680	194,520	1,907	1,479,801	1,707
3,301–10,000	527,174	5,325	284,306	5,802	811,480	5,483
10,001–50,000	206,735	20,674	236,482	23,648	443,217	22,161
50,001–100,000	50,807	50,807	71,963	71,963	122,770	61,385
100,001–1M	0	0	203,375	203,375	203,375	203,375
> 1M	0	0	0	0	0	0
TOTAL	**5,187,630**	**308**	**1,131,497**	**1,495**	**6,322,949**	**359**

Sources: SDWIS/Fed third quarter 2016 "frozen" dataset that contains information reported through June 30, 2016. See file "NTNCWS Inventory Characteristics_Final Rule.xlsx," available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov.

Notes:

B, E, and G: Derived by dividing the population served by the number of systems presented in Exhibit 4-4.

F and G: NTNCWSs with unreported primary source were not summarized individually, however they were included in the "TOTAL" columns. Thus, the "TOTAL" column reflects an additional 15 systems with unspecified primary source.

4.3.2.1 *Discussion of Data Limitations and Uncertainty*

As described in Section 4.2.1.4.1 , EPA periodically performs Program Reviews to verify key parameters in SDWIS/Fed including, but not limited to, population served, system type, and source type (USEPA, 2007). From 2006 to 2016, EPA identified only 82 individual inventory discrepancies (<1 percent) based on a detailed review of 2,180 systems, although some discrepancies could be unrelated to the population, source type, or system type, such as contact information or address. The results of the Program Review indicate a high level of completeness and accuracy in the -SDWIS/Fed population data (USEPA, 2007).

As noted previously, EPA consistently classifies systems in SDWIS/Fed according to the retail population served by the system and does not include the population served by wholesale customers. Wholesale customers that purchase water from another system and meet the PWS definition have their own

unique PWSID, retail population, and associated regulatory requirements under the SDWA. As described in Chapter 5, Section 5.3.3, EPA uses retail population to estimate design and average daily flow parameters, which are then used to estimate CCT costs associated with the rule. Use of retail population may overestimate costs by assuming that each PWSID will have an individual treatment plant instead of the more common scenario of the seller having one large plant and selling treated water to its wholesale customers.

4.3.3 Corrosion Control Treatment (CCT) Status

Under both the previous rule and the LCRR, systems with CCT in place have different requirements than those without this treatment. This section includes EPA's derivation of the number of CWSs and NTNCWSs with CCT. As noted in the introduction to Section 4.3, EPA used system-specific CCT information for systems serving greater than one million people where available.

To estimate the percent of CWSs and NTNCWSs with CCT, EPA used one approach for systems serving 50,000 or fewer people and a different approach for those systems serving more than 50,000 people. Both approaches rely on information reported to SDWIS/Fed but use different data fields and assumptions. Systems serving 50,000 or fewer are required under the previous rule to install CCT if they have a lead and/or copper ALE.[47] As a first step, EPA identified CWSs and NTNCWSs for which the Primacy Agency reported a treatment objective of "C" to identify those with CCT. As noted in Section 4.2.1.4, treatment code data in SDWIS/Fed is not part of the program review; thus, there is more uncertainty associated with these data as compared to SDWIS/Fed population and violation data. Therefore, to supplement the treatment code analysis, EPA reviewed milestone and violation data to identify additional CWSs that were required to install CCT as follows:

- The Primacy Agency reported a "DONE" or "DEEM" milestone with a reason code of "WQP." This indicates systems for which the Primacy Agency has set OWQPs, and thus would have CCT.[48]
- The system was in violation for failure to install CCT (i.e., was assigned violation code 58) and subsequently addressed this violation. Systems with an addressed code 58 violation were identified by the enforcement code of "SOX" or "EOX" that denotes compliance achieved.
- The system has an OWQP (59) violation code. As noted above, OWQPs are set for systems with CCT.
- The system purchased water from another system that EPA has identified as having CCT.

CWSs and NTNCWSs serving more than 50,000 people were required under the previous rule to install CCT unless they: 1) had completed treatment steps that are equivalent to those described in the 1991

[47] A system serving 50,000 or fewer is triggered into CCT steps that can include a study prior to CCT installation. However, these systems can discontinue CCT steps if they have two consecutive six-month monitoring periods at or below both the lead and copper ALs. If they have a subsequent ALE, they must recommence CCT steps but can discontinue the steps if they again have no ALEs for two consecutive six-month monitoring periods.
[48] Following the installation of CCT, the Primacy Agency will set OWQPs that represent the conditions under which systems must operate their CCT to most effectively minimize the lead and copper concentrations at their users' taps while not violating any National Primary Drinking Water Regulation.

LCR prior to December 7, 1992 (i.e., meet the criteria of 40 CFR 141.81(b)(2)) or 2) could demonstrate they have very low levels of lead and copper in the distribution system (i.e., qualify as a "b3" systems)[49] Therefore, EPA classified all systems as having CCT except those identified as a b3 system. EPA used the following criteria to identify b3 systems:

- Had a reported "b3" milestone,
- Did not have CCT using the criteria described above for systems serving ≤ 50,000 people, and
- Did not have a lead or copper ALE from 1992–2015 and all reported lead 90th percentile levels are ≤ 5 µg/L or non-detect.

Only 11 CWSs were found to be b3 systems.

As shown in Exhibit 4-7, EPA estimated that overall, approximately 29 percent of all CWSs have CCT. The percentage of CWSs with CCT is higher in the larger size categories. Specifically, about 28 percent of CWSs serving 3,300 or fewer have CCT. Whereas, more than 55 percent of those serving 3,301 to 50,000 people and approximately 99 percent of those serving more than 50,000 people have CCT.

As shown in Exhibit 4-8, EPA estimated that overall, approximately 13 percent of all NTNCWSs have CCT. Approximately 13 percent of those serving 3,300 or fewer and 46 percent of those serving 3,301 to 50,000 people have CCT. No NTNCWS met the b3 criteria, thus EPA assumed all systems serving more than 50,000 people had CCT.

[49] "b3 systems" is an abbreviated term for those systems that meet the criteria in 40 CFR 141.81(b)(3). Specifically under the previous rule, for two consecutive six-month monitoring periods, the system's: 1) 90th percentile lead level minus the highest source water level is < 0.005 mg/L (i.e., 5 µg/L); *or* 2) Source water lead levels are below the method detection limit (MDL) *and* the 90th percentile lead level is ≤ 0.005 mg/L. Under the final rule, a system meets the b3 criteria if its 90th percentile level is at or below the EPA practical quantitation level for lead of ≤ 0.005 mg/L for two consecutive monitoring periods. As stated above, EPA applied more stringent criteria in its analysis by limiting the b3 criteria to system serving more than 50,000 people for which all reported lead 90th percentile levels were ≤ 0.005 mg/L,.

Exhibit 4-7: Number of CWSs with and without CCT

System Size (Population Served)	Number of CWSs with CCT			Number of CWSs without CCT			TOTAL
	Ground Water	Surface Water	Total	Ground Water	Surface Water	Total	
	A	B	C=A+B	D	E	F=D+E	G=C+F
≤100	938	435	1,373	10,142	531	10,673	12,046
101–500	1,954	955	2,909	11,281	1,117	12,398	15,307
501–1,000	1,006	591	1,597	3,244	555	3,799	5,396
1,001–3,300	1,597	1,490	3,087	3,940	1,008	4,948	8,035
3,301–10,000	958	1,537	2,495	1,813	666	2,479	4,974
10,001–50,000	577	1,540	2,117	748	466	1,214	3,331
50,001–100,000	153	389	542	2	6	8	550
100,001–1M	64	340	404	2	1	3	407
> 1 M	2	19	21	0	0	0	21
TOTAL	**7,249**	**7,296**	**14,545**	**31,172**	**4,350**	**35,522**	**50,067**

Source: SDWIS/Fed third quarter 2016 "frozen" dataset that contains information reported through June 30, 2016. See file, "CWS Inventory Characteristics_Final Rule.xlsx," available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov.

Notes:

D & E: Includes 30 CWSs serving 10,000 or fewer people with no CCT for which no primary source type was reported to SDWIS/Fed. These systems were assigned to the source type of ground water or surface water based on the ratio of systems with known ground water to surface water source type for each size category. Based on this ratio, 27 systems were assigned to the source type of ground water and 3 to surface water. All CWSs identified as having CCT had a reported source type. Also see note in Exhibit 4-3 for an explanation of the difference in assignment of systems with unknown source status between the proposed and final LCRR.

Exhibit 4-8: Number of NTNCWS with and without CCT

System Size (Population Served)	Number of NTNCWSs with CCT			Number of NTNCWSs without CCT			TOTAL
	Ground Water	Surface Water	Total	Ground Water	Surface Water	Total	
	A	B	C=A+B	D	E	F=D+E	G=C+F
≤100	693	112	805	7,485	139	7,624	8,429
101–500	819	109	928	5,434	152	5,586	6,514
501–1,000	267	51	318	1,259	31	1,290	1,608
1,001–3,300	159	71	230	606	31	637	867
3,301–10,000	25	40	65	74	9	83	148
10,001–50,000	4	9	13	6	1	7	20
50,001–100,000	1	1	2	0	0	0	2
100,001–1M	0	1	1	0	0	0	1
> 1 M	0	0	0	0	0	0	0
TOTAL	**1,968**	**394**	**2,362**	**14,864**	**363**	**15,227**	**17,589**

Source: SDWIS/Fed third quarter 2016 "frozen" dataset that contains information reported through June 30, 2016. See file, "NTNCWS Inventory Characteristics_Final Rule.xlsx," available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov.

Notes:

D: Includes 15 NTNCWSs serving 3,300 or fewer people with no CCT for which no primary source type was reported to SDWIS/Fed. These systems were assigned to the source type of ground water or surface water based on the ratio of systems with known ground water to surface water source type for each size category. The majority of small NTNCWSs are ground water systems and based on these ratios, all 15 systems were assigned to the source type of ground water. All NTNCWSs identified as having CCT had a reported source type.

4.3.3.1 *Discussion of Data Limitations and Uncertainty*

There is uncertainty in the estimated percent of CWSs and NTNCWSs with CCT. For systems serving more than 50,000 people, the assumptions are based on the previous rule requirements that all systems must install CCT unless they had installed it previously (i.e., as required in the 1991 rule) or have very low lead and copper levels, which signifies that they have naturally non-corrosive water (i.e., they are b3 systems). Therefore, the uncertainty in these estimates is not expected to have a significant impact on benefits and costs of the final LCRR. For systems serving 50,000 or fewer people, EPA recognizes greater uncertainty in using treatment objective code data from SDWIS/Fed to identify systems with CCT. Thus, EPA supplemented these data with milestone and violation information to identify those systems that would have been required to install CCT under the previous LCR. The remaining uncertainty in the percent of systems with CCT may result in an under or overestimate of costs and benefits of the final LCRR.

4.3.4 **LSL Inventory and Duration of Mandatory Replacement**

The number of LSLs in the United States is a key input to calculating costs and benefits of the final LCRR. When present, LSLs provide the largest physical source of lead in a water system (Sandvig et al., 2008). Systems with LSLs have unique requirements and different burden and costs compared to non-LSL systems under the previous rule and final LCRR. Removing LSLs can have public health benefits, especially when sensitive subpopulations are present.

Service lines are defined as the physical pipe that connects the water main, which is typically under a street, to a building (e.g., home or small office). LSLs are often 1-inch in diameter and almost all have a 2-inch diameter or smaller (LSLR Collaborative, 2018). The use of LSLs was federally prohibited under the SDWA in 1986, but many states and localities had introduced their own bans much earlier.

LSLs can be configured in many ways. The following definitions are used for the purposes of benefit and cost analyses in this document:

- **Full LSL:** The service line is lead from the water main to the home or building.
- **System or Utility-owned LSL:** The portion of the LSL owned by the water utility, which is usually from the water main to the property line, curb stop, or water meter if it is in the yard. The customer's portion may or may not be made of lead.
- **Customer-owned LSL:** The portion of the LSL from the property line (or curb stop or water meter) to the home or building. The utility's portion may or may not be made of lead.
- **Gooseneck, pigtail, or connector:** A short section of piping, typically not exceeding two feet, which can be bent and used for connections between rigid service piping. For the purposes of the rule, lead goosenecks, pigtails and connectors are not considered to be part of the LSL.

Sections 4.3.4.1 and 4.3.4.2 provide the following baseline characterization of LSLs for CWSs and NTNCWSs, respectively:

1. **Systems with LSLs**, specifically the percent and number of systems with LSLs for each of the nine system size categories used in the EA.

2. **Number of LSLs** for each of the nine system size categories, including:
    a. The total number of LSLs nationally,
    b. The average number of LSLs per system for systems with LSLs, and
    c. The average percent of service connections that are lead for systems with LSLs.[50]

EPA provides the above information for two scenarios, low and high. Note that for the purposes of the baseline LSL inventory, EPA does not distinguish between the different LSL configurations. Systems are categorized as having LSLs if they have any locations with full, system (or utility)-side, or customer-side LSLs. Similarly, the estimated number of LSLs per system includes all types of LSLs (full, water system owned, customer owned). The cost and benefit analyses in this EA explain the assumptions related to the type of LSLs in water systems and discusses how these assumptions affect national costs and benefits estimates. Note that the LSL inventory presented in Sections 4.3.4.1 and 4.3.4.2 may underestimate the number of service lines requiring replacement because the final LCRR requires systems to replace galvanized service lines if they are or ever were previously downstream of an LSL.

Section 4.3.4.3 provides EPA's review of the duration of mandatory LSLR under the previous rule for CWSs and NTNCWSs.

4.3.4.1 *LSL Inventory for CWSs*

In previous economic analyses for lead and copper regulations, EPA used results from the 1998 LIS conducted by AWWA to develop the LSL inventory for CWSs (USEPA, 1991). Recently, a new estimate of LSLs was presented in Cornwell et al. (2016) based on AWWA surveys conducted in 2011 and 2013. EPA used both sources, combined with the SDWIS/Fed third quarter 2016 "frozen" dataset, to inform the LSL inventory estimates. This section describes the derivation of two key parameters related to the LSL inventory: 1) the percent of systems with LSLs, and 2) the percent of lead service connections within LSL systems.

EPA recognizes that the characterization of the national LSL inventory is uncertain and has a significant impact on estimated costs and benefits of the final LCRR. In order to capture the uncertainty associated with the national LSL inventory, EPA used the 1991 RIA (USEPA, 1991) to generate a "high" estimate (Section 4.3.4.1.1), and Cornwell et al. (2016) to generate a "low" estimate (Section 4.3.4.1.2) of the two

[50] EPA uses "percent of service connections that are lead" as an input in the cost and benefits model for the LCRR. Survey data are in the form of number of LSLs per system or per population served, so this input requires an estimate of the total number of service lines in CWSs and NTNCWSs. Estimates of the total number of service lines are based on SDWIS/Fed data, with adjustments as described in Sections 4.3.4.1 and 4.3.4.2 for CWSs and NTNCWSs, respectively.

LSL inventory parameters. As noted in the introduction to Section 4.3, EPA used system-specific LSL inventory data for systems serving greater than one million people where available.

Section 4.3.4.1.3 provides a discussion of the data limitations and uncertainties.

4.3.4.1.1 LSL Inventory for CWSs based on 1988 AWWA LIS (1991 RIA, Adjusted) – HIGH ESTIMATE

EPA developed the high estimate of LSLs in CWSs using the results of the 1988 AWWA LIS, as presented in the 1991 RIA. See Section 4.2.4 for information on the survey method, response, and representativeness. As a starting point, Exhibit 4-9 shows the number and percent of systems with LSLs, and the number of LSLs per system and total LSLs as presented in the 1991 RIA for the LCR for 12 system size categories. Note that the number of systems in this analysis reflects 1986 SDWIS data and was adjusted to remove mobile home parks.[51]

Exhibit 4-9: LSL Estimates from the 1991 RIA

System Size (Population Served)	Number of Systems	Number of Systems with LSLs	**Percent of Systems with LSLs**	Average Number of LSLs per System	**Total Number of LSLs**
	A	B	C = B/A	D	E = B*D
25-100	18,753	2,731	14.6%	26	71,006
101-500	18,016	3,654	20.3%	89	325,206
501-1000	6,777	2,624	38.7%	237	621,888
1001-3300	7,690	2,984	38.8%	257	766,888
3301-10K	4,169	1,751	42.0%	613	1,073,363
10K - 25K	1,737	764	44.0%	1,099	839,636
25K - 50K	785	346	44.1%	2,824	977,104
50K - 75K	300	132	44.0%	3,028	399,696
75K - 100K	154	68	44.2%	3,254	221,272
100K - 500K	255	159	62.4%	12,433	1,976,847
500K – 1M	50	31	62.0%	25,869	801,939
1M+	17	11	64.7%	200,000	2,200,000
TOTAL	**58,703**	**15,255**	**26.0%**		**10,274,845**

Source: USEPA, 1991.
Notes:
A: Total non-purchased and purchased water CWSs except mobile home parks as presented in Column 1, Exhibit 4-6 of the 1991 RIA (USEPA, 1991).
B: Based on EPA analysis of 1988 AWWA LIS data, as presented in Column 2, Exhibit 4-6 of the 1991 RIA (USEPA, 1991).

[51] EPA assumed that the distribution system and internal plumbing for mobile home parks is primarily comprised of PVC pipes.

D: Based on EPA analysis of 1988 AWWA LIS data, as presented in Column 4, Exhibit 4-6 of the 1991 RIA (USEPA, 1991).

Because the survey was done approximately 30 years ago, but after the use of LSLs was federally prohibited under the SDWA in 1986,the total number of LSLs and average number of LSLs per system were adjusted to account for LSLR since 1988. For the purposes of this analysis, EPA evaluated the potential impact of two types of LSLR: mandatory replacement under the previous LCR, and voluntary utility replacement programs, as described below.

- **Mandatory Replacement under the Previous LCR**: A system that exceeded the lead AL after installing CCT, would have begun LSLR at a rate of 7 percent of the number of LSLs at the time the replacement program begins, per year. The Primacy Agency could have required systems that did not install the required treatment to initiate LSLR and/or to replace LSLs at a faster replacement rate. Systems could have stopped LSLR after two six-month tap sampling periods at or below the lead AL (40 CFR 141.84(f)), but they would have recommenced replacement if they had a subsequent lead ALE. Systems could also "test out" an LSL if samples collected from the LSL did not exceed 15 ug/L; they could then consider the LSL replaced for purposes of meeting the 7 percent mandatory annual replacement rate. EPA reviewed SDWIS/Fed data to determine how many systems had an LSLR "milestone," indicating that a system must commence LSLR, from 1988 to 2016. EPA identified a total of 85 CWSs [52] that had this milestone over the 29-year period. Because this is a very small fraction of the total CWSs with LSLs, EPA considered it negligible for this analysis and did not adjust the number of LSLs to account for mandatory replacement.

- **Utility Replacement Programs**: As reported in the 1991 RIA (p. 4-28), the AWWA LIS found that approximately 1 percent of all LSLs were replaced each year as part of ongoing utility replacement programs. The RIA did not indicate if these replacements were water system-owned, customer-owned, or full replacements of the entire line. A survey conducted by Black & Veatch in 2004 provides insights into the proportion of each replacement type (Black & Veatch, 2004).[53] Based on survey results from 41 systems that were undertaking LSLR independently of LCR requirements, approximately 72 percent were conducting partial LSLR and 28 percent were undertaking full LSLR.[54] For more information on the survey, see AWWA (2005). Based on this information, EPA assumed that utilities replaced an average of approximately 1 percent of their LSLs each year, and that 28 percent of those are full LSLRs, so approximately 0.28 percent (1 percent x 28 percent) of LSLs are fully replaced each year.

[52] Note that LSLR milestones were reported for 9 additional CWSs. EPA excluded 1 CWS because the state indicated the system did not have LSLs, 2 CWSs because there were no reported lead ALEs, and 6 because the systems did not have any treatment or milestone information to indicate the system had CCT.
[53] Summary of the United States EPA Lead Service Line Replacement Workshop, Final Version, December 10, 2004.
[54] As described in AWWA (2005), "*Strategies to Obtain Customer Acceptance of Complete Lead Service Line Replacement*," the researchers contacted 65 systems and 41 responded. Twenty-one systems serve populations ranging from 6,000 to 100,000, and 20 systems serve more than 100,000. The respondents are more prevalent in the Northeast and Midwest, where LSLs are more common. The survey asked questions about rate of replacement, costs, communication strategies, financial incentives, barriers, and recordkeeping.

EPA started with the total numbers of LSLs from the 1991 RIA as shown in Exhibit 4-9 and reduced them by 0.28 percent per year from 1988 through 2024 or 36 years[55], which is equivalent to a 10.080 percent total reduction (1 percent*28 percent*36). EPA is assuming that 10.08 percent of LSLs have been replaced since 1991. An accurate count of the number of systems that fully removed all LSLs is unavailable, so EPA made a conservative assumption leaving the percent of systems with LSLs unchanged from the 1991 RIA, presented in Exhibit 4-9 above.

In order to reflect system consolidation that has occurred since 1988, EPA made a second adjustment to the number of LSLs accounting for movement in LSLs from smaller to larger CWS size categories. EPA assumed that the number of LSLs that moved to higher categories as a result of system consolidation was proportionate to the number of systems that were lost from the system size category of 100 or fewer between 1991 and 2016. These LSLs were re-assigned equally to the largest four system size categories.

Exhibit 4-10 shows the percent and number of systems with LSLs based on the 1991 RIA using the results of the 1988 AWWA LIS survey but using 2016 SDWIS/Fed data, adjusted to account for infrastructure replacement and system consolidation. The total projected number of CWSs is estimated at approximately 14,000, and the total number of LSLs is projected to be approximately 9.3 million using this methodology. The corresponding SafeWater LCR model data variable used to estimate costs in Chapter 5 is provided in red italics.

In general, inputs into the SafeWater LCR model are assigned a data variable name. Where appropriate, EPA has included data variable names in the drinking water system baseline tables in this and subsequent sections, and identified them using red italic font.

[55] Note that EPA updated this value from the proposed LCRR EA. The proposal version used 2023, or 35 years assuming rule promulgation in 2019. EPA updated to 2024 or 36 years to reflect a 2020 promulgation.

Exhibit 4-10: LSL Inventory Based on 1988 AWWA LIS (1991 RIA, Adjusted)

System Size (Population Served)	System Information based on SDWIS/Fed frozen database			Systems with LSLs		Number of LSLs (Adjusted)					
	Inventory of Systems	Total Number of Service Lines	Average Number of Connections/ System	**Percent of systems with LSLs**	Number of Systems with LSLs	Number of LSLs from 1991 RIA (represents 1988)	Percent Replaced through 2024	Projected Number of LSLs in 2024	LSLs Adjusted by Size Category to Account for System Consolidation	Average Number of LSLs per System for Systems with LSLs	**Percent of Service Connections in LSL Systems that are LSLs**
											perc_lsl
	A	B	C= B/A	**D**	E = A*D	F	G	H = F*(1-G)	I	J = I / E	**K = J / C**
≤100	12,046	324,257	27	**14.6%**	1,754	71,006	10.08%	63,849	41,013	23	**86.85%**
101-500	15,307	1,616,382	106	**20.3%**	3,105	325,206	10.08%	292,425	292,425	94	**89.20%**
501-1,000	5,396	1,626,622	301	**38.7%**	2,089	621,888	10.08%	559,202	559,202	268	**88.79%**
1,001-3,300	8,035	6,041,868	752	**38.8%**	3,118	766,888	10.08%	689,586	689,586	221	**29.41%**
3,301-10,000	4,974	10,941,012	2,200	**42.0%**	2,089	1,073,363	10.08%	965,168	965,168	462	**21.00%**
10,001-50,000	3,331	26,156,505	7,852	**44.0%**	1,466	1,816,740	10.08%	1,633,613	1,639,321	1,118	**14.24%**
50,001-100,000	550	12,744,116	23,171	**44.1%**	242	620,968	10.08%	558,374	564,083	2,328	**10.05%**
100,001-1M	407	32,161,495	79,021	**62.3%**	254	2,778,786	10.08%	2,498,684	2,504,393	9,878	**12.50%**
> 1M	21	12,681,341	603,873	**64.7%**	14	2,200,000	10.08%	1,978,240	1,983,949	146,005	**24.18%**
TOTAL	**50,067**	**104,293,598**			**14,131**	**10,274,845**		**9,239,141**	**9,239,141**		

Source: See "Derivation of LSL Number_CWS_Final Rule.xlsx" for detailed calculations, available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov

Notes:

A**:** See Exhibit 4-3.

B: SDWIS/Fed third quarter 2016 "frozen" dataset, reported number of service connection for each system, summed by size category and divided by the total number of systems in the size category from column A. EPA adjusted SDWIS service connection data in two ways: 1) EPA changed the population served to a minimum number of 25 people, and 2) EPA identified systems where the population per connection ratio was less than 1 or greater than 5. In these cases, EPA changed the number of connections so that the population per connection was the same as the average population per connection value for the size category. See the file "Derivation of LSL Number_CWS_Final Rule.xlsx," worksheet "Systems" for detailed calculations.

D. Percent of Systems with LSLs from the 1991 RIA Exhibit 4-6, Column 2 divided by Column 1 and adjusted to the 9 standard size categories for the LCRR.

F. Number of LSLs for each size strata from the 1991 RIA, Column 2 multiplied by Column 4 and adjusted to the 9 standard size categories for the LCRR.

G: Assumes replacement rate of 1 percent per year, 28 percent of those are full replacements, for 36 years (1988 - 2024 when the LSL replacement

requirement of the LCRR is anticipated to begin). This equals 1 percent x 28 percent x 36 years = 10.08 percent. Note that EPA updated this value from the proposed LCRR EA. The proposal version used 2023, or 35 years assuming rule promulgation in 2019. EPA updated to 2024 or 36 years to reflect a 2020 promulgation.

I: Adjustments to reflect system consolidation. EPA assumed that the number of LSLs that moved to higher categories as a result of consolidation was proportionate to the number of systems that were lost from the ≤ 100 system size category between 1991 and 2016. These LSLs were re-assigned equally to the largest four system size categories for systems serving above 10,000 people.

EPA's final step in developing this LSL inventory based on the 1991 RIA was to allocate the total number of systems with LSLs from Exhibit 4-10, Column E to the "with CCT" and "without CCT" categories. EPA made the following assumptions to estimate the percent of systems with LSLs according to CCT status for each of the nine system size categories as follows (assuming system with LSLs are more likely than non-LSL systems to have installed CCT):

- If more systems have CCT than LSLs, 100 percent of the LSL systems were assigned to the "with CCT" category, and zero systems were assigned to the "without CCT" category.
- If fewer systems have CCT than have LSLs, 100 percent of the "with CCT" systems were assumed to have LSLs, and the remaining LSL system were assigned to the "without CCT" category.

The resulting numbers and percent of systems with LSLs for the "with CCT" and "without CCT" categories are shown in Exhibit 4-11, columns E and G, respectively. The corresponding SafeWater LCR model data variable used to estimate costs in Chapter 5 is provided in red italics.

Exhibit 4-11: Estimated Systems with LSLs by CCT Status (1991 RIA: Adjusted)

Number of CWSs with and without CCT			Number and Percent with LSLs for CWSs with and without CCT based on Adjusted 1991 RIA Data				
System Size (Population Served)	Total Systems with CCT	Total Systems without CCT	Total Number of Systems with LSLs (based on 1991 RIA)	with CCT		without CCT	
				Number with LSLs	**Percent with LSLs**	Number with LSLs	**Percent with LSLs**
					p_lsl		*p_lsl*
	A	B	C	D	**E=D/A**	F	**G=F/B**
≤100	1,373	10,673	1,754	1,373	**100%**	381	**3.6%**
101-500	2,909	12,398	3,105	2,909	**100%**	196	**1.6%**
501-1,000	1,597	3,799	2,089	1,597	**100%**	492	**13.0%**
1,001-3,300	3,087	4,948	3,118	3,087	**100%**	31	**0.6%**
3,301-10,000	2,495	2,479	2,089	2,089	**84%**	0	**0.0%**
10,001-50,000	2,117	1,214	1,466	1,466	**69%**	0	**0.0%**
50,001-100,000	542	8	242	242	**45%**	0	**0.0%**
100,001-1M	404	3	254	254	**63%**	0	**0.0%**
> 1M	21	0	14	14	**65%**	0	**0.0%**
TOTAL	**14,545**	**35,522**	**14,131**	**13,031**	**90%**	**1,100**	**3.1%**

Source: See "Derivation of LSL Number_CWS_Final Rule.xlsx" for detailed calculations, available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov

Notes:

A, B: Exhibit 4-3.

C: Exhibit 4-10, Column E.

D, F: EPA assumed systems with LSLs are more likely to have CCT than systems without LSLs. Therefore, to create percent of systems with LSLs according to CCT status, EPA used the following approach for each of the nine system size categories:

1. If more systems have LSLs than have CCT (i.e., C > A), assume 100 percent of systems with CCT are LSL systems and assign the remaining LSL systems to the "without CCT" category.
2. If fewer systems have LSLs than have CCT (i.e., C < A), assign all of the LSL systems to the "with CCT" category and zero to the "without CCT" category.

4.3.4.1.2 LSL Inventory based on 2011 and 2013 AWWA Surveys (Cornwell et al., 2016) – LOW ESTIMATE

The AWWA journal article, "National Survey of Lead Service Line Occurrence" (Cornwell et al., 2016) provides a characterization of LSLs based on combined results of surveys conducted in 2011 and 2013 for 978 CWSs. Of these CWSs, 251 reported that they had LSLs, 578 reported that they did not have LSLs, and 149 had incomplete responses or reported that they were "not sure" if they had LSLs. For the 251 CWSs that reported that they had LSLs, 179 provided an estimate of the number of LSLs in their system. See Section 4.2.5 for more information on these surveys including data cleaning and representativeness.

The authors observed differences in the distribution of LSLs based on system size. Therefore, they grouped the data by the following three population size categories:

- Systems serving < 10,000 people.
- Systems serving 10,000 to 50,000 people.
- Systems serving > 50,000 people.

Cornwell et al. (2016) also evaluated the survey results for geographic differences. They initially grouped results by state, but this approach resulted in many bins having no survey responses. Thus, the authors sorted the data into 5 regional groups (representing one or more of EPA regions) each with 3 population categories, totaling 15 groups for analysis.

Cornwell et al. (2016) calculated the average percent of systems with LSLs and the average number of LSLs per population for the 15 size/regional groups as shown in Exhibit 4-12. The authors combined these results with 2015 SDWIS data to produce an estimate of the total number of LSLs in the United States, 6.1 million.

Exhibit 4-12: Percent of water systems with lead service lines and number of LSLs per 1,000 persons for systems with LSLs from Cornwell et al. (2016)

System Size (population served)	EPA Region	Percent of systems with LSLs	Average number of LSLs/1,000 people for those systems with LSLs
		A	B
< 10,000	1 & 2	26%	4.3
	3 & 4	14%	29.4
	5 & 7	36%	102.5
	6	16%	43.5
	8, 9, & 10	15%	97.3
10,000 - 50,000	1 & 2	57%	138.9
	3 & 4	39%	50.7
	5 & 7	56%	103.6
	6	33%	124.8
	8, 9, & 10	2%	7.4
> 50,000	1 & 2	89%	6.9
	3 & 4	40%	26.2
	5 & 7	87%	86
	6	33%	3.6
	8, 9, & 10	33%	9.1

Sources:
A: "Best Estimate" from Cornwell et al. (2016). Table 1, 5th column.
B: Cornwell et al. (2016). Table 3, 5th column.

Note that the percent of systems with LSLs shown in Exhibit 4-12 are the "best estimates" from the article, meaning that they only reflect "yes" and "no" responses. Cornwell et al. (2016) further utilized survey responses where systems reported "not sure" to the question of whether they had LSLs to provide a possible minimum and maximum. To calculate a possible minimum value, the authors assumed "not sure" was "no." To calculate a possible maximum value, they assumed that "not sure" was "yes." The final potential range of LSLs in the United States reported by Cornwell et al. using this method was 5.5 million to 7.1 million.

EPA used the same LSL occurrence factors (the "Best Estimate" values) from Cornwell et al. (2016) to estimate the baseline LSL inventory; however, EPA combined Cornwell's findings with 2016 instead of 2015 SDWIS/Fed inventory data for consistency with other cost and benefit analyses in this EA. Also, for systems serving greater than 1 million, EPA used available data to characterize LSLs for individual systems where possible.

Exhibit 4-13 shows the baseline inventory based on Cornwell et al. (2016) for the nine size categories used in this EA. The total projected number of CWSs in Column C is estimated at approximately 11,000 systems, which is lower than the approximately 14,000 CWSs based on the Adjusted 1991 RIA. The total number of LSLs using Cornwell et al. (2016) is projected to be approximately 6.3 million, which is also

lower than the estimate based on the 1991 RIA of 9.3 million. The corresponding SafeWater LCR model data variable used to estimate costs in Chapter 5 is provided in red italics.

Exhibit 4-13: LSL Inventory Based on 2011 and 2013 AWWA Surveys (Cornwell et al. 2016)

System Size (Population Served)	Systems with LSLs			Number of LSLs in Systems with LSLs			
	Total Number of Systems	**Percent of Systems with LSLs**	Total Number of Systems with LSLs	Total Number of LSLs	Average Number of LSLs/System for Systems with LSLs	Average Number of Service Connections per CWS	**Percent of Service Connections in LSL Systems that are LSLs** *perc_lsl*
	A	**B**	C = A*B	D	E = D/C	F	**G = E/F**
≤100	12,046	**20.2%**	2,430	9,457	3.9	27	**14.5%**
101-500	15,307	**20.8%**	3,182	55,740	17.5	106	**16.6%**
501-1,000	5,396	**22.1%**	1,193	63,611	53.3	301	**17.7%**
1,001-3,300	8,035	**21.5%**	1,729	222,650	128.8	752	**17.1%**
3,301-10,000	4,974	**20.9%**	1,041	401,740	386.1	2,200	**17.6%**
10,001-50,000	3,331	**38.0%**	1,267	2,695,576	2,128.0	7,852	**27.1%**
50,001-100,000	550	**52.1%**	287	727,541	2,538.5	23,171	**11.0%**
100,001-1M	407	**48.7%**	198	1,444,272	7,291.0	79,021	**9.2%**
> 1M	21	**55.6%**	12	666,376	57,052.7	603,873	**9.4%**
TOTAL	**50,067**	**22.6%**	**11,338**	**6,286,963**			

Source: See "Derivation of LSL Number_CWS_Final Rule.xlsx," available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov.

Notes:

A: SDWIS/Fed third quarter 2016 "frozen" dataset that contains information reported through June 30, 2016. See Exhibit 4-3.

B & D: Cornwell et al. (2016), combined data for all geographic regions. For systems serving > 1M, EPA used system-level data for LSL estimates when available. A summary of this information ("VLS system-provided data tables for appendix.xlsx") is available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov.

F: SDWIS/Fed third quarter 2016 "frozen" dataset, reported number of service connection for each system, summed by size category and divided by the total number of systems in the size category from column A. EPA adjusted SDWIS service connection data in two ways: 1) EPA changed the population served to a minimum number of 25 people, and 2) EPA identified systems where the population per connection ratio was less than 1 or greater than 5. In these cases, EPA changed the number of connections so that the population per connection was the same as the average population per connection value for the size category.

Consistent with the adjustments done for the Adjusted 1991 RIA estimate, EPA's final step in developing the LSL inventory estimate using Cornwell et al. (2016) was to allocate the total number of systems with LSLs from Exhibit 4-13, Column C to the "with CCT" and "without CCT" categories. As noted earlier in this chapter, CCT was required by the previous rule for systems serving more than 50,000 people (with a few exceptions) and for some systems serving 50,000 or fewer people that continued to exceed the lead and/or copper AL. See Exhibit 4-7 for the estimates of the number and percent of systems with CCT based on SDWIS/Fed data. EPA assumed that many of the smaller systems that installed CCT in response to the previous rule were LSL systems because LSLs represent a large source of lead in the distribution system and have been found to cause elevated lead at customer's taps (Sandvig et al., 2008). Thus, EPA estimated the percent of systems with LSLs according to CCT status for each of the nine system size categories using the following approach:

- If more systems have CCT than LSLs, 100 percent of the LSL systems were assigned to the "with CCT" category, and zero LSL systems were assigned to the "without CCT" category.
- If fewer systems have CCT than have LSLs, 100 percent of the "with CCT" systems were assumed to have LSLs, and the remaining LSL system were assigned to the "without CCT" category.

The resulting numbers and percent of systems with LSLs for the "with CCT" and "without CCT" categories are shown in Exhibit 4-14, column E and G, respectively. The corresponding SafeWater LCR model data variable used to estimate costs in Chapter 5 is provided in red italics.

Exhibit 4-14: Estimated Systems with LSLs by CCT Status (Cornwell et al. 2016)

Number of CWSs with and without CCT			Number and Percent with LSLs for CWSs with and without CCT based on Cornwell et al. 2016				
System Size (Population Served)	with CCT	without CCT	Total Number of Systems with LSLs (based on Cornwell et al. 2016)	with CCT		without CCT	
				Number with LSLs	Percent with LSLs	Number with LSLs	Percent with LSLs
					p_lsl		*p_lsl*
	A	B	C	D	**E=D/A**	F	**G=F/B**
≤100	1,373	10,673	2,430	1,373	**100%**	1,057	**9.9%**
101-500	2,909	12,398	3,182	2,909	**100%**	273	**2.2%**
501-1,000	1,597	3,799	1,193	1,193	**75%**	0	**0.0%**
1,001-3,300	3,087	4,948	1,729	1,729	**56%**	0	**0.0%**
3,301-10,000	2,495	2,479	1,041	1,041	**42%**	0	**0.0%**
10,001-50,000	2,117	1,214	1,267	1,267	**60%**	0	**0.0%**
50,001-100,000	542	8	287	287	**53%**	0	**0.0%**
100,001-1M	404	3	198	198	**49%**	0	**0.0%**
> 1M	21	0	12	12	**57%**	0	**0.0%**
TOTAL	**14,545**	**35,522**	**11,338**	**10,008**		**1,330**	

Notes:

A & B: Exhibit 4-7.

C: Exhibit 4-13, Column C.

D & F: EPA assumed that systems with LSLs are more likely to have CCT than systems without LSLs. Therefore, to create percent of systems with LSLs according to CCT status, EPA used the following approach for each of the nine system size categories:

1. If more systems have LSLs than have CCT (i.e., C > A), assume 100 percent of systems with CCT are LSL systems and assign the remaining LSL systems to the non-CCT category.
2. If fewer systems have LSLs than have CCT (i.e., C < A), assign all of the LSL systems to the "with CCT" category and zero to the "without CCT" category.

4.3.4.1.3 Discussion of Data Limitations and Uncertainty

The estimated number of LSLs nationally is based on surveys of water systems extrapolated nationally. EPA presents two possible data sources for estimating the percent of systems with LSLs, and the percent of lead connections in LSL systems: the 1988 LIS as presented in the 1991 LCR RIA (USEPA, 1991), and the 2011 and 2013 AWWA surveys of LSL occurrence as presented in Cornwell et al. (2016). Both sources and associated surveys are described in Sections 4.2.4 and 4.2.5 above for the 1991 LCR RIA and Cornwell et al. (2016), respectively. The 1988 and 2011/2013 surveys did not attempt to gather data by systematically sampling systems from a robust sample framework that would allow for detailed estimates of LSLs based on an understanding of associated system characteristics. Both surveys had low response rates resulting in low numbers of responses compared to the universe of systems. Neither survey conducted non-response follow-up efforts to attempt to characterize the degree and direction of bias these low response rates might produce in the survey results. Due to the quality of the survey data, uncertainty around the estimates of the number of systems with LSLs and the number of lead connections in those systems is high. Also, there is additional uncertainty in the adjustments made to the 1988 LIS results to account for infrastructure replacements and system consolidation. EPA does not account for LSLR conducted as a result of systems exceeding the AL and being required to replace lines. EPA also makes no adjustments for LSLR occurring as part of voluntary programs. Both of these omissions would overestimate the number of LSLs requiring replacement.

EPA recognizes that uncertainty in the characterization of the national LSL inventory has a significant impact on estimated costs and benefits of the final LCRR. In order to reflect the uncertainty associated with this variable in estimated costs and benefits, EPA used the Cornwell et al. (2016) estimate as the low cost model input, and the adjusted 1991 RIA as the high cost model input for the percent of systems with LSLs and the percent of service connections that are lead within systems that are known to have LSLs. Also as previously discussed, the estimated LSL inventory may underestimate the number of LSLs requiring replacement because it may not adequately reflect the number of galvanized service lines if they are or were previously downstream of an LSL.

4.3.4.2 *LSL Inventory for NTNCWSs*

Information comparable to the CWS surveys described in Section 4.3.4.1 has not been collected on the occurrence of LSLs in NTNCWSs. In the 1991 RIA for the original LCR (USEPA, 1991), EPA assumed NTNCWSs did not have LSLs because they lack extensive distribution systems. However, there is now evidence that some NTNCWSs may have LSLs. For example, milestone information[56] reported to SDWIS/Fed, as of June 30, 2016, indicates that 30 NTNCWSs were required to initiate LSLR.

This section outlines EPA's approach for estimating the number of NTNCWSs with LSLs (Section 4.3.4.1.1) and number of LSLs (Section 4.3.4.1.2). A discussion of data limitations and uncertainties is provided in Section 4.3.4.1.3.

4.3.4.2.1 Number of NTNCWSs with LSLs

In 2017, EPA disseminated a questionnaire to nine states regarding the burden and cost associated with the National Drinking Water Advisory Council's (NDWAC's) recommendation to require all systems to

[56] As previously discussed in Section 4.2.1.2, the SDWIS milestone "LSLR" indicates systems that are required to initiate the replacement of LSLs.

develop a comprehensive LSL inventory and to expand the definition of an LSL to include lead connectors even if the service line is not made of lead.[57] The questionnaire included questions on the estimated number or percentage of NTNCWSs with one or more LSLs and the total number of LSLs in NTNCWSs. States were selected for geographical diversity, known occurrence of LSLs in CWSs, and active LSLR projects. EPA received responses from seven states. Four states did not provide any estimate. The remaining three states provided estimates ranging from 0 to 5 percent. Exhibit 4-15 below provides a summary of the seven states' responses.

Exhibit 4-15: Summary of State Responses Regarding the Percentage of NTNCWSs with LSLs

Response	Number of States with this Response
Unknown/Information not readily available	3
Unknown but expected to be very low	1
Unknown but expected to be 0	1
Estimated to be 0 – 5 percent	1
Estimated to be <5 percent (gross estimate)	1
Estimated to be ≥5 percent	0
Total	**7**

Source: A copy of the questionnaire and each state's response is available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov.

Due to the uncertainty of the responses and the respondents being in states with known LSLs in CWSs, EPA used the midpoint of the range reported by states to estimate the number of NTNCWSs that had LSLs. Specifically, EPA assumed 2.5 percent (corresponds to SafeWater LCR model data variable, *p_lsl*) or 440 NTNCWSs have LSLs. EPA further assumed that systems without CCT are less likely to have LSLs because they would have installed CCT if they had sustained lead ALEs. Thus, EPA assumed all 440 NTNCWSs with LSLs are those with CCT. Exhibit 4-16 indicates the estimated number and percent of NTNCWSs with LSLs for systems with and without CCT.

[57] A copy of the questionnaire is available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov.

Exhibit 4-16: Estimated Number and Percentage of NTNCWSs with LSLs by CCT Status

System Size	Number of NTNCWSs by CCT Status			Estimated Number with LSLs by CCT Status		Estimated Percentage with LSLs by CCT Status	
	With CCT	No CCT	Total	With CCT	No CCT	With CCT	No CCT
	A	B	C = A+B	D = C*0.025 *p_lsl*	E = 0	F=D/A	G = 0%
≤100	805	7,624	8,429	211	0	26%	0%
101–500	928	5,586	6,514	163	0	18%	0%
501–1,000	318	1,290	1,608	40	0	13%	0%
1,001–3,300	230	637	867	22	0	9%	0%
3,301–10,000	65	83	148	4	0	6%	0%
10,001–50,000	13	7	20	1	0	4%	0%
50,001–100,000	2	0	2	0.05	0	3%	0%
100,001–1M	1	0	1	0.03	0	3%	0%
> 1M	0	0	0	N/A	N/A	N/A	N/A
Total	**2,362**	**15,227**	**17,589**	**440**	**0**	**19%**	**0%**

Notes:

A, B: Exhibit 4-8.

D, E: Estimate of 2.5 percent based on information from three states regarding the percentage of NTNCWSs in their state with any LSLs (see Exhibit 4-15). As a simplifying assumption, EPA assumed that all 2.5 percent of NTNCWSs with LSLs are those with existing CCT.

4.3.4.2.2 Number of LSLs in NTNCWSs

Two states provided an estimate of the number of LSLs in NTNCWSs in response to the August 2017 questionnaire. One estimated the number to be between 0 and 5. The second estimated between 0 and 50 LSLs and noted that the majority of their NTNCWSs (67 percent) have 5 or fewer connections. Due to the uncertainty of the responses and representativeness of the data, EPA did not use the responses to the state questionnaire to develop the national number of LSLs in NTNCWSs. Instead, EPA used the following approach.

1. Determined the median number of service connections from SDWIS/Fed for each of the NTNCWS size categories serving 1 million or fewer people.
2. For systems with LSLs:
   a. Assume 100 percent of service connections are lead when the median number of service connections is 10 or fewer.
   b. Assume NTNCWSs with more than 10 service connections have experienced expansion over time resulting in service lines of different materials. For these systems EPA developed a range, with a minimum of 50 percent and a maximum of 100 percent of service lines assumed to be lead.

Exhibit 4-17 provides the estimated total number of LSLs for each system size category. The corresponding SafeWater LCR model data variable used to estimate costs in Chapter 5 is provided in red italics. Note that the minimum is the same as the maximum except for the three size categories that serve populations of 10,001 – 1 million where the median number of service connections is above 10. As previously stated, EPA assumes that LSLs in NTNCWSs are limited to the subset of NTNCWSs with CCT.

Exhibit 4-17: Number of LSLs in NTNCWSs with CCT by Size Category

System Size Category	Number of Systems with LSLs (assumes 2.5%)	Median Number of Service Connections	Estimated Percent of Service Connections that Are LSLs		Total Estimated Number of LSLs per Size Category	
			perc_lsl			
			Minimum	Maximum	Minimum	Maximum
	A	B	C	D	E=A*B*C	F=A*B*D
<=100	211	1	100%	100%	211	211
101–500	163	1	100%	100%	163	163
501–1,000	40	1	100%	100%	40	40
1,001–3,300	22	2	100%	100%	44	44
3,301–10,000	4	6	100%	100%	24	24
10,001–50,000	1	29	50%	100%	15	29
50,001–100,000	0.05	112	50%	100%	3	6
100,001–1M	0.03	1,109	50%	100%	17	33
>1M						
Total	**440**				**516**	**550**

Notes:

General: Only systems with CCT are assumed to have LSLs. No NTNCWSs serve more than 1 million people.
A: Exhibit 4-16, Column D. As shown in Exhibit 4-16 very few NTNCWSs serve 50,001 to 1 million people. Thus, multiplying 2.5 percent by the number of systems in the 50,001 – 100,000 and 100,001 – 1 M size categories results in a fraction of systems with LSLs.
C, D: For systems with LSLs, EPA assumed 100 percent of service connections are lead when the median number of service connections was ≤ 10. For NTNCWSs with > 10 service connections, EPA assumed that service connections have been laid over a period of time and may be composed of different materials. Thus, for these systems, EPA assumed a minimum of 50 percent and maximum of 100 percent of service lines are lead.

4.3.4.2.3 Discussion of Data Limitations and Uncertainty

There is a high degree of uncertainty in using the 2.5 midpoint of the range as the estimated percentage of NTNCWSs with LSLs based on survey results from three states. This uncertainty could result in an under- or overestimate of national costs and benefits of the LCRR. EPA conservatively assumed that all service lines would be lead in those NTNCWSs with LSLs serving 10,000 or fewer based on the reported median number of service connections in SDWIS/Fed for each size category. This may result in an overestimate of costs and benefits based on the accuracy of the service connection information. However, the impact of these uncertainties is expected to be small due to the small estimated number of NTNCWSs with LSLs.

4.3.4.3 *Duration of Mandatory Replacement*

The previous rule required water systems with LSLs that continue to exceed the lead AL after the installation of treatment to annually replace a minimum of 7 percent of the initial number of LSLs in their distribution system. The Primacy Agency could require systems that did not install the required treatment also to initiate LSLR and/or to replace LSLs at a faster replacement rate. Systems could discontinue LSLR if they no longer exceed the lead AL for two consecutive six month tap sampling periods.

To estimate the average time a CWSs would continue LSLR before being eligible to stop LSLR, EPA:

1. Identified CWSs with a reported milestone of "LSLR." This milestone indicates systems that are required to initiate LSLR.
2. Assumed the Primacy Agency would only require LSLR if a system had a continued lead ALE after installing CCT. Thus, the analysis was restricted to only those CWSs with CCT (see Section 4.3.3) and at least one lead ALE prior to the date a system was required to initiate replacement of LSLs, i.e., the "Event Actual Date."[58] EPA applied these criteria to limit the analysis to 85 CWSs that EPA assumed initiated LSLR in response to the rule as opposed to voluntary replacement. If the "Event Actual Date" month was June through September, then a 1/2 year of LSLR was assumed for that same year. However, if the "Event Actual Date" month was October through December of a given year, it was assumed that LSLR began in January of the following year. If more than one "Event Actual Date" was reported to SDWIS/Fed, EPA used the earliest one.

[58] Nine CWSs with reported LSLR milestones were excluded from the analysis: 2 had no reported lead ALEs, and 6 had no indication in SDWIS/Fed as having CCT. For an additional system, the Primacy Agency noted that the system had no LSLs.

3. Identified all lead ALEs (i.e., lead 90th percentile levels above 15 µg/L) since the "Event Actual Date."
4. Determined the length of time from the "Event Actual Date" to the end of the period in which the CWS no longer had a lead ALE for two consecutive six month tap sampling periods and could discontinue LSL replacements. If no 90th percentile was reported, EPA assumed that the system had no lead ALE.[59] Any subsequent ALE(s) were also counted toward the years of LSLR until the system again had two subsequent tap sampling periods without a lead ALE.

The estimated average number of years of replacements based on 85 CWSs was 3 years. For additional details, see the file "Derivation of LSLR_Time_Span_Analysis_CWS_Final Rule.xlsx," available in the docket at EPA-HQ-OW-2017-0300.

For NTNCWSs, EPA applied the same average estimate of 3 years because there was less milestone data for NTNCWSs as compared to CWSs in SDWIS/Fed.[60]

4.3.4.3.1 Discussion of Data Limitations and Uncertainty

See Section 4.2.1.4 for a discussion of data uncertainty associated with SDWIS/Fed. EPA conservatively assumed that NTNCWSs would replace LSLs for 3 years; however, the timeframe may be shorter since NTNCWSs typically have fewer service connections, own their entire service line. EPA further assumed that NTNCWSs with fewer than 7 estimated LSLs (i.e., those serving 10,000 or fewer people) will replace their LSLs within one year.

4.3.5 Lead and Copper Tap Levels

The analyses described in this section draw from multiple sources to characterize baseline water quality including lead levels at customer's taps. Lead 90th percentile data were obtained from SDWIS/Fed, along with information on systems' CCT status. EPA also used information from 12 states, Region 9 tribes, and a web search of individual system LSLR programs to identify systems with LSLs.[61] As previously discussed, SDWIS/Fed does not identify which systems have LSLs, only those that are required to initiate LSLR.

The remainder of this section is organized as follows:

- **Section 4.3.5.1** explains the derivation of the percentage of systems with: 1) no trigger level exceedance (TLE) or ALE, 2) a TLE, or 3) an ALE as a function of LSL and CCT status:
    - Prior to implementation of the final LCRR (i.e., baseline conditions).

[59] Under the previous rule, Primacy Agencies were not required to report lead 90th percentile levels at or below the lead AL of ≤ 15 µg/L for systems serving 3,300 or fewer people and pre-2002 for systems serving more than 3,300 people.
[60] LSLR milestone data were reported for 34 NTNCWSs, of which four did not have any treatment or milestone data to indicate the system had CCT.
[61] For systems with known LSL status, additional state data were available to EPA for the final rule. Specifically, EPA added data for California, Louisiana, Michigan, and Nevada and included updated information for Illinois, North Carolina, Ohio, and Wisconsin.

- During the first year of implementation of the final LCRR when LSL systems must collect a fifth liter sample from available sites served by LSLs in lieu of a first liter sample from 50 percent of sites served by LSLs as required under the previous rule.

- **Section 4.3.5.2** provides the likelihood of an individual lead sample being greater than 15 µg/L.
- **Section 4.3.5.3** provides the likelihood that a system exceeds the copper AL of 1.3 mg/L but not the lead AL.

4.3.5.1 *Percent of Systems with No TLE or ALE, a TLE, or ALE*

The discussion of the percent of systems that fall into one of three lead 90th percentile classifications is presented in three subsections as follows:

- 4.3.5.1.1: Previous Rule
- 4.3.5.1.2: Final LCRR
- 4.3.5.1.3: Discussion of Data Limitations and Uncertainty

4.3.5.1.1 Previous Rule

As described in Chapter 3, the LCRR includes a new trigger level (TL) of 10 µg/L whereby a system with a lead tap sample 90th percentile level above 10 µg/L but at or below the existing AL of 15 µg/L (i.e., has a TLE) will be subject to additional requirements. For the purposes of estimating the costs of the final rule, EPA first estimated the proportion of systems that would be classified into one of three lead 90th percentile categories prior to implementation of the LCRR (i.e., under the baseline or previous rule) as follows:

1. No TLE or ALE: the lead 90th percentile level is at or below 10 µg/L,
2. A TLE: the lead 90th percentile value is above 10 µg/L but at or below 15 µg/L, or
3. An ALE: the lead 90th percentile level is above 15 µg/L.

The presence or absence of CCT and LSLs can impact lead 90th percentile levels; thus, EPA further characterized this analysis based on LSL.

The estimated percent of systems with no TLE or ALE, a TLE, and an ALE is based on SDWIS/Fed historical 90th percentile lead tap sample data from 2007 to 2015. EPA recognizes that there are uncertainties in predicting the future 90th percentile ranges from historical SDWIS/Fed data. Also, the Agency recognizes that these uncertainties could have a significant impact on estimated costs and benefits of the final LCRR. To provide a range of costs and benefits that reflects this uncertainty, EPA generated a "low" and "high" estimate of baseline conditions as detailed in the following four steps:

Step 1 – Identified "Low" and "High" 90th percentile level based on historical data: EPA reviewed all lead 90th percentile data from 38,707 CWSs that reported to SDWIS/Fed for monitoring conducted between 2007 and 2015 and excluded those results that were: 1) negative sample values (Maryland only) and 2) values > 1,500 µg/L, which is 100x higher than the AL. From the remaining results 37,286 CWSs, EPA selected the minimum lead 90th percentile level between 2007 and 2015 for the "low" estimate and the maximum lead 90th percentile for the "high" estimate.

Step 2 – Designated systems by LSL status: Data were grouped according to LSL status for analysis. LSL status for individual systems is not available in SDWIS/Fed; therefore, EPA reached out to states that had collected LSL inventory information and EPA Regions (for tribal systems) and conducted web searches to identify for which systems or additional states sufficient information was available to definitely determine if a system had any LSLs or no LSLs. Exhibit 4-18 summarizes the information from 6,978 systems that were assigned a "yes" / "no" LSL status based on this effort. For additional detail on systems' LSL determination for individual states, see file "Derivation of State LSL Status. _Final Rule.xlsx," available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov.

As shown in Exhibit 4-18, information on LSL status was available for systems in 12 states and Region 9 tribal systems, as well as select systems identified in web searches.[62] In all, the number of systems with known LSL status represents approximately 14 percent of the total CWS inventory of 50,067, with information collected from more than 50 percent of states.[63] Column D indicates the percentage of all CWSs for which EPA has known LSL status information. The fact that EPA is constrained by the available data that represents 14 percent of total systems results in a high degree of uncertainty around these estimated percentages for systems falling into the no TLE or ALE, a TLE, or an ALE category. For systems serving > 1M, EPA obtained system-level LSL estimates from available sources (see the data summary table provided as Exhibit B-2 in Appendix B).

Exhibit 4-18: Number of CWSs with LSL Determination Based on State, Tribal, and Web Data[1]

Source	Number of Systems per State or Region 9 Tribal Systems	Number of systems with "YES" LSL determination	Number of Systems with "NO" LSL determination	Percent of CWSs with Known LSL Status
	A	B	C	D = (B+C)/A
California	2,832	6	0	0.2%
Hawaii[2]	117	0	117	100%
Illinois	1,762	321	891	69%
Indiana	455	117	224	75%
Louisiana	71	0	36	51%
Maryland	250	23	171	78%
Michigan	1,053	172	595	73%
Nevada[3]	201	0	201	100%
North Carolina	2,197	59	2,138	100%
Ohio	1,205	179	712	74%
Washington	691	72	1	11%
Wisconsin	568	131	414	96%
Region 9 Tribes	276	0	276	100%
Systems Serving > 1M	21	13	6	90%
Web Searches[4]		138	17	
TOTAL[5]		**1,179**	**5,799**	

[62] See footnote 61.
[63] The web searches included some LSL data from 21 states plus Washington, D.C.

Notes:
[1] The data presented in this exhibit were compiled from numerous state surveys, as well as a web search of systems with prior or ongoing LSLR programs and were updated through May 2020. Determinations of whether systems had LSLs within each state were dependent on the information provided in the states' survey. (For additional detail on systems' LSL determination for individual states, see file "Derivation of State LSL Status_Final Rule.xlsx," available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov.) Note that this exhibit does not show counts of CWSs that reported "unknown" LSL status or for which the data were insufficient for EPA to determine the system's LSL status. Only those systems whose LSL status was known are described here.
[2] The LSL information for the State of Hawaii was extracted from an April 9, 2016 Associated Press article[64] that stated no drinking water systems in Hawaii have lead pipes.
[3] The LSL information for the State of Nevada was submitted as a public comment on the proposed LCRR, by the Nevada Division of Environmental Protection, stating that no drinking water systems in Nevada had documented LSLs. Refer to Attachment A that is available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov.
[4] The web search identified LSL status information for systems from 21 states plus Washington, D.C. For more details, see file "Derivation of State LSL Status_Final Rule.xlsx," available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov.
[5] Note that there was overlap with some of the systems with known LSL status in individual states, systems identified through web searches, and those that serve more than 1 million people.

Step 3 – Identified systems with reported lead 90th percentile results and known LSL status: EPA identified which systems had at least one reported lead 90th percentile value in SDWIS/Fed between 2007 and 2015 and known LSL status. This subset of 4,424 systems was used for the remainder of the analysis described in step 4. Of the 4,424 systems, 23 percent (1,031 systems) were identified as having LSLs and 77 percent (3,393 systems) were identified as having no LSLs.

Step 4 – Estimated the Percentage of CWSs in Each Category: Based on Steps 1 through 3, EPA assigned each CWS to the category of: 1) no TLE or ALE, 2) a TLE, or 3) an ALE based on each system's LSL status.[65]

Exhibit 4-19 presents the "low" and "high" estimates of the percentage of systems in each lead 90th percentile category by LSL status. The "low estimate" is based on the lowest 90th percentile lead value reported to SDWIS/Fed from 2007 to 2015; the "high estimate" is based on the highest 90th percentile lead value reported to SDWIS/Fed from 2007 to 2015. Based on the "low estimate," the percentage of systems without LSLs having an ALE was slightly higher than that of systems with LSLs, which is counterintuitive but may be reflective of the limitations of the known LSL status dataset[66]. For the categories TLE and no TLE/ALE, systems with LSLs had a slightly higher percentage than those without LSLs. For the "high estimate," the differences between systems with and without LSLs was greater. As expected, a higher percentage of systems with LSLs were classified as having an ALE or TLE than those without LSLs.

[64] Available at https://www.staradvertiser.com/2016/04/09/breaking-news/hawaii-tap-water-safer-from-lead-than-other-states/.
[65] In the proposed LCRR, estimates of CWSs in each 90th percentile category were presented by systems size and CCT status. However, some systems' size / CCT status categories had too few systems (e.g., there is only one system serving >50,000 people with no CCT); thus, for the final LCRR, estimates are only presented stratified by LSL status. EPA provides additional detail and stratification by CCT status and size category in the file, "Derivation of Initial P90 Categorization_Baseline_Final Rule.xlsx."
[66] EPA tested the significance with a two-tailed Z statistical test and found the difference to be significant.

Exhibit 4-19: Percent of CWSs with No TLE or ALE, a TLE, and an ALE (Baseline Conditions)

Category	No LSLs	Has LSLs
Low Estimate		
No TLE/ALE (P90 ≤10 µg/L)	**97%**	**99%**
≤ 5 µg/L	*94%*	*85%*
>5 and ≤10 µg/L	*3%*	*14%*
TLE (10 µg/L < P90 ≤ 15 µg/L)	**0%**	**1%**
ALE (P90 > 15 µg/L)	**2%**	**0%**
High Estimate		
No TLE/ALE (P90 ≤10 µg/L)	**87%**	**79%**
≤ 5 µg/L	*68%*	*49%*
>5 and ≤10 µg/L	*19%*	*30%*
TLE (10 µg/L < P90 ≤ 15 µg/L)	**7%**	**12%**
ALE (P90 > 15 µg/L)	**6%**	**9%**

Acronyms: ALE = action level exceedance; CWS = community water system; LSL = lead service line; P90 = lead 90th percentile level; TLE = trigger level exceedance.

Notes:

1. Includes CWSs with known LSL status that also reported at least one 90th percentile value to SDWIS/Fed between 2007 and 2015.
2. Totals may not add due to independent rounding.
3. For additional detail, see file, "Derivation of Initial P90 Categorization_Baseline_Final Rule," available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov.

Minimal data were available on the LSL status for NTNCWSs. Thus, the above analysis could not be conducted for NTNCWSs. However, an analysis was conducted to evaluate the likelihood of the NTNCWSs' 90th percentile values falling into the three lead 90th percentile categories without the consideration of LSL status. The likelihoods for the NTNCWSs were very similar to those calculated for CWSs. Based on this comparison and the lack of LSL information for NTNCWSs, EPA assumed the same estimated percentages for NTNCWSs as those presented in Exhibit 4-19 for CWSs. For additional detail, see file "Derivation of Initial P90 Categorization_CWS_NTNCWS Compare_Final Rule.xlsx," available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov.

4.3.5.1.2 Final LCRR

EPA estimated the percent of CWSs with no TLE or ALE, a TLE, or an ALE using historical SDWIS/Fed 90th percentile tap sample data (as done for the previous rule) with two important adjustments:

1) An adjustment to reflect the new requirement for LSL systems to collect all samples from LSL sites where possible, as opposed to the previous rule minimum of 50 percent of samples being collected from LSL sites.

2) An adjustment to reflect new requirements for LSL systems to collect fifth liter samples from LSL sites instead of first liter samples.

These two adjustments are discussed separately below.

1) *Adjustment to reflect that all LSL system lead tap samples come from LSL sites instead of 50 percent*

EPA recognizes that there is uncertainty in the impact of this new requirement on 90th percentile lead tap sample levels. EPA also recognizes that the approach used to make the adjustments may have a significant impact on costs and benefits of the final LCRR. To provide a range of costs and benefits that reflects this uncertainty, EPA developed both low and high multipliers for the adjustment of lead 90th percentile values to provide bounding around the uncertain impact of this LCRR requirement.

Slabaugh et al. (2015) evaluated LCR compliance data from 17 systems over 72 tap sampling periods, comparing the lead 90th percentile concentrations based on samples collected from all LSLs (either Tier 1 sites—single family structures, or Tier 2 sites—multiple-family residences) to lead 90th percentiles based on samples collected from both LSL and non-LSL sites. The median 90th percentile for LSL only sites was 8.95 compared to a median 90th percentile of 6.63 from all monitoring sites.[67] The ratio of the median 90th percentiles for LSL sites compared to all sites was 8.95/6.63 = 1.35. EPA selected this value (1.35) as a "high" multiplier, meaning that 1.35 was applied to all 90th percentile lead values for LSL systems to reflect the potential impacts of sampling from only LSL sites to predict the initial lead categorization under the final LCRR. This adjustment value may be biased high because the median 90th percentile value for the 1,031 systems with LSLs (from among the 4,424 systems used in EPA's analysis) was only 2.8 µg/L.[68] This 90th percentile value of 2.8 µg/L corresponded with the 9.8 percentile for the 72 tap sampling periods from the Slabaugh et al. (2015) dataset using all sampling sites (that is, for samples taken from all sites, there are 7 of the 72 tap sampling periods, or 9.8 percent, with 90th percentile lead values less than or equal to 2.8 µg/L). Ideally, this analysis would have been done at the system level, but EPA did not have access to the dataset of 72 tap sampling periods from the 17 systems. Thus, EPA could not confirm if the data from the tap sampling periods varied among the 17 systems and if system(s) above the AL were overrepresented as 9.8 percent of the rounds exceeded the AL. This is inconsistent with the historical SDWIS/Fed 90th percentile data at the system level and may be due to systems' exceeding the AL being on 6-month monitoring whereas the systems at or below the AL might be monitoring annually or triennially.

As an alternative approach, EPA also compared 90th percentile values for the LSL samples to that for all sample data. From the Slabaugh et al. data, EPA determined that the corresponding 90th percentile value for those samples taken only at Tier 1 or Tier 2 LSL tap sampling sites was 2.81 µg/L, versus the 90th percentile value of 2.80 µg/L for samples taken at all sites indicated above. The ratio of these two values, 2.81/2.80 = 1.004 was selected by EPA as a "low" multiplier, again meaning that 1.004 was applied to all 90th percentile lead values for LSL systems to reflect the potential impacts of sampling from only LSL sites to predict whether the system has no TLE or ALE, a TLE, or an ALE under the final LCRR.

EPA combined the low and high adjustment factor from Slabaugh et al. (2015) with the low and high 90th percentile values under the previous rule, to produce a "low" and "high" likelihood of being in each 90th

[67] The median 90th percentile values are based on data presented in Figure 2 of Slabaugh et al. (2015) and were read from the graph by WebPlotDigitizer (available at: https://automeris.io/WebPlotDigitizer/).
[68] As explained in footnote 61, additional state data were available to EPA for systems with known LSL status for the final rule as compared to the proposed rule.

percentile category under the final LCRR. As a summary, the assumptions for the "low" and "high" percent of CWSs with no TLE or ALE, a TLE, and ALE for adjustment 1 are as follows:

- "Low" estimate: minimum 90th percentile lead value from SDWIS/Fed from 2007 to 2015, and low multiplier (1.004) for 90th percentile values for LSL systems.
- "High" estimate: maximum 90th percentile lead value from SDWIS/Fed from 2007 to 2015, and high multiplier (1.35) for 90th percentile values for LSL systems.

2) Adjustment to reflect taking a fifth liter sample as opposed to the first liter for LSL systems

EPA expects that the fifth liter sampling for LSL systems will increase the percent of systems with a TLE or ALE. To estimate the probability that a system having LSLs would fall into each of the three lead 90th percentile categories as a result of a requirement that they use a fifth liter sample, EPA used paired first and fifth liter data from 133 systems in Michigan at LSL locations that were collected in 2019. The ratio of the fifth to the first liter lead concentrations was calculated for each of these 133 systems. Note that there was insufficient data to allow for calculation of separate fifth to first liter ratios with respect to CCT status. Overall, the ratios ranged from 0.003 to 889, with a median value of 1.22 and 10th and 90th percentile values of 0.12 and 3.21, respectively. The ratio of the average fifth liter value to the average first liter value was 1.85.

For this analysis, all 133 ratios were applied to the 90th percentile values for each of the 4,424 systems of known LSL status that have LSLs. Specifically, the ratios were applied to the low and high 90th percentile values for systems having LSLs to account for LSL systems taking all fifth liter, rather than first liter, samples. The fifth to first liter ratios were not applied to the non-LSL systems.

The resulting sets of adjusted 90th percentile values were then gathered into the various subsets of systems based on LSL status to obtain the probabilities of being in each of the three categories of no TLE or ALE, a TLE, or an ALE. Exhibit 4-20 presents the "low" and "high" estimates of the percentage of systems in each lead 90th percentile category by LSL status.

Exhibit 4-20: Number and Percent of CWSs with No TLE or ALE, a TLE, and an ALE (Final LCRR)

Category	No LSLs	Has LSLs
Low Estimate		
No TLE/ALE (P90 ≤10 µg/L)	**97%**	**89%**
≤ 5 µg/L	*94%*	*77%*
>5 and ≤10 µg/L	*3%*	*13%*
TLE (10 µg/L < P90 ≤ 15 µg/L)	**0%**	**5%**
ALE (P90 > 15 µg/L)	**2%**	**6%**
High Estimate		
No TLE/ALE (P90 ≤10 µg/L)	**87%**	**58%**
≤ 5 µg/L	*68%*	*40%*
>5 and ≤10 µg/L	*19%*	*18%*
TLE (10 µg/L < P90 ≤ 15 µg/L)	**7%**	**12%**
ALE (P90 > 15 µg/L)	**6%**	**30%**

Acronyms: ALE = action level exceedance; CWS = community water system; LCRR = Lead and Copper Rule revisions; LSL = lead service line; P90 = lead 90th percentile level; TLE = trigger level exceedance.

Notes:

1. Includes CWSs with known LSL status that also reported at least one 90th percentile value to SDWIS between 2007 and 2015.
2. Totals may not add due to independent rounding.
3. For additional detail, see file, "Derivation of Initial P90 Categorization_Final Rule," available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov.

4.3.5.1.3 Discussion of Data Limitations and Uncertainty

There are several factors that introduce uncertainty into the initial lead 90th percentile classification as follows:

- Use of historical SDWIS/Fed Data to predict future 90th percentile levels.
- Uncertainty in predicting the effects of sampling from 100 percent LSLs.
- Reliance on an incomplete universe of systems with known LSL status.
- Representativeness of first and fifth liter sampling results from a single state (Michigan).
- Variability of the ratio of first and fifth liter sampling results from a single state

Each of these limitations are described in more detail below.

1. Use of Historical SDWIS/Fed Data

As described previously in this section, EPA recognizes the uncertainty in using historical SDWIS/Fed data to predict future 90th percentile values by developing "low" and "high" end estimates of the percent of CWSs with no TLE or ALE, a TLE, or an ALE under the previous rule.

2. Uncertainty in Predicting the Effects of Sampling from 100 Percent LSLs

For the final LCRR, there is additional uncertainty in the effect of LSL systems being required to take all samples from LSL sites instead of the 50 percent minimum as required under the previous rule. EPA addressed this uncertainty by having a low and high estimate based on data provided in Slabaugh et al. (2015) paper.

3. Reliance of Incomplete Universe of Systems with Known LSL Status

An important factor in the analyses to determine a system's initial lead 90th percentile categorization is the distinction between systems with LSLs and systems without LSLs. Limited data are available that indicate a system's LSL status; thus, EPA conducted a series of analyses to evaluate the representativeness of the subset of 4,424 CWSs with known LSL status as follows:[69]

- Compared the subset of 4,424 CWSs to all 50,067 CWSs in the SDWIS/Fed inventory.
- Compared the subset of 4,424 CWSs to all 32,862 CWSs with at least one reported lead 90th percentile level during 2007 - 2015.
- Determined the geographic representation of the 4,424 CWSs.

Each of these analyses are described in more detail below.

Comparison of Known LSL Status Subset to All CWSs

To help characterize the uncertainty of the subset of 4,424 with known LSL status and lead 90th percentile data used to determine a system's initial lead 90th percentile classification, EPA compared this subset to the 50,067 active CWSs in SDWIS/Fed. As shown in Exhibit 4-21, although most of the 4,424 CWSs were those serving 3,300 or fewer people, they only represented 7 percent of all small CWSs. The subset of the 4,424 CWSs serving 3,301 to 50,000 people and serving more than 50,000 people comprised 17 percent and 21 percent of all CWSs that serve these size categories, respectively. The data set of known LSL status systems is therefore less robust in its representation of water systems serving fewer than 3,300 people. The data set is consistent in the degree of representation across the larger size categories representing water systems serving between 3,301 and 50,000 people and those serving greater than 50,000 people.

[69] As explained in footnote 61, additional state data were available to EPA for systems with known LSL status for the final rule as compared to the proposed rule. For the proposed rule, a total of 3,870 systems with known LSL status were used in the analysis.

Exhibit 4-21: Percent of CWSs with Known LSL Status to All CWSs by System Size

System Size Population Served	Number of Active CWSs	CWSs with Known LSL Status and Lead 90th Percentile Data	
		Number of Systems	Percent of All CWSs
	A	B	C = B/A
≤ 3,300	40,784	2,808	7%
3,301 to 50,000	8,305	1,410	17%
> 50,000	978	206	21%
Total	50,067	4,424	

Source: SDWIS/Fed, 3rd quarter 2016 frozen dataset. Also see file, "Extent of P90 Data.xlsx" for additional information.

Notes:

General: Refer to Section 4.3.5.1.1 and Exhibit 4-18 for more details on the development of the universe of systems with known LSL status.Exhibit 4-18: Number of CWSs with LSL Determination Based on State, Tribal, and Web Data[1]

A: Includes all active CWSs in SDWIS/Fed based on 3rd quarter 2016 frozen dataset.

B: Includes systems with known LSL status (either presence or absence of LSLs) and at least one reported lead 90th percentile value to SDWIS/Fed during the 9-year analysis period of 2007 - 2015. Lead 90th percentile values for this subset of systems were used to determine a system's initial lead 90th percentile classification.

Comparison of Known LSL Status Subset of All CWSs with Reported Lead 90th Percentile Data

EPA compared the subset of systems with known LSLs status and reported lead 90th percentile values to the larger set of CWSs with at least one reported lead 90th percentile value (but unknown LSL status) in SDWIS/Fed for 2007 - 2015. The first step was to generate the percentage of CWSs placed into each of the three lead 90th percentile categories (based on the maximum or "high estimate" lead 90th percentile value for 2007 – 2015) by system size and CCT status using the larger dataset of 32,862 CWSs (i.e., 37,286 minus 4,424 CWSs) for which LSL status is unknown and the 4,424 CWSs with known LSL status. The results of this lead 90th percentile assessment are shown in Exhibit 4-22. Next, EPA used a z-test to statistically evaluate the proportions for systems in each lead 90th percentile category for the two sets of systems. For all system sizes and CCT status groups, the resulting z-values fell within the critical range, indicating that differences in proportions observed between the two sets were not statistically significant. See file "P90_Unknown LSL vs LSL Known Status CWSs_Final Rule.xlsx" for additional information.

Exhibit 4-22: Comparison of P90 Data for CWSs with At Least One Reported Value to the Set of CWSs with Known LSL Status and P90 Data by Three P90 Ranges, System Size, and CCT Status (Percent) Using the Baseline/High Estimate

System Size	CCT	Percent								
		P90 ≤10 µg/L			10 µg/L < P90 ≤ 15 µg/L			P90 >15 µg/L		
		w/ Reported P90	Reported P90 & Known LSL Status	Difference	w/ Reported P90	Reported P90 & Known LSL Status	Difference	w/ Reported P90	Reported P90 & Known LSL Status	Difference
		A	B	C = A-B	D	E	F = D-E	G	H	I = G-H
≤ 3,300	No	86.1%	85.4%	0.7%	6.4%	7.7%	-1.3%	7.5%	6.9%	0.6%
≤ 3,300	Yes	82.5%	81.6%	0.8%	6.9%	7.5%	-0.6%	10.7%	10.9%	-0.2%
3,301-10K	No	90.4%	88.2%	2.2%	6.3%	8.3%	-2.0%	3.3%	3.5%	-0.2%
3,301-10K	Yes	89.8%	88.1%	1.7%	6.2%	6.2%	0.0%	4.0%	5.7%	-1.7%
10,001-50K	No	91.2%	89.9%	1.3%	6.0%	7.1%	-1.1%	2.8%	3.0%	-0.2%
10,001-50K	Yes	90.9%	85.1%	5.9%	5.4%	9.3%	-3.9%	3.7%	5.6%	-1.9%
> 50K	No	100.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
> 50K	Yes	91.3%	81.5%	9.8%	5.5%	13.2%	-7.7%	3.2%	5.4%	-2.1%

Acronyms: LSL = lead service line; P90 = lead 90th percentile.
Source: SDWIS/Fed 3rd Quarter Frozen Dataset, current through June 30, 2016. All see file, "P90_Unknown LSL vs LSL Known Status CWSs_Final Rule.xlsx" for additional detail.
Notes:
A, D, G: Includes all 33,816 CWSs that equals all 37,286 CWSs with at least one reported P90 value minus the 4,424 CWSs with both a reported P90 value and known LSL status (i.e., presence or absence of LSLs).
B, E, H: Includes the subset of 4,424 CWSs with both a reported P90 value and known LSL status.

Geographic Representativeness of Known LSL Status Subset

EPA recognizes that using the subset of systems with known LSL status for the analysis may under or over represent 90th percentile results from specific geographic regions. To evaluate the potential impacts of this uncertainty, EPA grouped known LSL status systems into three geographic regions: 1) Midwest (Illinois, Indiana, Michigan, Ohio, and Wisconsin), 2) East (Maryland and North Carolina), and 3) West (California, Nevada, and Washington). The 90th percentile values for these groups and for the full set of known LSL status systems are shown in Exhibit 4-23. Note that Cornwell et al. (2016) reported a higher proportion of LSL systems in the Midwest and Northeast compared to the rest of the United States; however, EPA recognizes uncertainty in not representing other geographic regions.

Exhibit 4-23: Number and Percent of CWSs with No TLE or ALE, a TLE, and ALE – Comparison of Results from Three Geographic Regions with Known LSL Status Using the Baseline/High Estimate

Category	No LSLs				Has LSLs			
	Number of CWSs		Percent		Number of CWSs		Percent	
	No CCT	Yes CCT	No CCT	Yes CCT	No CCT	Yes CCT	No CCT	Yes CCT
East (North Carolina and Maryland)								
No TLE/ALE (P90 ≤10 µg/L)	242	367	83%	86%	12	34	100%	83%
TLE (10 µg/L < P90 ≤ 15 µg/L)	17	17	6%	4%	0	1	0%	2%
ALE (P90 > 15 µg/L)	31	44	11%	10%	0	6	0%	15%
Midwest (Illinois, Indiana, Michigan, Ohio, and Wisconsin)								
No TLE/ALE (P90 ≤10 µg/L)	1,119	709	85%	88%	253	421	83%	79%
TLE (10 µg/L < P90 ≤ 15 µg/L)	115	59	9%	7%	34	64	11%	12%
ALE (P90 > 15 µg/L)	80	42	6%	5%	17	49	6%	9%
West (California, Nevada, and Washington)								
No TLE/ALE (P90 ≤10 µg/L)	142	19	91%	90%	33	20	85%	91%
TLE (10 µg/L < P90 ≤ 15 µg/L)	10	2	6%	10%	4	2	10%	9%
ALE (P90 > 15 µg/L)	4	0	3%	0%	2	0	5%	0%
All Systems with Known LSL Status								
No TLE/ALE (P90 ≤10 µg/L)	1,784	1,161	87%	87%	301	518	84%	77%
TLE (10 µg/L < P90 ≤ 15 µg/L)	149	80	7%	6%	38	84	11%	13%
ALE (P90 > 15 µg/L)	129	90	6%	7%	20	70	6%	10%

Acronyms: ALE = action level exceedance; CCT = corrosion control treatment; CWS = community water system; LSL = lead service line; P90 = lead 90th percentile level; TLE = trigger level exceedance.
Notes: Includes only systems with known LSLs status. See Exhibit 4-18 for the breakdown by state. Also, as explained in footnote 61, additional state data were available to EPA for systems with known LSL status for the final rule as compared to the proposed rule. For the proposed rule, a total of 3,870 systems with known LSL status were used in the analysis versus a total of 4,424 systems with known LSL status in the final rule analysis.

Representativeness of First and Fifth Liter Data from a Single State

Data from the State of Michigan were used to estimate the impact on the lead 90th percentile levels that are based on fifth liter vs. first liter samples under the final LCRR for LSL systems. As described earlier, ratios of fifth liter 90th percentile values to first liter 90th percentile values from 133 systems in Michigan were applied to 90th percentile values from the 4,424 systems with known LSL status to estimate the likelihood of systems under the final LCRR having an ALE, TLE, or no ALE/TLE. EPA recognizes the uncertainty introduced in using data from a single state that may not represent the values on a national level. However, the Michigan data represent actual compliance monitoring data collected recently from all systems within the state, as opposed to using historical sampling data from a smaller subset of systems that may have had lead issues (e.g., the "profile" data from five systems that was used for the proposed LCRR).

4.3.5.2 *Likelihood of an Individual Lead Sample Exceeding 15 µg/L*

As detailed in Chapter 3, Section 3.4.5 EPA is requiring all systems to take specific actions in response to any single lead tap sample that is above 15 µg/L. Individual sample results are not available in SDWIS/Fed; therefore, EPA used available compliance monitoring data from the State of Michigan to calculate the likelihood of an individual sample being greater than 15 µg/L based on system size, LSL status, and the three lead 90th percentile categories of: 1) no TLE or ALE, 2) a TLE, or 3) an ALE. The analysis for the final LCRR used fifth liter samples for systems with LSLs and first liter samples for systems without LSLs from the Michigan dataset using the following steps:

Step 1 – Categorized Michigan systems as with or without LSLs based on compliance monitoring data as follows:

- EPA assumed 132 CWSs have LSLs[70] because the system provided first and fifth liter lead samples as required by Michigan's new regulation and were identified as having LSLs in their online inventory information (Michigan EGLE, 2020).
- EPA assumed 251 CWSs have no LSLs because the system submitted only first liter data and did not report any LSLs in the online inventory information.

Step 2 – Calculated lead 90th percentile levels: EPA calculated lead 90th percentile values for CWSs as described below. The purpose of this step is to categorize each dataset by: 1) no TLE or ALE, 2) TLE, or 3) an ALE so that the likelihood of a sample being above 15 µg/L can be calculated for each 90th percentile category separately.

- For all systems with LSLs, to approximate the lead 90th percentile value if all samples were collected from LSL sites and all samples are fifth liter samples (new requirements in the final LCRR), EPA calculated a lead 90th percentile value using all fifth liter concentrations. (Note that fifth liter samples were only used in the 90th percentile calculation if they could be paired with first liter samples from the same system, date, and address.) EPA used this 90th percentile to categorize the dataset by: 1) no TLE or ALE, 2) a TLE, or 3) an ALE.
- For all systems with no LSLs, EPA calculated the 90th percentile using all first liter concentrations data for each dataset and used this information to categorize the dataset by: 1) no TLE or ALE, 2) a TLE, or 3) an ALE.

Step 3 – Calculated the likelihood of a sample > 15 µg/L: EPA calculated the proportion of samples above 15 µg/L for each 90th percentile category. Results are shown in Exhibit 4-24.

Systems with LSLs had a higher likelihood of having a sample above 15 µg/L when they had a lead ALE (25.4 percent) compared to those without LSLs (22.7 percent). The likelihood for having a sample above 15 µg/L in the lead 90th percentile concentration category of TLE was not consistently higher or lower between systems with and without LSLs when looking at the three size categories together. As shown in Exhibit 4-24, some of the system size strata with no ALE/TLE, a TLE, and an ALE contained very few to no samples (e.g., systems with LSLs serving ≤ 3,300 people with a TLE). Therefore, EPA combined the size categories and included the likelihoods for all systems by LSL stratum, i.e., with LSLs and without LSLs, as

[70] EPA excluded one system from the analysis because information on the population it served was not available.

inputs in the SafeWater LCR model. For additional detail on the number and percent of samples in the Michigan dataset that were greater than 15 µg/L, see file "Derivation of Probability_Sample_Above_15_Final Rule.xlsx," available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov.

Note that the Michigan dataset does not include first and fifth liter data for NTNCWSs. Therefore, EPA assumed the same likelihood for NTNCWSs as those presented in Exhibit 4-24 for CWSs.

Exhibit 4-24: Percent of Individual Lead Sample Result Above 15 µg/L Based on Michigan CWSs with Known LSL Status for Final LCRR

LSL Status	System Size	Number of Michigan lead samples associated with calculated P90 values that were:			Number of Michigan lead samples > 15 µg/L associated with calculated P90 values that were:			Percent of Michigan lead samples > 15 µg/L associated with calculated P90 values that were:		
		≤10 µg/L (No TLE/ALE)	**10 µg/L < P90 ≤ 15 µg/L** (TLE)	**>15 µg/L** (ALE)	**≤10 µg/L** (No TLE/ALE)	**10 µg/L < P90 ≤ 15 µg/L** (TLE)	**>15 µg/L** (ALE)	**≤10 µg/L** (No TLE/ALE)	**10 µg/L < P90 ≤ 15 µg/L** (TLE)	**>15 µg/L** (ALE)
		A	B	C	D	E	F	G = D/A	H=E/B	I=F/C
Has LSLs	≤3,300	232	0	48	1	0	22	0.4%	0.0%	45.8%
	3,301 – 50,000	1,385	444	246	20	27	56	1.4%	6.1%	22.8%
	>50,000	280	184	84	2	11	18	0.7%	6.0%	21.4%
	Total	**1,897**	**628**	**378**	**23**	**38**	**96**	**1.2%**	**6.1%**	**25.4%**
No LSLs	≤3,300	1,509	26	22	3	4	5	0.2%	15.4%	22.7%
	3,301 – 50,000	1,104	0	0	6	0	0	0.5%	0.0%	0.0%
	>50,000	258	0	0	1	0	0	0.4%	0.0%	0.0%
	Total	**2,871**	**26**	**22**	**10**	**4**	**5**	**0.3%**	**15.4%**	**22.7%**

Acronyms: ALE: action level exceedance; P90 = lead 90th percentile level; TLE = trigger level exceedance.

Notes:

1. Due to the low number of results for some size categories, the SafeWater LCR model uses the total percentage of systems with and without LSLs presented in bold in Columns G through I as inputs in the SafeWater LCR model. The bold percentages in Column G corresponds to SafeWater LCR model data variable *pp_above_al_bin_one*, those in Column H to *pp_above_al_bin_two* and those in Column I to *pp_above_al_bin_three*.
2. EPA assumed a zero percent likelihood of a sample being greater that 15 µg/L for systems serving 1,000 or fewer people that are on a 9-year monitoring waiver because to meet the waiver requirement, these systems must be free of any lead-containing plumbing materials in their distribution system including the buildings they serve.
3. For additional detail, see file "Derivation of Probability_Sample_Above_15_Final Rule.xlsx," available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov.

4.3.5.2.1 Discussion of Data Limitations and Uncertainty

Recent data from the State of Michigan were used to estimates the likelihood of a single sample result above 15 µg/L for systems with LSLs as compared to systems without LSLs. While there is uncertainty in the national representativeness of the data (i.e., does lead tap sample data from Michigan represent lead tap data from other states), there are advantages to the use of these data. The Michigan data contains more than 5,800 individual lead sample results from systems with and without LSLs, with both first and fifth liter sampling results.

4.3.5.3 ***Systems with Copper Only ALEs***

The previous rule sets an AL concentration of 1.3 mg/L for copper. If a system exceeds the AL in more than ten percent of tap water samples collected during any monitoring period (i.e., if the 90th percentile level is greater than the AL), the system has not violated the rule but must conduct additional actions such as CCT steps, WQP monitoring, and source water monitoring. EPA reviewed SDWIS/Fed 90th percentile copper data from 2012 through 2015 to identify systems that had exceeded the copper AL but not the lead AL.

The average annual percentage of all CWSs exceeding the copper AL during this time period is shown in Exhibit 4-25 by size, CCT status, and source type and was extremely low. For CWSs with CCT, the percentages ranged from 0 percent for CWSs serving 50,000 – 100,000 people and those serving above 1 million people to 2.3 percent for ground water systems serving 501 – 1,000 people. The overall percentage of CWSs with CCT and a copper ALE was 1 percent. For those without CCT, all systems serving above 50,000 people were assumed to be b3 systems and had no copper ALEs. No CWS size or source category had a copper ALE percentage above 0.8 percent and, overall, all CWSs without CCT had an estimated copper exceedance percentage of less than 0.5 percent. For a detailed derivation, see "CWS Inventory Characteristics_Final Rule.xlsx," available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov.

Similar information is shown in Exhibit 4-26 for NTNCWSs. The overall percentages of NTNCWSs with a copper ALE were 3.4 percent and less than 1 percent for NTNCWSs with and without CCT, respectively. For additional detail, see "NTNCWS Inventory Characteristics.xlsx," available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov.

Note that for the cost estimates presented in Chapter 5 for the LCRR and Appendix B for the previous rule, EPA made a simplifying assumption no system with CCT would have a copper ALE, because < 1 percent of CWSs and < 3.5 percent of NTNCWSs were estimated to have a copper ALE. See Chapter 5, Section 5.3.2.3.1and Appendix B, Section B.5.1 for additional detail.

Exhibit 4-25: Average Percent of CWSs that Had Any Copper Only ALE from 2012–2015

Size Category	Average (2012–2015)					
	with CCT			without CCT		
	Ground Water	Surface Water	All Sources	Ground Water	Surface Water	All Sources
≤100	2.2%	0.7%	1.7%	0.4%	0.7%	0.4%
101–500	1.5%	0.7%	1.2%	0.4%	0.8%	0.4%
501–1,000	2.3%	0.5%	1.6%	0.4%	0.6%	0.4%
1,001–3,300	1.8%	0.3%	1.1%	0.5%	0.5%	0.5%
3,301–10,000	1.1%	0.2%	0.5%	0.3%	0.3%	0.3%
10,001–50,000	0.8%	0.2%	0.4%	0.2%	0.3%	0.2%
50,001–100,000	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
100,001–1M	0.4%	0.1%	0.1%	0.0%	0.0%	0.0%
>1M	0.0%	0.0%	0.0%			
All Sizes	1.6%	0.3%	1.0%	0.4%	0.6%	0.4%

Source: "CWS Inventory Characteristics_Final Rule.xlsx," available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov.

Note: EPA estimated that 11 CWSs are b3 systems, serve 50,001 – 1 million people, and have no CCT. No b3 systems serve more than 1 million people. Refer to Section 4.3.3 for EPA's approach for estimating the number of b3 systems based on SDWIS/Fed data.

Exhibit 4-26: Average Percent of NTNCWSs that Had Any Copper Only ALE from 2012–2015

Size Category	Average (2012–2015)					
	with CCT			without CCT		
	Ground Water	Surface Water	All Sources	Ground Water	Surface Water	All Sources
≤100	4.3%	0.7%	3.8%	0.7%	1.1%	0.8%
101–500	3.9%	2.1%	3.7%	0.7%	1.3%	0.7%
501–1,000	3.3%	1.0%	2.9%	0.7%	1.6%	0.8%
1,001–3,300	3.6%	1.4%	2.9%	0.8%	0.8%	0.8%
3,301–10,000	1.0%	1.3%	1.2%	1.0%	0.0%	0.9%
10,001–50,000	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
50,001–100,000	0.0%	0.0%	0.0%			
100,001–1M	0.0%	0.0%	0.0%			
>1M						
All Sizes	3.9%	1.3%	3.4%	0.7%	1.2%	0.8%

Source: "NTNCWS Inventory Characteristics_Final Rule.xlsx," available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov.
Note: Three NTNCWSs serve 50,001 – 1 million people and each have CCT. No NTNCWS serves > 1 million people.

4.3.6 Treatment Plant Characterization

This section explains the baseline inputs for the following treatment-related PWS characteristics:

- Entry points per system
- Average daily flow
- Design flow
- pH of finished water
- Orthophosphate (PO_4) dose

For additional detail and values used in this EA, see the file, "Derivation of Baseline CCT Characteristics_Final Rule.xlsx," available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov.

As described in Section 4.2.2, EPA developed the likelihood of a CWS's having 1 to 50 entry points using data from the 2006 CWSS. For example, ground water CWSs serving 101 to 500 people have a 72 percent chance of having one entry point, a 12 percent chance of having two entry points, and a 10 percent chance of having three entry points. For systems serving greater than one million people, EPA gathered system-specific information on the number of treatment plants and flow and used this information wherever available. EPA assumes that NTNCWSs always have one entry point since they tend to be single facilities covering a small geographical area.

Average daily production flow and design flow per system are based on regression equations from the EPA Report, *Geometries and Characteristics of Public Water Supplies* (USEPA, 2000). The average daily flow and design flow are functions of the population served, with different equations for source water type (surface or ground water), ownership (public or private) and for purchased and non-purchased systems. The flow was then divided by the number of entry points to calculate the flow per treatment plant for the system (assuming each entry point has one treatment plant). As a conservative estimate, the flow-population regression equations for CWSs were also used for NTNCWSs.

EPA evaluated historical SDWIS/Fed data to determine the proportion of systems with CCT that use pH adjustment, orthophosphate treatment, or both. This analysis is detailed in Chapter 5, Section 5.3.2.2.1.

Baseline pH levels and orthophosphate (PO_4) dosages are also important inputs in calculating the incremental costs of the final LCRR. EPA used the SYR3 ICR dataset to characterize the distribution of finished water pH for those systems that have CCT installed and those that do not under baseline conditions. EPA also estimated the distribution of PO_4 dosages for large, medium, and small systems with and without LSLs. See the file, "Derivation of Baseline CCT Characterization_Final Rule.xlsx" for additional detail and for final baseline pH and PO_4 input values used to develop costs and benefits for this EA.

4.3.6.1 *Discussion of Data Limitations and Uncertainties*

EPA recognizes that there is uncertainty in assuming a system's total flow is divided equally among each entry point because a single system may have a mix of large and small plants to support their

population. There is also uncertainty in using the equations from the 2000 Geometries Document (USEPA, 2000) to predict future average daily and design flow based on a system's retail population. Water use efficiency has increased substantially since the 1980's, with a major improvement between 2005 and 2010 (Rockaway et al., 2011). A 2016 Water Research Foundation study reported a 22 percent decline in indoor water use (WaterRF, 2016). Several factors have contributed to increases in water efficiency. Technological changes, supported by policy, increased the efficiency of water use. For example, the Energy Policy Act of 1992 required water efficiency standards for fixtures, including shower heads, toilets, and washing machines. Water recycling and increased efficiency of power generation also reduces freshwater use. The economic downturn of 2008 contributed to the drop in water use and the increase in use of water-efficient fixtures, xeriscaping, and other demand side management measures contributed to reduction in per capita use as well. The trend of lower residential water use could result in lower flow per population and, lower treatment costs as compared to predicted values in this EA.

4.3.7 Lead and Copper Tap and WQP Monitoring Schedules

Under the previous rule, systems were allowed to reduce the frequency and, in some cases, the number of samples for required lead and copper tap and WQP monitoring if they met certain criteria. Section 4.3.7.1 provides a summary of the requirements and the methodology used by EPA to estimate the percent of systems on reduced lead and copper tap sampling schedules. Section 4.3.7.2 provides the same analysis for reduced WQP monitoring.

4.3.7.1 *Lead and Copper Tap Monitoring*

Under the previous rule, systems on routine (semi-annual) lead and copper tap sampling could have qualified for reduced sampling by meeting specific criteria. These criteria varied for the three broad LCR system size categories.[71] Reduced monitoring allows a system to collect lead and copper tap samples from a reduced number of sites on an annual, triennial, or 9-year tap sampling monitoring schedule; the number of sampling sites for reduced monitoring is the same under the previous and final rules. The reduced monitoring criteria are presented in detail in Exhibit 4-27 and apply to both CWSs and NTNCWSs.

Exhibit 4-27: Criteria for Reduced and Increased Lead and Copper Tap Sampling under the Previous Rule

Tap Sampling Monitoring Frequency	Criteria
Reduced Monitoring Criteria (Collect Reduced Number of Samples)[1]	
Annual	• ≤ 50,000: No lead or copper ALE for 2 consecutive 6-month tap sampling periods. • All sizes: No lead ALE and meet OWQP specifications for 2 consecutive 6-month tap sampling periods.[2]

[71] The previous rule defines three broad size categories: Systems serving more than 50,000 people, systems serving 3,301 to 50,000 people, and systems serving 3,300 or fewer people. Some of the requirements of the rule vary across these size categories.

Tap Sampling Monitoring Frequency	Criteria
Triennial	• ≤ 50,000: No lead or copper ALE for 3 consecutive years. • All sizes: No lead ALE and meet OWQP specifications for 3 consecutive years. • All sizes: Meet 40 CFR 141.81(b)(3).[3] • All sizes: Meet accelerated reduced monitoring criteria in 40 CFR 141.86(d)(4)(v).[4]
9-year[5]	• ≤ 3,300 only: Lead and copper 90th percentile levels are ≤ 0.005 mg/L and ≤ 0.65 mg/L, respectively, and plumbing materials are free of lead- and copper-containing materials.
Increased Monitoring Criteria (Collect Routine Number of Samples)[1]	
Semi-Annual	• ≤ 50,000: Lead or copper ALE. • All sizes: Lead ALE or has an OWQP excursion for more than 9 days in a 6-month period.

Acronyms: ALE = action level exceedance; OWQP = optimal water quality parameter.
Notes:
[1] The number of sampling sites for reduced monitoring is specified in 40 CFR 141.86 and is the same under the previous and final rules. Refer to Exhibit 3-7 in Chapter 3 for a comparison of the reduced lead and copper criteria under the previous rule and final LCRR.
[2] OWQPs are measured to determine whether a system is operating its CCT at a level that most effectively minimizes the lead and copper concentrations at users' taps.
[3] In the final rule, a water system is deemed to have optimized or re-optimized corrosion control if it submits results of tap water monitoring in accordance with 40 CFR 141.86 demonstrating that the 90th percentile tap water lead level is less than or equal to the lead practical quantitation level of 0.005 mg/L and meets the copper AL for two consecutive 6-month tap sampling monitoring periods.
[4] Criteria in 40 CFR 141.86(d)(4)(v) were met if for 2, consecutive, 6-month monitoring periods the system has 90th percentile lead and copper levels of ≤ 0.005 mg/L and ≤ 0.65 mg/L, respectively.
[5] To qualify for a 9-year monitoring waiver, systems had to meet the following criteria in 40 CFR 141.86(g): 1) serve ≤ 3,300 people; 2) demonstrate that its distribution system and service lines and all drinking water supply plumbing, including plumbing conveying drinking water within all residences and buildings connected to the system, are free of lead-containing materials and/or copper-containing materials; and 3) all lead and copper 90th percentile levels cannot exceed 0.005 mg/L and 0.65 mg/L, respectively.

EPA determined a system's lead tap sampling monitoring schedule at the start of rule implementation primarily based on its lead ALE history and size. For systems without CCT, EPA further categorized these systems according to whether or not they received a 9-year monitoring waiver (meaning that they are only required to conduct lead and copper tap compliance monitoring once every 9 years). EPA assumed that these systems meeting the following criteria would receive the 9-year monitoring waiver from their Primacy Agency:

- A CWS or NTNCWS that:

- Serves 1,000 or fewer people and has no lead or copper ALEs during 1993 through 2015.[72]
- Has a first reported date on or after January 1, 1989. The first reported date may indicate when the system became operational.[73]

- A CWS that meets the definition of a mobile home park as follows:
  - System has a primary service type of "Mobile Home Park" or "Mobile Home Park Principal Residence" reported to SDWIS/Fed.
  - System has a primary service type of "Residential Area" and "Mobile"[74], "Trailer," or "MHP" in their name.

Exhibit 4-28, below, provides a summary of the criteria used to estimate the various lead and copper tap sampling monitoring schedules based on information reported to SDWIS/Fed.

Exhibit 4-28: SDWIS/Fed Criteria Used to Estimate Lead Tap Sampling Monitoring Schedules

Monitoring Frequency	Description
Semi-Annual	• System's latest lead or copper ALE occurred after 12/31/2014. Thus, the system **did not** have two consecutive 6-month monitoring periods without a lead ALE. • All sizes: Lead ALE or had an OWQP violation (59 violation).
Annual (Reduced)[1]	• System's latest lead or copper ALE occurred between 1/1/2012 and 12/31/2014. Thus, the system had two consecutive 6-month monitoring periods without a lead ALE.
Triennial (Reduced)[1]	• System's latest lead or copper ALE occurred before 1/1/2012; or • System's latest lead or copper 90th percentile result that was at or below the AL was reported for a sampling period between 1.5 and 5 years,[2] or • System does not have any reported lead or copper 90th percentile results,[3] or • System serves >50,000 and meets the b3 criteria.

[72] SDWIS/Fed does not have a milestone or other required reporting that identifies systems on 9-year monitoring. Although the 9-year monitoring waiver criteria can apply to systems serving as many as 3,300 people and is not restricted to mobile home parks for CWSs, EPA believes it is unlikely that systems that are not mobile home parks and/or those serving more than 1,000 would be able to meet the stringent nine-year waiver criteria. Specifically, to qualify for a 9-year monitoring waiver a water system must demonstrate that its distribution system, service lines, and all drinking water plumbing including the residences and buildings it serves are free of lead-containing materials.

[73] The 1986 SDWA Amendments began to ban the use of lead pipe and required the use of "lead-free" solders, fluxes, pipes and pipe fittings in the installation or repair of public water systems (USEPA, 1987). States were required to implement this provision by August 6, 1988. EPA assumed these systems that came on-line after 1988 and the system and customers they serve would be more likely to use lead-free plumbing materials that would allow the system to meet the requirements for a nine-year monitoring waiver (see 40 CFR 141.86(g)).

[74] EPA did not count the two systems in Mobile, Alabama as mobile home parks that were incorrectly identified as such using this criterion.

Monitoring Frequency	Description
9-year[1,4]	• **CWS:** Is a mobile home park, had no lead or copper exceedances during 1993–2015, the SDWIS/Fed first reported date is on or after January 1, 1989, population served is ≤ 1,000, and does not have CCT. • **NTNCWS:** Had no lead or copper exceedances during 1993–2015, the SDWIS/Fed first reported date is on or after January 1, 1989, population served is ≤ 1,000, and does not have CCT.

Source: For additional information see "Derivation of Pb Schedules_CWS_Final Rule.xlsx" and "Derivation of Pb Schedules_NTNCWS_Final Rule.xlsx," both available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov.

Notes:

[1] Systems on annual, triennial, or 9-year monitoring collect samples at the reduced number of sites specified in the rule (see 40 CFR 141.86(c).

[2]The length of the tap sampling period was determined by the difference between the sampling period begin and end dates. EPA assumed if the difference was greater than 1 year, but the system did not meet the 9-year monitoring criteria, it was on triennial monitoring.

[3] The previous rule only requires Primacy Agencies to report 90th percentile levels to SDWIS/Fed that are above the lead AL for systems serving ≤ 3,300 people and above the copper AL for any size system.

[4] SDWIS/Fed does not have a milestone or other required reporting that identifies systems on 9-year monitoring. Although the rule allows systems serving ≤ 3,300 people to qualify for 9-year monitoring, EPA assumed only a subset of systems serving ≤ 1,000 people met this requirement. EPA further assumed only water systems that became active after January 1, 1989 (based on the first reported date) would qualify for 9-year monitoring. EPA selected this date because it is well after when systems stopped using LSLs and when all states had to adopt the lead provisions (i.e., by August 6, 1988) that limited the amount of lead in plumbing materials.

Based on the criteria in Exhibit 4-28, the majority of CWSs are on triennial monitoring. Specifically, for those with CCT depending on system size and source water type, EPA estimated approximately 87 percent to 100 percent will be on triennial monitoring. For those without CCT, EPA estimated that all systems serving more than 50,000 people will meet the b3 criteria and be on triennial monitoring. Across the smaller system sizes and source water types EPA found that approximately 91 to 99 percent of CWSs will be on the triennial schedule. See Exhibit 4-29 and Exhibit 4-30, for additional detail on CWSs with CCT and without CCT, respectively.

Exhibit 4-29: Estimated Percentage of CWSs with CCT on Various Lead Tap Monitoring Schedules by Size and Source Type

Size Category	CWS with CCT: Surface Water				CWS with CCT: Ground Water			
	6 Month	Annual	Triennial	9 Year	6 Month	Annual	Triennial	9 Year
<=100	1.6%	4.1%	94.3%	0%	4.1%	8.5%	87.4%	0%
101–500	1.9%	4.0%	94.1%	0%	2.0%	5.6%	92.3%	0%
501–1,000	1.4%	4.2%	94.4%	0%	2.7%	4.4%	92.9%	0%
1,001–3,300	1.1%	2.5%	96.4%	0%	2.0%	3.9%	94.1%	0%
3,301–10,000	0.5%	1.8%	97.7%	0%	1.3%	2.8%	95.9%	0%
10,001–50,000	0.3%	1.7%	98.0%	0%	0.9%	2.4%	96.7%	0%
50,001–100,000	0.8%	2.1%	97.2%	0%	0.0%	0.0%	100.0%	0%
100,001–1M	1.8%	2.4%	95.9%	0%	0.0%	1.6%	98.4%	0%

Size Category	CWS with CCT: Surface Water				CWS with CCT: Ground Water			
	6 Month	Annual	Triennial	9 Year	6 Month	Annual	Triennial	9 Year
>1M	0.0%	0.0%	100.0%	0%	0.0%	0.0%	100.0%	0%

Source: For additional information, see "Derivation of Pb Schedules_CWS_Final Rule.xlsx," available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov.

Notes:

1. Refer to Exhibit 4-28 for the criteria EPA applied to determine systems' lead and copper tap monitoring schedules and Section 4.3.3 for the criteria EPA used to identify systems with and without CCT.
2. Systems on annual, triennial, or 9-year monitoring collect samples at the reduced number of sites specified in the rule (see 40 CFR 141.86(c)).

Exhibit 4-30: Estimated Percentage of CWSs without CCT on Various Lead Tap Monitoring Schedules by Size and Source Type

Size Category	CWS without CCT: Surface Water				CWS without CCT: Ground Water			
	6 Month	Annual	Triennial	9 Year	6 Month	Annual	Triennial	9 Year
<=100	1.5%	3.2%	93.4%	1.9%	1.1%	2.6%	91.1%	5.2%
101–500	1.5%	4.3%	91.9%	2.2%	1.0%	2.5%	93.9%	2.6%
501–1,000	1.6%	3.4%	93.8%	1.1%	0.6%	2.0%	96.2%	1.1%
1,001–3,300	1.8%	1.7%	96.5%	0.0%	0.6%	2.5%	97.0%	0.0%
3,301–10,000	0.6%	1.5%	97.9%	0.0%	0.5%	1.3%	98.2%	0.0%
10,001–50,000	0.6%	1.1%	98.3%	0.0%	0.1%	1.1%	98.8%	0.0%
50,001–100,000	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	100.0%	0.0%
100,001–1M	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	100.0%	0.0%
>1M								

Source: For additional information, see "Derivation of Pb Schedules_CWS_Final Rule.xlsx," available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov.

Notes:

1. Refer to Exhibit 4-28 for the criteria EPA applied to determine systems' lead and copper tap monitoring schedules and Section 4.3.3 for the criteria EPA used to identify systems with and without CCT.
2. Systems on annual, triennial, or 9-year monitoring collect samples at the reduced number of sites specified in the rule (see 40 CFR 141.86(c)).
3. The gray shaded cells denote that there were no CWSs serving >1M people without CCT in the CWS inventory.

Exhibit 4-31 and Exhibit 4-32 provide similar information for NTNCWSs with CCT and without CCT, respectively. EPA estimated that most NTNCWSs will also be on a triennial monitoring schedule. Specifically, EPA estimated that depending on system size and source water type about 75 percent to 100 percent of NTNCWSs with CCT and about 85 to 100 percent without CCT will be on a triennial schedule.

Exhibit 4-31: Estimated Percentage of NTNCWSs with CCT on Various Lead Monitoring Schedules by Size and Source Type

Size Category	NTNCWS with CCT: Surface Water				NTNCWS with CCT: Ground Water			
	6 Month	Annual	Triennial	9 Year	6 Month	Annual	Triennial	9 Year
<=100	4.5%	2.7%	92.9%	0.0%	5.5%	13.6%	81.0%	0.0%
101–500	6.4%	6.4%	87.2%	0.0%	6.0%	11.7%	82.3%	0.0%
501–1,000	2.0%	3.9%	94.1%	0.0%	5.6%	10.9%	83.5%	0.0%
1,001–3,300	2.8%	4.2%	93.0%	0.0%	3.8%	13.8%	82.4%	0.0%
3,301–10,000	0.0%	5.0%	95.0%	0.0%	0.0%	12.0%	88.0%	0.0%
10,001–50,000	0.0%	11.1%	88.9%	0.0%	0.0%	25.0%	75.0%	0.0%
50,001–100,000	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	100.0%	0.0%
100,001–1M	0.0%	0.0%	100.0%	0.0%				
>1M								

Source: For additional information, see "Derivation of Pb Schedules_NTNCWS_Final Rule.xlsx," available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov.

Notes:

1. Refer to Exhibit 4-28 for the criteria EPA applied to determine systems' lead and copper tap monitoring schedules and Section 4.3.3 for the criteria EPA used to identify systems with and without CCT.
2. Systems on annual, triennial, or 9-year monitoring collect samples at the reduced number of sites specified in the rule (see 40 CFR 141.86(c)).
3. The gray shaded cells denote that there were no surface water NTNCWSs serving 100,001 to 1M people with CCT and no NTNCWSs serving > 1M in the NTNCWS inventory.

Exhibit 4-32: Estimated Percentage of NTNCWSs without CCT on Various Lead Tap Monitoring Schedules by Size and Source Type

Size Category	NTNCWS without CCT: Surface Water				NTNCWS without CCT: Ground Water			
	6 Month	Annual	Triennial	9 Year	6 Month	Annual	Triennial	9 Year
<=100	7.2%	7.2%	84.8%	0.7%	2.4%	3.7%	93.8%	0.1%
101–500	3.3%	4.6%	90.8%	1.3%	1.9%	4.6%	93.5%	0.1%
501–1,000	3.2%	0.0%	96.7%	0.0%	1.4%	2.9%	95.7%	0.0%
1,001–3,300	6.4%	0.0%	93.4%	0.0%	1.3%	5.1%	93.6%	0.0%
3,301–10,000	0.0%	0.0%	100.0%	0.0%	1.4%	4.1%	94.6%	0.0%
10,001–50,000	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%
50,001–100,000								
100,001–1M								
>1M								

Source: For additional information, see "Derivation of Pb Schedules_NTNCWS_Final Rule.xlsx," available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov.

Notes:

1. Refer to Exhibit 4-28 for the criteria EPA applied to determine systems' lead and copper tap monitoring schedules and Section 4.3.3 for the criteria EPA used to identify systems with and without CCT.
2. Systems on annual, triennial, or 9-year monitoring collect samples at the reduced number of sites specified in the rule (see 40 CFR 141.86(c)).
3. The gray shaded cells denote that there were no NTNCWSs serving greater than 50,000 people without CCT in the NTNCWS inventory.

4.3.7.1.1 Discussion of Data Limitations and Uncertainty

As previously discussed, for systems serving 3,300 or fewer people, the previous rule required Primacy Agencies to only report those lead 90th percentile values that exceed the lead AL of 15 µg/L, but to report all lead 90th percentile values for larger water systems. To determine if systems in this smallest size category were underrepresented, EPA estimated the percentage of systems with any reported lead 90th percentile data during 2007 - 2015 within this size category, as well as for systems serving 3,301 to 50,000 people and greater than 50,000 people. As shown in Column C of Exhibit 4-33 below, lead 90th percentile data were reported for only 69 percent of all CWSs in this smallest size category compared to 98 percent in the larger two categories. EPA also estimated the percentage of CWSs in which only lead exceedance data were reported to try to assess any bias in reporting for the smallest size category. As shown in Column F of Exhibit 4-33, in general, both exceedances and non-exceedances were reported for approximately 98 percent of systems in the smallest size category, and essentially all of those in the highest two categories (1 system serving 3,301 – 50,000 people reported lead ALE data only). This indicates that Primacy Agencies tended to report exceedance and non-exceedance data for even the smallest size category.

Exhibit 4-33: Estimated Number and Percentage of CWSs with Reported Lead ALEs Only

System Size Population Served	All CWSs	All CWSs w/ any Reported Lead 90th Percentile Data		All CWSs w/ Reported P90 Data Above the AL Only		
	Number	Number	Percent of All CWSs	Number	Percent of all CWSs	Percent of Any w/ Reported P90 Data
	A	B	C = B/A	D	E = D/A	F = D/B
≤ 3,300	40,784	28,185	69%	574	1%	2%
3,301 to 50,000	8,305	8,141	98%	1	0%	0%
> 50,000	978	960	98%	0	0%	0%
Total	50,067	37,286		575	1%	2%

Source: SDWIS/Fed, 3rd quarter 2016 freeze. Also see, "Extent of P90 Data_Final Rule.xlsx."

Notes:

A: Includes all active CWSs in SDWIS/Fed based on 3rd quarter 2016 freeze.

B: Includes CWSs with one or more P90 value reported to SDWIS/Fed during 2007- 2015.

D: Includes the subset of CWSs for which all reported P90 values are above the AL of 15 µg/L.

4.3.7.2 *Water Quality Parameter Monitoring*

The discussion of WQP monitoring schedules is presented in three subsections as follows:

- 4.3.7.2.1: Previous Rule
- 4.3.7.2.2: Final LCRR
- 4.3.7.2.3: Discussion of Data Limitations and Uncertainty

4.3.7.2.1 Previous Rule

The previous rule required all systems serving more than 50,000 people (except b3 systems) and systems serving 50,000 or fewer people with a lead or copper ALE to conduct WQP sampling at entry points and within the distribution system.[75] Systems with CCT can qualify for reduced WQP monitoring in the distribution system after the Primacy Agency sets OWQPs. As explained in Exhibit 4-34, systems qualify for reduced monitoring by meeting the OWQPs set by the Primacy Agency. The number of consecutive monitoring periods in which a system meets its OWQPs determines if a system will collect two samples at a reduced number of sites on a semi-annual, annual, or triennial frequency. Reduced monitoring for WQPs at the entry point (at a frequency less than every two weeks) is not allowed. The criteria for reduced WQP distribution system monitoring under the previous rule are provided in Exhibit 4-34.

Exhibit 4-34: Criteria for Reduced and Increased WQP Distribution System Monitoring

Monitoring Frequency	Criteria
Reduced Monitoring Criteria (Collect 2 Samples at Reduced Number of Sites)[1]	
Semi-Annual	• All sizes: Meet OWQP specifications for 2, consecutive 6-month monitoring periods. Systems monitor at same frequency as routine monitoring but at a reduced number of sites.
Annual	• All sizes: Meet OWQP specifications for 6 consecutive 6-month monitoring periods.
Triennial	• All sizes: Meet OWQP specifications for 3 consecutive years of annual monitoring, or • All sizes: Meet accelerated reduced monitoring criteria in 40 CFR 141.87(e)(2)(ii).[2]
Increased Monitoring Criteria (Collect 2 Samples at Routine Number of Samples[1])	
Semi-Annual	• All sizes: Have an OWQP excursion for more than 9 days in a 6-month period.

Acronyms: OWQP = optimal water quality parameter; WQP = water quality parameter.
Notes:
[1] The number of sampling sites for reduced monitoring is specified in 40 CFR 141.87(e) and is the same under the previous rule and LCRR.

[75] The previous rule refers to distribution system WQP samples as "tap samples." Specifically, 141.87(a)(1)(i) states, "Tap samples shall be representative of water quality throughout the distribution system. . ." It also states that these WQP samples do not need to be collected at the same locations used for lead and copper tap sampling and that systems can use coliform testing sites as possible sampling locations.

[2] To meet the accelerated reduced WQP criteria, the system must, for 2 consecutive 6-month monitoring periods, have 90th percentile lead and copper levels of < 0.005 mg/L and < 0.65 mg/L, respectively, and comply with OWQP specifications.

EPA determined a system's WQP distribution system monitoring schedule at the start of rule implementation primarily based on its size, lead and/or copper ALE history, and OWQP violation history from SDWIS/Fed. Exhibit 4-35 provides a summary of the criteria EPA applied to determine the number of CWSs and NTNCWSs on each monitoring schedule. Specifically, the number of systems on a six-month monitoring schedule that must collect at the standard number of sites (i.e., six- month standard), and those that can collect at the reduced number of sites on a six-month, annual, or triennial schedule. Results are presented in Exhibit 4-36 through Exhibit 4-39.

Exhibit 4-35: SDWIS/Fed Data and Criteria Used to Estimate WQP Distribution System Monitoring Schedules under the Previous Rule

Monitoring Frequency (number of sites)	Criteria
6-Month (Routine)	• System serves > 50,000 people and: ○ Has lead or copper ALE and no CCT, or ○ Has CCT, an OWQP violation (code 59) for which the system has not achieved compliance (denoted by the code SOX or EOX), or ○ Has CCT, a 59 violation for which the system has achieved compliance for <1 year. • System serves ≤ 50,000 people with a lead and/or copper ALE.[1]
6-Month (Reduced)	• System serves > 50,000 people and has CCT, a 59 violation for which the system has achieved compliance for ≥ 1 to 3 years.
Annual (Reduced)	• System serves > 50,000 people and has CCT, a 59 violation for which the system has achieved compliance for > 3 years to 6 years.
Triennial (Reduced)	• System serves > 50,000 people and has ○ CCT and no 59 violation, or ○ a 59 violation for which the system has achieved compliance for > 6 years.
WQP Monitoring Not Required	• System serves ≤ 50,000 people in those monitoring periods without a lead or copper ALE, and • System serves > 50,000 and qualifies as a b3 system.

Acronyms: ALE = action level exceedance; CCT = corrosion control treatment; OWQP = optimal water quality parameters; WQP = water quality parameter.
Note:
[1] Systems serving 50,000 or fewer people with and without CCT are not required to conduct WQP monitoring unless they have a lead or copper ALE exceedance. EPA conservatively assumed that systems would not continue WQP monitoring long enough to qualify for reduced monitoring.

Exhibit 4-36 and Exhibit 4-37 provide the number of CWSs with CCT that use ground water and surface water as their primary source, respectively, on each WQP distribution system monitoring schedules.

Exhibit 4-38 and Exhibit 4-39 provide similar information for NTNCWSs with CCT that use ground water and surface water as their primary source, respectively. These exhibits do not include systems without CCT because EPA assumed:

- No systems serving 50,000 or fewer with and without CCT will qualify for reduced WQP distribution system monitoring. These systems are only required to conduct monitoring in those monitoring periods in which they have a lead or copper ALE. Thus, EPA assumed these systems would not continue WQP monitoring long enough to qualify for reduced monitoring and all would be on six-month standard monitoring during those periods in which they must conduct WQP monitoring.
- All systems meeting the b3 criteria are not subject to WQP monitoring. This includes 11 CWSs without CCT that serve more than 50,000 people. No NTNCWSs met the b3 criteria (see Section 4.3.3 for criteria).

Applying the above criteria to the remaining systems serving more than 50,000 people:

- One CWS met the criteria for annual reduced monitoring and all others met the criteria for triennial reduced monitoring.
- One of the three NTNCWSs met the criteria for six-month standard monitoring, and the other two met the criteria for triennial monitoring.

Exhibit 4-36: Number of Ground Water CWSs with CCT on Various WQP Distribution System Monitoring Schedules (Previous Rule)

Size Category	6 Month Standard	6 Month Reduced	Annual Reduced	Triennial Reduced	Total
≤100	938	0	0	0	938
101–500	1,954	0	0	0	1,954
501–1,000	1,006	0	0	0	1,006
1,001–3,300	1,597	0	0	0	1,597
3,301–10,000	958	0	0	0	958
10,001–50,000	577	0	0	0	577
50,001–100,000	0	0	1	152	153
100,001–1M	0	0	0	64	64
> 1 M	0	0	0	2	2
TOTAL	**7,030**	**0**	**1**	**218**	**7,249**

Source: For additional information, see "Derivation of WQP Schedules_CWS_Baseline_Final Rule.xlsx," available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov.
Note: Systems serving ≤ 50,000 are only required to conduct WQP monitoring if they have a lead or copper ALE. EPA conservatively assumed that none of these systems would continue WQP monitoring long enough to qualify for reduced monitoring and would be on standard semi-annual monitoring in those monitoring periods when they had a lead or copper ALE.

Exhibit 4-37: Number of Surface Water CWSs with CCT on Various WQP Distribution System Monitoring Schedules (Previous Rule)

Size Category	6 Month Standard	6 Month Reduced	Annual Reduced	Triennial Reduced	Total
≤100	435	0	0	0	435
101–500	955	0	0	0	955
501–1,000	591	0	0	0	591
1,001–3,300	1,490	0	0	0	1,490
3,301–10,000	1,537	0	0	0	1,537
10,001–50,000	1,540	0	0	0	1,540
50,001–100,000	0	1	0	388	389
100,001–1M	0	1	1	338	340
> 1 M	0	0	1	18	19
TOTAL	**6,548**	**2**	**2**	**744**	**7,296**

Source: For additional information, see "Derivation of WQP Schedules_CWS_Baseline_Final Rule.xlsx," available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov.
Note: Systems serving ≤ 50,000 are only required to conduct WQP monitoring if they have a lead or copper ALE. EPA conservatively assumed that none of these systems would continue WQP monitoring long enough to qualify for reduced monitoring and would be on standard semi-annual monitoring in those monitoring periods when they had a lead or copper ALE.

Exhibit 4-38: Number of Ground Water NTNCWSs with CCT on Various WQP Distribution System Monitoring Schedules (Previous Rule)

Size Category	6 Month Standard	6 Month Reduced	Annual Reduced	Triennial Reduced	Total
≤100	693	0	0	0	693
101–500	819	0	0	0	819
501–1,000	267	0	0	0	267
1,001–3,300	159	0	0	0	159
3,301–10,000	25	0	0	0	25
10,001–50,000	4	0	0	0	4
50,001–100,000	0	0	0	1	1
100,001–1M	0	0	0	0	0
> 1 M	0	0	0	0	0
TOTAL	**1,967**	**0**	**0**	**1**	**1,968**

Source: For additional information, see "Derivation of WQP Schedules_NTNCWS_Baseline_Final Rule.xlsx," available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov.
Notes:

1. Systems serving ≤ 50,000 are only required to conduct WQP monitoring if they have a lead or copper ALE. EPA conservatively assumed that none of these systems would continue WQP monitoring long enough to qualify for reduced monitoring and would be on standard semi-annual monitoring in those monitoring periods when they had a lead or copper ALE.
2. The gray shaded cells denote that there were no NTNCWSs serving > 1M in the NTNCWS inventory.

Exhibit 4-39: Number of Surface Water NTNCWSs with CCT on Various WQP Distribution System Monitoring Schedules (Previous Rule)

Size Category	6 Month Standard	6 Month Reduced	Annual Reduced	Triennial Reduced	Total
≤100	112	0	0	0	112
101–500	109	0	0	0	109
501–1,000	51	0	0	0	51
1,001–3,300	71	0	0	0	71
3,301–10,000	40	0	0	0	40
10,001–50,000	9	0	0	0	9
50,001–100,000	1	0	0	0	1
100,001–1M	0	0	0	1	1
> 1 M	0	0	0	0	0
TOTAL	393	0	0	1	394

Source: For additional information, see "Derivation of WQP Schedules_NTNCWS_Baseline_Final Rule.xlsx," available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov.

Notes:

1. Systems serving ≤ 50,000 are only required to conduct WQP monitoring if they have a lead or copper ALE. EPA conservatively assumed that none of these systems would continue WQP monitoring long enough to qualify for reduced monitoring and would be on standard semi-annual monitoring in those monitoring periods when they had a lead or copper ALE.
2. The gray shaded cells denote that there were no NTNCWSs serving > 1M in the NTNCWS inventory.

4.3.7.2.2 Final LCRR

Under the final rule, EPA is requiring that for every phase of potential reduced WQP monitoring, the water system's lead 90th percentile level must be at or below the TL of 10 µg/L in addition to the previous rule requirements shown in Exhibit 4-35 above. Further, EPA is no longer allowing systems to monitor WQP in the distribution system on a triennial basis. Systems can still qualify for a reduced WQP monitoring on an annual frequency.

Exhibit 3-15 provides a summary of the revised reduced monitoring criteria under the final LCRR.

Exhibit 4-40: Revised Reduced WQP Tap Monitoring Criteria under the Final LCRR

Criteria[1] *(Required time period in which system is in compliance with its OWQP specifications and P90 is ≤10 µg/L)*	**Monitoring Frequency** *(Samples are collected at reduced number of sites)*
Two consecutive 6-month periods	Every 6 months
Minimum of three consecutive years (equals six, six-month periods)	Annual
Two consecutive monitoring periods in which all the following are met:[2]	

Criteria[1] *(Required time period in which system is in compliance with its OWQP specifications and P90 is ≤10 µg/L)*	Monitoring Frequency *(Samples are collected at reduced number of sites)*
1. 90th percentile lead level < 0.005 mg/L; 2. 90th percentile copper level < 0.65 mg/L; and 3. In compliance with OWQP specifications.	

Acronyms: OWQP = optimal water quality parameter; P90 = lead 90th percentile level.
Notes:
[1] Compliance with OWQPs must occur in consecutive monitoring periods in order for a system to qualify for reduced monitoring.
[2] As shown in Exhibit 4-34 under the previous rule, systems meeting these criteria were allowed to monitor triennially at the reduced number of sites.

Exhibit 4-41 and Exhibit 4-42 provide the initial number of CWS with CCT on each of the three possible distribution system monitoring schedules under the final LCRR by source water type. For NTNCWSs, this information Is provided in Exhibit 4-43 and Exhibit 4-44. Note that no NTNCWS had a reported result greater than the TL during 2007–2015.

Exhibit 4-41: Number of Ground Water CWSs with CCT on Various WQP Distribution System Monitoring Schedules (Final Rule)

Size Category	6 Month Standard	6 Month Reduced	Annual Reduced	Total
≤100	938	0	0	938
101–500	1,954	0	0	1,954
501–1,000	1,006	0	0	1,006
1,001–3,300	1,597	0	0	1,597
3,301–10,000	958	0	0	958
10,001–50,000	577	0	0	577
50,001–100,000	0	0	153	153
100,001–1M	0	1	63	64
> 1 M	0	0	2	2
TOTAL	**7,030**	**1**	**218**	**7,249**

Source: For additional information, see "Derivation of WQP Schedules_CWS_Final Rule.xlsx," available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov.
Note: Systems serving ≤ 50,000 are only required to conduct WQP monitoring if they have a lead or copper ALE. EPA assumed that none of these systems would continue WQP monitoring long enough to qualify for reduced monitoring and would be on standard semi-annual monitoring in those monitoring periods when they had a lead or copper ALE.

Exhibit 4-42: Number of Surface Water CWSs with CCT on Various WQP Distribution System Monitoring Schedules (Final Rule)

Size Category	6 Month Standard	6 Month Reduced	Annual Reduced	Total
≤100	435	0	0	435
101–500	955	0	0	955
501–1,000	591	0	0	591
1,001–3,300	1,490	0	0	1,490
3,301–10,000	1,537	0	0	1,537
10,001–50,000	1,540	0	0	1,540
50,001–100,000	7	9	373	389
100,001–1M	6	19	315	340
> 1 M	1	0	18	19
TOTAL	**6,562**	**28**	**706**	**7,296**

Source: For additional information, see "Derivation of WQP Schedules_CWS_Final Rule.xlsx," available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov.
Note: Systems serving ≤ 50,000 are only required to conduct WQP monitoring if they have a lead or copper ALE. EPA assumed that none of these systems would continue WQP monitoring long enough to qualify for reduced monitoring and would be on standard semi-annual monitoring in those monitoring periods when they had a lead or copper ALE.

Exhibit 4-43: Number of Ground Water NTNCWSs with CCT on Various WQP Distribution System Monitoring Schedules (Final Rule)

Size Category	6 Month Standard	6 Month Reduced	Annual Reduced	Total
≤100	693	0	0	693
101–500	819	0	0	819
501–1,000	267	0	0	267
1,001–3,300	159	0	0	159
3,301–10,000	25	0	0	25
10,001–50,000	4	0	0	4
50,001–100,000	0	0	0	0
100,001–1M	0	0	0	0
> 1 M	0	0	0	0
TOTAL	**1,967**	**0**	**0**	**1,967**

Source: For additional information, see "Derivation of WQP Schedules_NTNCWS_Final Rule.xlsx," available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov.
Notes:
1. Systems serving ≤ 50,000 are only required to conduct WQP monitoring if they have a lead or copper ALE. EPA conservatively assumed that none of these systems would continue WQP monitoring long enough to qualify for reduced monitoring and would be on standard semi-annual monitoring in those monitoring periods when they had a lead or copper ALE.

2. The gray shaded cells denote that there were no NTNCWSs serving > 1M in the NTNCWS inventory.

Exhibit 4-44: Number of Surface Water NTNCWSs with CCT on Various WQP Distribution System Monitoring Schedules (Final Rule)

Size Category	6 Month Standard	6 Month Reduced	Annual Reduced	Total
≤100	112	0	0	112
101–500	109	0	0	109
501–1,000	51	0	0	51
1,001–3,300	71	0	0	71
3,301–10,000	40	0	0	40
10,001–50,000	9	0	0	9
50,001–100,000	1	0	0	1
100,001–1M	0	0	0	0
> 1 M	0	0	0	0
TOTAL	**393**	**0**	**0**	**393**

Source: For additional information, see "Derivation of WQP Schedules_NTNCWS_Final Rule.xlsx," available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov.

Notes:

1. Systems serving ≤ 50,000 are only required to conduct WQP monitoring if they have a lead or copper ALE. EPA conservatively assumed that none of these systems would continue WQP monitoring long enough to qualify for reduced monitoring and would be on standard semi-annual monitoring in those monitoring periods when they had a lead or copper ALE.
2. The gray shaded cells denote that there were no NTNCWSs serving > 1M in the NTNCWS inventory.

4.3.7.2.3 Discussion of Data Limitations and Uncertainty

To estimate the initial WQP monitoring schedules under the previous rule and LCRR, EPA assumed systems serving 50,000 or fewer people would stop WQP monitoring as allowed under the previous rule and never qualify for reduced monitoring. There is uncertainty in this assumption because some states may require these smaller systems to continue to conduct WQP regardless of whether they exceed the AL to ensure CCT is operating properly. For systems serving more than 50,000 people, EPA used a combination of data to estimate monitoring schedules including the monitoring criteria outlined in the previous and final rules, historical lead 90th percentile data, and violation information from SDWIS/Fed.

4.3.8 Source and Treatment Changes

This section presents EPA's methodology for estimating the annual likelihood that a system will add a new source or change treatment. Under the previous rule, systems that conduct lead and copper tap sampling less frequently than semi-annually had to report plans to add a source or make a long-term treatment change to the Primacy Agency and obtain approval prior to making this change. The Primacy Agency could require systems to conduct additional monitoring or take other action it deemed

appropriate in response to this change. Under the final rule these requirements would apply to any system regardless of its monitoring schedule.

4.3.8.1 *Source Change*

EPA used historical data from SDWIS/Fed to estimate the likelihood that systems would have a source change in any given year. SDWIS/Fed assigns a unique facility ID for each source in a system. A change in source was defined as any year-to-year increase in the number of facility IDs within the same system for each non-emergency source type. EPA compared the sum of facility IDs for each source type and identified cases where the facility IDs increased between 2013 and 2016. These increases were assumed to represent a new source. Because of concerns that the analysis would not capture cases where a new source was added and an old source was removed from SDWIS/Fed (creating a net zero for the system), EPA evaluated changes in facility IDs separately for each source type. For example, if a given system had two source types identified, 1) groundwater active (GWA) and 2) groundwater under the influence of surface water active (GUA), then the total number of facility IDs for each of the two source codes was summed for that system. If the count of facility IDs for either system/source type combination increased from year to year, it was counted as a change in source. Note that multiple increases in facility counts per source type (e.g., 5 to 7 facility counts) were considered a single change in source if they all occurred in the same calendar year. Decreases in counts were not included as a change in source as systems are not required to report when they abandon or consolidate sources. Exhibit 4-45 illustrates this example scenario, where a change of source was identified from 2015–2016.

Exhibit 4-45: Change in Source Example Scenario

System ID	Source Type	Facility Count (2013)	Facility Count (2014)	Facility Count (2015)	Facility Count (2016)	Total Increase
XX0106001	GWA	5	4	5	6	2
XX0106001	GUA	5	5	5	7	1
XX0106001	ALL					3

Acronyms: GUA = ground water under the direct influence – active system; GWA = ground water – active system.
Note:
In this example, the GWA facility ID count for this particular system decreases from 2013 to 2014 but does not count as a change in source because systems must only report the addition of a new source. However, the facility count increases from 2014 to 2015 and from 2015 to 2016, which counts as two distinct changes in source. Similarly, the GUA facility ID count increases from 2015 to 2016, which is counted as an additional change. This yields a total change count of three for this example system.

The percentage of CWSs that had a change in source was calculated for each year interval from 2013 to 2016 (i.e., 2013-2014, 2014-2015, and 2015-2016). The values were then averaged across the three individual year sequences. These estimates are shown in Exhibit 4-46 and Exhibit 4-47 for CWSs and NTNCWSs, respectively. Although most results are similar across CCT status and source water type, results for larger sized ground water systems are high, likely due to the small total number of systems in those size categories.

To produce estimates that can be used to predict future changes over a 30+ year time period, EPA combined the size categories. Specifically, EPA calculated a weighted average using the number of CWSs

in each stratum multiplied by their result to get an overall percentage for all systems of a given source water type and CCT status. The averages were very similar: 6 percent for systems with CCT and, 5 percent for those without CCT. Because of these similarities EPA used one estimate of 5 percent across all CWSs in its cost estimates, which corresponds to the SafeWater LCR model data variable, *p_source_chng*.

Exhibit 4-46: Estimated Percent of CWSs that Will Change Source Each Year

Size Category	Estimated Percent of CWSs that will Change Source (Based on 2013 – 2016 SDWIS/Fed Data)			
	With CCT		Without CCT	
	Ground Water	Surface Water	Ground Water	Surface Water
≤100	3%	5%	4%	6%
101-500	3%	5%	4%	5%
501-1,000	4%	4%	5%	4%
1,001-3,300	5%	4%	5%	5%
3,301-10,000	7%	6%	8%	7%
10,001-50,000	10%	6%	13%	9%
50,001-100,000	17%	13%	67%	11%
100,001-1M	24%	16%	17%	0%
>1M	50%	25%	0%	0%
WEIGHTED AVERAGE	5%	6%	5%	6%
	6%		5%	
	5% *(p_source_chng)*			

Note: For additional information, see file "Derivation of Probability_SourceChange_Final Rule.xlsx," available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov.

In general, the estimates for NTNCWSs were similar regardless of CCT status or source water type with one exception. Thirty-three percent (33 percent) of NTNCWSs without CCT using surface water and serving 10,001-50,000 are estimated to change source each year. Again, this high likelihood is a result of a small number of total systems (i.e., one system). Thus, EPA combined size categories for NTNCWSs and estimated a weighted average for each CCT and source stratum, for those with and without CCT and all NTNCWSs. The combined weighted averages by CCT status and for all NTNCWSs yield the same estimates as those for CWSs of 5 percent (*p_source_chng*).

Exhibit 4-47: Estimated Percent of NTNCWS that Will Change Source Each Year

Size Category	Estimated Percent of NTNCWSs that will Change Source (Based on 2013 – 2016 SDWIS Data)			
	With CCT		Without CCT	
	Ground Water	Surface Water	Ground Water	Surface Water
≤100	3%	11%	6%	8%
101-500	3%	8%	4%	8%
501-1,000	3%	7%	3%	0%
1,001-3,300	6%	8%	4%	4%
3,301-10,000	9%	11%	6%	4%
10,001-50,000	8%	11%	11%	33%
50,001-100,000	0%	0%	0%	0%
100,001-1M	0%	0%	0%	0%
>1M	0%	0%	0%	0%
WEIGHTED AVERAGE	5%	9%	5%	9%
	6%		5%	
	5% *(p_source_chng)*			

Note: For additional information, see file "Derivation of Probability_SourceChange_Final Rule.xlsx," available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov.

4.3.8.1.1 Discussion of Data Limitations and Uncertainty

Although SDWIS/Fed provides the most comprehensive dataset of available system information, the reporting of source information to SDWIS/Fed has associated uncertainties. See Section 4.2.1 for a discussion of SDWIS/Fed. EPA worked to minimize the impacts of these uncertainties by counting only non-emergency sources, net increases in the number of sources, averaging results over three two-year periods, and combining size categories to minimize over-representation of small numbers of large systems in a single size category in order to develop a more representative prediction of changes throughout the rule analysis period for all water systems in the United States. EPA recognizes that using SDWIS may underestimate the percent of systems changing sources because it does not include systems that add and subtract the same type of source in a given calendar year.

4.3.8.2 *Primary Source Change*

EPA assumed Primacy Agencies at a minimum would require systems that change their primary source to take additional actions such as source water monitoring. EPA defined a change in primary source as a year-to-year change from groundwater to surface water or surface water to groundwater. Changes in primary source were evaluated at the facility level, so that each system/facility combination was counted as a distinct change. Specifically, a change in primary source includes the following options:

- Change from ground water consecutive active[76] or surface water consecutive active to ground water active, groundwater under the influence of surface water active, or surface water active, or vice versa.
- Change from ground water active to surface water active, or vice versa.
- Change from ground water consecutive active to surface water consecutive active, or vice versa.

The counts of systems meeting these criteria in SDWIS/Fed from 2013 to 2016 were quite small for both CWSs (81 system/facility combinations) and NTNCWSs (8 system/facility combinations). This is expected since changing source water type would change the overall water chemistry significantly and affect numerous regulatory requirements. As a conservative estimate, EPA estimated that 1 percent of CWSs and NTNCWSs would change primary source water each year. For additional information, see "Derivation of Probability_SourceChange_Final Rule.xlsx," available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov.

4.3.8.2.1 Discussion of Data Limitations and Uncertainty

The EPA estimate of 1 percent of systems changing their primary source water type in a given year over the rule analysis period is uncertain given that the Agency is using historical data to predict future rates of change. EPA found that very few systems, far less than 1 percent, changed primary source water designation as reported to SDWIS/Fed between 2013 and 2016. However, EPA believes that a baseline rate of change of 1 percent is a reasonable predictor of future changes allowing for the potential increases in source water type changes due to population movement, ground water quality changes, drought, and other climate-related factors.

4.3.8.3 *Treatment Change*

EPA used historical data from SDWIS/Fed to estimate the percent of systems that would change treatment in a given year. For this analysis, EPA identified a treatment change as any year-to-year *increase* in the count of treatment codes[77] for a given system. For example, if a system had three total treatment codes in 2013 and five total treatment codes in 2014, that increase from 2013 to 2014 was counted as one change in treatment.

The analysis was limited to:

- Treatment changes that were associated with non-emergency sources.
- Treatment code entries with a reported treatment code as opposed to a blank field or with a dash.

[76] The term "ground water consecutive active" refers to an active public water system that is classified as a ground water system (see Section 4.2.1.1.3) and that buys or otherwise receives some or all of its finished water from a wholesale system.

[77] Although systems may drop a treatment, it is more common for systems to add advanced treatment technologies to their existing treatment train to address new regulations and emerging contaminants. EPA evaluated changes in both treatment objective codes and process codes to identify year-to-year changes in treatment.

- Systems that did not also have a source change in a given year, to avoid double counting.

Changes in treatment were identified for each 2-year sequence from 2013-2016. This yields a total of three, 2-year sequences. These 2-year sequences include 2013-2014, 2014-2015, and 2015-2016.

The estimated percent of systems that will change treatment each year is shown in Exhibit 4-48 and Exhibit 4-49 for CWSs and NTNCWSs, respectively. For CWSs, the percentages are low across all size categories but tend to be higher for those systems without CCT. Similar to the approach taken for estimating source water changes, EPA estimated the weighted average for CWSs by CCT status, source water type, and for all CWSs. The weighted average percentages are between 1 and 2 percent, with an overall weighted average of 2 percent, which corresponds to the value of the SafeWater model LCR data variable, *p_treat_chng*.

The estimated percent of NTNCWSs that will change treatment each year is also low across all size categories, but the variation tends to be more random. EPA estimated the weighted average for NTNCWSs by CCT status, source water type, and for all NTNCWSs. The weighted average percentages were between 1 and 2 percent. The overall weighted average for NTNCWSs was the same as CWSs of 2 percent (*p_treat_chng*).

Exhibit 4-48: Estimated Percent of CWSs that Will Change Treatment Each Year

Size Category	Estimated Percent of CWSs that will Change Treatment (Based on 2013 – 2016 SDWIS Data)			
	With CCT		Without CCT	
	Ground Water	Surface Water	Ground Water	Surface Water
≤100	4%	2%	2%	2%
101-500	2%	1%	1%	1%
501-1,000	2%	1%	1%	2%
1,001-3,300	2%	1%	1%	2%
3,301-10,000	3%	2%	2%	2%
10,001-50,000	3%	2%	2%	2%
50,001-100,000	2%	3%	0%	0%
100,001-1,000,000	2%	4%	0%	0%
>1M	0%	8%	0%	0%
WEIGHTED AVERAGE	2%	2%	1%	2%
	2%		1%	
	2% *(p_treat_chng)*			

Note: For additional information, see file "Derivation of Probability_TreatmentChange_Final Rule.xlsx," available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov.

Exhibit 4-49. Estimated Percent of NTNCWSs that Will Change Treatment Each Year

Size Category	Estimated Percent of NTNCWSs that Will Change Treatment (Based on 2013 – 2016 SDWIS Data)			
	With CCT		Without CCT	
	Ground Water	Surface Water	Ground Water	Surface Water
≤100	4%	2%	1%	3%
101-500	2%	1%	2%	2%
501-1,000	3%	3%	2%	4%
1,001-3,300	4%	3%	2%	2%
3,301-10,000	3%	1%	2%	7%
10,001-50,000	0%	0%	0%	0%
50,001-100,000	0%	0%	0%	0%
100,001-1,000,000	0%	0%	0%	0%
>1M				
WEIGHTED AVERAGE	3%	2%	1%	3%
	3%		2%	
	2% *(p_treat_chng)*			

Note: For additional information, see file "Derivation of Probability_TreatmentChange_Final Rule.xlsx," available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov.

4.3.8.3.1 Discussion of Data Limitations and Uncertainty

There is uncertainty in using counts of treatment codes from SDWIS/Fed to predict the future likelihood of treatment changes. In addition, there is uncertainty in how consistently states reported this information to SDWIS/Fed. Using an average rate from 2013 to 2016 may over or underrepresent costs across the LCRR implementation period depending on future drinking water regulations and trends in source water quality.

4.3.9 Schools, Child Cares, Local Health Departments, and Targeted Medical Providers

The previous LCR required CWSs that exceed the lead AL to provide lead PE materials to facilities that include but are not limited schools, child cares, community-based organizations, and medical providers that offer services to pregnant women, children, and infants to better reach these at-risk populations and their caregivers. CWSs must also contact local health departments by phone or in person to request the health agency's support in disseminating information on lead in drinking water and the steps that vulnerable populations can take to reduce their exposure. This requirement is unchanged under the LCRR. Section 4.3.9.1 explains how EPA derived the average number of each of these facility types per system.

Under the LCRR, CWSs must conduct a lead in drinking water testing program at schools and child cares in their service area that were constructed prior to January 1, 2014 or the date the state adopted the lead ban. States with equivalent programs to the LCRR, which is discussed in Section 4.3.9.2 can waive these requirements.

4.3.9.1 ***Estimated Number of Facilities***

This section is organized into four subsections as follows:

- 4.3.9.1.1: Schools
- 4.3.9.1.2: Child Cares
- 4.3.9.1.3: Local Health Agencies and Targeted Medical Providers
- 4.3.9.1.4: Discussion of Data Limitations and Uncertainty

Schools and child cares that are NTNCWSs, are not served by CWSs and have separate PE requirements and under the final LCRR, would not be included in the CWS's lead in drinking water testing program at school and child cares. Thus, as shown below they are excluded from the estimated number of schools and child cares provides in Sections 4.3.9.1.1 and 4.3.9.1.2, respectively. Also, for additional detail, see file, "Derivation of School_Child Care Inputs_Final Rule.xlsx," available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov.

4.3.9.1.1 Schools

EPA used the following approach to estimate the total number of public and private elementary and secondary schools per State and United States territory and for the Navajo Nation:

1. Obtained the most current estimate of public elementary and secondary schools per state and United States territory from the United States Department of Education, NCES (NCES, 2018a). Categorized combined elementary/secondary schools and schools that did not report a grade span as elementary schools. Obtained the most current estimate of private schools per state from the NCES Private School Universe Survey (NCES, 2018b) and used the ratio of the numbers of elementary and secondary public schools to estimate the proportion of private schools that are elementary vs. secondary. Supplemented NCES data with data from other sources to estimate the number of public and private schools in the Navajo Nation and the number of private schools in United States territories.
2. Determined the number of NTNCWSs that are schools in each state and United States territory based on the system's reported service area type code for schools of "SC" in SDWIS/Fed. Used the owner type information to determine how many schools were public vs. private. Used the ratio of elementary and secondary schools for all public schools from NCES (NCES, 2018a) to estimate the proportion of NTNCWSs that are elementary vs. secondary.
3. Subtracted the number of public and private NTNCWSs schools per state and United States territory calculated in Step 2 from the national number of public and private elementary and secondary schools per state and United States territories estimated in Step 1 to produce the adjusted number of schools served by CWSs.

Exhibit 4-50 (presented following the description of the estimated child cares) shows the results of these steps in columns A through F.

4.3.9.1.2 Child Cares

EPA used a similar approach to the one used for schools to estimate the average number of child cares per CWS:

1. Obtained the national number of child cares per state from *Figure 24, U.S. Child Care Industry Statistics* (CED, 2019). The estimated total number of child cares in 2017 was 674,332. Note that this figure is lower than what was reported for 2012 (768,521), which was used in the proposed rule analysis. CED explained this decrease as a shift from non-employer firms to larger, employee-based firms (CED, 2019). The estimate, however, is more than double the number recorded in the 2008 Child Care Licensing Study, which was 329,882 (The National Child Care Information and Technical Assistance Center and the National Association for Regulatory Administration, 2010). Also, because states have different definitions of child care, CED (2019, p. 6) notes that "… industry estimates may vary state by state depending upon the data sources used." EPA supplemented CED data with additional web-based information on the number of child cares in the Navajo Nation and in United States territories. See the file "Derivation of Schools_Child Care Inputs_Final Rule.xlsx" for details.

2. Determined the number of NTNCWSs that are child cares in each state and United States territories based on the system's reported service area type code for Daycare Center of "DC" in SDWIS/Fed.

3. Subtracted the number of NTNCWS child cares per state and United States territory calculated in Step 2 from the national number of child cares per state and United States territory, Step 1, to produce the adjusted number of child cares served by CWSs.

   Exhibit 4-50 shows the results of these steps in column G. The corresponding SafeWater model LCR data variables used to estimate costs in Chapter 5 are provided in notes below the exhibit.

Exhibit 4-50: Number of Schools and Child Cares by State and United States Territory, Adjusted to Remove NTNCWS Schools and Child Cares

States/ Territories	Public Schools (adjusted to remove NTNCWSs)			Private Schools (adjusted to remove NTNCWSs)			Number of Child Cares (adjusted to remove NTNCWSs)
	Total	Secondary	Elementary	Total	Secondary	Elementary	
	A	B	C	D	E	F	G
Alabama	1,513	406	1,107	370	99	271	7,162
Alaska	436	68	368	42	7	36	1,535
Arizona	2,240	728	1,512	324	105	219	11,432
Arkansas	1,087	373	714	230	79	151	5,187
California	9,928	2,422	7,506	3,267	797	2,470	95,125
Colorado	1,848	393	1,455	391	83	308	9,016
Connecticut	1,152	274	878	340	81	259	7,766
Delaware	225	38	188	151	25	126	1,386

States/ Territories	Public Schools (adjusted to remove NTNCWSs)			Private Schools (adjusted to remove NTNCWSs)			Number of Child Cares (adjusted to remove NTNCWSs)
	Total	Secondary	Elementary	Total	Secondary	Elementary	
	A	B	C	D	E	F	G
Dist. of Columbia	223	36	187	58	9	49	1,299
Florida	4,106	664	3,442	2,817	455	2,362	34,500
Georgia	2,265	446	1,819	819	161	657	22,966
Hawaii	290	52	238	131	24	107	1,209
Idaho	706	191	515	253	69	184	2,769
Illinois	4,067	871	3,196	1,273	273	1,000	40,944
Indiana	1,768	432	1,336	866	211	655	12,516
Iowa	1,309	343	966	310	81	229	11,584
Kansas	1,307	337	970	197	51	146	7,751
Kentucky	1,536	416	1,120	424	115	309	6,430
Louisiana	1,392	278	1,114	529	105	423	9,854
Maine	447	108	339	62	15	47	2,598
Maryland	1,284	217	1,067	678	115	563	14,198
Massachusetts	1,774	357	1,417	637	128	509	10,436
Michigan	3,459	864	2,595	378	94	283	19,134
Minnesota	2,444	833	1,611	792	270	522	15,795
Mississippi	1,063	328	735	199	61	138	8,654
Missouri	2,359	611	1,748	757	196	561	13,005
Montana	727	291	436	97	39	58	2,085
Nebraska	1,062	293	769	265	73	192	6,671
Nevada	645	123	522	137	26	111	5,513
New Hampshire	363	81	282	301	67	234	1,683
New Jersey	2,419	507	1,912	997	209	788	16,317
New Mexico	847	223	624	167	44	123	2,677
New York	4,659	1,089	3,570	1,571	367	1,204	63,997
North Carolina	2,507	522	1,985	610	127	483	15,546
North Dakota	529	183	346	50	17	33	2,890
Ohio	3,536	991	2,545	1,244	349	896	21,428
Oklahoma	1,769	550	1,219	148	46	102	6,019
Oregon	1,114	245	869	375	82	293	8,781
Pennsylvania	2,658	695	1,963	2,436	637	1,799	16,908
Rhode Island	291	65	226	99	22	77	1,672
South Carolina	1,239	278	961	373	84	289	8,015
South Dakota	711	246	465	74	26	49	2,826

States/ Territories	Public Schools (adjusted to remove NTNCWSs)			Private Schools (adjusted to remove NTNCWSs)			Number of Child Cares (adjusted to remove NTNCWSs)
	Total	Secondary	Elementary	Total	Secondary	Elementary	
	A	B	C	D	E	F	G
Tennessee	1,768	344	1,424	487	95	392	13,184
Texas	8,821	2,071	6,750	2,047	481	1,566	56,358
Utah	1,035	281	754	150	41	109	4,970
Vermont	201	42	159	66	14	52	1,700
Virginia	1,960	400	1,560	765	156	609	15,853
Washington	2,397	645	1,752	608	164	444	9,762
West Virginia	712	116	596	117	19	98	2,308
Wisconsin	2,086	517	1,569	781	193	587	10,415
Wyoming	361	98	263	34	9	25	1,359
Puerto Rico	1,282	251	1,031	565	111	454	228
Guam	41	7	34	22	4	18	41
United States Virgin Islands[1]	8	3	5	0	0	0	137
American Samoa	28	6	22	15	3	12	22
North Mariana Islands	0	0	0	15	0	15	13
Navajo Nation	278	67	211	40	10	30	19
TOTAL	**96,282**	**23,312**	**72,970**	**30,951**	**7,223**	**23,728**	**673,648**

Sources: Derivation of Schools_Child Care Inputs_Final Rule.xlsx

Notes:
B: Corresponds to the SafeWater LCR model data variable: *numb_second_schools_pub*.
C: Corresponds to the SafeWater LCR model data variable: *numb_elem_schools_pub*.
E: Corresponds to the SafeWater LCR model data variable: *numb_second_schools_priv*.
F: Corresponds to the SafeWater LCR model data variable: *numb_elem_schools_priv*.
G: Corresponds to the SafeWater LCR model data variable: *numb_daycares*.

4.3.9.1.3 Local Health Agencies and Targeted Medical Providers

EPA used the following approach to estimate the average number of local health agencies and targeted medical providers per CWS:

1. Determined the total number of local health agencies and targeted medical providers by summing the numbers of local health agencies, obstetrician/gynecologists (ob/gyns), and pediatricians, which were obtained from various data sources:

    a. The number of local health agencies was obtained from data collected by the National Association of County and City Health Officials (NACCHO) in the 2016 National Profile of

Local Health Departments (NACCHO, 2017). The estimated number of local health agencies in 2016 was 2,800.

b. The number of ob/gyns was obtained from a 2012 article published in Obstetrics and Gynecology that analyzed 2010 data (Rayburn et al. 2012). The estimated number of ob/gyns in 2010 was 33,624. The number of pediatricians was obtained from 2011 data collected by the American Medical Association (AMA) (AMA, 2013, as cited in American Academy of Pediatrics, 2019). The estimated number of pediatricians in 2011 was 91,915. The estimated combined number of ob/gyns and pediatricians is 125,539.

2. Assumed the number of local health agencies and targeted medical providers were proportionally distributed across the size categories. For example, as previously discussed, the percentage of the people served by smallest size category of CWSs is approximately 0.24 percent of the total population served by CWSs (i.e., 723,487/303,490,537). The 0.24 percent was multiplied by the number of health agencies and targeted medical providers to yield an estimated number of health agencies and targeted medical providers served by all systems in this size category (0.24%*128,339 = 306).

3. Divided the number of health agencies and targeted medical providers in each of the nine system size categories by the number of systems in the category.

4. Rounded up values to the nearest whole number. EPA assumed all CWSs would contact at least one agency because the LCR requires CWSs to contact local public health agencies even if they are outside their service area. Exhibit 4-51 provides the average number of health agencies and targeted medical providers per CWSs.

Exhibit 4-51: Estimated Average Number of Local Health Agencies and Targeted Medical Providers per CWS

System Size	# of Systems	Population Served	Number of Agencies Proportionally Distributed	Number of Agencies per System	Number of Agencies per System (Rounded Up to Nearest Whole Number)
	A	B	C	D = C/A	E
<=100	12,046	723,487	305	0.0	1
101–500	15,307	3,884,780	1,637	0.1	1
501–1000	5,396	3,989,089	1,681	0.3	1
1001–3300	8,035	15,312,930	6,453	0.8	1
3301–10000	4,974	29,070,747	12,250	2.5	3
10001–50000	3,331	72,870,205	30,707	9.2	10
50001–100000	550	38,134,020	16,070	29.2	30
100001–1M	407	98,526,569	41,519	102.0	102
>1M	21	42,043,440	17,717	843.7	844
Total	**50,067**	**304,555,267**	**128,339**		

Sources:
A: Exhibit 4-3.

B: Exhibit 4-5.
C: Calculated from SDWIS/Fed data, 2013–2014 NCES data, 2012 United States Census Bureau data, 2010 data from a 2013 Obstetrics and Gynecology article, and 2011 AMA data (see Steps 1 and 2 above). For additional detail, see sheet "Pb ALE_Recipients" in file "Derivation of Public Education Inputs_CWS_Final Rule.xlsx," available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov.

4.3.9.1.4 Discussion of Data Limitations and Uncertainty

The number of entities that will receive PE under the previous and final rules in response to a lead ALE may be an underestimation because the number of entities may continue to increase each year to meet the needs of growing populations. In addition, the estimated number of facilities focused on schools, child care centers, pediatricians, and ob/gyns, and does not include other groups that are required to receive PE, i.e., Women, Infants, and Children (WIC); Head Start; public and private hospitals and clinics; family planning centers; and local welfare agencies. From a national perspective, EPA does not anticipate these limitations to have an impact on the incremental costs to deliver PE in response to a lead ALE under the final LCRR because the requirements remain unchanged from the previous rule.

The uncertainty in the estimated number of schools that exist when the LCRR goes into effect may result in an underestimate of costs for CWSs to conduct lead sampling at these facilities. In contrast, the uncertainty in designating schools that did not report a grade span as elementary may result in an overestimate of sampling costs for elementary schools because all these schools must be sampled within the first five years of the schools sampling program. In addition, the number of child cares may be overestimated because the source, CED (2019), may include non-licensed facilities, which are not subject to LCRR requirements and would result in an overestimate of costs. As described in the next section, the methodology used to estimate the percent of CWSs that already conduct school sampling programs may also result in an overestimate of costs of the final rule. The resulting impact of all these factors may be an under or overestimate of national costs. EPA does not expect this uncertainty to have a significant impact on national cost and benefit estimates in this EA.

4.3.9.2 *Estimated Percentage of States with Existing School and Child Care Testing Programs*

As part of the final LCRR, EPA is adding the following requirements for CWSs that provide water to schools and child cares:

- Provide information about the health risks and sources of lead in drinking water to schools and child cares within their service area.
- Collect five samples for lead at schools and two samples from licensed child cares in their service area that were constructed prior to January 1, 2014 or the date the State adopted standards that meet the definition of lead free in accordance with Section 1417 of the SDWA, as amended by the Reduction of Lead in Drinking Water Act.
- Conduct this monitoring at 20 percent of elementary schools and child cares for one, 5-year cycle (i.e., "mandatory" testing). Thereafter, conduct monitoring only at those facilities that request testing (i.e., "on request" testing). Conduct monitoring at secondary schools on request only.

- Provide sampling results to tested facilities, Primacy Agencies, and state and local health departments.
- Provide a more in-depth annual report to the Primacy Agency.

For more information about these requirements, see Section 3.11.

Some states have developed their own requirements for lead testing of drinking water at schools and child cares. The purpose of this section is to describe EPA's approach for identifying states with programs that are at least as stringent as the final LCRR for public and/or private elementary through secondary schools (i.e., K-12) and licensed child cares. EPA assumed CWSs in these states would not incur burden or costs to meet these requirements under the final LCRR because states will elect to waive these requirements.

From 2018 through 2020, EPA collected data and conducted internet searches for each state to determine the extent of state-level lead testing programs at schools and child cares. In particular, EPA evaluated:

- Type of programs (i.e., mandatory or on request),
- Applicability (e.g., public vs. private schools, elementary vs. secondary schools),
- If programs were required by state legislation,
- How these programs are funded,
- Frequency of testing,
- Number of samples/locations, and
- Sampling protocol and consistency with EPA's *3Ts for Reducing Lead in Drinking Water in Schools and Child Care Facilities: A Training, Testing, and Taking Action Approach (Revised Manual)* (USEPA, 2018), hereafter referred to as *3Ts*.

EPA used the following assumptions to identify CWSs that would qualify for a mandatory program waiver under the final LCRR for K-12 schools:

- Programs must include testing for all K-12 public and private or public only schools. Those that included a targeted subset of schools based on grade, economic considerations, or other factors were not considered to have equivalent programs and thus would not qualify for a mandatory program waiver. EPA also did not consider programs that targeted schools constructed prior to the construction date of January 1, 2014 or the date the state adopted the lead ban.
- If regulations, state websites, or other sources used for state programs did not specify whether the program applied to public and private schools, EPA assumed that the state's program applied to both.
- If regulations and other state resources used for state programs did not specify whether the program applied to all elementary and secondary schools, EPA assumed that the state's program applied to both.

- Testing must meet the minimum testing requirements of 5 samples per school and testing frequency unless the state included a more stringent requirement of remediation in response to a high lead sample. Note that many regulations and state resources did not specify the number of samples, instead referring to the 3Ts (USEPA, 2018) as a guide. Because the 3Ts recommends sampling at all outlets used for human consumption, EPA assumed that the state program met the sample requirements if they met all other minimum requirements of the final testing program under the LCRR.
- CWS in states that received a Water Infrastructure Improvements for the Nations (WIIN) grant and that had pre-existing lead testing programs or indicated new lead testing programs would be ongoing would qualify for a mandatory testing waiver assuming the conditions described in the bullets above were met.

Based on these assumptions, CWSs in four states would qualify for a mandatory program testing waiver for public and private K-12 schools, and five states and the District of Columbia would qualify for a testing waiver for public K-12 schools, as shown in Exhibit 4-52. The corresponding SafeWater LCR model data variable used to estimate costs in Chapter 5 is provided in red italics.

Exhibit 4-52: States Where CWSs Meet the Requirements for Mandatory Program Waivers at Schools

Waiver Type	Number of States	States	Notes
Mandatory: K-12 for Public (*p_grandfather_mand_pub*) and Private (*p_grandfather_mand_priv)*	4	Maryland, Minnesota, New Hampshire, and Vermont	CWSs in these states are assumed to incur no burden for the lead in drinking water testing program at these schools.
Mandatory: K-12 Public Only (*p_grandfather_mand_pub*)	6	District of Columbia, Montana, New Jersey, New York, Oregon, Pennsylvania	

Exhibit 4-53 provides the number of states where CWSs would qualify for an "on request" testing program. As previously discussed in this section, after the first 5-year cycle is completed (years 4 – 8 in the EA) CWSs can switch to an on request program for elementary schools. Sampling at secondary schools is on request only. An additional four states would qualify for an on request program waiver for public and private elementary schools and an additional seven states would qualify for public schools only starting in year 9 of the analysis period for elementary schools and year 4 for secondary schools.

Exhibit 4-53: States Where CWSs Meet the Requirements for On Request Waivers at Schools

Waiver Type	Number of States	States	Notes
On Request: K-12 for Public (*p_grandfather_opt_pub*) and Private (*p_grandfather_opt_priv*)	8	• Maryland, Minnesota, New Hampshire, and Vermont • Maine, Michigan, New Mexico, North Dakota	• Also meet mandatory program requirements. • Only meet upon request requirements.[1]
On Request: K-12 Public Only (*p_grandfather_opt_pub*)	13	• District of Columbia, Montana, New Jersey, New York, Oregon, Pennsylvania • Colorado, Idaho, Indiana, Massachusetts, Oklahoma, Utah, Virginia	• Also meet mandatory program requirements • Only meet on request requirements.[1]

Note:
[1]Systems in these states are assumed to incur no burden for the lead in drinking water testing program at secondary schools starting in year 4 and for elementary schools starting in year 9.

Exhibit 4-54 provides the number of states that would not have CWSs that qualify for a mandatory or on request testing program waiver. A total of 14 states had some testing requirements but did not met the criteria previously discussed in this section. The remaining 17 states had insufficient or no information on which to determine if CWSs in the state would qualify for a waiver.

Exhibit 4-54: States Where CWSs Do Not Meet the Requirements for Waivers at Schools

Waiver Type	Number of States	States	Notes
No waiver: Testing targets subset of schools[1]	8	Alaska, Arizona, Illinois, Iowa, Louisiana, Ohio, Tennessee, Washington	Includes states that: • Prioritize younger children and/or low income communities (AK, WA) • Limit testing to a subset of charter schools (AZ), pre-K through 5 only (IL), or subset of elementary schools (IA, LA) • Exclude some facilities based on construction date (OH, TN)
No waiver: some testing requirements but do not satisfy all LCRR requirements	6	Alabama, California, Nevada, Ohio, Rhode Island, South Carolina	Includes states that require < 5 samples (AL, NV, RI) or have one-time testing (CA, RI, SC)
Insufficient information about program	4	Arkansas, Georgia, Texas, Wyoming	

Waiver Type	Number of States	States	Notes
No information found[2]	13	Connecticut, Delaware, Florida, Hawaii, Kansas, Kentucky, Mississippi, Missouri, Nebraska, North Carolina, South Dakota, West Virginia, Wisconsin	

Notes:

[1] Aside from having a one-time testing program, South Carolina's program also does not qualify for a CWS waiver because the testing was limited to certain economic zones.

[2] From 2018 through 2020, EPA collected data and conducted internet searches for each state to determine the extent of state-level lead testing programs at schools and eligibility for waivers. No information was found for 13 states based on these efforts.

To identify states with programs at least as stringent as the LCRR for child cares, EPA used the following criteria:

- Programs must include testing for all licensed child cares. Those that included a targeted subset were not considered to have equivalent programs and thus would not qualify for a mandatory waiver. EPA also did not consider programs that targeted child cares constructed prior to the construction date of January 1, 2014 or the date the state adopted the lead ban.
- Testing must meet the minimum testing requirements of two samples per child care and testing frequency unless the state includes a more stringent requirement of remediation in response to a high lead sample. EPA also assumed that regulations and state resources that referenced the 3Ts would be consistent with those required under the final LCRR.
- States that received and used a WIIN grant in the past would continue to use it in the future and CWSs would qualify for a mandatory testing waiver assuming the conditions described in the bullets above were met.

Based on these assumptions, seven states and the District of Columbia would qualify for CWS waivers from mandatory child care testing, as shown in Exhibit 4-55.

Exhibit 4-55: States Where CWSs Meet the Requirements for Mandatory Program Waivers at Child Cares

Waiver Type	Number of States	States	Notes
Mandatory (*p_grandfather_mand_child*)	8	California, Connecticut, District of Columbia, New Hampshire, New Jersey, North Carolina, Oregon, Vermont	CWSs in these states are assumed to incur no burden for the lead in drinking water testing program at child cares

Exhibit 4-56 provides the number of states where CWSs that would qualify for an on request testing program waiver at child cares that could be issued after the first 5-year cycle of testing is completed. CWSs in an additional six states would qualify for an on request program waiver.

Exhibit 4-56: States Where CWSs Meet the Requirements for On Request Waivers at Child Cares

Waiver Type	Number of States	States	Notes
On Request (*p_grandfather_opt_child*)	14	• California, Connecticut, District of Columbia, New Hampshire, New Jersey, North Carolina, Oregon, Vermont • New Mexico, Oklahoma, Rhode Island, Utah, Virginia, Washington	• Also meet mandatory program requirements. • Only meet on request requirements.*

* Note: Systems in these states are assumed to incur no burden for the lead in drinking water testing program at child cares in year 9.

Exhibit 4-57 provides the number of states that do not have CWSs that qualify for a mandatory or on request testing program waiver for child cares. A total of 3 states had some testing requirements but did not met the criteria previously discussed in this section. The remaining 34 states had insufficient or no information on which to determine if CWSs in the state would qualify for a waiver.

Exhibit 4-57: States Where CWSs Do Not Meet the Requirements for Waivers at Child Cares

Waiver Type	Number of States	States	Notes
No waiver: Testing targets subset of child care	2	Illinois, South Carolina	Includes states that: • Exclude some facilities based on construction date (IL) • Limit WIIN grant to certain economic areas (SC)
No waiver: some testing requirements but do not satisfy all LCRR requirements	1	Maine	Includes states that require < 5 samples (ME)
Insufficient information about program	12	Alaska, Arizona, Colorado, Georgia, Idaho, Indiana, Iowa, Massachusetts, Michigan, Montana, New York, North Dakota,	Includes states that: • Received WIIN Grant but no additional information (AK, GA, ID, IN, IA, MT, NY, ND) or pre-existing program (CO) • Sampling protocol is unknown or other insufficient information (AZ, MA, MI)
No information found[1]	22	Alabama, Arkansas, Delaware, Florida, Hawaii, Kansas, Kentucky, Louisiana, Maryland, Minnesota, Mississippi, Missouri, Nebraska, Nevada, Ohio, Pennsylvania, South Dakota, Tennessee, Texas, West Virginia, Wisconsin, Wyoming	

[1] From 2018 through 2020, EPA collected data and conducted internet searches for each state to determine the extent of state-level lead testing programs at schools and eligibility for waivers. No information was found for 13 states based on these efforts.

4.3.9.2.1 Discussion of Data Limitations and Uncertainty

EPA assumed that when the school type (public vs. private) was not specifically referenced in the state program that the program covered both and met the requirements of the final LCRR program. The Agency also assumed that when the number of samples was not specified but instead referenced EPA's 3Ts (USEPA, 2018) the state program met the requirements of the final LCRR. This may lead to an overestimate of the number of systems already operating under the requirements of the final rule and underestimating costs of the program.

On the other hand, there are several reasons that the estimated number of systems that already meet the final LCRR requirements for school and child care PE and testing as presented in Exhibit 4-52 and Exhibit 4-53 for schools and Exhibit 4-55 and Exhibit 4-56 for child cares may be an underestimate:

- The analysis does not consider programs at the county or local level and does not recognize situations where water systems have implemented their own sampling programs in response to customer requests or to gain additional data on their system. Testing programs were only reviewed at the state level.
- The eight states that target a subset of schools and two states that target a subset of child cares as identified in Exhibit 4-54 and Exhibit 4-57, respectively, were not considered to have CWSs that qualify for a mandatory or on request waiver. Similarly, the analysis did not consider states that had some testing requirements but did not satisfy all LCRR requirements that are also identified in these two exhibits. CWSs in these states are already conducting some of the activities required under the LCRR. However, due to the variation in these state programs, it would have been difficult to capture this partial compliance in the analysis. As a result, this may lead to an underestimation of CWSs that already meet the final LCRR requirements for school and child care testing.

Additional testing that is already happening at schools and child cares may reduce the incremental estimated costs and burden related to school and child care testing under the final LCRR if states waive requirements in these situations.

4.3.10 **Labor Rates**

This section is divided into three subsections:

- 4.3.10.1: presents PWS labor rates,
- 4.3.10.2: presents Primacy Agency labor rates, and
- 4.3.10.3: provides a discussion of data limitations and uncertainty associated with the labor rates.

4.3.10.1 *Public Water System Labor Rates*

EPA recognizes that there may be variation in labor rates across all systems. However, for purposes of this EA, EPA used national-level estimates from *Labor Costs for National Drinking Water Rules* (USEPA, 2011) with a few modifications, as described below.

The 2011 document evaluated three data sources for labor rates:

1. The Occupational Employment Survey (OES), a semi-annual Bureau of Labor Statistics (BLS) survey that provides hourly wage estimates by occupation and industry.
2. The Water Utility Compensation Survey, an annual AWWA survey that provides hourly wage estimates for the water and wastewater industry by occupation. Data are in 2008 dollars.
3. The 2006 CWSS, a periodic EPA survey that obtains employment information from a sample of CWSs.

In 2011, EPA evaluated these data sources against suitability criteria (see Exhibit 4-58) (USEPA, 2011). EPA determined that the 2006 CWSS was the most suitable source for labor rates associated with national drinking water rules particularly because: the data are specific to drinking water; the survey responses can be extrapolated to national estimates since the survey has a known sampling framework; and the data can be organized by system size, source, and ownership (USEPA, 2011).

Exhibit 4-58: Comparison of Wage Rate Surveys

Suitability Criteria	OES (BLS)	AWWA (2008)	2006 CWSS
National average wage rates	Yes Annual updates available	No Sample of systems serving <10,000 people may not be representative of all small systems Annual updates available	Yes Updates are periodic
Data quality	High Statistically precise wage estimates	Unknown Sampling procedures unknown; no information on statistical precision of wage estimates	Moderate Low item response rates among small systems lead to large confidence intervals
Drinking water industry data	No[1]	Yes	Yes
Management, Technical, and Administrative occupations	Yes	No administrative occupation to match WBS needs	Administrative occupation may differ from WBS needs
System size differentiation	No	Yes	Yes
Source water differentiation	No	No	Yes Estimates are not statistically significantly different across source waters

Suitability Criteria	OES (BLS)	AWWA (2008)	2006 CWSS
Ownership differentiation	No	No	Yes Estimates are not statistically significantly different across private and public ownership

Acronyms: AWWA = American Water Works Association; CWSS = Community Water System Survey; BLS = Bureau of Labor Statistics; OES = Occupational Employment Survey; WBS = work breakdown structure.
Source: From Exhibit ES-1 (USEPA, 2011).
Notes:
[1] OES data are available for two North American Industry Classification System (NAICS) categories that are likely to contain drinking water systems: 221300 (Water, Sewage, and Other Systems) for private water systems and 999300 (Local Government) for PWSs.

Exhibit 4-59 presents the labor rate estimates used in USEPA (2011) in 2007 dollars. Labor rates were calculated for four occupation categories: manager, treatment plant operator, administrative personnel, and distribution system operator. The rates include benefits. EPA considered benefit multipliers from BLS and the 2006 CWSS. Benefit multipliers from BLS ranged from 1.3 to 1.5, and benefit multipliers from the 2006 CWSS ranged from 1.2 to 1.4. The BLS estimates are more precise than the 2006 CWSS estimates, but information was not available at the industry level. The CWSS estimates are related to the drinking water industry but have large confidence intervals and low precision. As a result, EPA used a benefit multiplier of 1.4 because: ranges from both sources overlapped at 1.4; the CWSS data do not indicate consistent variations by occupation, water source, or ownership; and the large confidence intervals in the CWSS data tend to overlap between adjacent size categories, indicating that differences in the multiplier among size categories are not statistically significant (USEPA, 2011).

Exhibit 4-59: Hourly Labor Costs Including Wages Plus Benefits (2007$)

System Size (Population Served)	Hourly Labor Cost by Occupation			
	Manager	Treatment plant operator	Administrative personnel	Distribution system operator
≤500	$33.68	$23.76	$22.69	$22.51
501-3,300	$33.68	$23.76	$22.69	$22.51
3,301-10,000	$38.52	$25.35	$22.69	$23.90
10,001-50,000	$42.91	$26.76	$29.30	$26.05
50,001-100,000	$50.07	$27.93	$29.30	$26.74
100,001-500,000	$53.49	$32.64	$29.30	$29.62
>500,000	$56.71	$33.93	$29.30	$32.14

Source: From Exhibit ES-3 (USEPA, 2011). Based on 2006 CWSS (USEPA, 2009).

The general employment cost index (ECI) from BLS for civilian workers in June 2007 (105.1) and 2016 (126.7) was used to adjust the rates from USEPA 2011 to 2016 dollars that yielded a multiplier of 126.7/105.1, or 1.206.

To account for the general composition of staff at systems of smaller sizes, (i.e., those serving 3,300 or fewer people), EPA used only the technical rate (i.e., treatment plant operator rate). For systems serving more than 3,300 people, EPA used proportions of 80 percent technical labor and 20 percent managerial

labor (i.e., manager rate) to arrive at a labor cost, or weighted labor rate. The actual proportions between technical and managerial rates employed may vary by PWS and among the different compliance activities under the final LCRR. However, for simplicity, EPA used the 80/20 proportions as a general assumption to develop system labor costs for this EA. This approach for developing system labor rates is consistent with that used for other economic analyses, such as the Revised Total Coliform Rule (USEPA, 2012).

EPA applied the same system labor rates to both CWSs and NTNCWSs. The final labor rates used in this EA are in column D in Exhibit 4-60 below.

Exhibit 4-60: Weighted Labor Rates for CWSs and NTNCWSs (2016$)

System Size (Population Served)	Technical Labor Rate (2007$/hour)	Managerial Labor Rate (2007$/hour)	Weighted System Labor (2007$/hour)	Weighted System Labor Adjusted to 2016$ (2016$/hour)
	A	B	C = A for PWSs ≤ 3,300); C = (0.8*A) + (0.2*B) for PWSs > 3,300	D = C*(126.7/105.1)
≤3,300	$23.76	$33.68	$23.76	$28.64
3,301-10,000	$25.35	$38.52	$27.98	$33.74
10,001-50,000	$26.76	$42.91	$29.99	$36.15
50,001-100,000	$27.93	$50.07	$32.36	$39.01
>100,000	$32.64	$53.49	$36.81	$44.38

Sources: A, B: Labor Costs for National Drinking Water Rules (USEPA, 2011). Hourly labor costs include wages and benefits. Technical labor wage rates are based on wage rates for treatment plant operators.
Notes:
General: Labor rates for each size category are assumed to be the same regardless of system type (CWSs or NTNCWSs). In general, information in Chapter 4 is presented by the nine size categories used in the SafeWater LCR model. In this exhibit for the final EA, EPA merged size categories with the same hourly rate.
C: EPA estimates that systems serving 3,300 people or fewer use 100 percent technical labor, whereas systems serving more than 3,300 use 80 percent technical (operator) labor and 20 percent managerial (engineer) labor.
D: The weighted system hourly rate was adjusted to 2016 dollars using the general ECI seasonally adjusted (June) for 2007 (105.1) and 2016 (126.7): http://www.bls.gov/web/eci/echistrynaics.pdf.

4.3.10.2 *Primacy Agency Labor Rates*

EPA used the hourly mean state employee labor rate from the BLS from the category "State Government - Environmental Scientists and Specialists, Including Health" as an approximation for the Primacy Agency labor rate. This approximation is a reasonable estimate because the majority of Primacy Agencies are states. The base hourly state labor rate is $36.23 in 2016 dollars. The labor rate is further adjusted using a 1.58 loading factor that reflect additional employee benefits from the BLS Employer Costs for Employee Compensation report, Table 3, September 2016. Percent of total compensation - Wages and Salaries - All Workers - State and Local Government Workers. See worksheet BLS Table 3 in the file, "General Cost Model Input_Final Rule.xlsx." The final "loaded" hourly rate of $57.24 is used for the Primacy Agency labor rate in the SafeWater LCR and is designated with the data variable name of *rate_js*. Calculations and the loaded labor rate are shown in the Exhibit 4-61.

Exhibit 4-61: Loaded Labor Rate for Primacy Agency Staff (2016$)

Base Hourly Labor Cost	Loading Factor	Loaded Hourly Labor Rate (2016$)
		rate_js
A	**B**	**C = A*B**
$36.23	1.58	**$57.24**

Sources:
A: State employee wage rates from National Occupational Employment and Wage Estimates, United States, BLS SOC Code 19-2041, "State Government - Environmental Scientists and Specialists, Including Health," hourly mean wage rate. May 2016 data (published in March 2017): https://stats.bls.gov/oes/2016/May/oes192041.htm. See worksheet OES in the file, "General Cost Model Input_Final Rule.xlsx."
B: Wages are loaded using a factor from the BLS Employer Costs for Employee Compensation report, Table 3, September 2016. Percent of total compensation - Wages and Salaries - All Workers - State and Local Government Workers (https://www.bls.gov/news.release/archives/ecec_12082016.pdf). See worksheet BLS Table 3 in the file, "General Cost Model Input_Final Rule.xlsx."

4.3.10.3 *Discussion of Data Limitations and Uncertainty*

There is uncertainty in the derivation of water system labor rates that could result in an over or underestimate of national costs of the final LCRR. The mean labor rate is based on findings of the 2006 CWSS – see Section 4.2.2 for discussion of the 2006 CWSS as a data source. The labor rate mix may have changed since the time of the survey. Moreover, the labor rate used is a national average and does not capture differences across regions or between urban and rural areas. EPA accounted for general changes in cost of labor by adjusting 2007 values to 2016 using the employment cost index.

There is also uncertainty in assuming a 1.4 benefits multiplier and that a labor mix of 80/20 technical/managerial staff will apply to activities conducted by CWSs and NTNCWSs serving more than 3,300 people. There may be situations where an activity is performed just by technical staff, e.g., sample analysis, or just by managerial staff. This may cause an under or overestimation of cost of the final LCRR.

Similarly, there is uncertainty in the derivation of the state labor rate that could result in an over or underestimation of national cost. The base hourly labor rate is an average rate that is based on the labor category of an environmental scientists and specialist category. Some of the activities undertaken by the Primacy Agency may include support staff, more technical staff, or management staff that have a lower or higher base rate. There is also uncertainty in assuming an average state employee hourly labor rate includes a loading factor of 1.58. This factor, provided by BLS, is an average across all state and local governments and job categories. This assumption could result in an under or overestimation of the state labor costs estimated for the LCRR.

4.4 Uncertainties in the Baseline and Compliance Characteristics of Systems

Uncertainties in the baseline and compliance characteristics of PWSs, which can apply to systems under both the previous rule and LCRR analysis, are due to the limits of available information. The largest sources of uncertainty include the following five variables: 1) the baseline number of systems with LSLs and the percent of connections in those system that are LSLs, 2) the number of PWSs that will exceed the AL and/or TL under the revised tap sampling requirements, 3) the cost of LSL replacement, 4) the

cost of CCT treatment, and 5) the effectiveness of CCT in PWSs with LSLs. EPA is using low and high cost scenarios defined by the assignment of low and high values for the set of uncertain cost drivers listed above to assess the potential impact of these uncertain variables on the costs and benefits of the final LCRR. Detailed descriptions of these five uncertain variables and the derivation of their values under the low and high cost scenarios can be found in Chapter 5, Section 5.2.4.2.

In addition to the uncertainty, which is represented in the cost range, EPA acknowledges that there are other uncertainties associated with the input to the cost-benefit model. EPA has described these uncertainties throughout the text in Chapter 4 and Exhibit 4-62 provides a summary of these uncertainties.

Exhibit 4-62: Summary of Uncertainties in the Baseline and Compliance Characteristics of Drinking Water Systems

Uncertainty Description	Effect on Costs	Effect on Benefits	Relevant Section(s)
System and CCT Characterization			
For PWSs with unknown source type, uncertainty in assigning source type based on the ratio of systems with known primary ground water or surface water sources.	+/-	+/-	4.3.1
Uncertainty in using 2010 census data on average persons per household to estimate number of households served by CWSs.	+/-	+/-	4.3.2
Uncertainty in using retail population to predict average daily flow per PWS in situations where the PWS is a wholesale system that sells water to a consecutive PWS.	+	None	4.3.2
Uncertainty in assuming that all PWSs serving 50,000 or more except "b3" systems[1] have CCT. For those serving 50,000 or fewer, uncertainty in using SDWIS/Fed treatment data to estimate percent with CCT.	+/-	+/-	4.3.3
Uncertainty in assuming that flow is proportioned equally among all entry points in a given system.	+/-	+/-	4.3.6
Uncertainty in using historical CWSS data as analyzed in the Geometries document (USEPA, 2000) to predict population/flow relationships given water efficiency trends over the last 20 years.	+	None	4.2.3 4.3.6
Uncertainty in estimated percent of PWSs with pH adjustment only, orthophosphate only, or both based on SDWIS/Fed historical data. Uncertainty in using SYR3 ICR dataset to estimate baseline pH and orthophosphate concentration.	+/-	+/-	4.3.6

Uncertainty Description	Effect on Costs	Effect on Benefits	Relevant Section(s)
Lead Service Line Characterization			
For CWSs, uncertainty in using survey data to estimate 1) percent with LSLs, and 2) percent of service connections that are lead within CWSs that are known to have LSLs.	+/-	+/-	4.2.4 4.2.5 4.3.4
For CWSs, uncertainty in adjustments to LSL estimates from the 1991 RIA to account for LSL infrastructure replacement and system consolidation.	+/-	+/-	4.3.4
For NTNCWS, uncertainty in using data from 2 states to estimate percent of systems with LSLs. Uncertainty in assumptions related to percent of connections that are lead within NTNCWSs that are known to have LSLs.	+/-	+/-	4.3.4.2
For CWSs and NTNCWSs, uncertainty in using LSL survey data that did not explicitly ask systems to consider galvanized service lines that were ever downstream of LSL.	-	`	4.3.4
Uncertainty in using LSLR milestone data and 90th percentile levels from SDWIS/Fed to estimate the length of time CWSs and NTNCWSs would replace LSLs under the previous rule.	+/-	+/-	4.3.4.3
Lead and Copper Tap Sample 90th Percentile Levels			
Uncertainty in using historical SDWIS/Fed 90th percentile lead data from 2007 – 2015 to predict future 90th percentile lead levels and percent of systems that would have no TLE, a TLE but no ALE, and an ALE under previous rule conditions.	+/-	+/-	4.2.1 4.3.5.1
Uncertainty in using historical SDWIS/Fed 90th percentile data from 2007 – 2015 to predict future 90th percentile lead levels and percent of systems with no TLE, a TLE but no ALE, and an ALE under final LCRR conditions. Includes adjustments for final LCRR requirement for LSL systems to collect all samples from locations served by an LSL (as opposed to 50 percent under the previous rule).	+/-	+/-	4.2.1 4.3.5.1
Uncertainty in using a subset of CWSs with known LSL status to predict future 90th percentile values.	+/-	+/-	4.3.5.1
Uncertainty in using data from a single state (Michigan) to estimate the impact on the lead 90th percentile levels that will be based on fifth liter vs. first liter samples under the final LCRR for LSL systems.	+/-	+/-	4.2.7 4.3.5.1
Uncertainty in basing the likelihood of a sample exceeding 15 µg/L based on data from a single state (Michigan).	+/-	+/-	4.2.7 0
Uncertainty in basing the likelihood a system has a copper ALE based on historical Cu90 data reported for 2012 – 2015.	+/-	+/-	4.3.5.3

Uncertainty Description	Effect on Costs	Effect on Benefits	Relevant Section(s)
Lead and WQP Monitoring Schedules			
Uncertainty in using historical P90, Cu90, milestone, treatment, and violation data from SDWIS/Fed to estimate the tap sampling schedules for systems under previous rule conditions.	+/-	+/-	4.3.7.1
Uncertainty in using schedule based on historical P90, Cu90, milestone, treatment, and violation data from SDWIS/Fed to estimate initial WQP schedules under the previous and final rule.	+/-	+/-	4.3.7.2
Change in Source or Treatment			
Uncertainty in using historical information on source water type from SDWIS/Fed to estimate the percent of systems that will change source each year. May underestimate costs by not counting when the same type of source was added and removed at a system in a given year.	-	+/-	4.2.1 4.3.8.1
Uncertainty in using historical treatment code data from SDWIS/Fed to estimate the percent of systems making a treatment change each year.	+/-	+/-	4.2.1 4.3.8.3
Schools, Child Cares, Local Health Departments, and Targeted Medical Providers			
Uncertainty in number of schools based on NCES data for 2016 – 2017 (NCES, 2018a) due to population growth.	-	None	0 4.3.9.1
Uncertainty in number of child cares based on 2017 industry statistics (CED, 2019) due to potential inclusion of unlicensed at-home facilities.	+	None	0 4.3.9.1
Uncertainty in identification of local health agencies number based on 2016 statistics (NACCHO, 2017).	No effect on incremental costs. Requirement to deliver to this group is the same under the previous and final rules.	None	0 4.3.9.1
Possible underestimation of states that may grant waivers to CWSs for sampling in schools and child cares because it does not consider states that target a subset of these facilities or require one round of testing.	+	None	4.3.9.2
Labor Rates			
Uncertainty in using 2006 CWSS data for PWS labor rates, 1.4 benefits multiplier, and 80/20 technical/managerial staffing mix for PWSs serving more than 3,300 people.	+/-	None	4.3.10.1

Uncertainty Description	Effect on Costs	Effect on Benefits	Relevant Section(s)
Uncertainty in basing the State labor rate on the wage rate category for Environmental Scientists and Specialists (activities may be done by staff with higher or lower rates) and uncertainty in using a single benefits loading factor of 1.58 for employee compensation.	+/-	None	4.3.10.2

Acronyms: ALE = action level exceedance; CED = Committee for Economic Development; Cu90 = copper 90th percentile value; CCT = corrosion control treatment; CWS = community water system; CWSS = Community Water System Survey; LCRR = Lead and Copper Rule revisions; LSL = lead service line; LSLR = lead service line replacement; NACCHO = National Association of County and City Health Officials; NCES = National Center for Education Statistics; NTNCWS = non-transient non-community water system; P90 = lead 90th percentile value; PWS = public water system; RIA = regulatory impact assessment; SDWIS/Fed = Safe Drinking Water Information System – Federal version; SYR3 ICR = Six-Year Review 3 Information Collection Request; TLE = trigger level exceedance.

Notes:

General: This exhibit indicates whether each uncertainty factor contributes to understating (-), overstating (+), or either understating or overstating (+/-) the overall economic impact results.

[1] Excluded 11 CWSs serving 50,000 that were assumed to meet the b3 criteria, i.e., have naturally non-corrosive water, and under the previous rule are not required to install CCT. See Section 4.3.3 for additional information.

4.5 References

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5 Economic Impact and Cost Analysis of the Final Lead and Copper Rule Revisions

5.1 Introduction

In this chapter the United States Environmental Protection Agency (EPA) presents its estimates of, and approach to estimate, the national cost of the final Lead and Copper Rule revisions (LCRR). To determine the national cost of the final LCRR, EPA estimated the additional costs public water systems (PWSs), households, and Primacy Agencies will incur in response to the final LCRR, above the cost they would face under the previous Lead and Copper Rule (LCR) if no revisions were enacted. To determine the incremental cost of the final LCRR, the Agency first calculated the costs that would be incurred in continuing to comply with the previous LCR. Next, the Agency estimated the cost PWSs, households, and Primacy Agencies would incur in response to the final LCRR if no rule were currently in place. The national cost of the final LCRR, or incremental cost, is the difference between the cost of compliance with the final LCRR and the cost of compliance with the previous LCR.

5.1.1 Summary of Rule Costs

The annualized costs, discounted at 3 percent and 7 percent, that PWSs, households, and Primacy Agencies will incur in complying with the previous LCR and the final LCRR are summarized Exhibit 5-1 and Exhibit 5-2, respectively. EPA used these discount rates as prescribed by the Office of Management and Budget (OMB Circular A-4, 2003). See Section 5.2.4.3 below for additional information on discounting. EPA estimated costs of the final LCRR under both low cost and high cost scenarios to reflect uncertainty in the cost estimates. The low cost scenario and high cost scenario differ in their assumptions made about: 1) the existing number of lead service lines (LSLs) in PWSs; 2) the number of PWSs above the action level (AL) or trigger level (TL) under the previous and final monitoring requirements; 3) the cost of installing and optimizing corrosion control treatment (CCT); 4) the effectiveness of CCT in mitigating lead concentrations; and 5) the cost of lead service line replacement (LSLR). EPA discusses these assumptions in more detail below and in Section 5.2.4.2.

The incremental annualized cost of the final LCRR ranges from $161 to $335 million at a 3 percent discount rate, and from $167 to $372 million at a 7 percent discount rate in 2016 dollars. The exhibits also detail the proportion of the annualized costs attributable to each rule component.

Exhibit 5-1: National Annualized Rule Costs - All PWSs at 3 Percent Discount Rate (2016$)

	Low Cost Estimate			High Cost Estimate		
	Previous LCR[1]	Final LCRR	Incremental	Previous LCR[1]	Final LCRR	Incremental
PWS Annual Costs						
Sampling	$41,962,000	$67,744,000	$25,782,000	$45,099,000	$78,739,000	$33,641,000
PWS LSLR	$628,000	$44,372,000	$43,744,000	$27,277,000	$140,242,000	$112,965,000
Corrosion Control Technology	$344,483,000	$363,894,000	$19,412,000	$385,681,000	$471,087,000	$85,407,000
Point-of Use Installation and Maintenance	$0	$3,418,000	$3,418,000	$0	$20,238,000	$20,238,000
Public Education and Outreach	$345,000	$37,207,000	$36,861,000	$1,467,000	$45,461,000	$43,994,000
Rule Implementation and Administration	$0	$2,576,000	$2,576,000	$0	$2,576,000	$2,576,000
Total Annual PWS Costs	$387,417,000	$519,210,000	$131,792,000	$459,523,000	$758,343,000	$298,820,000
State Rule Implementation and Administration	$6,145,000	$25,852,000	$19,707,000	$7,137,000	$27,893,000	$20,756,000
Household LSLR	$182,000	$8,100,000	$7,918,000	$5,466,000	$19,542,000	$14,076,000
Wastewater Treatment Plant Costs	$161,000	$1,313,000	$1,152,000	$695,000	$2,523,000	$1,828,000
Total Annual Rule Costs	$393,904,000	$554,475,000	$160,571,000	$472,821,000	$808,301,000	$335,481,000

1. Previous LCR costs are projected over the 35-year period of analysis and are affected by EPA's assumptions on five uncertain variables which vary between the low and high cost scenarios. The low/high variable assignments for the number of LSLs, CCT cost and effectiveness, LSLR costs, and the 90th percentile tap sample assignments for non-LSL systems are consistent across the previous rule and final LCRR projections. The 90th percentile tap sample assignments for LSL systems varies between the previous rule and final LCRR. Details may not add exactly to total due to independent rounding.

Exhibit 5-2: National Annualized Rule Costs - All PWSs at 7 Percent Discount Rate (2016$)

	Low Cost Estimate			High Cost Estimate		
	Previous LCR[1]	Final LCRR	Incremental	Previous LCR[1]	Final LCRR	Incremental
PWS Annual Costs						
Sampling	$40,890,000	$70,197,000	$29,307,000	$45,164,000	$84,407,000	$39,243,000
PWS LSLR	$667,000	$46,803,000	$46,136,000	$38,327,000	$169,562,000	$131,235,000
Corrosion Control Technology	$322,684,000	$340,307,000	$17,623,000	$364,809,000	$457,554,000	$92,745,000
Point-of Use Installation and Maintenance	$0	$3,308,000	$3,308,000	$0	$19,928,000	$19,928,000
Public Education and Outreach	$471,000	$36,555,000	$36,084,000	$2,016,000	$45,628,000	$43,612,000
Rule Implementation and Administration	$0	$4,147,000	$4,147,000	$0	$4,147,000	$4,147,000
Total Annual PWS Costs	$364,711,000	$501,316,000	$136,605,000	$450,316,000	$781,224,000	$330,908,000
State Rule Implementation and Administration	$6,073,000	$26,949,000	$20,876,000	$7,429,000	$29,645,000	$22,216,000
Household LSLR	$193,000	$8,587,000	$8,393,000	$7,681,000	$24,409,000	$16,728,000
Wastewater Treatment Plant Costs	$211,000	$1,669,000	$1,458,000	$1,097,000	$3,705,000	$2,607,000
Total Annual Rule Costs	$371,188,000	$538,521,000	$167,333,000	$466,523,000	$838,983,000	$372,460,000

1. Previous LCR costs are projected over the 35-year period of analysis and are affected by EPA's assumptions on five uncertain variables which vary between the low and high cost scenarios. The low/high variable assignments for the number of LSLs, CCT cost and effectiveness, LSLR costs, and the 90th percentile tap sample assignments for non-LSL systems are consistent across the previous rule and final LCRR projections. The 90th percentile tap sample assignments for LSL systems varies between the previous rule and final LCRR. Details may not add exactly to total due to independent rounding.

5.1.2 Overview of the Chapter

In Section 0, EPA provides an overview of its approach to estimate the cost of the final LCRR. In Section 5, EPA provides the data and algorithms used to calculate the cost of each activity PWSs will undertake to comply with the final rule. In addition, Section 5 provides EPA's estimates of these costs. In Section 5.4, EPA provides the data and algorithms used to calculate the cost of each activity Primacy Agencies will undertake to implement and administer the final rule, as well as EPA's estimates of these costs. While this chapter includes EPA's national cost estimates for both the previous LCR and final LCRR, only details on the approach, data, and algorithms used to calculate the costs of the final LCRR are provided in this chapter. The details on the approach, data, and algorithms used to calculate the costs of the previous LCR are provided in Appendix B.

An important compliance option for PWSs is to add additional phosphate for corrosion control. Some of this phosphate may eventually enter wastewater treatment plants (WWTPs). In Section 5.5, EPA estimates the costs and impacts associated with increased phosphorous loadings.

5.2 Cost Modeling Method

Section 0 begins with an overview of the SafeWater Lead and Copper Rule (LCR) model that EPA used to estimate the costs, as well as the benefits, of the final LCRR (Section 5.2.1). EPA next describes the development of the SafeWater CBX model (Section 5.2.2 and Section 5.2.3). In Section 5.2.4, a number of topics are discussed in subsections: the modification of the SafeWater CBX model for use with the treatment technique LCR; the development of the low and high cost scenarios that characterize uncertainty for the regulatory cost estimates; the assignment of low and high variable values for the scenarios; the use of model PWSs; how data was developed for very large systems; the period of analysis; annualization discount rates; the compliance schedule for the final rule; and simulating compliance activities in the SafeWater LCR model.

5.2.1 Overview of the SafeWater LCR Model

In order to estimate the compliance costs (and benefits) of the final LCRR, EPA developed a new variant of its existing SafeWater CBX model, which is designed to estimate the impacts of a maximum contaminant level (MCL) based rulemaking. This new model, called the SafeWater LCR model, is designed to estimate the costs and benefits of a treatment technique rule, and focuses on water contamination in the distribution system.

Like previous versions of the model, this new model improves the accuracy of estimated cost values by incorporating the large degree of variability across water system baseline characteristics that influence compliance and costs. For example, under the final LCRR, PWSs will face different compliance scenarios and costs depending on their size, primary source water type, number of entry points to the distribution system,

number of LSLs in their distribution system, and existing corrosion controls in place. The SafeWater LCR model also includes variability in compliance characteristics like different labor rates and number of tap and water quality parameter (WQP) samples required by system size.

Compared to the SafeWater CBX MCL model, this new treatment technique model is more complex incorporating multiple compliance triggers (e.g., AL exceedance, TL exceedance, single sample exceedance/find-and-fix) that require multiple and varying compliance actions (LSLR, CCT installation or re-optimization, find-and-fix, public education). The complexity of the final LCRR treatment technique means there are significantly more required inputs for the estimation of total compliance costs. Many of these inputs, which are specific to the assessment of the cost impacts of the final LCRR, are uncertain. EPA only has limited data, including midpoint and/or high and low estimates available and does not have robust information on the relative likelihood of the available estimates for these inputs. The inability to fully assess the level or distribution of model variables affects the following major final LCRR compliance cost drivers: the number of PWSs that will exceed the AL and TL under the final tap sampling requirements; the baseline number and geographic distribution of LSLs; the cost of LSL replacement; the cost of CCT treatment; and the effectiveness of CCT in PWSs with LSLs. EPA determined it does not have enough information to perform a Monte-Carlo based uncertainty analysis as part of the SafeWater LCR model. Instead, in order to capture uncertainty, EPA estimated compliance costs (and benefits) using the SafeWater LCR model under high and low bracketing scenarios.

In Section 5.2.2, the development history of the SafeWater modeling platform is discussed, including the first version of the model used in the estimation of cost for the 2001 final Arsenic Rule, the inclusion of uncertainty assessment and benefits valuation in the SafeWater CBX model, and the external peer review of the model and relevant changes as a result of the peer review. Section 5.2.4 details the development of the SafeWater LCR model, the lack of information to describe the uncertainty in major LCR cost drivers, and the high and low cost bracketing scenarios ultimately used to capture a broad understanding of uncertainty in the costs of the final LCRR.

5.2.2 History of SafeWater Model Development

The first version of the SafeWater model platform, known as SafeWater XL, was developed to estimate costs for the 1997 proposal for the Arsenic Rule. The model platform has been under continual development to improve its function since that time. Prior to 1997, EPA used mean unit cost inputs when calculating the national costs of drinking water regulations. Mean values were typically assigned to all PWSs within a category. Each category was defined by system attributes, including population served, source water type, and ownership type (e.g., publicly owned ground water systems serving 100-500 people). In other words, all PWSs in a given category were assumed to be identical and face identical compliance costs.

The SafeWater model was developed in response to the recognition that PWSs have a great deal of inherent variability even within each category and that ignoring this variability can result in inaccurate compliance cost estimates. These inaccuracies often result from cost functions being non-linear in their inputs.

The model allows input values to vary across and within PWS types, which makes it possible to output not only the mean estimate of costs, but also distributions that show how costs vary across PWSs.

Based on a better understanding of the level of variability among PWSs, and the importance of modeling variability among PWSs, EPA changed its cost modeling approach during the development of the National Primary Drinking Water Regulations (NPDWR) for Arsenic. To estimate the national costs of the Arsenic Rule, EPA developed an Excel based model[78] that incorporated the large variability among systems within each system size and source water category. This avoided the prior problem of treating all PWSs in a category as if they are identical and equal to the "average" system.

This model was subjected to extensive review by the National Drinking Water Advisory Council (NDWAC). Concurrent with the NDWAC's review of the Arsenic Rule cost analysis, EPA's Science Advisory Board (SAB) made a series of recommendations to improve the estimation of the health benefits of the Arsenic Rule.

5.2.3 Development of SafeWater CBX

The second phase of the development of the SafeWater platform began in 2002. The goal being to have a single, customizable model that with the appropriate user inputs and data, could estimate both the costs and benefits of any new or revised MCL based drinking water standard while employing a consistent and standard modeling approach across rules. This next generation of the model was called SafeWater CBX. The model was designed to incorporate not only the PWS variability and compliance data on costs but also variability on the exposure and risk impacts when computing benefits estimates at the same time. As suggested by the NDWAC Arsenic Rule peer reviewers, the model also incorporated the uncertainty in input values in order to estimate the confidence in the cost and benefit estimates.

5.2.3.1 *Modeling PWS Variability in SafeWater CBX*

As discussed above, the costs incurred by a PWS depend on particular water system characteristics. The values for some of these characteristics for the PWS are reported in the federal version of the Safe Drinking Water Information System (SDWIS/Fed). The SDWIS/Fed data provide information on the PWS characteristics that typically define PWS categories, or strata, for which EPA develops costs in rulemakings:

1. System type (community water system (CWS), non-transient non-community water system (NTNCWS))
2. Number of people served by the PWS

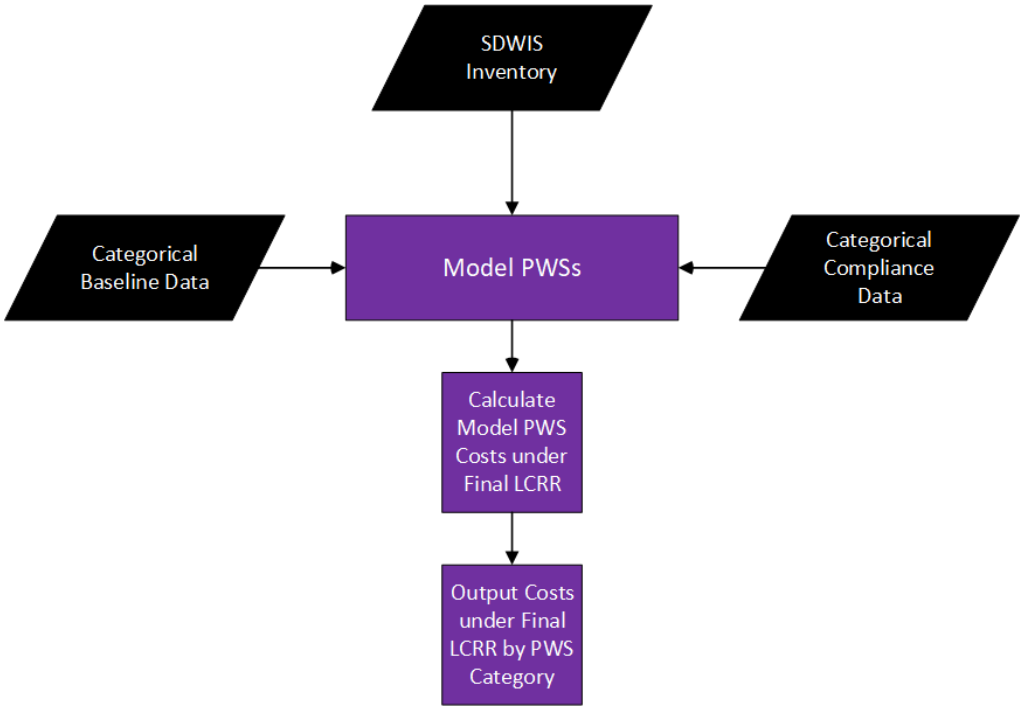
[78] EPA used the SafeWater XL model for the Arsenic Rule and the GREAT model (which utilized a very similar modeling methodology) for the Ground Water Rule.

3. PWS's primary raw water source (ground water or surface water)
4. PWS's ownership type (public or private)
5. Location
6. Number of service connections

Since EPA does not have complete PWS specific data across the 50,067 CWSs and 17,589 NTNCWS in SDWIS/Fed for many of the baseline and compliance characteristics necessary to estimate costs and benefits, such as average and daily flow rates, water quality characteristics, treatment in-place, and labor rates, EPA adopted a "model PWS" approach. SafeWater CBX creates model PWSs by combining the PWS-specific data available in SDWIS/Fed with data on baseline and compliance characteristics available at the PWS category level. In some cases, the categorical data are simple point estimates. In this case, every model PWS in a category is assigned the same value. In other cases, where more robust data representing system variability are available the category-level data includes a distribution of potential values. In the case of distributional information, SafeWater CBX assigns each model PWS a value sampled from the distribution.

Because of this model PWS approach, SafeWater CBX does not output any results at the PWS level, but rather, outputs cost and benefit estimates for 36 PWS categories, or strata. Each PWS category is defined by the system type (CWS and NTNCWS), primary water source (ground or surface), and size category (there are nine). In order to ensure stability in results, each PWS category must have a large enough number of the model PWSs to capture the full range of potential variability in the data.

Exhibit 5-3: Model PWS Approach Utilized by SafeWater CBX to Model PWS Variability



As illustrated in Exhibit 5-3, once all the model PWSs are created and assigned baseline and compliance characteristics, SafeWater CBX estimates the cost and benefits of compliance for each model PWS under the final rule. For each PWS category, the model then calculates summary statistics that describe the costs and benefits associated with final LCRR compliance. These summary statistics include total costs and benefits, total costs per final regulatory requirement, total benefits per final regulatory requirement, the variability in PWS-level costs (i.e., 10th, 25th, 75th, and 90th percentile system costs), and the variability in household-level costs.

5.2.3.2 *Modeling Uncertainty in SafeWater CBX*

Many of the input values used to calculate the costs of drinking water regulations are not known with certainty. For example, technology unit costs, population served to drinking water treatment plant flow relationships, and contaminant occurrence are all uncertain. Prior to the development of SafeWater CBX, past modeling approaches have used “best estimates” or mean values for these inputs when calculating the

benefits and costs of drinking water regulations. SafeWater CBX instead allows input parameters to be treated as uncertain when data are available to characterize the underlying distribution of these parameters.

Incorporating input uncertainty into the calculation of costs and benefits is important for the same reasons it is important to incorporate input variability. First, calculating costs and benefits at the mean values will lead to inaccurate estimates if costs and/or benefits are not linear in these input parameters. Second, by incorporating input uncertainty it is possible to output not only estimates of costs, but also distributions that show how confident EPA is in these estimates, when the underlying data are sufficiently robust to characterize input uncertainty.

SafeWater CBX allows analysts to use a standard Monte-Carlo approach for modeling uncertainty when sufficient data are available to characterize the full distribution. When using the Monte-Carlo approach, for each iteration of the model, SafeWater CBX randomly pulls a value for each uncertain input.[79] Using these input values, SafeWater CBX calculates the costs for all model PWSs and calculates the costs at each PWS category. It then randomly pulls new values for each uncertain input and repeats the process. This process is repeated many times until the results become stable (i.e., additional iterations do not significantly change the output).

5.2.3.3 *External Peer Review of SafeWater CBX*

SafeWater CBX's Beta version was completed in 2010. In that same year, EPA conducted an external letter peer review of the model by three economists (IntelliTech Systems, Inc., 2010). As a result of some of the comments, EPA added a number of additional pre-programmed outputs to the model code including: scalable contaminant occurrence graphs, the calculation of net benefits, and graphical representations of marginal costs and benefits. Two computational improvements were also made. SafeWater CBX was modified to allow for regional differences in contaminant occurrence and a water loss percentage was included to account for the treatment costs of water associated with firefighting and leakages.

5.2.4 **Overview of SafeWater LCR**

SafeWater CBX was designed to calculate the costs and benefits associated with setting a new or revised MCL. Since the final LCRR is a treatment technique rule, and focuses on water contamination in the distribution system, significant changes needed to be made to the existing model framework. This next version of the model is the SafeWater LCR model. The changes in the new model were driven by the need to model multiple compliance triggers (e.g., AL exceedance, TL exceedance, individual tap sample AL exceedance/find-and-fix) that require multiple

[79] Note: For each uncertainty iteration, if an uncertain input does not vary across PWSs in a category, SafeWater CBX will draw a point estimate from the uncertainty distribution and assign it to every model PWS in a category. If, however, an uncertain input does vary across PWSs in a category, SafeWater CBX will draw a probability distribution that defines the variability and assign from this distribution different point estimates to each model PWS in a category.

compliance actions (LSLR, CCT installation or re-optimization, find-and-fix, public education). The complexity of this treatment technique also means there are many more required inputs for the estimation of total compliance costs than is the case for an MCL based rulemaking.

5.2.4.1 *Modeling PWS Variability in the SafeWater LCR Model*

To reflect variability across PWS categories in modeling the final LCRR, the SafeWater LCR model applies the same "model PWS" approach developed in SafeWater CBX. From a set of system baseline characteristic data including system type, system size, and primary water source, EPA defined PWS categories in the SafeWater LCR model. The SafeWater LCR model creates model PWSs representing systems in each category by combining the PWS-specific data available in SDWIS/Fed with data on baseline and compliance characteristics available at the PWS category level. When categorical data are point estimates, every model PWS in a category is assigned the same value. When EPA has robust data representing system variability, the category-level data includes the categorical data as a distribution of potential values. In the case of distributional information, the SafeWater LCR model assigns each model PWS a value sampled from the distribution. Examples of the distributional data inputs that characterize variability in the SafeWater LCR model include the number of distribution system entry points, and the burden for PWS and Primacy Agency staff to conduct tasks like sampling and compliance documentation and review. For additional detail on the development of model-PWSs in the SafeWater LCR model, see Appendix B, Section B.2.1.

5.2.4.2 *Modeling Uncertainty in the SafeWater LCR Model*

The available LCR data limit EPA's ability to quantify uncertainty in the SafeWater LCR model. During the development of the SafeWater LCR model, it became clear that not only were many of the inputs uncertain, but for many LCR specific inputs, EPA only has limited midpoint, high, and low estimates available and does not have information on the relative likelihood of the available estimates. This included major drivers of the cost of compliance, including:

1. Baseline number of LSLs
2. Likelihood a model PWS will exceed the AL and/or TL under the previous rule and the final LCRR
3. The effectiveness of CCT installation or re-optimization
4. LSLR unit costs
5. CCT unit Costs

Therefore, EPA determined it does not have enough information about the level or distribution of uncertainty to conduct a Monte-Carlo based uncertainty analysis as part of the SafeWater LCR model. Instead, EPA estimated final LCRR compliance costs under two scenarios, one for low

cost and one for high cost, defined by these five uncertain cost drivers. Descriptions of these uncertain variables and the derivation of their values under the low and high cost scenarios follows.

5.2.4.2.1 Baseline Number of Lead Service Lines

The number of LSLs in the United States is a key input to calculating costs of the LCRR. Systems with LSLs have unique requirements and different burden and costs compared to non-LSL systems under the previous rule and LCRR. EPA recognizes that the characterization of the national LSL inventory is uncertain and has a significant impact on estimated costs and benefits of the LCRR. In order to capture the uncertainty associated with this variable, EPA developed low and high model inputs that correspond to two key parameters related to the LSL inventory: 1) the percent of systems with LSLs, and 2) the percent of service connections that are lead within systems that are known to have LSLs. The derivation of these input variables for the low cost scenario, which assumed 6,286,963 LSLs distributed nationwide, is described in detail in Chapter 4, Section 4.3.4.1 based on data from Cornwell et al. (2016). EPA used data the 1991 Regulatory Impact Assessment (RIA) (USEPA, 1991) to generate the high cost scenario estimate of these LSL inventory parameters. The RIA assumed that 10,274,845 LSLs existed nationwide in 1988. Based on this initial number, EPA adjusted the value to 9,239,141 for the year 2024. This adjustment is also described in Chapter 4, Section 4.3.4.1. Exhibit 5-4 summarizes the LSL inventory information used in the estimation of the LCRR. EPA assumed that a significant majority of systems serving 50,000 persons or fewer that have installed CCT under the previous LCR have done so because the presence of LSLs in their system has caused the system to exceed the lead AL.

Exhibit 5-4: Percent of CWSs with CCT that have LSLs, Percent of CWSs without CCT that Have LSLs, and Percent of Connections that Are Lead in CWSs with LSLs under Low and High Cost Scenarios [1]

CWS Size Category	High Cost Scenario			Low Cost Scenario		
	Percent CWSs with LSLs by CCT Status *(p_lsl)*[3]		Percent of Connections that are Lead in CWSs with LSLs *(perc_lsl)*	Percent CWSs with LSLs by CCT Status *(p_lsl)*[3]		Percent of Connections that are Lead in CWSs with LSLs *(perc_lsl)*
	Have CCT	No CCT		Have CCT	No CCT	
≤100	100%	3.6%	86.9%	100%	9.9%	14.5%
101-500	100%	1.6%	89.2%	100%	2.2%	16.6%
501-1,000	100%	13.0%	88.8%	75%	0.0%	17.7%
1,001-3,300	100%	0.6%	29.4%	56%	0.0%	17.1%
3,301-10,000	84%	0.0%	21.0%	42%	0.0%	17.6%

CWS Size Category	High Cost Scenario			Low Cost Scenario		
	Percent CWSs with LSLs by CCT Status *(p_lsl)*[3]		Percent of Connections that are Lead in CWSs with LSLs *(perc_lsl)*	Percent CWSs with LSLs by CCT Status *(p_lsl)*[3]		Percent of Connections that are Lead in CWSs with LSLs *(perc_lsl)*
	Have CCT	No CCT		Have CCT	No CCT	
10,001-50,000	69%	0.0%	14.2%	60%	0.0%	27.1%
50,001-100,000	45%	0.0%	10.0%	53%	0.0%	11.0%
100,001-1,000,000	63%	0.0%	12.5%	49%	0.0%	9.2%
> 1,000,000[2]	65%	0.0%	24.2%	57%	0.0%	9.4%

[1] Low cost scenario data are replicated from Exhibit 4-13 and Exhibit 4-14. High cost scenario data are replicated from Exhibit 4-10 and Exhibit 4-11.
[2] Values presented for systems serving > 1 million people are only used when EPA does not have specific data collected from individual systems.
[3] The percentages of systems with LSLs are within each category of CCT status and do not need to sum to 100 percent. They represent the percent of systems with LSLs of the systems within the given "Have CCT" or "No CCT" category of systems.

5.2.4.2.2 Percent of Model PWSs that are Expected to Exceed the AL and/or TL under the Previous Rule and the Final LCRR

As described in Chapter 4, Section 4.3.5.1, the likelihood a model PWS would have an initial lead 90th percentile value (P90) not greater than the TL, greater than the TL but not greater than the AL, or greater than the AL is based on SDWIS/Fed historical 90th percentile lead data from 2007 to 2015. EPA recognizes that there are uncertainties in predicting the future percent of systems having 90th percentile values that fall within the set of three ranges (not greater than the TL, greater than the TL but not greater than the AL, or greater than the AL) from historical SDWIS data. Also, the Agency recognizes that these uncertainties could have a significant impact on estimated costs and benefits of the final LCRR. Therefore, EPA developed two sets of expected percentages for placement of model PWSs into one of the three possible 90th percentile -ranges. Because the implementation of a number of final rule requirements are driven by TL and AL exceedances, the greater the estimated percent of systems above those levels the greater the total final rule costs. Therefore, the low cost scenario uses data derived from the lowest 90th percentile value each PWS reported in SDWIS/Fed between 2007 to 2015. The data used in the high cost scenario is derived by using the highest 90th percentile value each PWS reported in SDWIS/Fed between 2007 to 2015. Exhibit 5-5 provides the likelihood a model PWS, with or without LSLs, would be assigned a 90th percentile in each of the 90th percentile-ranges by the SafeWater LCR model under the previous rule in the low and high cost scenarios.

Exhibit 5-5: Likelihood of Initial Model PWS 90th Percentile Placement under Previous LCR

Category	No LSLs	Has LSLs
Low Estimate		
No TLE/ALE (P90 ≤10 µg/L)	97%	99%
TLE (10 µg/L < P90 ≤15 µg/L)	0%	1%
ALE (P90 > 15 µg/L)	2%	0%
High Estimate		
No TLE/ALE (P90 ≤10 µg/L)	87%	79%
TLE (10 µg/L < P90 ≤15 µg/L)	7%	12%
ALE (P90 > 15 µg/L)	6%	9%

Acronyms: ALE = action level exceedance; PWS = Public water system; LSL = lead service line; P90 = lead 90th percentile level; TLE = trigger level exceedance.
Note: Data in this exhibit replicates data provided in Chapter 4, Exhibit 4-19.

As discussed in Chapter 4, Section 4.3.5.14.3.5.1, under the final LCRR, EPA estimated the percent of CWSs with no TLE or ALE, a TLE, or an ALE using historical SDWIS/Fed 90th percentile tap sample data (as done for the previous rule) with two important adjustments:

1. An adjustment to reflect the new requirement for LSL systems to collect all samples from LSL sites where possible, as opposed to the previous rule minimum of 50 percent of samples being collected from LSL sites.
2. An adjustment to reflect new requirements for LSL systems to collect fifth liter samples from LSL sites instead of first liter samples (as required under the previous rule).

Exhibit 5-6 provides the likelihood a model PWS, with or without LSLs, would be assigned a 90th percentile in each of the 90th percentile -ranges by the SafeWater LCR model under the final rule in the low and high cost scenarios.

Exhibit 5-6: Likelihood of Initial Model PWS 90th Percentile Placement under Final LCRR

Category	No LSLs	Has LSLs
Low Estimate		
No TLE/ALE (P90 ≤10 µg/L)	97%	89%
TLE (10 µg/L < P90 ≤15 µg/L)	0%	5%

ALE (P90 > 15 µg/L)	2%	6%
High Estimate		
No TLE/ALE (P90 ≤10 µg/L)	87%	58%
TLE (10 µg/L < P90 ≤15 µg/L)	7%	12%
ALE (P90 > 15 µg/L)	6%	30%

Acronyms: ALE = action level exceedance; PWS = public water system; LCRR = Lead and Copper Rule revisions; LSL = lead service line; P90 = lead 90th percentile level; TLE = trigger level exceedance

Note: Data in this exhibit replicates data provided in Chapter 4, Exhibit 4-20.

5.2.4.2.3 Effectiveness of CCT Installation or Re-optimization

The effectiveness of CCT installation or re-optimization is uncertain, given variability in system specific water quality, the flow rate of water through the distribution system, and the possibility that other competing treatment requirements may exist for individual systems because of other NPDWRs that may limit the full effectiveness of CCT. This uncertainty can have an impact on the estimated cost of all modeled systems required to install or re-optimize CCT under both the previous and final LCRR. This impact on cost follows from the rule structure with systems that continue to exceed the TL and AL being required to take additional actions (e.g., increase frequency of sampling, LSLR, and public education). In determining the likely ranges of effectiveness among PWSs under the low and high cost scenarios, EPA made the following assumptions:

1. There is no difference between the effectiveness of a new installation of CCT or the re-optimization of existing CCT under the final LCRR as systems are assumed to get to the same endpoint of orthophosphate dose or pH adjustment through either process.

2. For PWSs with no LSLs, CCT is always effective enough to ensure the model PWS's post installation or re-optimization 90th percentile is always lower than or equal to the TL.

3. Under the low cost scenario, CCT is highly effective in lowering lead levels in model PWSs with LSLs. Ninety percent of PWSs that begin with a 90th percentile greater than the AL will reach a 90th percentile lower than or equal to the TL after CCT installation or re-optimization. The remaining 10 percent will have a 90th percentile greater than the TL but not greater than the AL after installing or re-optimizing CCT. All PWSs that begin with a 90th percentile greater than the TL but not greater than the AL will have a 90th percentile below or equal to the TL after CCT installation or re-optimization.

4. Under the high cost scenario, CCT is somewhat less effective in lowering lead levels in model PWSs with LSLs. Seventy-five percent of PWSs that begin with a 90th percentile greater than the AL will reach a 90th percentile lower than or equal to the TL after CCT installation or re-optimization. The remaining 25 percent will have a 90th percentile greater than the TL but not greater than the AL after installing or re-optimizing CCT. Ninety percent of PWSs that begin with a 90th percentile greater than the TL but not greater than the AL will have a

90th percentile below or equal to the TL after CCT installation or re-optimization. The remaining 10 percent will not be able to lower their 90th percentile to the TL or below.

The assumptions about CCT effectiveness under the low and high cost scenarios are summarized in Exhibit 5-7 and Exhibit 5-8.

Exhibit 5-7: Low Cost Scenario Assumptions for CCT Effectiveness Likelihood of Change in Post CCT Installation or Re-optimization $P90_{y+1}$ Range

$P90_{y+1}$-Range Prior to Change in CCT	Likelihood $P90_{y+1}$ greater than the TL and not greater than the AL after change in CCT		Likelihood $P90_{y+1}$ not greater than the TL after change in CCT	
	LSLs	No LSL	LSLs	No LSLs
Greater than the AL	10%	0%	90%	100%
Greater than the TL but not greater than the AL	0%	0%	100%	100%

Note: In SafeWater LCR, $P90_{y+1}$ is the 90th percentile tap sample level for the PWS in the next year to be modeled. PWS decisions about CCT installation are made in year y based on $P90_{y+1}$ as changes in treatment technology or source water in year y could change $P90_{y+1}$. In other words, EPA assumes that before a treatment change, or source water change, is made, Primacy Agencies would require adequate CCT to be in place that ensures the PWS does not have an ALE.

Exhibit 5-8: High Cost Scenario Assumptions for CCT Effectiveness Likelihood of Change in Post CCT Installation or Re-optimization $P90_{y+1}$ Range

$P90_{y+1}$-Range Prior to Change in CCT	Likelihood $P90_{y+1}$ greater than the TL and not greater than the AL after change in CCT		Likelihood $P90_{y+1}$ not greater than the TL after change in CCT	
	LSLs	No LSL	LSLs	No LSLs
Greater than the AL	25%	0%	75%	100%
Greater than the TL but not greater than the AL	10%	0%	90%	100%

Note: In SafeWater LCR, $P90_{y+1}$ is the 90th percentile tap sample level for the PWS in the next year to be modeled. PWS decisions about CCT installation are made in year y based on $P90_{y+1}$ as changes in treatment technology or source water in year y could change $P90_{y+1}$. In other words, EPA assumes that before a treatment change, or source water change, is made, Primacy Agencies would require adequate CCT to be in place that ensures the PWS does not have an ALE.

5.2.4.2.4 LSLR Unit Costs

EPA collected LSLR estimates available from the web in the form of news reports, press releases, and utility websites, primarily representing costs and practices from 2016 to 2020. The compiled dataset provides costs estimates across full, customer-side, and system-side replacements from 38 systems that have reported actual replacement costs from pilot studies and recent or on-going LSLR projects.[80] Additional information on the unit cost data sources is described in Appendix A, Section A.2.1. Utilizing the utility data EPA collected on the average unit cost of full, utility-side, and customer-side LSLR to represent the potential universe of LSLR costs facing PWSs is also uncertain given the small number of observations. Because of this uncertainty in the LSLR cost estimate and the potentially large impact this unit cost may have on the overall national cost estimates, EPA chose to develop low and high LSLR unit cost estimates that will be used as inputs for the SafeWater LCR model in the development of cost ranges that potentially bracket the overall uncertainty in EPA's estimated average LSLR unit costs.
Based on a review of the data from all sources and experience with LSLR in high-profile systems including Flint, Michigan, EPA developed a low and high LSLR unit cost estimate as follows:

- Low estimate: 25th percentile of utility estimates for each type of replacement: utility-side, customer-side, and full, as well as planned full and planned utility-side.
- High estimate: 75th percentile of utility estimates for each type of replacement: utility-side, customer-side, and full, as well as planned full and planned utility-side.

EPA did not use the minimum and maximum values for this bounding exercise given that applying these figures to 100 percent of LSLRs seemed unreasonably extreme. Moreover, a key cost driver is the length of the LSL to be replaced, and the minimum and maximum would represent an extremely short or long line and not a typical length. Using minimum and maximum values would have produced a national estimate range greater than what is warranted given the uncertainty in the distribution of LSLR unit costs.

[80] In the proposed rule analysis, EPA used a 2011 American Water Works Assocation (AWWA) survey as the source for the estimated average LSLR costs. EPA received public comments on the cost of LSLR, primarily dealing with the need for more current data. EPA agreed with the commenters that new information had become available since the time of proposal that would provide better estimates of LSLR unit costs for the final rule analysis. Since the proposal, EPA identified cost data in news reports, press releases, and utility websites that allowed the Agency to develop a dataset of cost estimates from 87 utilities. EPA selected only the subset of data values that represent actual reported replacement costs from pilot studies and/or recent or on-going LSLR projects. This resultant dataset provides costs estimates across full, customer-side, and system-side replacements from 38 systems. The estimated mean costs for utility-side, customer-side, and full LSLR have increased by 122, 26, and 13 percent, respectively, using the newly developed data as compared with the AWWA 2011 values used for proposal.

The low and high estimates used in this economic analysis (EA) are presented in Exhibit 5-9. They are expected to provide a range of national costs for the final LCRR that reflects the degree of uncertainty in the average LSLR unit costs.

Exhibit 5-9: LSLR Unit Costs for Low and High Cost Scenarios ($2016)

Replacement Type	Low Cost Scenario	High Cost Scenario
Utility-Side	$2,449	$5,689
Customer-Side	$2,514	$3,929
Full Replacement	$3,953	$6,024
Utility-Side, Planned	$1,959	$4,551
Full Replacement, Planned	$3,163	$4,819

Note: Data in this exhibit replicated data provided in Appendix A, Exhibit A-3.

The unit costs estimates used in the SafeWater LCR model do not include certain indirect and non-market costs such as traffic congestion costs, inconvenience to homeowners and neighbors at LSLR sites, potential short term impact to the aesthetic appeal of the property, and additional impacts to landscaping and cost of replacement beyond lawn repair, which is covered in the unit cost estimates above.

5.2.4.2.5 CCT Unit Costs

EPA developed the cost estimates for CCT scenarios using outputs from the caustic feed and phosphate feed Work Breakdown Structure (WBS) models. Outputs from these models are point estimates of total capital and operation and maintenance (O&M) cost that correspond to a given set of inputs that include treatment plant design flow (DF) and average flow in million gallons per day (MGD). To estimate costs for CCT, EPA fit cost curves to the WBS outputs for up to 49 different flow rates. Specifically, for each scenario modeled and separately for total capital and for O&M costs, EPA fit three curves: one covering small systems (less than 1 MGD DF), one covering medium systems (1 MGD to less than 10 MGD DF), and one covering large systems (10 MGD DF and greater).

For each CCT scenario modeled, EPA also estimated separate equations for low, mid, and high costs (see *Technologies and Costs for Corrosion Control to Reduce Lead in Drinking Water* (USEPA, 2020)). EPA developed the low, mid, and high cost equations by varying the component level input in the WBS models. This input drives the selection of materials for items of equipment that can be constructed of different materials. For example, a low cost system might include fiberglass storage tanks and polyvinyl chloride (PVC) piping. A high cost system might include stainless steel storage tanks and stainless steel piping. The component level input also drives other WBS model assumptions that can affect the total cost, such as building quality and heating and cooling. Because of uncertainty in the component level materials selection a PWSs would choose for

real world installation or re-optimization of CCT technology, EPA chose to use the low CCT cost equations in the SafeWater LCR model for the low cost scenario and, for the high cost scenario, the SafeWater LCR model uses the high CCT cost equations.

5.2.4.3 *Model PWSs, Large Systems, Discounting, Compliance Schedule, and Simulating Compliance Activities*

As discussed above in Sections 5.2.4.1 and 5.2.4.2, under the regulatory provisions of the final rule, PWSs will face different compliance scenarios depending on the size, the type of water system, the presence of LSLs, and existing corrosion controls. In addition, PWSs will also face different unit costs based on water system size, type, and number of entry points (e.g., labor rates and CCT capital, and O&M unit costs). PWSs have a great deal of inherent variability across the water system characteristics that dictate both compliance activities and cost.

Because of this variability, to accurately estimate the national level compliance costs (and benefits) of the final LCRR, as well as describe how compliance costs are expected to vary across types of PWSs, the SafeWater LCR model creates a sample of representative "model PWSs" by combining the PWS-specific data available in SDWIS/Fed with data on baseline and compliance characteristics available at the PWS category level. The SafeWater LCR model follows each model PWS in the sample through each year of analysis – determining how the PWS will comply with each requirement of the final rule, estimating the yearly compliance cost, and tracking the impact of the compliance actions on drinking water lead concentrations. It also tracks how other events, such as changing a water source or treatment, affect the water system's compliance requirements for the next year.

In constructing the initial model PWS sample for the cost-benefit analysis, EPA began with the 50,067 CWSs and 17,589 NTNCWSs in SDWIS/Fed. Also, from SDWIS/Fed, EPA knows each water system's type (CWS or NTNCWS); primary water source (surface water or groundwater); population served; CCT status (yes/no); ownership (public or private); and number of connections. The available limited data on major LCR compliance cost drivers including: the baseline number of systems with LSLs and the percent of connections in those system that are LSLs; the number of PWSs that will exceed the AL and/or TL under the final revised tap sampling requirements; the cost of LSL replacement; the cost of CCT; and the effectiveness of CCT in PWSs with LSLs constrained EPA's ability to develop accurate point cost estimates for the previous rule and final LCRR or quantify uncertainty around the point estimates in the SafeWater LCR model. Therefore, EPA estimated previous rule and final LCRR compliance costs under low and high bracketing scenarios. These low and high cost scenarios are defined by the assignment of low and high values for the set of uncertain cost drivers. Detailed descriptions of these five uncertain variables and the derivation of their values under the low and high cost scenarios can be found in Section 5.2.4.2, above. With the exception of the five uncertain variables, which define the difference between the low and high cost scenarios, the remaining baseline water system and compliance characteristics are assigned to model PWSs, as described in Section 5.2.4.1 above and Appendix B section B.2.1, and remain constant across the scenarios. This allows EPA to define the uncertainty characterized in the cost range provided by the low and high scenarios and maintains consistency between the estimation of costs for the previous and final rules (e.g., percentage of lead tap water samples that will be invalidated).

Because PWS baseline characteristics are being assigned from distributional source data to capture the variability across PWS characteristics, EPA needed to ensure that its sample size was large enough that the results of the cost-benefit model were stable for each of the 36 PWS categories. To ensure stability in modeled results, EPA oversampled the SDWIS/Fed inventory to increase the number of water systems in each PWS category. For every PWS category, EPA set the target minimum number of model-PWSs to 5,000. To calculate the total estimated costs for each PWS category, the SafeWater LCR model weights the estimated per water system costs so that, when summed, the total cost is appropriate for the actual number of water systems known to be in the category. See Appendix B Section B.2.1 for more detail.

The exception to the assignment of water system characteristics discussed in Sections 5.2.4.1, and Appendix B.2.1 are the 21 very large water systems serving more than one million people. Because of the small number of water systems in this size category, the uniqueness of their system characteristics, and the potential large cost for these systems to comply with the final regulatory requirements, using the methods described above to assign system attributes could result in substantial error in the estimation of the national costs. Therefore, EPA attempted to collect information on very large water systems' CCT practices and chemical doses, pH measurements and pH adjustment practices, number of LSLs, service populations, and average annual flow rates for each entry point to the distribution system. EPA gathered this information from publicly available data such as SDWIS/Fed facility-level data, Consumer Confidence Reports, and water system websites. In addition, the American Water Works Association (AWWA) provided additional data from member water systems to fill in gaps. When facility-specific data was available, EPA used it to estimate compliance costs for the very large water systems. If data were not available, EPA assigned baseline characteristics using the same process as previously described. See Appendix B, Section B.2.1.1 for a summary of the data EPA collected on these very large systems.

The SafeWater LCR model estimates the incremental cost of the final LCRR over a 35-year period. In accordance with EPA's policy, and based on guidance from OMB, when calculating social costs and benefits, EPA discounted future costs (and benefits) under two alternative social discount rates, 3 percent and 7 percent.

When evaluating the economic impacts on PWSs and households, EPA uses the estimated PWS cost of capital to discount future costs, as this best represents the actual costs of compliance that water systems would incur over time. EPA used data from the 2006 Community Water System Survey (CWSS) to estimate the PWS cost of capital (USEPA, 2009). EPA calculated the overall weighted average cost of capital (across all funding sources and loan periods) for each size/ownership category, weighted by the percentage of funding from each source. The cost of capital for each CWS size category and ownership type is shown in Exhibit B-3 in Appendix B.2.2. Since similar cost of capital information is not available for NTNCWSs, EPA used the CWS cost of capital when calculating the annualized cost per NTNCWS. Total estimated cost of capital may be greater than actual costs water systems bear when complying with future regulatory revisions because financing support for lead reduction efforts may be available from state and local governments, EPA programs (e.g., the Drinking Water State Revolving Fund (DWSRF), the Water Infrastructure Finance and Innovations Act (WIFIA) Program, and the Water Infrastructure Improvements for the Nation Act of 2016 (WIIN Act) grant programs), and other federal agencies (e.g., the United States Department of Housing and Urban Development's (HUD's) Community

Development Block Grants). The availability of funds from government sources, while potentially reducing the cost to individual PWSs, does not reduce the social cost of capital to society.

EPA projects that rule implementation activities will begin immediately after rule promulgation. These activities will include one-time PWS and Primacy Agency costs for staff to read the rule, become familiar with its provisions, and develop training materials and train employees on the new rule. Primacy Agencies will also incur burden hours associated with adopting the rule into State requirements, updating their LCR program policies and practices, and modifying data record keeping systems. PWSs will incur costs to comply with the service line materials inventory requirements and develop an initial LSLR plan in years one through three of the analysis. EPA expects that water systems will begin complying with all other final rule requirements three years after promulgation, or in year four of the analysis.

Some requirements of the final rule must be implemented by water systems regardless of their water quality and tap sampling results (e.g., CWS school and child care sampling programs); however, most of the major cost drivers are a function of a water systems 90th percentile lead tap sample value. The 90th percentile value, and if it exceeds the lead TL or AL, dictates:

- the tap water sampling and WQP monitoring schedules,
- the installation/re-optimization of CCT, "find-and-fix" adjustments to CCT (triggered by single lead tap sample exceedances of the 15 µg/L AL, which has an increasing likelihood in the model as 90th percentile tap sample results increase),
- the installation of point-of-use (POU) filters at water systems selecting this treatment option as part of the small water system flexibilities of the final rule,
- the goal-based or mandatory removal of LSLs, and water system and Primacy Agency administrative costs.

Because of uncertainty in the estimation of the 90th percentile values, the Agency developed low and high estimates for this cost driving variable affecting both the estimation of costs for the previous rule and the final LCRR. EPA used both the minimum and maximum 90th percentile tap sample values from SDWIS/Fed over the period from 2007 to 2015, to assign a percentage of PWSs by LSL status to each of three groups, those at the TL or below, those above the lead trigger but at or below AL, and those above the lead AL. These assignments represent the status of systems under the previous rule. Because the tap sampling requirements under the final LCRR call for 100 percent of compliance tap samples to be taken from sites with LSLs, for water systems with LSLs, and for sampling the fifth liter instead of the first liter (as required under the previous rule) at LSL sites, EPA's estimate of the likelihood that a PWS would have a lead 90th percentile greater than the TL or AL is higher under the final rule compared to under the previous LCR. See Section 5.2.4.2.2 for additional information on the estimation of the low and high 90th percentile values for the previous rule assessment and the further adjustments made to project 90th percentile values for the final LCRR.

Once water systems are assigned to the groupings based on their LSL status, individual 90th percentile lead tap sample values are assigned from the distribution of 90th percentile values within each grouping.

Several regulatory compliance activities are assumed to not affect a water system's 90th percentile value. These include, for example, developing an inventory of LSLs, CWS sampling at schools and child cares, and public education. In the SafeWater LCR model, the only compliance activities that will change a water system's 90th percentile lead tap sample are: installation of CCT; re-optimization of existing CCT; removal of LSLs; and a water system-wide "find-and-fix" activity (assumed to be a system-wide increase in pH). In addition to these final rule compliance activities, changing a water source or treatment technology can also result in a change in a water system's 90th percentile tap sample value.

Because a water system's lead 90th percentile value is so important to determining regulatory requirements and cost under the final rule, the SafeWater LCR model, under both the low and high cost scenarios, tracks each water system's 90th percentile value over each annual time step in the model. Based on the initial 90th percentile values, a number of final rule compliance actions are triggered. With the implementation of CCT, LSLR, and "find-and-fix" corrections, 90th percentile tap sample values are expected to decrease. The SafeWater LCR model allows for future increases in 90th percentile values as a result of changes in source water and treatment. The likelihood of these events occurring have been derived from SDWIS/Fed data (see Chapter 4). When a change in source or treatment occurs in a modeled year, a new 90th percentile value is assigned to the water system. This value may be higher or lower than the current value thus potentially triggering new corrective actions. In the SafeWater LCR model, if a water system already has "optimized" CCT in place, it is assumed that no additional action is needed and that the current treatment is adequate; therefore, the 90th percentile will not change.

5.3 Estimating Public Water System Costs

This section details how EPA estimated the cost of water system compliance for each major rule component of the LCRR, including:

- 5.3.1: PWS Implementation and Administrative Costs
- 5.3.2: PWS Sampling Costs
- 5.3.3: PWS Corrosion Control Costs
- 5.3.4: PWS Lead Service Line Inventory and Replacement Costs

0: Exhibit 5-108: National Annualized Lead Service Line Replacement Costs – All PWSs at 3 Percent Discount Rate

Exhibit 5-109: National Annualized Lead Service Line Replacement Costs – All PWSs at 7 Percent Discount Rate

	Low Cost Estimate			High Cost Estimate		
	Previous LCR	**Final LCRR**	**Incremental**	**Previous LCR**	**Final LCRR**	**Incremental**
LSL Inventory	$0	$6,863,000	$6,863,000	$0	$10,593,000	$10,593,000
System LSLR Plan	$0	$467,000	$467,000	$0	$607,000	$607,000
System LSLR (Mandatory)	$638,000	$16,681,000	$16,044,000	$37,623,000	$79,869,000	$42,246,000
LSLR Ancillary Activities (Mandatory)	$29,000	$1,249,000	$1,220,000	$704,000	$4,438,000	$3,734,000
System LSLR (Goal Based)	$0	$6,676,000	$6,676,000	$0	$28,204,000	$28,204,000
LSLR Ancillary Activities (Goal Based)	$0	$824,000	$824,000	$0	$1,956,000	$1,956,000
Activities Triggered by Not Meeting Goal	$0	$6,636,000	$6,636,000	$0	$25,589,000	$25,589,000
System LSLR (Customer-initiated)	$0	$6,442,000	$6,442,000	$0	$17,189,000	$17,189,000
LSLR Ancillary Activities (Customer-initiated)	$0	$965,000	$965,000	$0	$1,118,000	$1,118,000
Total Annual PWS Lead Service Replacement Costs	$667,000	$46,803,000	$46,136,000	$38,327,000	$169,562,000	$131,235,000
Household LSLR (Mandatory)	$193,000	$0	$-193,000	$7,681,000	$0	$-7,681,000
Household LSLR (Goal based)	$0	$8,587,000	$8,587,000	$0	$24,409,000	$24,409,000
Total Annual Lead Service Replacement Costs	$860,000	$55,389,000	$54,529,000	$46,008,000	$193,971,000	$147,963,000

Acronyms: LSL = lead service line; LSLR = lead service line replacement; PWS = public water system.

Note: Detail may not add exactly to total due to independent rounding.

- PWS POU-Related Costs
- 5.3.6: PWS Lead Public Education and Outreach Costs

Section 5.3.7 provides a summary of PWS costs including PWSs counts and population affected by each major requirement, as well as costs by system and source water type and size category for low and high cost scenarios at a 3 percent and 7 percent discount rate. In addition, the cost per household is also presented.

For most activities, water systems will incur costs in the form of burden (*i.e.,* hours). The burden is multiplied by the labor rate ($/hr), as presented in Chapter 4, Section 4.3.10.1, to estimate labor unit costs. Systems will also incur capital and O&M costs for some activities. Exhibit 5-10 provides an overview of the rule components, subcomponents, and activities for which EPA estimates water system costs for the LCRR. The derivation of unit burden and/or cost is provided in each referenced subsection.

At the end of each subsection, EPA provides a summary exhibit showing the SafeWater LCR modeling approach for each water system activity (e.g., Exhibit 5-12, Exhibit 5-20). The exhibits are organized as follows:

- The first and second columns show how unit burden and labor rate information is combined to estimate a CWS and NTNCWS cost per activity, respectively.
- The third and fourth columns indicate the conditions under which the water system activity occurs. The columns indicate if the system activity is dependent on:
    - The system's 90th percentile range. See Appendix B, Section B.3 for a detailed discussion of how the SafeWater LCR model tracks a water system's 90th percentile level and accounts for changes in the 90th percentile level over the 35-year analysis period.
    - Other characteristics of the system such as presence or absence of LSLs and/or CCT, and frequency of monitoring.
- The fifth column indicates the frequency of the activity (e.g., one-time, annually, every 3 years).

The SafeWater LCR model uses the information from these exhibits to calculate total annualized water system cost for each activity. See Section 5.2.4 for detail on the cost modeling methodology.

As noted in Section 5.1, costs for water systems presented in this section are ***LCRR costs if no previous rule were in place***. The national costs of the LCRR, or incremental costs, are the difference between the cost of compliance with the LCRR and the cost of compliance with the previous LCR. These incremental national costs are presented in Section 5.1.

For the purpose of the SafeWater LCR modeling, all cost model inputs are assigned a unique data variable name, usually in the form of abbreviations, or shorthand, separated by underlined spaces (e.g.*, rate_op, hrs_read_rule_op*). The SafeWater LCR model uses these data variables to model LCRR scenarios for different system sizes and types.

Exhibit 5-10: PWS Cost Components, Subcomponents, and Activities Organized by Section[1]

Component	Subcomponents	Activities[2]
5.3.1: PWS Implementation and Administration Costs	5.3.1.1: One-time Costs	a) Read and understand the rule b) Assign personnel and resources for rule implementation c) Participate in training and technical assistance from Primacy Agency during rule implementation d) Provide small system flexibility option recommendation to Primacy Agency
5.3.2: PWS Sampling-Related Costs	5.3.2.1: Lead Tap Sampling Costs	a) Update sampling instruction for lead tap sampling and submit to Primacy Agency b) Contact homes to establish new 100 percent LSL tap sampling pool c) Report any changes in sampling location to the Primacy Agency d) Confer with Primacy Agency on initial lead sampling data and status under the LCRR e) Obtain households for each round of lead tap sampling f) Offer incentives to households to encourage participation in lead tap sampling program g) Ship tap sampling material and instructions to participating households h) Collect lead tap samples i) Determine if sample should be rejected and not analyzed j) Analyze lead tap samples in-house or commercially k) Prepare and submit sample invalidation request to Primacy Agency l) Inform customers of lead tap sample results m) Certify to Primacy Agency that results were reported to customers n) Submit request to renew 9-year monitoring waiver to Primacy Agency o) Submit sampling results and 90th percentile calculation to Primacy Agency
	5.3.2.2: Lead WQP Monitoring Costs	p) Collect lead WQP samples in the distribution system q) Analyze distribution system lead WQP samples r) Collect lead WQP samples from entry points s) Analyze entry point lead WQP samples t) Report lead WQP sampling data and compliance with OWQPs to Primacy Agency
5.3.2: PWS Sampling-Related Costs (continued)	5.3.2.3: Copper WQP Monitoring Costs	u) Collect copper WQP samples in the distribution system v) Analyze distribution system copper WQP samples w) Collect copper WQP samples from entry points x) Analyze entry point copper WQP samples y) Report copper WQP sampling data and compliance with OWQPs to Primacy Agency
	5.3.2.4: Source Water Monitoring Costs	z) Collect source water sample aa) Analyze source water sample bb) Report source water monitoring results to Primacy Agency

Component	Subcomponents	Activities[2]
	5.3.2.5.1: School and Child Care Lead Sampling Costs - Mandatory	cc) Create a contact list of schools and child cares served by CWS and submit to Primacy Agency dd) Develop lead outreach materials for schools and child cares ee) Prepare and distribute initial letter explaining the sampling program and the 3Ts Toolkit ff) Contact school or child care to determine and finalize its sampling schedule gg) Contact school or child care to coordinate sample collection logistics hh) Conduct walkthrough at school or child care before the start of sampling ii) Travel to collect samples jj) Collect samples kk) Analyze samples ll) Provide sampling results to tested facilities mm) Discuss sampling results with school or child care nn) Conduct detailed discussion of high sampling results with school and child cares oo) Prepare and provide annual report on school and child care sampling program to the Primacy Agency
	5.3.2.5.2: School and Child Care Lead Sampling Costs – On Request	pp) Contact school and child cares to offer sampling qq) Contact school or child care to coordinate sample collection logistics rr) Conduct walkthrough at school or child care before the start of sampling ss) Travel to collect samples tt) Collect samples uu) Analyze samples vv) Provide sampling results to tested facilities ww) Discuss sampling results with school and child care xx) Conduct detailed discussion of high sampling results with school and child cares yy) Prepare and provide annual report on school and child care sampling program to the Primacy Agency
5.3.3: PWS CCT-Related Costs	5.3.3.1: CCT Installation Costs	a) Conduct a CCT study b) Install CCT Treatment (PO_4, PO_4 with post treatment, pH adjustment, or modify pH)
	5.3.3.2: Re-optimization of Existing Corrosion Control Treatment	c) Revise CCT study d) Reoptimize existing CCT
	5.3.3.3: Find-and-Fix Costs	e) Contact customers and collect follow-up tap sample f) Analyze follow-up lead tap sample g) Collect distribution system WQP sample h) Analyze distribution system WQP sample i) Review incidents of system-wide event and other system conditions j) Consult with Primacy Agency prior to making CCT changes k) Report to Primacy Agency follow-up sample results and overall “find-and-fix” responses

Component	Subcomponents	Activities[2]
	5.3.3.4 System Lead CCT Routine Costs	l) Review CCT guidance m) Provide water quality data to Primacy Agency and discuss during sanitary survey n) Notify and consult with Primacy Agency on required actions in response to source water change o) Notify and consult with Primacy Agency on required actions in response to treatment change
5.3.4: PWS LSL Inventory and Replacement Costs	5.3.4.1: LSL Inventory Costs	a) Create initial LSL inventory and submit to Primacy Agency b) Submit documentation of no LSLs to Primacy Agency c) Develop general LSL outreach materials and submit to Primacy Agency for review d) Distribute general LSL outreach materials e) Submit annual or triennial LSL inventory update to Primacy Agency
	5.3.4.2: LSLR Plan	f) Develop LSLR plan and submit to Primacy Agency for review
	5.3.4.3: LSL Replacement Costs	g) Systems replace LSLs h) Households replace privately-owned portion of LSLs if goal-based or customer-initiated program
	5.3.4.4: Ancillary LSL Replacement Activities	i) Conduct planning and identify financial options for LSLRs and submit to Primacy Agency j) Consult with Primacy Agency and develop targeted LSLR program outreach materials k) Distribute targeted LSLR program outreach materials l) Contact customers and conduct site visits prior to LSLR m) Inspect and test lines to confirm they are not lead n) Deliver filters and cartridges at time of LSLR and maintain them for 6 months o) Collect tap sample post-LSLR p) Analyze post-LSLR tap sample q) Inform customers of tap sample result r) Submit annual report on LSLR program to Primacy Agency
	5.3.4.5: PWS Failure to Meet Goal-Based Replacement Rate Costs	s) Consult with Primacy Agency on activities to satisfy additional goal-based LSLR program outreach requirements t) Conduct activities in response to the first failure to meet LSLR goal u) Conduct activities in response to each additional failure to meet LSLR goal
0: PWS POU-Related Costs	5.3.5.1: POU Installation and Maintenance	a) Provide, monitor, and maintain POU devices
	5.3.5.2: POU Ancillary Costs	b) Develop POU plan and submit to Primacy Agency c) Develop PE materials and submit to Primacy Agency d) Print POU education materials e) Obtain households for POU monitoring f) Deliver POU monitoring materials and instructions to participating households g) Collect tap samples after POU installation

Component	Subcomponents	Activities[2]
		h) Determine if sample should be rejected and not analyzed i) Analyze POU tap samples j) Prepare and submit sample invalidation request to Primacy Agency k) Inform customers of POU tap sample results l) Certify to Primacy Agency that POU tap results were reported to customers m) Prepare and submit annual report on POU program to Primacy Agency
5.3.6: PWS PE and Outreach Costs	5.3.6.1: Consumer Notice in Response to Lead Sample > 15 µg/L	a) Provide notice to customers with lead tap sample > 15 µg/L within 3 calendar days b) Provide a copy of the 3 calendar day notice to the Primacy Agency
	5.3.6.2: Activities Regardless of 90th Percentile Level	c) Update CCR language d) Develop new customer outreach plan e) Develop approach for improved public access to lead health-related information and tap sample results f) Establish a process for public access to information on LSL locations g) Maintain a process for public access to lead health information, LSL locations, and tap sample results h) Respond to customer request for LSL information i) Respond to requests from realtors, home inspectors, and potential home buyers for LSL information j) Develop list of state and local health agencies k) Develop lead outreach materials for state and local health agencies l) Deliver lead outreach materials for state and local health agencies m) Develop PE materials for disturbances of service lines and submit to Primacy Agency n) Deliver PE during disturbances of service lines o) Deliver filters and cartridges during disturbances of service lines and maintain them for 6 months
	5.3.6.3: Activities in Response to Lead ALE	p) Update mandatory language for lead ALE PE and submit to Primacy Agency for review q) Deliver lead ALE PE materials to all customers r) Contact public health agencies to obtain additional organizations and update recipient list s) Notify public health agencies and other organizations t) Post notice to website u) Consult with Primacy Agency on other PE activities v) Implement other PE activities w) Prepare press release x) Certify to Primacy Agency that lead outreach was completed[3]

Acronyms: 3Ts = "3Ts for Reducing Lead in Drinking Water in Schools and Child Care Facilities Toolkit: A Training, Testing, and Taking Action Approach (Revised Manual)"; AL = action level; ALE = action level exceedance; CCR = consumer confidence report; CCT = corrosion control treatment; CWS = community water system; LCRR = Lead and Copper Rule revisions; LSL = lead service line; LSLR = lead service line replacement; OWQPs = optimal water quality

parameters; PE = public education; PO_4 = orthophosphate; POU = point-of-use; PWS = public water system; WQP = water quality parameter.

Notes:

[1] Systems will also incur burden for recordkeeping activities under the LCRR, such as retaining records of decisions, supporting documentation, technical basis for decisions, and documentation submitted by the system. EPA has included burden for recordkeeping with each activity when applicable and opposed to providing separate burden estimates.

[2] EPA assigned a unique letter identification (ID) for each activity under a given rule component. Activities are generally organized with upfront, one-time activities first followed by ongoing activities.

[3] This certification is inclusive of outreach activities in Sections 5.3.6.1 through 5.3.6.3.

5.3.1 PWS Implementation and Administrative Costs

PWSs will incur one-time burden to implement new requirements. These activities and associated SafeWater LCR model cost inputs are described in Section 5.3.1.1. Section 5.3.1.2 provides the estimated annualized national PWS implementation and administrative costs for the LCRR at 3 percent and 7 percent discount rates.

5.3.1.1 *PWS One-Time Implementation and Administrative Costs*

EPA estimated that systems will incur a one-time burden to begin rule implementation. EPA has identified and developed costs for four activities as shown in Exhibit 5-11. The exhibit provides the unit burden and/or cost estimate for each activity. The last column provides the data variable used in the SafeWater LCR cost model. The assumptions used in the estimation of each activity follow the exhibit. EPA recognizes that systems would also incur administrative burden related to specific requirements under the LCRR. In these cases, the system burden is estimated under that particular rule requirement.

Exhibit 5-11: PWS One-Time Administration Activities and Unit Burden Estimates

Activity	Unit Burden and/or Cost (hours/system)	*SafeWater LCR Data Variable*
a) Read and Understand Rule	4 per PWS	*hrs_read_rule_op*
b) Assign personnel and resources for rule implementation	8 per PWS	*hrs_assign_staff_imp_op*
c) Participate in training and technical assistance from Primacy Agency during rule implementation	8 per PWS	*hrs_initial_ta_op*
d) Provide small system flexibility option recommendation to Primacy Agency	10 hrs/CWSs serving ≤10,000 and all NTNCWSs	*hrs_sm_flex_option_op*

Acronyms: CWS = community water system; NTNCWS = non-transient non-community water system; PWS = public water system

Sources:

a), b): Based on implementation burden estimated for USEPA's 2012, *Economic Analysis for the Final Revised Total Coliform Rule* (USEPA, 2012b). Available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov.

c): Based on EPA's 2015, *Public Water System Supervision Program Information Collection Request (Renewal)* (USEPA, 2015a). Available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov.

d): "Derivation of CCT Study and Review Costs_Final Rule.xlsx."

Note: These data variables are also provided in "Derivation of Administrative Burden and Costs_Final Rule.xlsx."

a) ***Read and understand the rule (hrs_read_rule_op).*** Based on previous experience with rule implementation and consistent with estimates used in the Economic Analysis for the Final Revised Total Coliform Rule (USEPA, 2012b), EPA estimated that systems would require a total of 4 hours to read and understand the rule revisions.

b) ***Assign personnel and resources for rule implementation (hrs_assign_staff_imp_op).*** EPA assumed systems would require an additional 8 hours to assign appropriate personnel and resources to carry out the new requirements under the LCRR. This estimate is also consistent with estimates used in the Economic Analysis for the Final Revised Total Coliform Rule (USEPA, 2012b).

c) ***Participate in training and technical assistance from Primacy Agency during rule implementation (hrs_initial_ta_op).*** EPA assumed systems would require an additional 8 hours to attend training and receive other technical assistance from the Primacy Agency. This estimate is based on the data from EPA's 2015, *Public Water System Supervision Program* Information Collection Request (ICR) (Renewal) (USEPA, 2015a).

d) ***Provide Recommended Small System Flexibility Option to Primacy Agency (hrs_sm_flex_option_op).*** CWSs serving 10,000 or fewer people and all NTNCWSs that exceed the TL of 10 µg/L must submit a recommended compliance option to their Primacy Agency to address lead. EPA estimates each system will require 10 hours to develop and submit this recommendation, which is twice the burden estimated by the Association of State Drinking Water Administrators (ASDWA) in their CoSTS model (ASDWA, 2020a) for Primacy Agencies to review this plan (data variable, *hrs_sm_flex_option_js*). See Section 5.4.1.1, activity e) for a discussion of the corresponding Primacy Agency input.

Exhibit 5-12 provides the SafeWater LCR model cost estimation approach for system one-time PWS administrative and rule implementation activities including additional cost inputs required to calculate these costs.

Exhibit 5-12: PWS Administration and Rule Implementation Cost Estimation in SafeWater LCR by Activity

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
a) Read and understand the rule				
The total hours per system multiplied by the system labor rate. *(hrs_read_rule_op*rate_op)*	Cost applies as written to NTNCWSs.	All	All model PWSs	One time
b) Assign personnel and resources for rule implementation				
The total hours per system multiplied by the system labor rate. *(hrs_assign_staff_imp_op*rate_op)*	Cost applies as written to NTNCWSs.	All	All model PWSs	One time

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
c) Participate in training and technical assistance from Primacy Agency during rule implementation				
The total hours per system multiplied by the system labor rate. *(hrs_initial_ta_op*rate_op)*	Cost applies as written to NTNCWSs.	All	All model PWSs	One time
d) Provide small system flexibility lead compliance option to Primacy Agency				
The total hours per system multiplied by the system labor rate. *(hrs_sm_flex_option_op*rate_op)*	Cost applies as written to NTNCWSs.	Above TL	CWSs serving ≤ 10,000 people and NTNCWSs	One time

Acronyms: CWS = community water system; NTNCWS = non-transient non-community water system; PWS = public water system; TL = trigger level.
Note: The data variables in the exhibit are defined previously in Section 5.3.1.1 with the exception of:

- *rate_op:* PWS hourly labor rate (Section 4.3.10.1).

5.3.1.2 *Estimate of PWS National Implementation and Administrative Costs*

The estimated annualized national PWS implementation and administrative costs for the LCRR are $2,576,000 at a 3 percent discount rate and $4,147,000 at a 7 percent discount rate. Since this cost category represents startup costs associated with the new LCRR regulatory requirements there are no estimated costs for the previous LCR in this category for the period being analyzed; therefore, the PWS implementation and administrative incremental costs are also $2,576,000 at a 3 percent discount rate and $4,147,000 at a 7 percent discount rate (see Exhibit 5-1 and Exhibit 5-2). The number of LSLs, costs to optimize CCT, and effectiveness of CCT do not affect the national PWS implementation and administrative costs.

5.3.2 PWS Sampling Costs

This section provides system unit burden and cost for lead tap sampling, lead WQP monitoring, copper WQP monitoring, source water monitoring, and sampling in schools and child cares in Sections 5.3.2.1 through 5.3.2.5, respectively. National annualized sampling costs are presented at 3 percent and 7 percent discount rates in Section 5.3.2.6 in Exhibit 5-52 and Exhibit 5-53, respectively.

5.3.2.1 *PWS Lead Tap Sampling*

The discussion of lead tap sampling costs for water systems is presented in three subsections as follows:

- 5.3.2.1.1: Lead Tap Sampling Schedules and Required Number of Samples
- 5.3.2.1.2: Lead Tap Sampling Activities
- 5.3.2.1.3: Lead Tap Sampling PWS Unit Cost Estimation Example

Exhibit 5-20 at the end of Section 5.3.2.1 is a summary exhibit that indicates how the cost inputs are modeled by the SafeWater LCR model. Note that the SafeWater LCR model does not include the costs of

copper tap sampling. Because the LCRR does not change the current regulatory requirements associated with copper tap sampling the incremental cost associated with these provisions under the LCRR are equal to zero.

Activities and costs for tap monitoring associated with the POU program are not included in this section but are provided in Section 0.

5.3.2.1.1 Lead Tap Sampling Schedules and Required Number of Samples

All CWSs and NTNCWSs are subject to lead tap sampling requirements. The frequency and required number of samples depend on the systems' lead 90th percentile level but all systems are assumed to conduct one year of semi-annual monitoring at the start of the rule (assumed to be year 4). Only systems with a 90th percentile level at or below the TL of 10 µg/L can qualify to conduct lead tap sampling at the reduced number of sites annually, triennially, or every 9 years. Those with a lead ALE must conduct lead tap sampling every six months at the standard number of sample sites (i.e., routine semi-annual monitoring); those with a TLE must sample annually at the standard number of sites. In addition, systems must sample for a minimum of two, six-month tap sampling monitoring periods following a change in source water or significant or long-term change in treatment. Systems without a lead ALE can qualify for reduced monitoring (see Chapter 4, Section 4.3.7.1 for additional detail).

Because the number of required sampling sites and sampling schedules can vary, costs are estimated separately for systems on the different lead tap sampling monitoring schedules. All systems are assumed to conduct semi-annual monitoring in year 4 to determine their 90th percentile lead level. After year 4, EPA estimated the percentages of systems with a 90th percentile level at or below 10 µg/L that would be on semi-annual monitoring,[81] and on a reduced annual *(p_tap_annual)*, triennial *(p_tap_triennial)*, or 9-year *(p_tap_nine)* monitoring schedule based on historical SDWIS/Fed data. Chapter 4, Section 4.3.7.1 provides a detailed discussion of how these percentages were derived. Exhibit 4-29 and Exhibit 4-30 provide the percentage of CWSs with 90th percentile levels of ≤ 10 µg/L with CCT and without CCT, respectively, on semi-annual monitoring, and on a reduced annual, triennial, or 9-year monitoring schedule. Exhibit 4-31 and Exhibit 4-32 provide similar information for NTNCWSs with and without CCT, respectively.

Exhibit 5-13 provides the minimum number of tap samples for CWSs and NTNCWSs on routine monitoring and reduced monitoring schedules. These requirements have not been modified under the LCRR.

[81] The likelihood that a system with a 90th percentile value at or below 10 µg/L being on an initial semi-annual monitoring schedule is 1 minus (*p_tap_annual* + *p_tap_triennial* + *p_tap_nine*).

Exhibit 5-13: Minimum Number of Lead Tap Sampling Sites for Routine and Reduced Monitoring

System Size (Population Served)	Routine Monitoring	Reduced Monitoring
	Minimum Number of Tap Samples	
	numb_samp_customer	*numb_reduced_tap*
	A	B
≤100	5	5
101-500	10	5
501-3,300	20	10
3,301-10,000	40	20
10,001-100,000	60	30
>100,000	100	50

Source: Lead and Copper Rule, 40 CFR 141.86(c).
Notes: The LCRR did not modify the minimum required number of lead tap samples.
A: The required number of sites for CWSs and NTNCWSs on routine monitoring schedules.
B: The required number of sites for CWSs and NTNCWSs on reduced monitoring schedules. Under the LCRR, only systems with lead 90th percentile levels at or below 10 µg/L can qualify for reduced monitoring schedule.

5.3.2.1.2 Lead Tap Sampling Activities

EPA has developed costs for system activities associated with lead tap sampling as shown in Exhibit 5-14. The exhibit provides the unit burden and/or cost for each activity. The assumptions used in the estimation of each activity follows the exhibit. The last column provides the corresponding SafeWater LCR model data variable in red/italic font. In a few instances, some of these activities are conducted by the state instead of the water system. These activities are identified in the exhibit and further explained in the exhibit notes. This section does not pertain to CWSs serving 10,000 or fewer and NTNCWSs that are using the POU provision and maintenance program as their lead compliance option. These systems have some different lead tap sampling requirements that are discussed in Section 0.

Exhibit 5-14: PWS Lead Tap Sampling Unit Burden and Cost Estimates

Activity	Unit Burden and/or Cost[1]	*SafeWater LCR Data Variable*
a) Update sampling instruction for lead tap sampling and submit to Primacy Agency (one-time)	2 hrs/CWS and NTNCWS	*hrs_devel_samp_op*[2]
b) Contact homes to establish new 100 percent LSL tap sampling pool (one-time)	5 to 100 hrs/CWS with LSLs	*hrs_add_lsl_samp_op*
c) Report any changes in sampling location to the Primacy Agency	3 hrs/CWS	*hrs_chng_tap_op*
d) Confer with Primacy Agency on initial lead sampling data and status under the LCRR (one-time)	1 hr/PWS	*hrs_initial_tap_confer_op*

Activity	Unit Burden and/or Cost[1]	*SafeWater LCR Data Variable*
e) Obtain households for each round of lead tap sampling	Burden per sample (CWSs only) No LSLs: 0.5 hrs With LSLs: 1 hrs	*hrs_samp_volunt_op*
f) Offer incentives to households to encourage participation in lead tap sampling program	$10 to $100/sample per CWS	*cost_incentive*
g) Ship tap sampling material and instructions to participating households	Burden per sample (CWSs only) 0.25 hrs Cost per sample (CWSs only) No LSLs: $6.85 to $11.37 With LSLs: $6.85 to $24.82	Burden *hrs_discuss_samp_op* Cost *cost_5_lt_samp*[3]
h) Collect lead tap samples	Burden per sample 0.39 to 0.67 hrs per CWS; 0.5 hrs per NTNCWS Cost per sample $5.29 to $9.07 per CWS	Burden *hrs_pickup_samp_op* Cost *cost_pickup_samp*
i) Determine if sample should be rejected and not analyzed	0.25 hrs/rejected sample for CWSs	*hrs_samp_reject_op*
j) Analyze lead tap samples in-house or commercially	In-house Analysis (CWSs > 100K only) Burden: 0.44 hrs/sample Cost: $2.38/sample Commercial Analysis $21.58/ sample without LSLs $35.03/sample with LSLs	In-house Analysis *hrs_analyze_samp_op*[3] *cost_lab_lt_samp*[3] Commercial Analysis *cost_5_commercial_lab*[3]
k) Prepare and submit sample invalidation request to Primacy Agency	2 hrs per sample per CWS and NTNCWS	*hrs_samp_invalid_op*
l) Inform customers of lead tap sample results	CWS per sample Burden: 0.05 hrs Cost: $0.58 NTNCWS per sample Burden: 1 hr Cost: $0.025	CWS *hrs_inform_samp_op* *cost_cust_lt* NTNCWS *hrs_ntncws_inform_samp_op* *cost_ntncws_cust_lt*
m) Certify to Primacy Agency that results were reported to customers	0.66 to 1 hr per CWS or NTNCWS	*hrs_cert_cust_lt_op*
n) Submit request to renew 9-year monitoring waiver to Primacy Agency	1 hr/9 years per qualifying CWS or NTNCWS	*hrs_renew_nine_op*
o) Submit sampling results and 90th calculation to Primacy Agency	No LSLs: 1 to 1.5 hrs per CWS and NTNCWS With LSLs: 1.25 to 1.88 hrs per CWS and NTNCWS	*hrs_annual_lt_op*[3]

Acronyms: CWS = community water system; LSL = lead service line; NTNCWS = non-transient non-community water system; PWS = public water system.
Source: "Derivation of Lead Analytical Burden and Costs_Final Rule.xlsx." See Section 5.3.2.1 for a summary of how the unit burden is derived for each activity.
Notes:
[1] All activities other than one-time activities are per monitoring period. In addition, many of the activities listed above do not apply to NTNCWSs because unlike CWSs they collect their own samples from sampling locations under their control and thus, are unlikely to change sampling sites or reject samples for analysis. They also do not need to solicit sampling participation for customers or travel to their residences to pick up samples.
[2] In Arkansas, Louisiana, Mississippi, Missouri, North Dakota, and South Carolina the state sends sampling instructions to the water systems and thus are assumed to incur the burden to update the sampling instruction in lieu of the system.
[3] In Arkansas, Louisiana, Mississippi, Missouri, and South Carolina the state pays for the cost of bottles, shipping, analysis, and providing sample results to the system. Thus, the state will incur the burden and cost for these activities in lieu of the system.

a) ***Update sampling instruction for lead tap sampling and submit to Primacy Agency (hrs_devel_samp_op).*** *All CWSs and NTNCWSs will incur a one-time burden to update their sampling instructions to be consistent with the revised tap sampling procedures related to aerators, pre-stagnation flushing, and use of wide-mouth bottles for sample collection (see Chapter 3, Section 3.3.2). Systems are assumed to use an EPA template provided by the Primacy Agency as the basis for updating their sampling instructions. EPA assumed all systems will use the template to update the sampling instructions and would require 2 hours per system. EPA also assumed systems would submit their revised plans electronically and would not incur non-labor costs.*

b) ***Contact homes to establish new 100 percent LSL tap sampling pool (hrs_add_lsl_samp_op).*** Under the LCRR, CWSs with LSLs incur a one-time burden to contact additional residents to have enough volunteers to collect all samples from sites served by LSLs meeting their minimum required number of tap samples. The estimated burden associated with this activity *(hrs_add_LSL_samp_op)* is provided in Exhibit 5-15 below. The burden would only apply to those systems with LSLs. See Section 4.3.4.1 for the percentage of CWSs with LSLs *(p_lsl)*. Note that most CWS without LSLs will not need to update their initial sampling pool because they are subject to less restrictive sampling criteria regarding the age of the copper and lead solder sites under the LCRR. Specifically, these systems no longer need to prioritize sampling at sites with copper pipes and lead solder installed after 1982. In addition, NTNCWSs generally have control over their entire distribution system and are not expected to incur this additional burden.

Exhibit 5-15: CWS Burden to Achieve a Sampling Pool with 100 Percent Lead Service Line Sites

System Size (Population Served)	Required number of samples for standard monitoring	Number of new sites needed for systems with LSLs	Total hours to recruit one new LSL sample location	Total hours per system to contact residences and obtain required additional LSL sample locations
	numb_samp_customer			*hrs_add_LSL_samp_op*
	A	**B = A*50%**	**C**	**D = B*C**
≤100	5	2.5	2	5
101-500	10	5	2	10
501-3,300	20	10	2	20
3,301-10,000	40	20	2	40
10,001-100,000	60	30	2	60
>100,000	100	50	2	100

Acronyms: LSL = lead service line.
Notes:
A: Exhibit 5-13, column A.
C: Based on a November 2, 2018 meeting with Gary Burlingame, Philadelphia Water Department (PWD) regarding steps PWD takes in response to a high lead level at an individual residence (available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov). Of the 263 people contacted at residences with potential LSLs sites, only 71 had LSLs. This is approximately 25 percent of contacted customers. Based on this information, EPA assumed that a water system would need to contact four residences to obtain one new LSL site for their sampling program and would require 0.5 hours per resident. This may be an overestimate because LSL systems will be updating their LSL inventory to identify residences with LSLs. Thus, they may need to contact fewer residences to find those with LSLs that are interested in participating in the sampling program.

c) ***Report any changes in sampling location to the Primacy Agency (hrs_chng_tap_op).*** Systems must report any changes in their tap sampling locations from the prior monitoring period and the reason for the change. EPA estimates CWSs will require 3 hours per monitoring period to submit this documentation based on the *Disinfectants/Disinfection Byproducts, Chemical, and Radionuclides Rules ICR (Renewal)*, Exhibit 35 in Appendix H (Move Tap Sampling Location) (USEPA, 2015b). EPA assumed CWSs would change monitoring locations every monitoring period due to customers dropping out of the testing program. NTNCWSs are not assumed to incur this burden because in general they have control over their entire distribution system and, unlike CWSs, should have access to all sampling locations. Thus, EPA assumed NTNCWS would be unlikely to change tap sampling locations. Note that this assumption would underestimate burden in those instances in which a NTNCWS had to change sampling sites (e.g., the site no longer meets the tiering criteria because the LSL was removed).

d) ***Confer with Primacy Agency on initial lead sampling data and status under the LCRR (hrs_initial_tap_confer_op).*** EPA assumed systems will incur one-time burden in year 4 to discuss their requirements with the Primacy Agency based on their most recent two six-month monitoring periods. EPA assumes each system will incur a burden of 1 hour for this consultation. This estimate

is based on the Primacy Agency estimate in ASDWA's CoSTS model (ASDWA, 2020a).[82] Specifically, ASDWA estimated that each state will require 2.1 hours to review and consult with the system. EPA assumed that the consultation is approximately 50 percent of this estimate and would apply to the water system and Primacy Agency.

e) Obtain households for each round of lead tap sampling (hrs_samp_volunt_op). For each monitoring period, CWSs will contact customers from the tap sampling pool (see b above) to obtain volunteers to participate in the lead tap sampling program. EPA assumed:

- CWSs will contact customers by phone.
- CWSs will spend 20 minutes with those that agree to participate to explain the program, or 50 percent of customers, and 5 minutes with those that do not, for an average of 15 minutes or 0.25 hours per sample.
- CWSs without LSLs will contact two customers for every one sample, resulting in an average burden of 0.5 hours per sample.
- CWSs with LSLs must contact additional customers because they must collect all samples from LSL sites and previous sites will become ineligible if LSLs are replaced. EPA assumed these systems will contact four customers for every one sample, resulting in an average burden of 1 hour.[83]

An important input for this activity is the number of customers that are contacted each monitoring period. EPA started with the required number of samples (*numb_samp_customer* or *numb_reduced_tap* from Section 5.3.2.1.1) and increased it to recognize that systems commonly start with a larger sampling pool to account for situations where customers do not actually take the sample, the sample is rejected for improper sampling protocol methods, or invalidated after it is analyzed. For modeling purposes, EPA inflated the starting number of customers in the sampling pool using the following percentages:

- **1 - *pp_hh_return_samp***: EPA assumed that 90 percent of volunteer customers would collect their lead sample each monitoring period, with 1 – 90 percent, or 10 percent not returning their sample bottles to be picked up by the water system. This likelihood is based on New York City's Department of Environmental Protection response to a 2016 questionnaire about their voluntary lead testing program in which they indicated that customers returned the test kits 50 percent of the time. EPA assumed a higher return rate of 90 percent because CWSs will have contact with their customers prior to sample collection as opposed to

[82] ASDWA developed a model to estimate the increase in costs to Primacy Agencies to implement the final LCRR requirements. This model was provided to the Agency as part of the public comment process on the proposed rulemaking and can be found in the file, "Final CoSTS 2-6-20" that is available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov.

[83] EPA doubled the estimated burden to recruit households for LSL CWSs from the proposed LCRR in response to a comment from the Colorado Department of Public Health and Environment who stated that systems will require additional time to recruit households because many are unaware of their service line materials, and more turnover in the sampling pool due to the new LSLR requirements (see Section 5.3.4) and find-and-fix requirements that are triggered by a single sample above 15 µg/L (see Section 5.3.3.3). This comment is available in the docket under EPA-HQ-OW-2017-0300 at https://www.regulations.gov.

customer-initiated sampling that may be done via a website. This likelihood does not apply to NTNCWSs.

- ***pp_samp_reject***: EPA assumed CWSs would reject 5 percent of samples prior to sample analysis based on the sample rejection rate provided by the City of Chicago Department of Water Management (DWM) regarding their free customer-request testing program. The DWM indicated they reject approximately 26 percent of test kits for improper sampling procedures. EPA assumed a lower rejection rate because customers will collect one sample as opposed to the three sets of samples that are part of Chicago's sampling protocol.[84] In addition, some customers participate in multiple sampling events and should be familiar with the sample collection protocol. Also refer to activity i) for the burden to CWSs to determine if a sample should be rejected (*hrs_samp_reject_op*). EPA assumed NTNCWSs would not reject any samples because they collect their own samples and should be familiar with the sampling protocol.

- ***pp_samp_invalid***: EPA estimated that a small percentage (0.6 percent) of samples will be invalidated by the Primacy Agency after the sample is analyzed. This estimate is based on the average of Indiana and North Carolina's response to a 2016 ASDWA survey regarding the number of invalidation requests per year. Indiana indicated they receive about 15 invalidations per year or 1.1 percent of their 1,375 CWSs and NTNCWSs. North Carolina responded they have 1 to 2 requests per year. This translates to 0.08 percent using the higher number of requests of 2 per the 2,375 CWSs and NTNCWSs in North Carolina. EPA used the average of the two percentages, approximately 0.6 percent. EPA assumed the same invalidation percentage for CWSs and NTNCWSs across all system sizes. Refer to activity k) for the burden to systems to prepare and submit a sample invalidation request to the Primacy Agency (*hrs_samp_invalid_op*). A copy of the questionnaire and each state's responses are available in the docket under EPA-HQ-OW-2017-0300 at www.regulations.gov.

f) Offer incentives to households to encourage participation in lead tap sampling program (cost_incentive). Some CWSs offer monetary incentives to their customers to encourage their participation in their lead tap sampling program. Other systems elect not to or are prohibited from providing financial incentives. EPA considered the following information provided by the Greater Cincinnati Water Works (GCWW) for 12 water systems in developing the likelihood that a system would offer an incentive and the amount of that incentive:

- Three systems (25 percent) offered no incentives.
- Nine systems offered incentives ranging from $10 to $100. Most (four) offered $25. Two systems offered $10, one system each offered $20, $50, and $100.

Based on this information, EPA:

[84] Chicago DWM's free testing program includes three bottles and instructions for an initial first-draw, a 3 minute flush, and a 5 minute flush.

- Assumed 75 percent of systems would offer incentives during each monitoring period in order to obtain customer participation (*p_incentive*).
- Set a minimum and maximum value by size category due to the variability across the 12 systems (*cost_incentive*). EPA assumed systems serving 3,300 or fewer people would not have the financial resources to offer large incentives and thus, set a minimum and maximum of $10 and $20, respectively. EPA assumed systems serving more than 3,300 would offer a minimum and maximum of $25 and $100, respectively.

EPA assumed that incentives are only provided to customers that collect a sample that is not later rejected or invalidated.

g) Ship tap sampling materials and instructions (hrs_discuss_samp_op, cost_5_lt_samp). The rule allows customers to collect tap samples after receiving proper instructions from the water system. EPA assumed each CWS will spend an average of 0.25 hours to discuss sampling instructions with customers *(hrs_discuss_samp_op)*. This estimate is based on information provided by Chicago DWM regarding its water testing program. DWM responded that on average staff required 0.25 hours to send out test kits. EPA assumed this burden included time to discuss sampling instructions with volunteers.

EPA assumed CWSs will ship sampling materials to customers. Thus, CWSs will also incur non-labor costs for a CWS to provide a test kit (including bottles and instructions) and ship the kits to customers *(cost_5_lt_samp)*. The inputs and assumptions for this cost are provided in Exhibit 5-16 for systems without LSLs and in Exhibit 5-17 for systems with LSLs.

Exhibit 5-16: Non-Labor Costs for CWS without LSLs to Provide Test Kits (per Sample)

System Size (Population Served)	Test Kit Cost	Shipping Cost to customers	Total Non-Labor Costs to Provide Test Kits
			cost_5_lt_samp
	A	B	C = A+B
≤100,000	$0.00	$6.85	$6.85
100,001-1,000,000	$4.52	$6.85	$11.37
>1,000,000	$4.52	$6.85	$11.37

Notes:
A: Bottles are provided as part of the commercial laboratory fee and all CWSs serving 100,000 or fewer people are assumed to use commercial labs. Bottle costs for CWSs serving > 100,000 people are based on 3 vendor quotes. See file, "Derivation of Lead Analytical Burden and Costs_Final Rule.xlsx," worksheet: In-House_Bottle_$.
B: Shipping cost based on information provided by the Chicago DWM in response to a 2016 questionnaire regarding their free testing program on the cost to ship a 3-bottle test kit of $6.85. (A copy of the questionnaire and DWM's responses are available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov.) Note that this may overestimate shipping cost because systems will only be shipping a 1-bottle sample kit.

Exhibit 5-17: Non-Labor Costs for CWS with LSLs to Provide Test Kits (per Sample)

System Size (Population Served)	Test Kit Cost	Shipping Cost to customers	Total Non-Labor Costs to Provide Test Kits
			cost_5_lt_samp
	A	B	C = A+B
≤100,000	$0.00	$6.85	$6.85
100,001-1,000,000	$17.97	$6.85	$24.82
>1,000,000	$17.97	$6.85	$24.82

Notes:
A: Bottles are provided as part of the commercial laboratory fee and all CWSs serving 100,000 or fewer people are assumed to use commercial labs. Bottle costs for CWSs serving > 100,000 people are based on 3 vendor quotes. See file, "Derivation of Lead Analytical Burden and Costs_Final Rule.xlsx," worksheet: In-House_Bottle_$. The test kit cost for CWSs with LSLs that serve more than 100,000 people includes the cost of four additional 1-liter bottles that have a discounted rate of $3.36 or $13.45 for a total cost of $24.82. For CWSs serving 100,000 or fewer with LSLs, the additional bottle costs are reflected in a higher commercial laboratory cost. See activity j) below.
B: Shipping cost based on information provided by the Chicago DWM in response to a 2016 questionnaire regarding their free testing program on the cost to ship a 3-bottle test kit of $6.85. This may slightly underestimate costs for systems with LSLs because they will now be shipping five, 1-liter bottles to each customer. (A copy of the questionnaire and DWM's responses are available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov.)

These unit costs are combined with the total number of tap sampling locations to produce the total cost in the SafeWater LCR model. To estimate the number of tap sampling locations, EPA inflated the number of required samples for CWSs (*numb_samp_customer* or *numb_reduced tap* from Section 5.3.2.1.1) by the likelihood a customer would not collect the sample of 10 percent (1 - *pp_hh_return_samp*), the likelihood that the sample would be rejected of 5 percent (*pp_samp_reject*), and the likelihood that a sample would be invalidated of 0.6 percent (*pp_samp_invalid*). See activity e) for a more detailed discussion of these likelihoods.

h) Collect lead tap samples (hrs_pickup_samp_op, cost_pickup_samp). EPA assumed CWSs will pick up filled sample bottles versus having the customer ship them back. The Agency has heard from a number of systems that picking up the sample bottles ensures a demonstrable chain of custody for the sample and ensures no damage to the sample before being analyzed by the laboratory. The system will incur burden and O&M costs to travel round-trip to pick-up a sample from each customer who participated in the sampling event. EPA calculated the average driving distance for each of the nine system size categories used in the SafeWater LCR model. For CWSs serving 100,000 or fewer people, EPA calculated the total service area for each active CWS in SDWIS/Fed with available zip code information from the 2006 CWSS and Zip Code Tabulation Areas from United States Census Bureau's Geography program TIGER GIS data (2019 release of 2010 decennial geographies). For CWSs serving more than 100,000 people, EPA determined the service area from the county information reported to SDWIS/Fed or the city's area. The latter was used for those CWSs that have system names identifying the city served (e.g., the CWS "San Diego, City Of").

EPA summed the total service area for all systems in each of the nine system size categories. EPA assumed each service area could be approximated by a circular shape and estimated the average driving distance as 2/3 the radius of the service area. Due to the limited availability of service area zip code information,[85] EPA used a weighted average for all systems serving 100,000 or fewer people based on the representativeness of the sample of systems with zip code information and the total number of systems within each size category. A summary of this analysis is presented in Exhibit 5-18 and additional data can be found in the file, "Derivation of Estimated Driving Distances_Final Rule.xlsx."

EPA also assumed systems would travel an average speed of 25 miles per hour to pick up a lead sample from participating customers that equals a burden of 0.39 to 0.67 *(hrs_pickup_samp_op)*, depending on the system size as shown in Column C of Exhibit 5-18 below. In addition, EPA used the Federal vehicle reimbursement rate of $0.54 per mile to calculate an average cost of $5.29 to $9.07 (*cost_pickup_samp_op*) per trip based on system size as shown in Column E of Exhibit 5-18.

Similar to previous activities, an important input is the number of locations at which systems collect lead tap samples. EPA started with the required number of samples for CWSs (*numb_samp_customer* or *numb_reduced tap* in Section 5.3.2.1.1) and increased it by the likelihoods a customer would not collect the sample of 10 percent (1 - *pp_hh_return_samp*), the sample would be rejected of 5 percent (*pp_samp_reject*), and the sample would be invalidated of 0.6 percent (*pp_samp_invalid*).

Exhibit 5-18: Travel Burden and Cost for Lead Tap Sample Pickup

System Size (Population Served)	Miles one way	Time one way (hrs)	Time Roundtrip (hrs)	2016 Mileage Rate	2016 Vehicle Cost
			hrs_pickup_samp_op		*cost_pickup_samp*
	A	B=A/25	C= B*2	D	E = A*2*D
≤100,000	4.9	0.20	0.39	$0.54	$5.29
100,001 – 1,000,000	6.3	0.25	0.50	$0.54	$6.80
>1,000,000	8.4	0.34	0.67	$0.54	$9.07

Source: See file "Derivation of Estimated Driving Distances_Final Rule.xlsx," available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov.

Notes:

A & B: Geographic extent of water systems from the 2006 Community Water Systems Survey, and Census Data. See file "Derivation of Estimated Driving Distances_Final Rule.xlsx" for derivation of mileage. Assumed travel speed of 25 mph.

D: Vehicle O&M based on Federal reimbursement rate of $0.54 (2016 mileage rate).

NTNCWSs collect their own samples and are assumed to require 0.5 hours to collect a sample *(hrs_pickup_samp_op)*. This burden is based on the estimated source water sample collection burden from the *Disinfectants/Disinfection Byproducts, Chemical, and Radionuclides Rules ICR*

[85] Between 1 and 14 percent of CWSs serving 100,000 or fewer were currently active systems with zip code information from the 2006 CWSS. For systems serving 100,000 to 1 million people, 5 percent and 95 percent of CWSs were included in the average driving distance estimates, respectively.

(Renewal) (Exhibit 15 in Appendix H) (USEPA, 2015b). EPA inflated the number of required samples for NTNCWS by the likelihood a sample would be invalidated of 0.6 percent (*pp_samp_invalid*) to account for the additional burden for a NTNCWS to collect another sample. See activity e) for a more detailed discussion of this likelihood.

i) Determine if sample should be rejected and not analyzed (hrs_samp_reject_op). CWSs will determine if samples collected by customers meet the required sampling protocol and if any should be rejected prior to analysis. For example, the sample volume may not be one-liter or a review of the chain-of-custody information could indicate the customer did not follow other proper sampling procedures. EPA assumed systems would spend an average of 15 minutes or 0.25 hours per rejected sample *(hrs_samp_reject_op)*.

The unit burden is multiplied by the number of samples that the system receives from customers, which is estimated as the required number of rejected samples (*numb_samp_customer* or *numb_reduced tap* from Section 5.3.2.1.1) multiplied by the 5 percent likelihood that the sample would be rejected (*pp_samp_reject*).

As discussed under activity e), EPA assumed all NTNCWSs collect their own samples and should be familiar with the sampling protocol and thus would not incur burden to determine if a sample should be rejected.

j) Analyze lead tap samples in-house or commercially (hrs_analyze_samp_op, cost_lab_lt_samp, cost_5_commercial_lab). Based on input from laboratories, EPA assumed only CWSs serving more than 100,000 people will have in-house capabilities to analyze lead. All NTNCWSs and all other CWSs are assumed to use a commercial laboratory for lead analysis. Thus, the likelihood that a model PWS will conduct lead analyses in-house *(pp_lab_samp)* is 1 for CWSs serving more than 100,000 people and 0 for all other systems. Conversely, the assigned likelihood that a system will use a commercial lab for lead, or *pp_commercial_samp*, is 0 for CWSs serving more than 100,000 people and 1 for all other systems.

Based on estimates provided by three laboratories, EPA assumed that systems conducting lead analysis in-house would require an average of 0.44 hours per sample for a lead analysis *(hrs_analyze_samp_op).* This burden includes sample preparation, sample analysis, quality control checks and data entry. Refer to "Derivation of Lead Analytical Burden and Costs_Final Rule.xlsx," worksheet "In-House Burden_hrs" for additional information. These systems would also incur non-labor costs for analytical materials such as preservatives, calibration standards, and quality assurance (QA) standards of $2.38 per sample *(cost_lab_lt_samp)* based on quotes from three vendors. See worksheet "In_House_Consumables_Summary_$," in the file, "Derivation of Lead Analytical Burden and Costs_Final Rule.xlsx."

Based on estimates from six laboratories, EPA assumed an average cost of $21.58 for lead tap sample analysis conducted by a commercial laboratory *(cost_5_commercial_lab)*. See worksheet Commercial Analytical_$ in the file "Derivation of Lead Analytical Burden and Costs_Final Rule.xlsx" for additional information. EPA increased this estimate for systems with LSLs to add bottle costs for

four additional 1 liter bottles[86] at an average discounted cost of $3.36 per bottle for an adjusted total commercial cost of $35.03 per sample.

The unit costs are multiplied by the number of samples analyzed each monitoring period to produce total costs. EPA began with the required number of samples (*numb_samp_customer* or *numb_reduced tap* from Section 5.3.2.1.1) and increased it by the 0.6 percent likelihood the sample would be invalidated (*pp_samp_invalid*) to estimate the number of samples analyzed in-house or commercially. Note that the number of samples analyzed does not include those rejected by the water system because they are not analyzed.

k) Prepare and submit a sample invalidation request to Primacy Agency (hrs_samp_invalid_op). Some CWSs and NTNCWSs will request that the Primacy Agency invalidate a lead tap sample. EPA assumed that systems will not require extensive time to prepare and submit their sample invalidation requests because the rule provides the allowable criteria for sample invalidation. EPA assumed systems will incur a burden of 2 hours per request *(hrs_samp_invalid_op)* based on Indiana's and North Carolina's responses to a questionnaire. A copy of the questionnaire and each state's responses are available in the docket under EPA-HQ-OW-2017-0300 at www.regulations.gov.

EPA estimated that 0.6 percent of samples will be invalidated for CWSs and NTNCWSs *(pp_samp_invalid*), as previously discussed in activity e). As a simplifying assumption, EPA assumed the Primacy Agency will grant all sample invalidation requests. Thus, the probability a system will request sample invalidation is equal to the probability that a sample will be invalidated.

l) Inform customers of lead tap sample results (hrs_inform_samp_op, cost_cust_lt, hrs_ntncws_inform_samp_op, cost_ntncws_cust_lt). CWSs must report individual lead sample results to customers who participated in the sampling pool. EPA estimates that systems will require an average of 0.05 hours per customer *(hrs_inform_samp_op).* This estimate is based on the public education burden for systems to notify occupants of monitoring results estimated as part of the *Disinfectants/Disinfection Byproducts, Chemical, and Radionuclides Rules ICR (Renewal)* (Exhibit 35 in Appendix H) (USEPA, 2015b). This ICR assumed a burden of 1 hour per 20 letters for all systems sizes. Systems are also assumed to mail these results at a cost of $0.58 *(cost_cust_lt)* that includes postage ($0.49), and paper and envelope costs based on three vendors of $0.025 and $0.067, respectively (see "General Cost Model Inputs_Final Rule.xlsx").

NTNCWSs are also required to provide sampling results to the people they serve. For NTNCWSs, EPA assumed the systems will deliver materials via email to all customers and post in a public location at a burden of 1 hour for all system sizes *(hrs_ntncws_inform_samp_op)*. This estimate includes 0.5 hours to develop and send the e-mails and an additional 0.5 hours to post public education materials publicly. EPA assumed NTNCWSs will incur paper costs of $0.025 *(cost_ntncws_cust_lt)* to post the flyer.

m) Certify to Primacy Agency that results were reported to customers (hrs_cert_cust_lt_op). EPA assumed CWSs and NTNCWSs serving 50,000 or fewer people will incur a burden of 0.66 hour per

[86] As previously discussed in Chapter 3, Section 3.3.2.2, the sampling methodology associated with collecting a fifth liter sample uses five one-liter bottles. The system returns the first for copper analysis if scheduled for analyses and the fifth liter for lead analysis.

monitoring period to prepare and submit a certification that customers were notified of their sampling results. Those serving more than 50,000 people will incur a burden of 1 hour for this activity. The burden estimates of 0.33 hours and 0.5 hours are based on North Carolina and Indiana's response, respectively, to a 2016 ASDWA questionnaire regarding the estimated burden to review these certifications. EPA assumed systems would require twice the burden to prepare these certifications than would be required for the Primacy Agency to review them. EPA used the higher estimated burden from Indiana for systems serving more than 50,000 people because these systems collect a larger number of samples than smaller systems and thus, would be certifying that they reported results to more customers. EPA assumed systems will submit this certification electronically and thus incur no paper or mailing costs.

n) ***Submit request to renew 9-year monitoring waiver to Primacy Agency (hrs_renew_nine_op).*** CWSs and NTNCWSs on 9-year monitoring waivers must submit documentation to the Primacy Agency every 9 years that demonstrates their system and their customers continue to have no lead- or copper-containing plumbing materials. As discussed in Section 4.3.7.1, EPA assumed only a subset of systems serving 1,000 or fewer people would qualify for this waiver. EPA assumed systems will incur a burden of 1 hour for this request based on the *Disinfectants/Disinfection Byproducts, Chemical, and Radionuclides Rules ICR (Renewal)*, Exhibit 35 in Appendix H (Monitoring Waiver Application) (USEPA, 2015b). See file, "Derivation of Pb Schedules_CWS_Final Rule.xlsx" for additional information on how EPA estimated the number of systems with 9-year monitoring waivers.

o) ***Submit sampling results and 90th percentile calculations to Primacy Agency (hrs_annual_lt_op).*** EPA estimated the burden for CWSs and NTNCWSs to submit tap sampling results and their 90th percentile calculations. This information is provided in Exhibit 5-19 for systems with and without LSLs with more detailed assumptions provided in the exhibit notes.

Exhibit 5-19: Burden to Submit Lead Tap Sampling Results and 90th Percentile Level

System Size (Population Served)	Provide Lead Tap Sampling Results and 90th percentile Calculation (hrs/system/monitoring period)	
	hrs_annual_lt_op	
	A	B=A*1.25
	No LSL	LSL
≤10,000	1	1.25
10,001-100,000	1.25	1.56
> 100,000	1.5	1.88

Notes:
A: Burden based on the *Disinfectants/Disinfection Byproducts, Chemical, and Radionuclides Rules ICR (Renewal)*, Exhibit 35 in Appendix H (Tap Sample Calcs) (USEPA, 2015b).
B: LSL systems must also provide documentation if they have an insufficient number of sites served by LSLs that are needed to meet minimum sampling requirements. Thus, EPA assumed an additional 25 percent burden for LSL systems.

Exhibit 5-20 shows the SafeWater LCR model cost estimation approach for system lead tap sampling activities. As shown in the exhibit, the SafeWater LCR model relies upon additional inputs, such as

number of samples for lead tap sampling and the likelihood a system is below an AL or TL, to compute the cost per activity. For example, unit costs for activity k) *Prepare and submit sample invalidation requests to Primacy Agency* is the product of the required number of samples, the probability of sample invalidation, the burden to prepare and submit the sample invalidation request, and the PWS hourly rate. A description of the data variables and section where they are described in more detail are provided in footnote 1 to the exhibit.

Exhibit 5-20: PWS Lead Tap Sampling Cost Estimation in SafeWater LCR by Activity[1]

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions[2]	
a) Update sampling instructions for Lead Tap Sample Monitoring program and submit to Primacy Agency[3]				
Total hours per system multiplied by the system labor rate. *(hrs_devel_samp_op*rate_op)*	Cost applies as written to NTNCWSs.	All	All model PWSs	One time
b) Contact homes to establish new 100 percent LSL tap sampling pool				
Total hours per system multiplied by the system labor rate. *(hrs_add_lsl_samp_op*rate_op)*	Cost does not apply to NTNCWSs.	All	Model PWSs with at least one LSL *p_lsl*	One time

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions[2]	
c) Report any changes in sampling location to the Primacy Agency[3, 4]				
Total system hours per monitoring period multiplied by the system labor rate. *(hrs_chng_tap_op*rate_op)*	Cost does not apply to NTNCWSs.	At or below TL	Model PWS is not on reduced tap sampling and not doing POU sampling 1 - *(p_tap_annual + p_tap_triennial + p_tap_nine)*	Twice per year
			Model PWS on annual reduced tap sampling and not doing POU sampling *p_tap_annual*	Once a year
			Model PWS on triennial reduced tap sampling and not doing POU sampling *p_tap_triennial*	Every 3 years
			Model PWS is on nine-year reduced tap sampling and not doing POU sampling *p_tap_nine*	Every 9 years
		At or below AL and above TL	All model PWSs not doing POU sampling	Once a year
		Above AL	All model PWSs not doing POU sampling	Twice a year
d) Confer with Primacy Agency on initial lead monitoring data and status under the LCRR				
Total system hours multiplied by the system labor rate. *(hrs_initial_tap_confer_op*rate_op)*	Cost applies as written to NTNCWSs.	All	All model PWSs	One Time

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions[2]	
e) Obtain households for each round of lead tap sampling				
The number of required samples per system multiplied by the hours per sample and the system labor rate. The number of required samples is inflated to include those unreturned, invalidated, and rejected to ensure that the cost reflects the additional burden that must occur to meet the sampling requirement. *(numb_samp_customer+(numb_samp_customer*(1-pp_hh_return_samp))+(numb_samp_customer*pp_samp_invalid)+(numb_samp_customer*pp_samp_reject))*(hrs_samp_volunt_op*rate_op)*	Cost does not apply to NTNCWSs.	At or below TL	Model PWS is not on reduced tap sampling and not doing POU sampling 1 - *(p_tap_annual + p_tap_triennial + p_tap_nine)*	Twice per year
		At or below AL and above TL	All model PWSs not doing POU sampling	Once a year
		Above AL	All model PWSs not doing POU sampling	Twice per year
The number of required samples per system multiplied by the hours per sample and the system labor rate. The number of required samples is inflated to include those unreturned, invalidated, and rejected to ensure that the cost reflects the additional burden that must occur to meet the sampling requirement. *(numb_reduced_tap+(numb_reduced_tap*(1-pp_hh_return_samp))+(numb_reduced_tap*pp_samp_invalid)+(numb_reduced_tap*pp_samp_reject))*(hrs_samp_volunt_op*rate_op)*	Cost does not apply to NTNCWSs.	At or below TL	Model PWS on annual reduced tap sampling and not doing POU sampling *p_tap_annual*	Once a year
			Model PWS on triennial reduced tap sampling and not doing POU sampling *p_tap_triennial*	Every 3 years
			Model PWS is on nine-year reduced tap sampling and not doing POU sampling *p_tap_nine*	Every 9 years
f) Offer incentives to households to encourage participation in lead tap sampling program				
The number of required samples per system multiplied by the cost of the incentive. This number is not inflated by the number of samples deemed invalid or rejected because it is assumed that if a sample is invalid or rejected the system will return to the same customer to resample. EPA also assumes that unreturned samples would not be eligible for an incentive. *numb_samp_customer*cost_incentive*	Cost does not apply to NTNCWSs.	At or below TL	Model PWS is not on reduced tap sampling and not doing POU sampling that offers an incentive *[*1 - *(p_tap_annual + p_tap_triennial + p_tap_nine)] * p_incentive*	Twice per year
		At or below AL and above TL	Model PWS not doing POU sampling that offers an incentive *p_incentive*	Once a year
		Above AL		Twice per year

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions[2]	
The number of required samples per system multiplied by the cost of the incentive. This number is not inflated by the number of samples deemed invalid or rejected, because it is assumed that if a sample is invalid or rejected the system will return to the same customer to resample. EPA also assumes that unreturned samples would not be eligible for an incentive. *numb_reduced_tap*cost_incentive*	Cost does not apply to NTNCWSs.	At or below TL	Model PWS on annual reduced tap sampling and not doing POU sampling that offers an incentive *p_tap_annual * p_incentive*	Once a year
			*Model PWS is on triennial reduced tap sampling and not doing POU sampling that offers an incentive p_tap_triennial * p_incentive*	Every 3 years
			Model PWS is on nine-year reduced tap sampling and not doing POU sampling that offers an incentive *p_tap_nine * p_incentive*	Every 9 years
g) Ship tap sample monitoring materials and instructions to participating households[5]				
Number of required samples multiplied by the total of the hours per sample to provide instructions times the system labor rate, plus the cost of materials per sample. The number of required samples is inflated to include those unreturned, invalidated, and rejected, to ensure that the cost reflects the additional burden that must occur to meet the sampling requirement. *(numb_samp_customer+(numb_samp_customer*(1-pp_hh_return_samp))+(numb_samp_customer*pp_samp_invalid)+(numb_samp_customer*pp_samp_reject))*((hrs_discuss_samp_op*rate_op)+cost_5_lt_samp)*	To calculate the sampling material costs for NTNCWSs this equation is still used. Number of required samples multiplied by the cost of materials per sample. The number of required samples is inflated to include those invalidated to ensure that the cost reflects the additional burden that must occur to meet the sampling requirement. *((numb_samp_customer+(numb_samp_customer*pp_samp_invalid))*cost_5_lt_samp)*	At or below TL	Model PWS is not on reduced tap sampling and not doing POU sampling 1 - *(p_tap_annual + p_tap_triennial + p_tap_nine)*	Twice per year
		At or below AL and above TL	All model PWSs not doing POU sampling	Once a year
		Above AL		Twice per year

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions[2]	
Number of required samples multiplied by the total of the hours per sample to provide instructions times the system labor rate, plus the cost of materials per sample. The number of required samples is inflated to include those unreturned, invalidated, and rejected, to ensure that the cost reflects the additional burden that must occur to meet the sampling requirement. *(numb_reduced_tap+(numb_reduced_tap*(1-pp_hh_return_samp))+(numb_reduced_tap*pp_samp_invalid)+(numb_reduced_tap*pp_samp_reject))*((hrs_discuss_samp_op*rate_op)+cost_5_lt_samp)*	To calculate the sampling material costs for NTNCWSs this equation is still used. Number of required samples multiplied by the cost of materials per sample. The number of required samples is inflated to include those invalidated to ensure that the cost reflects the additional burden that must occur to meet the sampling requirement. *((numb_reduced_tapr+(numb_reduced_tap*pp_samp_invalid))*cost_5_lt_samp)*	At or below TL	Model PWS on annual reduced tap sampling and not doing POU sampling *p_tap_annual*	Once a year
			Model PWS is on triennial reduced tap sampling and not doing POU sampling *p_tap_triennial*	Every 3 years
			Model PWS is on nine-year reduced tap sampling and not doing POU sampling *p_tap_nine*	Every 9 years
h) Collect lead tap samples				
The number of required samples per system multiplied by the hours per sample and the system labor rate. The number of required samples is inflated to include those invalidated and rejected to ensure that the cost reflects the additional burden that must occur to meet the sampling requirement. *(numb_samp_customer+(numb_samp_customer*pp_samp_invalid)+(numb_samp_customer*pp_samp_reject)+(numb_samp_customer*(1-pp_hh_return_samp))*((hrs_pickup_samp_op*rate_op)+cost_pickup_samp)*	Cost applies as written to NTNCWSs.	At or below TL	Model PWS is not on reduced tap sampling and not doing POU sampling 1 - *(p_tap_annual + p_tap_triennial + p_tap_nine)*	Twice per year
		At or below AL and above TL	All model PWSs not doing POU sampling	Once a year
		Above AL		Twice per year

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions[2]	
The number of required samples multiplied by the total of the hours per sample to provide instructions times the system labor rate, plus the cost of materials per sample. The number of required samples is inflated to include those unreturned, invalidated, and rejected, to ensure that the cost reflects the additional burden that must occur to meet the sampling requirement. *(numb_reduced_tap+(numb_reduced_tapr*pp_samp_invalid)+(numb_reduced_tap*pp_samp_reject)+(numb_reduced_tap*(1-pp_hh_return_samp))*((hrs_pickup_samp_op*rate_op)+cost_pickup_samp)*	Cost applies as written to NTNCWSs.	At or below TL	Model PWS on annual reduced tap sampling and not doing POU sampling *p_tap_annual*	Once a year
			Model PWS is on triennial reduced tap sampling and not doing POU sampling *p_tap_triennial*	Every 3 years
			Model PWS is on nine-year reduced tap sampling and not doing POU sampling *p_tap_nine*	Every 9 years
i) Determine if sample should be rejected and not analyzed				
The number of samples expected to be rejected (calculated by multiplying the total number of required samples by the likelihood of rejection) multiplied by the hours per sample and the system labor rate. *(numb_samp_customer*pp_samp_reject)*(hrs_samp_reject_op*rate_op)*	Cost does not apply to NTNCWSs.	At or below TL	Model PWS is not on reduced tap sampling and not doing POU sampling 1 - *(p_tap_annual + p_tap_triennial + p_tap_nine)*	Twice per year
		At or below AL and above TL	All model PWSs not doing POU sampling	Once a year
		Above AL		Twice per year
The number of samples expected to be rejected (calculated by multiplying the total number of required samples by the likelihood of rejection) multiplied by the hours per sample and the system labor rate. *(numb_reduced_tap*pp_samp_reject)*(hrs_samp_reject_op*rate_op)*	Cost does not apply to NTNCWSs.	At or below TL	Model PWS on annual reduced tap sampling and not doing POU sampling *p_tap_annual*	Once a year
			Model PWS is on triennial reduced tap sampling and not doing POU sampling *p_tap_triennial*	Every 3 years
			Model PWS is on nine-year reduced tap sampling and not doing POU sampling *p_tap_nine*	Every 9 years

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions[2]	
j) Analyze lead tap samples in-house or commercially[5]				
The number of samples multiplied by the probabilities for a sample analyzed in house and a sample analyzed in a commercial lab times the different labor and material cost burdens for each type of analysis. The number of samples is inflated to include those invalidated, to ensure that the cost reflects the additional burden that must occur to meet the sampling requirement. *(((numb_samp_customer+(numb_samp_customer*pp_samp_invalid))*pp_lab_samp)*((hrs_analyze_samp_op*rate_op)+cost_lab_lt_samp))+(((numb_samp_customer+(numb_samp_customer*pp_samp_invalid))*pp_commercial_samp)*((hrs_analyze_samp_op*rate_op)+cost_5_commercial_lab))*	Cost applies as written to NTNCWSs.	At or below TL	Model PWS is not on reduced tap sampling and not doing POU sampling *1 - (p_tap_annual + p_tap_triennial + p_tap_nine)*	Twice per year
		At or below AL and above TL	All model PWSs not doing POU sampling	Once a year
		Above AL		Twice per year
The number of samples multiplied by the probabilities for a sample analyzed in house and a sample analyzed in a commercial lab times the different labor and material cost burdens for each type of analysis. The number of samples is inflated to include those invalidated, to ensure that the cost reflects the additional burden that must occur to meet the sampling requirement. *(((numb_reduced_tap+(numb_reduced_tap*pp_samp_invalid))*pp_lab_samp)*((hrs_analyze_samp_op*rate_op)+cost_lab_lt_samp))+(((numb_reduced_tap+(numb_reduced_tap*pp_samp_invalid))*pp_commercial_samp)*((hrs_analyze_samp_op*rate_op)+cost_commercial_lab))*	Cost applies as written to NTNCWSs.	At or below TL	Model PWS is on annual reduced tap sampling and not doing POU sampling *p_tap_annual*	Once a year
			Model PWS on triennial reduced tap sampling and not doing POU sampling *p_tap_triennial*	Every 3 years
			Model PWS is on nine-year reduced tap sampling and not doing POU sampling *p_tap_nine*	Every 9 years

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions[2]	
k) Prepare and submit sample invalidation request to Primacy Agency				
The number of samples expected to be invalid (calculated by multiplying the total number of required samples by the likelihood of invalidation) multiplied by the hours per sample and the system labor rate. *(numb_samp_customer*pp_samp_invalid)*(hrs_samp_invalid_op*rate_op*	Cost applies as written to NTNCWSs.	At or below TL	Model PWS not on reduced tap sampling and not doing POU sampling 1 - *(p_tap_annual + p_tap_triennial + p_tap_nine)*	Twice per year
		At or below AL and above TL	All model PWSs not doing POU sampling	Once a year
		Above AL		Twice per year
The number of samples expected to be invalid (calculated by multiplying the total number of required samples by the likelihood of invalidation) multiplied by the hours per sample and the system labor rate. *(numb_reduced_tap*pp_samp_invalid)*(hrs_samp_invalid_op*rate_op)*	Cost applies as written to NTNCWSs.	At or below TL	Model PWS on annual reduced tap sampling and not doing POU sampling *p_tap_annual*	Once a year
			Model PWS is on triennial reduced tap sampling and not doing POU sampling *p_tap_triennial*	Every 3 years
			Model PWS is on nine-year reduced tap sampling and not doing POU sampling *p_tap_nine*	Every 9 years
l) Inform customers of lead tap sample results				
The number of required of samples per system multiplied by the total of the hours per sample times the system labor rate plus the material cost per sample. *numb_samp_customer*((hrs_inform_samp_op*rate_op)+cost_cust_lt)*	Hours per sampling event multiplied by the system labor rate, plus the material cost per sampling event. *((hrs_ntncws_inform_samp_op*rate_op)+cost_ntncws_cust_lt)*	At or below TL	Model PWS is not on reduced tap sampling and not doing POU sampling 1 - *(p_tap_annual + p_tap_triennial + p_tap_nine)*	Twice per year
		At or below AL and above TL	All model PWSs not doing POU sampling	Once a year
		Above AL		Twice per year

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions[2]	
The number of required samples per system multiplied by the total of the hours per sample times the system labor rate plus the material cost per sample. *numb_reduced_tap*((hrs_inform_samp_op*rate_op)+cost_cust_lt)*	Hours per sampling event multiplied by the system labor rate, plus the material cost per sampling event. *((hrs_ntncws_inform_samp_op*rate_op)+cost_ntncws_cust_lt)*	At or below TL	Model PWS is on annual reduced tap sampling and not doing POU sampling *p_tap_annual*	Once a year
			Model PWS on triennial reduced tap sampling and not doing POU sampling *p_tap_triennial*	Every 3 years
			Model PWS is on nine-year reduced tap sampling and not doing POU sampling *p_tap_nine*	Every 9 years
m) Certify to Primacy Agency that results were reported to customers				
Total hours per sampling event multiplied by the system labor rate. (hrs_cert_cust_lt_op*rate_op)	Cost applies as written to NTNCWSs.	At or below TL	Model PWS is not on reduced tap sampling and not doing POU sampling 1 - *(p_tap_annual + p_tap_triennial + p_tap_nine)*	Twice per year
			Model PWS is on annual reduced tap sampling and not doing POU sampling *p_tap_annual*	Once a year
			Model PWS on triennial reduced tap sampling and not doing POU sampling *p_tap_triennial*	Every 3 years
			Model PWS is on nine-year reduced tap sampling and not doing POU sampling *p_tap_nine*	Every 9 years
		At or below AL and above TL	All model PWSs not doing POU sampling	Once a year
		Above AL		Twice per year

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions[2]	
n) Submit request to renew 9-year monitoring waiver to Primacy Agency[6]				
Total hours per sampling event multiplied by the system labor rate. *(hrs_renew_nine_op*rate_op)*	Cost applies as written to NTNCWSs.	All	Model PWS is on nine-year reduced tap sampling and not doing POU sampling *p_tap_nine*	Every 9 years
o) Submit monitoring results and 90th percentile calculations to Primacy Agency[5]				
Total hours per sampling event multiplied by the system labor rate. *(hrs_annual_lt_op*rate_op)*	Cost applies as written to NTNCWSs.	At or below TL	Model PWS is not on reduced tap sampling and not doing POU sampling 1 - *(p_tap_annual + p_tap_triennial + p_tap_nine)*	Twice per year
			Model PWS is on annual reduced tap sampling and not doing POU sampling *p_tap_annual*	Once a year
			Model PWS on triennial reduced tap sampling and not doing POU sampling *p_tap_triennial*	Every 3 years
			Model PWS is on nine-year reduced tap sampling and not doing POU sampling *p_tap_nine*	Every 9 years
		At or below AL and above TL	All model PWSs not doing POU sampling	Once a year
		Above AL		Twice a year

Acronyms: AL = action level; CWS = community water system; LSL = lead service line; NTNCWS = non-transient non-community water system; POU = point-of-use; PWS = public water system; TL = trigger level.

Notes:

[1] The data variables in the exhibit are defined previously in this section with the exception of:

- *numb_reduced tap*: the number of lead tap samples for system on reduced annual, triennial, or 9-year monitoring (Section 5.3.2.1.1).
- *numb_samp_customer*: the number of lead tap samples for system on routine 6-month tap monitoring (Section 5.3.2.1.1).
- *p_tap_annual, p_tap_triennial*, and *p_tap_nine*: likelihood a systems is collecting the reduced number of lead tap samples on an annual, triennial, or 9-year frequency, respectively (Section 5.3.2.1.1).
- *rate_op:* PWS hourly labor rate (Section 4.3.10.1).

[2] Does not apply to CWSs serving ≤ 3,300 people and all NTNCWSs that have selected POU as their compliance option if they exceeded the lead AL. See Section 0 for additional detail.
[3] In Arkansas, Louisiana, Mississippi, Missouri, North Dakota, and South Carolina the state sends sampling instructions to the water systems and thus are assumed to incur the burden to update the sampling instruction in lieu of the system.
[4] For modeling purposes, EPA assumed that systems would report changes in sampling location during each monitoring period.
[5] The burden and costs to provide sample bottles (*cost_5_lt_samp*) under activity g), conduct analyses under activity j), and provide sampling results under activity o) are incurred by the state in Arkansas, Louisiana, Mississippi, Missouri, and South Carolina.
[6] Only systems with 90th percentile values ≤ the TL can quality for a 9-year monitoring waiver.

5.3.2.1.3 Lead Tap Sampling PWS Unit Cost Estimation Example

This section provides examples of the estimation of the Lead Tap Sample Monitoring unit cost calculations for each activity a) through o) that are presented in Section 5.3.2.1.2 and Exhibit 5-20 and follows the same lettering system. These examples include, when relevant, both the upper and lower bounds of the unit costs that model PWSs might incur when conducting Lead Tap Sampling.

For this example, EPA is using data that describe a surface water CWS with the following attributes:

- serves a population of 10,001 to 50,000;
- has LSLs in the distribution system;
- has CCT in place;
- is on a triennial Lead Tap Monitoring schedule;
- has a 90th percentile at or below the TL; and
- is not conducing POU monitoring.

Model PWSs within the SafeWater LCR model are assigned either a 0 (no) or 1 (yes) for a number of system characteristics at the start of analysis, including LSL status. As shown in Exhibit 5-4, this model PWS has a 60 percent chance of having LSLs under the low cost scenario and 69 percent under the high cost scenario. As shown in Exhibit 4-20, the likelihood of this model PWS having a 90th percentile initially at or below the TL under the LCRR is 97 percent under the low cost scenario and 87 percent under the high cost scenario. Given that the model PWS has a 90th percentile at or below the TL, the model PWS has a 98 percent likelihood of being on a triennial lead tap sample monitoring schedule (see Exhibit 4-29 and Exhibit 4-30 for systems with and without CCT, respectively).

a) <u>Update Sampling Instructions and Submit to Primacy Agency</u>

The model PWS would begin by updating their sampling instructions to reflect the requirements in the LCRR. The estimation of this cost is represented by the following expression, which can be found in the first row under the heading "Update sampling instructions for lead tap sampling and submit to Primacy Agency" in Exhibit 5-20:

Cost to update sampling instructions = *hrs_devel_samp_op* * *rate_op*

where:

- *hrs_devel_samp_op* is the number of hours a system will require to update sampling instructions (see Section 5.3.2.1.2, activity a)).
- *rate_op* is the hourly rate for PWS staff (see Section 4.3.10.1).

Cost to update sampling instructions = (2 hrs * $36.15/hr) = $72.30

The model PWS will incur this $72.30 cost to update its sampling instructions in year 4.

b) <u>Contact Homes to Establish a New 100 percent LSL Tap Sampling Pool</u>

Next, the example system would contact homes to establish a new 100 percent LSL tap sampling pool. The estimation of this cost is represented by the following expression:

Cost to contact homes = *hrs_add_lsl_samp_op* * *rate_op* (equation provided in Exhibit 5-20).

where:

- *hrs_add_lsl_samp_op* is the number of hours the system will require to contact homes with LSLs to achieve a 100 percent LSL sampling pool (see Exhibit 5-15).
- *rate_op* is the hourly rate for PWS staff (see Section 4.3.10.1).

Cost to contact homes = (60 hrs * $36.15/hr) = $2,169.

The model PWS will incur this $2,169 cost to contact homes to establish a new sampling pool once within the first four years after promulgation.

c) <u>Report Changes in Sampling Location to Primacy Agency</u>

Systems then report to the Primacy Agency on any changes in sampling location for lead tap sampling. The estimation of this cost is represented by the following expression:

Cost to report changes in sampling location = *hrs_chng_tap_op* * *rate_op*

where:

- *hrs_chng_tap_op* is the number of hours the system will require to report a Change in Tap locations to the Primacy Agency (see Section 5.3.2.1.2, activity c)).
- *rate_op* is the hourly rate for PWS staff (see Section 4.3.10.1).

Cost to report changes in sampling location = (3 hrs * $36.15/hr) = $108.45

The model PWS will incur this $108.45 cost to report changes in sampling location once per sampling period, or every three years for this example system on triennial monitoring.

d) <u>Confer with Primacy Agency on Initial Lead Monitoring Data and Status under LCRR</u>

Systems will confer with their Primacy Agencies to discuss their requirements with the Primacy Agency based on their most recent two six-month monitoring periods.

Cost to confer with the Primacy Agency = *hrs_initial_tap_confer_op* * *rate_op*

where:

- *hrs_initial_tap_confer_op* is the number of hours the system will require to report a confer with the Primacy Agency on their initial monitoring data and status under the LCRR (see Section 5.3.2.1.2, activity d)).
- *rate_op* is the hourly rate for PWS staff (see Section 4.3.10.1).

Cost to confer with the Primacy Agency = (1 hr * $36.15/hr) = $36.15

The model PWS will incur this $36.15 cost to confer with the Primacy Agency one-time during year 4.

e) <u>Recruit Household Volunteers</u>

Systems also recruit household volunteers for the Lead Tap Sample Monitoring program for each round of sampling. The number of required samples is inflated to include those not collected, rejected, and invalidated to ensure that the cost reflects the additional burden that must occur to meet the sampling requirement. The estimation of this cost is represented by the following expression:

Cost to recruit household volunteers = [*numb_reduced_tap* + *numb_reduced tap* * ((1 - *pp_hh_return_samp*) + *pp_samp_reject* + *pp_samp_invalid)*] * *hrs_samp_volunt_op* * *rate_op*

where:

- *numb_reduced_tap* is the number of reduced tap samples required per system (i.e., number of customers from whom a system must obtain samples for systems on reduced Lead Tap Sample Monitoring (see Exhibit 5-13).
- 1 - *pp_hh_return_samp* is the likelihood that a volunteer household will not collect the sample for Lead Tap Sample Monitoring (see Section 5.3.2.1.2, activity e)).
- *pp_samp_reject* is the likelihood that a sample will be rejected by the system following lead tap sample monitoring but prior to sample analysis(see Section 5.3.2.1.2, activity e)).
- *pp_samp_invalid* is the likelihood that a lead sample will be deemed invalid by the Primacy Agency (see Section 5.3.2.1.2, activity e)).
- *hrs_samp_volunt_op* is the number of hours per customer to obtain volunteer customers for Lead Tap Sample Monitoring samples (see Section 5.3.2.1.2, activity e)).
- *rate_op* is the hourly rate for PWS staff (see Section 4.3.10.1).

Cost to recruit household volunteers = [30 samples + 30 samples * ((1 - 0.9) + 0.05 + 0.006)] * (1 hr * $36.15/hr) = $1,253.68.

The model PWS will incur this $1,253.68 cost to recruit household volunteers once per sampling period, or in this example once every three years.

f) <u>Offer an Incentive to Households for Participation</u>

Systems that offer an incentive, do so to encourage participation in the lead tap sampling program. Seventy-five percent of systems are expected to offer an incentive. The number of households is

assumed to equal the number of required samples. This number is not inflated by the number of samples rejected or deemed invalid because EPA assumed that incentives are only provided to customers that collect a sample that is not later rejected or invalidated. The estimation of this cost is represented by the following expression:

Cost to offer incentives = *numb_reduced_tap* * *cost_incentive*

where:

- *numb_reduced_tap* is the number of reduced tap samples required per system (i.e., number of customers from whom a system must obtain tap samples) for systems on reduced lead tap sample monitoring (see Exhibit 5-13).
- *cost_incentive* is the cost per customer for an incentive to participate in the sampling program (see Section 5.3.2.1.2, activity f)).

The variable *cost_incentive* ranges from $25 to $100 for the example PWS (see Section 5.3.2.1.2, subsection e)). In the case of this example, EPA assumed a value of $50.

Cost to offer incentives = (30 samples * $50/sample) = $1,500

The model PWS will incur this $1,500 cost to offer incentives once per sampling period, or in this example, once every three years.

g) <u>Ship Sample Material and Instructions</u>

Systems then ship the lead tap sampling sample materials and instructions to the participating households. The number of required samples is inflated to include those not collected, rejected, and invalidated to ensure that the cost reflects the additional burden that would occur to meet the sampling requirement. The estimation of this cost is represented by the following expression:

Cost to deliver sample material and instructions = [*numb_reduced_tap* + *numb_samp_customer* * ((1 - *pp_hh_return_samp*) + *pp_samp_reject* + *pp_samp_invalid*)] * (*hrs_discuss_samp_op* * *rate_op* + *cost_lt_samp*)

where:

- *numb_reduced_tap* is the number of reduced tap samples required per system for systems (i.e., number of customers from whom a system must obtain tap samples) on reduced Lead Tap Sample Monitoring (see Exhibit 5-13).
- 1 - *pp_hh_return_samp* is the likelihood that a volunteer household will not collect the sample for Lead Tap Sample Monitoring (see Section 5.3.2.1.2, activity e)).
- *pp_samp_reject* is the likelihood that a sample will be rejected following lead tap sample monitoring (see Section 5.3.2.1.2, activity e)).
- *pp_samp_invalid* is the likelihood that a lead or copper sample will be deemed invalid (see Section 5.3.2.1.2, activity e)).

- *hrs_discuss_samp_op* is the number of hours per volunteer household to discuss and deliver Lead Tap Sample Monitoring sample instructions (see Section 5.3.2.1.2, activity g)).
- *rate_op* is the hourly rate for PWS staff (see Section 4.3.10.1).
- *cost_5_lt_samp* is the material cost excluding consumables for in-house analyses for Lead Tap Sample Monitoring (i.e., test kit and shipping to customers, and cost to travel to pick-up bottles) (see Exhibit 5-16).

Cost to deliver sample material and instructions = [30 samples + 30 samples * ((1 - 0.9) + 0.05 + 0.006)] * ((0.25 hrs * $36.15/hr) + $6.85/sample) = $550.98

The model PWS will incur this $550.98 cost to ship materials and instructions once per sampling period, or in this example once every three years.

h) <u>Collect lead tap samples</u>

Systems then pick up lead tap samples from the participating households. The number of required samples is inflated to include those rejected and invalidated to reflect the additional burden that must occur to meet the sampling requirement. The estimation of this cost is represented by the following expression:

Cost to pick up lead tap samples = [*numb_reduced_tap* + *numb_reduced_tap* * (*pp_samp_reject* + *pp_samp_invalid*)] * *((hrs_pickup_samp_op * rate_op) + cost_pickup_samp)*

where:

- *numb_reduced_tap* is the number of reduced tap samples required per system for systems (i.e., number of customers from whom a system must obtain tap samples) on reduced Lead Tap Sample Monitoring (see Exhibit 5-13).
- 1 - *pp_hh_return_samp* is the estimated likelihood that a volunteer household will not collect the sample for Lead Tap Sample Monitoring (see Section 5.3.2.1.2, activity e)).
- *pp_samp_reject* is the likelihood that a sample will be rejected following Lead Tap Sample Monitoring (see Section 5.3.2.1.2, activity e).
- *pp_samp_invalid* is the likelihood that a lead sample will be deemed invalid (see Section 5.3.2.1.2, activity e)).
- *hrs_pickup_samp_op* is the number of hours per sample for PWS staff to travel to the customer's residence to pick up lead tap sample from customer (see Section 5.3.2.1.2, activity h)).
- *cost_pickup_samp* is the travel cost per sample for PWS to travel to the customer's residence to pick up lead tap sample from customer (see Section 5.3.2.1.2, activity h)
- *rate_op* is the hourly rate for PWS staff (see Section 4.3.10.1).

Cost to pick up lead tap samples = [30 samples + 30 samples * (0.05 + 0.006)] * ((0.39 hrs * $36.15/hr) + $5.29/sample) = $616.52.

The model PWS will incur this $616.52 cost to pick up lead tap samples once per sampling period, or in this example once every three years.

i) Determine if a Lead Tap Sample Should be Rejected

Systems must determine if a lead tap sample collected by a household should be rejected and not analyzed. The number of required samples is inflated to include those rejected and invalidated. The estimation of this cost is represented by the following expression:

Cost to determine if a lead tap sample should be rejected = [*numb_reduced_tap* + *numb_reduced_tap* * (*pp_samp_reject* + *pp_samp_invalid*)] * *hrs_samp_reject_op* * *rate_op*

where:

- *numb_reduced_tap* is the number of reduced tap samples required per system (i.e., number of customers from whom a system must obtain tap samples) for systems on reduced Lead Tap Sample Monitoring (see Exhibit 5-13).
- *pp_samp_invalid* is the likelihood that a lead sample will be deemed invalid (see Section 5.3.2.1.2, activity e)).
- *pp_samp_reject* is the odds that a sample will be rejected following Lead Tap Sample Monitoring (see Section 5.3.2.1.2, activity e)).
- *hrs_samp_reject_op* is the number of hours per rejected sample for PWS staff to decide to reject sample (see Section 5.3.2.1.2, activity i)).
- *rate_op* is the hourly rate for PWS staff (see Section 4.3.10.1).

Cost to determine if a lead tap sample should be rejected = [30 samples + 30 samples * (0.05 + 0.006)] * 0.25 hrs * $36.15/hr = $13.56

The model PWS will incur this $13.56 cost to determine if lead tap samples should be rejected once per sampling period, or in this example once every three years.

j) Analyze Lead Tap Samples

Systems then analyze the lead tap samples, either in-house or in a commercial laboratory. Systems serving populations of 10,001 to 50,000 are assumed to use commercial labs. The number of samples is inflated to include those invalidated, to ensure that the cost reflects the additional burden that must occur to meet the sampling requirement. The estimation of this cost is represented by the following expression:

Cost to analyze lead tap samples = [*numb_reduced_tap* + *numb_reduced_tap* * *pp_samp_invalid*] * [(*pp_commercial_samp* * (*hrs_analyze_samp_op* * *rate_op* + *cost_lab_lt_samp*)) + (*pp_commercial_samp* * *cost_5_commercial_lab*)]

where:

- *numb_reduced_tap* is the number of reduced tap samples required per system (i.e., number of customers from whom a system must obtain tap samples) for systems on reduced Lead Tap Sample Monitoring (see Exhibit 5-13).
- *pp_samp_invalid* is the likelihood that a lead or copper sample will be deemed invalid (see Section 5.3.2.1.2, activity e)).
- *pp_commercial_samp* is the likelihood that a sample will be analyzed in a commercial lab (see Section 5.3.2.1.2, activity j)).
- *hrs_analyze_samp_op* is the number of hours per sample it takes to analyze lead tap samples or source water monitoring results (see Section 5.3.2.1.2, activity j)).
- *rate_op* is the hourly rate for PWS staff (see Section 4.3.10.1).
- *cost_5_commercial_lab* is the commercial laboratory cost per sample (see Section 5.3.2.1.2, activity j)).

Cost to analyze lead tap samples = [30 samples + 30 samples * 0.006] * [(0 * (0 hrs * $36.15/sample + $0)) + (1 * $35.03/sample)] = $651.28

The model PWS will incur this $651.28 cost to analyze lead tap samples once per sampling period, or in this example once every three years.

k) <u>Prepare and Submit Sample Invalidation Request to Primacy Agency</u>

The system must determine whether any of the samples may be invalid and submits the invalidation request to the Primacy Agency. The estimation of this cost is represented by the following expression:

Cost to prepare and submit sample invalidation request = *numb_reduced_tap * pp_samp_invalid * hrs_samp_invalid_op * rate_op*.

where:

- *numb_reduced_tap* is the number of reduced tap samples required per system for systems (i.e., number of customers from whom a system must obtain tap samples) on reduced Lead Tap Sample Monitoring (see Exhibit 5-13).
- *pp_samp_invalid* is the likelihood that a lead sample will be deemed invalid (see Section 5.3.2.1.2, activity e)).
- *hrs_samp_invalid_op* is the number of hours per invalidated samples to submit sample invalidation request (see Section 5.3.2.1.2, activity k)).
- *rate_op* is the hourly rate for PWS staff (see Section 4.3.10.1).

Cost to prepare and submit sample invalidation request = 30 samples * 0.006 * 2 hrs * $36.15/hrs = $13.02

The model PWS will incur this $13.02 cost to prepare and submit a sample invalidation request once per sampling period, or in this example once every three years.

l) Inform Customers of Results

After the sampling, systems inform customers of results of the Lead Tap Sampling Monitoring collected at their household. The estimation of this cost is represented by the following expression:

Cost to inform customers of results = *numb_reduced_tap* * (*hrs_inform_samp_op* * *rate_op* + *cost_cust_lt*)

where:

- *numb_reduced_tap* is the number of reduced tap samples required per system (i.e., number of customers from whom a system must obtain tap samples) for systems on reduced Lead Tap Sample Monitoring (see Exhibit 5-13).
- *hrs_inform_samp_op* is the number of hours per sample to inform customers of lead results (see Section 5.3.2.1.2, activity l)).
- *rate_op* is the hourly rate for PWS staff (see Section 4.3.10.1).
- *cost_cust_lt* is the mailing cost per sample to inform customers of lead results (see Section 5.3.2.1.2, activity l)).

Cost to inform customers of results = 30 samples * (0.05 hrs * $36.15/hr + $0.58/sample) = $71.63

The model PWS will incur this $71.63 cost to inform customers of results once per sampling period, or in this example once every three years.

m) Certify to the Primacy Agency that Results were Reported

Systems then certify to the Primacy Agency that the Lead Tap Sample Monitoring results were reported to the customer. The estimation of this cost is represented by the following expression:

Cost to certify that results were reported = *hrs_cert_cust_lt_op* * *rate_op*

where:

- *hrs_cert_cust_lt_op* is the number of hours to certify to Primacy Agency that Lead Tap Sample Monitoring results were reported to customers (see Section 5.3.2.1.2, subsection l)).
- *rate_op* is the hourly rate for PWS staff (see Section 4.3.10.1).

Cost to certify that results were reported = 0.66 hrs * $36.15/hr = $23.86

The model PWS will incur this $23.86 cost to certify that results were reported once per sampling period, or in this example once every three years.

n) Submit Renewal of Nine-Year Monitoring Waiver Application

Systems on nine-year sampling schedules would also be required to submit renewal of their nine-year monitoring waiver application, but this would not apply in the case of this example system because as

discussed in Section 4.3.7.1, EPA assumed only a subset of systems serving 1,000 or fewer would qualify for this waiver.

o) Provide Monitoring Results and 90th Percentile Calculations

Finally, systems will submit their lead monitoring results and 90th percentile calculations to their Primacy Agency. The estimation of this cost is represented by the following expression:

Cost to draft and submit report on results = *hrs_annual_lt_op* * *rate_op*

where:

- *hrs_annual_lt_op* is the number of hours it takes to draft and report lead results and 90th percentile calculations (see Section 5.3.2.1.2, activity o)).
- *rate_op* is the hourly rate for PWS staff (see Section 4.3.10.1).

Cost to draft and submit report on results = 1.56 hrs * $36.15/hr = $56.39

The model PWS will incur this $56.39 cost to draft and submit a report on results once per sampling period or, in this example, once every three years.

Total One-Time Costs and Per Sampling Period Costs

The total one-time cost for the model PWS for activities a) through n) is $2,277.45 and the reoccurring cost that the PWS will incur once every three years is $4,859.37.

The lead tap water sampling costs of each model PWS in the SafeWater LCR model will vary depending on the characteristics of the model PWS. For example, if a model PWS with all of the attributes listed above had a 90th percentile above the AL, the model PWS sampling costs would be quite different. Instead of conducting one round of sampling every three years (i.e., triennial sampling), the model PWS would conduct sampling every six months. In addition, instead of taking 30 samples each sampling period, the model PWS will be required to take 60 samples each sampling period (see *numb_samp_customer* in Exhibit 5-13). The fixed, one-time costs would remain the same, $2,277.45; however, the reoccurring cost would be $10,877.36 per 6-month sampling period, or $21,774.72 annually.

5.3.2.2 *PWS Lead Water Quality Parameter Monitoring*

Lead WQP monitoring is required for all systems serving more than 50,000 people with CCT (except systems that meet the criteria in 40 CFR 141.81(b)(3) or "b3" systems) and those serving 50,000 or fewer people that exceed the lead AL of 15 µg/L.[87] WQP samples are collected at representative sites throughout the distribution system (also referred to as tap samples) and at each entry point to the distribution system. Systems must conduct WQP monitoring prior to the installation of CCT and after CCT installation. The Primacy Agency may designate optimal water quality parameters (OWQPs) after

[87] Note that systems that have CCT but no OWQPs and have a TLE must monitor for 2 consecutive six-month monitoring periods starting in the month following the end of the tap monitoring period with the exceedance. These costs are not captured in the EPA cost mode, thereby underestimating the impacts to systems from the LCRR WQP monitoring requirements.

the installation of CCT. Systems with CCT must continue to maintain WQPs at or above minimum values or within OWQP ranges designated by the Primacy Agency. Under the LCRR, systems with CCT that have a single sample above 15 µg/L must conduct WQP monitoring in the distribution system at or near the site with the high result and determine if problems with CCT contributed to elevated lead. See 5.3.3.3 for a discussion of inputs related to this requirement.

The remainder of this section is divided into four subsections:

- 5.3.2.2.1: Baseline Corrosion Control Treatment
- 5.3.2.2.2: Initial Monitoring Schedules
- 5.3.2.2.3: Number of Samples
- 5.3.2.2.4: Lead WQP Monitoring Activities

Exhibit 5-41 at the end of Section 5.3.2.2 is a summary exhibit that explains how the cost inputs are modeled by the SafeWater LCR model.

5.3.2.2.1 Baseline Corrosion Control Treatment

WQP monitoring requirements vary for systems with and without CCT and by type of CCT. To estimate costs associated with WQP monitoring, EPA identified systems with and without CCT, as described in Chapter 4, Section 4.3.3. For those with CCT, EPA estimated the percentage of systems that currently have one of the three types of CCT used in the cost model:

- Modify pH (*pbaseph*),
- Add PO_4 without pH post-treatment (*pbasepo4*), and
- Add PO_4 and modify pH (*pbasephpo4*).

To develop these percentages, EPA reviewed the treatment process codes reported for each system with a reported treatment objective code of "C" for corrosion control in the SDWIS/Fed third quarter 2016 frozen dataset. EPA considered systems to:

- Have pH adjustment if they had a reported treatment process of: pH adjustment; pH adjustment, post; or pH adjustment, pre.
- Use a phosphate-based inhibitor if they had a reported treatment process of: inhibitor, polyphosphate; inhibitor, orthophosphate; inhibitor, bimetallic phosphate; or inhibitor, hexametaphosphate.
- Have both types of treatment if they had at least one of the treatment processes for both pH adjustment and phosphate-based inhibitor.
- Have only one of these treatments if they had one of the treatment processes for pH adjustment but none for a phosphate-based inhibitor or vice versa.

The results of this review are presented in Exhibit 5-21. Eighty-six percent of systems serving 3,300 or fewer people and 90 percent of systems serving more than 3,300 people reported a process code that indicated the use of pH adjustment and/or phosphate inhibitor.

Exhibit 5-21: Baseline Percentage of Systems Modifying pH and/or Adding PO_4

System Size (Population Served)	Add PO_4 and Modify pH	Modify pH	Add PO_4	Total
≤ 3,300	10%	46%	30%	86%
> 3,300	22%	36%	32%	90%

Since these percentage values will be used to assign CCT process type to systems already known to have CCT in place, the values in Exhibit 5-21 were normalized to represent the percent of systems with CCT using pH adjustment, phosphate inhibitor, or both phosphate inhibitor and pH adjustment. For example, of the 86 percent of systems serving 3,300 or fewer people that reported a treatment process of phosphate and/or pH adjustment, 11 percent reported both a phosphate inhibitor and pH process code (10 percent/86 percent). These adjusted or normalized percentages are used in the cost model and are shown in Exhibit 5-22 below.

Exhibit 5-22: Normalized Baseline Percentage of Systems Modifying pH and/or Adding PO_4

System Size (Population Served)	Add PO_4 and Modify pH	Modify pH	Add PO_4	Total
	pbasephpo4	*pbaseph*	*pbasepo4*	
≤ 3,300	11%	54%	35%	100%
> 3,300	24%	40%	36%	100%

5.3.2.2.2 Initial Monitoring Schedules

As described in Section 4.3.7.2, systems with CCT can qualify for reduced WQP monitoring in the distribution system under the LCRR if they are in compliance with Primacy Agency set OWQP ranges and do not exceed the TL of 10 µg/L. The number of consecutive monitoring periods in which a system meets these criteria determines if a system will collect two samples at a reduced number of sites in the distribution system on a semi-annual or annually. Under the LCRR, systems can no longer qualify for triennial WQP tap monitoring.

EPA assumed only systems serving more than 50,000 people would qualify for reduced distribution system monitoring because systems with and without CCT that serve 50,000 or fewer are only required to monitor for WQPs in those monitoring periods in which they have a lead or copper ALE and under the LCRR to continue such monitoring until they no longer exceed the AL for two consecutive 6-month monitoring periods. Section 4.3.7.2 in Chapter 4 also provides EPA's approach for determining the estimated percentage of systems with CCT in each size category that would be on one of three WQP distribution monitoring schedules at the start of rule implementation based on historical SDWIS/Fed data. These percentages are provided in Exhibit 4-41 and Exhibit 4-42 for ground water and surface water CWSs with CCT, respectively and in Exhibit 4-43 and Exhibit 4-44 for ground water and surface water NTNCWSs with CCT, respectively.

5.3.2.2.3 Number of Samples

Exhibit 5-23 provides the minimum number of WQP distribution system samples for CWSs and NTNCWSs on routine and reduced monitoring. These are from the previous rule requirements, which have not been modified by the LCRR with one exception. As discussed in Section 5.3.3.3.3, systems with a lead tap sample result above 15 µg/L must conduct WQP monitoring in the distribution system at or near the site with the high lead result. If an existing WQP site does not meet these criteria, the system must identify a new WQP monitoring site and those with CCT must use it for future sampling in addition to the existing number of WQP sites (*numb_enhance_wqp* or *numb_reduced_wqp*) shown in Exhibit 5-23. Refer to Section 5.3.3.3.3 for a more detailed discussion.

Exhibit 5-23: Minimum Number of WQP Distribution Samples for Systems on Routine or Reduced Monitoring

System Size (Population Served)	Routine Monitoring		Reduced Monitoring	
	Number of Sites	Number of Samples (2 per site)	Number of Sites	Number of Samples (2 per site)
		numb_enhance_wqp		*numb_reduced_wqp*
	A	B = A*2	C	D = C*2
≤500	1	2	1	2
501-3,300	2	4	2	4
3,301-10,000	3	6	3	6
10,001-100,000	10	20	7	14
>100,000	25	50	10	20

Notes: The required minimum number of WQP samples under the LCRR is the same as under the previous rule.
A&B: Specifies the number of samples collected in the distribution system for CWSs and NTNCWSs on routine monitoring during each 6-month period for systems serving > 50,000 people with CCT and systems serving ≤ 50,000 people during those monitoring periods in which they have a lead or copper ALE and each subsequent monitoring period until they no longer have an ALE for two consecutive monitoring periods. Systems must collect 2 samples per site and Column B reflects the input used in the cost model.
C&D: Specifies the reduced number of samples collected in the distribution system for CWSs and NTNCWSs on reduced monitoring for systems subject to WQP monitoring. Systems on reduced monitoring may be sampling on a 6-month or annual frequency. (See Exhibit 4-41 through Exhibit 4-44 or "Derivation of WQP Schedules_CWS_Final Rule.xlsx" and "Derivation of WQP Schedules_NTNCWS_Final Rule.xlsx"for initial WQP monitoring schedules.) Systems must collect 2 samples per site and Column D reflects the input used in the cost model.

Systems must also collect WQP samples at each entry point to the distribution system. The number of entry points, which corresponds to the SafeWater LCR model data input *numb_ep_wqp,* is as follows:

- Systems without CCT serving 50,000 or fewer people must collect 2 samples from each entry point to the distribution system during each 6-month monitoring periods in which they have a lead or copper ALE. Under the LCRR, they must continue this monitoring until they no longer have an ALE during two consecutive 6-month monitoring periods.
- Systems with CCT must collect 1 sample per entry point every 2 weeks. This applies to all systems serving more than 50,000 except "b3" systems and those serving 50,000 or fewer

people during each 6-month monitoring periods in which they have a lead or copper ALE and subsequent monitoring periods until they no longer have an ALE for two consecutive monitoring periods.

There are no reduced monitoring provisions for WQPs collected at entry points, as was true under the previous rule.

The estimated number of entry points per system, which corresponds to the SafeWater LCR model input *numb_ep,* is provided in Section 4.2.2 and Section 4.3.6 and additional information is available in "Derivation of Baseline CCT Characteristics_Final Rule.xlsx."

5.3.2.2.4 Lead WQP Monitoring Activities

EPA has developed water system costs for five lead WQP monitoring activities as shown in Exhibit 5-24. The exhibit provides the unit burden and/or cost for each activity. The assumptions used in the estimation of the unit burden and costs follow the exhibit. The last column provides the corresponding SafeWater LCR model data variable in red/italic font.

Exhibit 5-24: PWS Lead WQP Monitoring Unit Burden and Cost Estimates

Activity	Unit Burden and/or Cost	*SafeWater LCR Data Variable*
p) Collect lead WQP samples in the distribution system	Burden per sample per PWS 0 hrs Cost per sample No CCT: $2.15 (CWS & NTNCWS) pH adjustment: • $2.15 to $2.32 (CWS); • $1.83 to $2.15 (NTNCWS) Orthophosphate: • $2.15 to $4.14 (CWS) • $1.83 to $2.15 (NTNCWS)	Burden *hrs_wqp_op* Cost *No CCT: cost_wqp_material* *pH: cost_wqp_material_ph* *Orthophosphate: cost_wqp_material_ortho*
q) Analyze distribution system lead WQP samples	In-House Burden per sample No CCT: 0.15 hrs (CWS & NTNCWS) pH adjustment: • 0.15 to 0.46 hrs (CWS) • 0.15 hrs (NTNCWS) Orthophosphate: • 0.15 to 1.34 hrs (CWS) • 0.15 hrs (NTNCWS) In-House Cost per sample No CCT: $0.52 (CWS & NTNCWS) pH adjustment: • $0.52 to $0.72 (CWS) • $0.52 (NTNCWS) Orthophosphate: • $0.52 to $0.78 (CWS) • $0.52 (NTNCWS)	In-House Burden *No CCT: hrs_wqp_analyze_dist_op* *pH: hrs_wqp_analyze_ph_op* *Orthophosphate: hrs_wqp_analyze_ortho_op* In-House Cost *No CCT: cost_wqp_analyze* *pH: cost_wqp_ph_analyze* *Orthophosphate: cost_wqp_ortho_analyze*

Activity	Unit Burden and/or Cost	*SafeWater LCR Data Variable*
	Commercial Cost per sample No CCT: $23.92 (CWS & NTNCWS) pH adjustment: $23.92 (CWS & NTNCWS) Orthophosphate: $49.35 (CWS & NTNCWS)	Commercial Cost *No CCT: cost_lab_wqp* *pH: cost_lab_ph_wqp* *Orthophosphate: cost_lab_ortho_wqp*
r) Collect lead WQP samples from entry points	Burden per sample 0.5 hrs for 80 percent of ground water PWSs[1] Cost per sample No CCT: $2.15 (CWS & NTNCWS) pH adjustment: • $2.15 to $2.32 (CWS); • $1.83 to $2.15 (NTNCWS) Orthophosphate: • $2.15 to $4.14 (CWS) • $1.83 to $2.15 (NTNCWS)	Burden *hrs_ep_wqp_op* Cost *cost_ep_wqp_material* *cost_ep_wqp_ph_material* *cost_ep_wqp_ortho_material*
s) Analyze entry point lead WQP samples	In-House Burden per sample No CCT: 0.15 hrs (CWS & NTNCWS) pH adjustment: • 0.15 to 0.46 hrs (CWS) • 0.15 hrs (NTNCWS) Orthophosphate: • 0.15 to 1.34 hrs (CWS) • 0.15 hrs (NTNCWS) In-House Cost per sample No CCT: $0.52 (CWS & NTNCWS) pH adjustment: • $0.52 to $0.72 (CWS) • $0.52 (NTNCWS) Orthophosphate: • $0.52 to $0.78 (CWS) • $0.52 (NTNCWS) Commercial Cost per sample No CCT: $23.92 (CWS & NTNCWS) pH adjustment: $23.92 (CWS & NTNCWS) Orthophosphate: $49.35 (CWS & NTNCWS)	In-House Burden *hrs_wqp_analyze_ep_op* *hrs_wqp_analyze_ph_ep_op* *hrs_wqp_analyze_ortho_ep_op* In-House Cost *cost_wqp_analyze_ep* *cost_wqp_analyze_ph_ep* *cost_wqp_analyze_ortho_ep* Commercial Cost *cost_lab_wqp_ep* *cost_lab_wqp_ph_ep* *cost_lab_wqp_ortho_ep*
t) Report lead WQP sampling data and compliance with OWQPs to Primacy Agency	No CCT: 4 hrs/PWS With CCT: 5 hrs/PWS	Burden *hrs_report_wqp_op*

Acronyms: CCT = corrosion control treatment; CWS = community water system; NTNCWS = non-transient non-community water system; PWS = public water system; WQP = water qualify parameter.
Source: "Derivation of WQP Analytical Burden and Costs_Final Rule.xlsx."
Notes:

[1] EPA assumed the burden to collect WQP samples to be 0 hours for all surface water systems and 20 percent of ground water systems because they are already collecting entry point samples to comply with other drinking water regulations and 0.5 hours for the remaining 80 percent of ground water systems.

p) Collect lead WQP samples in the distribution system (hrs_wqp_op, cost_wqp_material, cost_wqp_material_ph, cost_wqp_material_ortho). Systems subject to lead WQP monitoring requirements must conduct WQP monitoring in the distribution system. EPA assumed systems will collect distribution WQPs with their total coliform samples and incur no additional burden (*hrs_wqp_op*). This assumption is based on the *Disinfectants/Disinfection Byproducts, Chemical, and Radionuclides Rules ICR (Renewal)* (USEPA, 2015b).

Material costs for sample collection are for sample bottles. All systems subject to WQP requirements are assumed to conduct pH analyses in-house and for each sample will incur the cost for a 250-mL bottle in which the sample is collected. For systems using a commercial laboratory, all other bottle costs are included in the lab cost. Systems conducting in-house analysis of all WQPs (i.e., CWSs serving more than 100,000 people) will incur additional bottle costs for other analytes.

Exhibit 5-25 and Exhibit 5-26 provides the materials cost associated with sample collection by CCT status and type for CWSs and NTNCWSs, respectively. EPA's assumptions for each of these inputs are detailed in the exhibit notes.

Exhibit 5-25: CWS Material Costs Associated with Distribution System Sample Collection

System Size (Population Served)	Without CCT	With pH Adjustment	With Orthophosphate
	cost_wqp_material	*cost_wqp_material_ph*	*cost_wqp_material_ortho*
	A	B	C
≤50,000	$2.15	$2.15	$2.15
50,001-100,000	$0	$2.15	$2.15
> 100,000	$0	$2.32	$4.14

Source: "Derivation of WQP Analytical Burden and Costs_Final Rule.xlsx," worksheet "In-House_Bottles_$."
Notes:
General: All CWSs subject to WQP monitoring analyze pH in-house, so the likelihood CWSs will conduct pH analyses in-house or *pp_lab_samp* is 100 percent. CWSs serving 100,000 or fewer people are assumed to use commercial laboratories to analyze other parameters for alkalinity and/or orthophosphate so the likelihood a system will use a commercial lab or *pp_commercial_samp* is 100 percent for these parameters. The commercial laboratory cost includes sample bottles. CWSs serving more than 100,000 people are assumed to analyze all WQPs in-house. For these systems, *pp_lab_samp* is 100 percent and *pp_commercial_samp* is 0 percent.
A: Systems without CCT sample pH and alkalinity within the distribution system. EPA assumed no costs for systems serving > 50,000 people without CCT because they are b3 systems (11 in total) and are not subject to WQP requirements. Costs for systems serving ≤ 50,000 people is the cost of a 250-mL bottle in which the pH sample will be collected.
B: Systems using pH adjustment for CCT sample pH and alkalinity within the distribution system. Costs for systems serving ≤ 100,000 people is the cost of a 250-mL bottle in which the pH sample is collected. The bottle for the alkalinity sample is included in the commercial lab cost. Costs for systems serving > 100,000 people is for one 500-ml bottle to collect a sample for pH and alkalinity together. These large systems are assumed to buy in bulk at a 15 percent discount rate.
C: Systems using orthophosphate treatment sample pH, alkalinity, and orthophosphate within the distribution system. Costs for systems serving ≤ 100,000 people is the cost of a 250-mL bottle in which the pH sample will be collected, with all other bottles being provided by the commercial lab and included in the commercial lab cost.

Costs for systems serving > 100,000 people is for: one 250-ml bottle for orthophosphate, and one 500-ml bottle to collect a sample for pH and alkalinity together. These large systems are assumed to buy in bulk at a 15 percent discount rate.

Exhibit 5-26: NTNCWS Material Costs Associated with Distribution System Sample Collection

System Size (Population Served)	Without CCT	With pH Adjustment	With Orthophosphate
	cost_wqp_material	*cost_wqp_material_ph*	*cost_wqp_material_ortho*
	A	B	C
≤50,000	$2.15	$2.15	$2.15
50,001-100,000	$0	$2.15	$2.15
100,001-1,000,000	$0	$1.83	$1.83
>1,000,000			

Source: "Derivation of WQP Analytical Burden and Costs_Final Rule.xlsx," worksheet "In-House_Bottle_$."
Notes:
General: All NTNCWSs serving 50,001 to 1 million people are assumed to have CCT. No NTNCWS serves > 1 million people. All NTNCWSs subject to WQP monitoring analyze pH in-house, so the likelihood NTNCWSs will conduct pH analyses in-house or *pp_lab_samp* is 100 percent. All NTNCWSs are assumed to use commercial laboratories to analyze other parameters for alkalinity and/or orthophosphate so the likelihood a system will use a commercial lab or *pp_commercial_samp* is 100 percent for these parameters. The commercial laboratory cost includes sample bottles.
A: Systems without CCT sample pH and alkalinity samples within the distribution system. All NTNCWSs serving > 50,000 people are assumed to have CCT. Cost for systems serving ≤ 50,000 people is the cost of a 250-mL bottle in which the pH sample will be collected.
B: Systems using pH adjustment for CCT sample pH and alkalinity within the distribution system. The cost is for a 250-mL bottle in which the pH sample will be collected. Systems serving 100,001 to 1 million people are assumed to buy in bulk at a 15 percent discounted rate of $1.83.
C: Systems using orthophosphate treatment sample pH, alkalinity, and orthophosphate within the distribution system. Costs for systems serving ≤ 100,000 people is the cost of a 250-mL bottle in which the pH sample will be collected, with all other bottles being provided by the commercial lab and included in the commercial lab cost.

q) Analyze distribution system lead WQP samples. Systems will also incur burden and costs to analyze WQP samples collected in the distribution system. CWSs serving 100,000 or more people are assumed to analyze all samples in-house. All CWSs serving 100,000 or fewer people and all NTNCWSs are assumed to analyze pH in-house and to use a commercial laboratory to analyze other WQPs such as alkalinity or orthophosphate. Exhibit 5-27 and Exhibit 5-28 provide the analytical burden for CWSs and NTNCWSs to conduct in-house analyses, respectively. Exhibit 5-29 and Exhibit 5-30 provide the in-house analytical costs for CWSs and NTNCWSs, respectively. Lastly, Exhibit 5-31 and Exhibit 5-32 provide the commercial costs per sample for CWSs and NTNCWSs, respectively. Detailed assumptions are provided in the notes to each exhibit.

Exhibit 5-27: CWS In-House WQP Analytical Burden for Distribution System Samples (hrs/sample)

System Size (Population Served)	Without CCT	With pH Adjustment	With Orthophosphate
	hrs_wqp_analyze_dist_op	*hrs_wqp_analyze_ph_op*	*hrs_wqp_analyze_ortho_op*
	A	B	C
≤50,000	0.15	0.15	0.15
50,001-100,000	0	0.15	0.15
>100,000	0	0.46	1.34

Source: "Derivation of WQP Analytical Burden and Costs_Final Rule.xlsx," worksheet "In-House_Burden_LCRR."
Notes:
General: Burden estimates are the average of estimates provided by three laboratories. All CWSs subject to WQP monitoring will analyze pH in-house, so the likelihood CWSs will conduct pH analyses in-house or *pp_lab_samp* is 100 percent. CWSs serving 100,000 or fewer people are assumed to use commercial laboratories to analyze other parameters for alkalinity and/or orthophosphate so the likelihood a system will use a commercial lab or *pp_commercial_samp* is 100 percent for these parameters. CWSs serving more than 100,000 people are assumed to analyze all WQPs in-house. For these systems, *pp_lab_samp* is 100 percent and *pp_commercial_samp* is 0 percent.
A: Systems without CCT sample pH and alkalinity. Assumed no burden for systems serving > 50,000 people without CCT because they are b3 systems (11 in total) and not subject to WQP requirements. The burden estimate for systems serving ≤ 50,000 people is to analyze pH in-house.
B: Systems using pH adjustment for CCT sample pH and alkalinity. The burden estimate for systems serving ≤ 50,000 people is to analyze pH in-house and for those serving > 100,000 people to analyze pH and alkalinity in-house.
C: Systems using orthophosphate treatment sample pH, alkalinity, and orthophosphate. The burden estimate for systems serving ≤ 100,000 of is to analyze pH in-house and for those serving > 100,000 people to analyze pH, alkalinity, and orthophosphate in-house.

Exhibit 5-28: NTNCWS In-House WQP Analytical Burden for Distribution System Samples (hrs/sample)

System Size (Population Served)	Without CCT	With pH Adjustment	With Orthophosphate
	hrs_wqp_analyze_dist_op	*hrs_wqp_analyze_ph_op*	*hrs_wqp_analyze_ortho_op*
	A	B	C
≤50,000	0.15	0.15	0.15
50,001-100,000	0	0.15	0.15
100,001-1,000,000	0	0.15	0.15
>1,000,000			

Source: "Derivation of WQP Analytical Burden and Costs_Final Rule.xlsx," worksheet "In-House_Burden Quotes."
Notes:
General: All NTNCWSs serving 50,000 to 1 million people are assumed to have CCT; no NTNCWS serves > 1 million people. Burden is based on estimates from three laboratories. All NTNCWSs subject to WQP monitoring will analyze pH in-house, so the likelihood NTNCWSs will conduct pH analyses in-house or *pp_lab_samp* is 100 percent. All NTNCWSs are assumed to use commercial laboratories to analyze other parameters for alkalinity and/or orthophosphate so the likelihood a system will use a commercial lab or *pp_commercial_samp* is 100 percent for these parameters.
A: Systems without CCT sample pH and alkalinity. EPA assumed no costs for systems serving > 50,000 people without CCT because all NTNCWSs are assumed to have CCT. The burden estimate for systems serving ≤ 50,000 is to analyze pH in-house.
B: Systems using pH adjustment for CCT sample pH and alkalinity. The burden estimate is to analyze pH in-house.

C: Systems using orthophosphate treatment sample pH, alkalinity, and orthophosphate. The burden estimate for all NTNCWSs serving ≤ 50,000 is to analyze pH in-house.

Exhibit 5-29: CWS In-House WQP Analytical Cost for Distribution System Samples ($/sample)

System Size (Population Served)	Without CCT	With pH Adjustment	With Orthophosphate
	cost_wqp_analyze	*cost_wqp_ph_analyze*	*cost_wqp_ortho_analyze*
	A	B	C
≤50,000	$0.52	$0.52	$0.52
50,001-100,000	$0	$0.52	$0.52
>100,000	$0	$0.72	$0.78

Source: "Derivation of WQP Analytical Burden and Costs_Final Rule.xlsx," worksheet "In-House_Consumables_Summary_$."

Notes:

General: The exhibit presents in-house consumable costs for pH, alkalinity, and orthophosphate that are based on the average of three vendor quotes. All CWSs subject to WQP monitoring will analyze pH in-house, so the likelihood CWSs will conduct pH analyses in-house or *pp_lab_samp* is 100 percent. CWSs serving 100,000 or fewer people are assumed to use commercial laboratories to analyze other parameters for alkalinity and/or orthophosphate so the likelihood a system will use a commercial lab or *pp_commercial_samp* is 100 percent for these parameters. CWSs serving > 100,000 people are assumed to analyze all WQPs in-house. For these systems, *pp_lab_samp* is always 100 percent and *pp_commercial_samp* is always 0 percent.

A: Systems without CCT sample pH and alkalinity. Assumed no costs for systems serving > 50,000 people without CCT because they are b3 systems (11 in total) and not subject to WQP requirements.

B: Systems using pH adjustment for CCT sample pH and alkalinity. The consumables cost for systems serving ≤ 100,000 is to analyze pH in-house and for those serving > 100,000 people is to analyze pH and alkalinity in-house.

C: Systems using orthophosphate treatment sample pH, alkalinity, and orthophosphate. The consumables cost for systems serving ≤ 100,000 people is to analyze pH in-house and for those serving > 100,000 people is to analyze pH, and alkalinity, and orthophosphate in-house.

Exhibit 5-30: NTNCWS In-House WQP Analytical Cost for Distribution System Samples ($/sample)

System Size (Population Served)	Without CCT	With pH Adjustment	With Orthophosphate
	cost_wqp_analyze	*cost_wqp_ph_analyze*	*cost_wqp_ortho_analyze*
	A	B	C
≤50,000	$0.52	$0.52	$0.52
50,001-100,000	$0	$0.52	$0.52
100,001-1,000,000	$0	$0.52	$0.52
>1,000,000			

Source: "Derivation of WQP Analytical Burden and Costs_Final Rule.xlsx," worksheet "In-House_Consumables_Summary_$."

Notes:

General: The exhibit presents in-house consumable costs for NTNCWSs that are based on the average of three vendor quotes. All NTNCWSs serving 50,000 to 1 million people are assumed to have CCT; no NTNCWS serves > 1 million people. All NTNCWSs subject to WQP monitoring will analyze pH in-house, so the likelihood NTNCWSs will conduct pH analyses in-house or *pp_lab_samp* is 100 percent. All NTNCWSs are assumed to use commercial laboratories to analyze other parameters for alkalinity and/or orthophosphate so the likelihood a system will use a commercial lab or *pp_commercial_samp* is 100 percent for these parameters.

A: Systems without CCT sample pH and alkalinity. EPA assumed no costs for systems serving > 50,000 people without CCT because all NTNCWSs are assumed to have CCT. The consumables cost for systems serving ≤ 50,000 people is to analyze pH in-house.
B: Systems using pH adjustment sample pH and alkalinity. All system subject to WQP monitoring analyze pH in-house. The consumables cost for all NTNCWSs is to analyze pH in-house.
C: Systems using orthophosphate treatment sample pH, alkalinity, and orthophosphate. The consumables cost for all NTNCWSs is to analyze pH in-house.

Exhibit 5-31: CWS Commercial WQP Analytical Cost for Distribution System Samples ($/sample)

System Size (Population Served)	Without CCT	With pH Adjustment	With Orthophosphate
	cost_lab_wqp	*cost_lab_ph_wqp*	*cost_lab_ortho_wqp*
	A	B	C
≤50,000	$23.92	$23.92	$49.35
50,001-100,000	$0	$23.92	$49.35
>100,000	$0	$0.00	$0.00

Source: "Derivation of WQP Analytical Burden and Costs_Final Rule.xlsx," worksheet "Commercial WQP."
Notes:
General: The exhibit presents commercial laboratory costs for alkalinity and orthophosphate. Alkalinity costs are based on the average of quotes from six laboratories; those for orthophosphate are based on seven laboratory quotes. CWSs serving ≤ 100,000 people will use commercial laboratories for these analyses. CWSs serving > 100,000 people are assumed to conduct all WQP analyses in-house and thus, will incur no commercial costs. All systems are assumed to conduct pH analyses in-house, which results in no commercial costs.
A: Systems without CCT sample pH and alkalinity. EPA assumed no costs for systems serving > 50,000 people without CCT because they are b3 systems (11 in total) and not subject to WQP requirements. The commercial cost for systems serving ≤ 50,000 people is for alkalinity analyses.
B: Systems using pH adjustment for CCT sample pH and alkalinity. The commercial cost for systems serving ≤ 100,000 people is for alkalinity analyses.
C: Systems using orthophosphate treatment sample pH, alkalinity, and orthophosphate. The commercial cost for systems serving ≤ 100,000 is for alkalinity and orthophosphate analysis.

Exhibit 5-32: NTNCWS Commercial WQP Analytical Cost for Distribution System Samples ($/sample)

System Size (Population Served)	Without CCT	With pH Adjustment	With Orthophosphate
	cost_lab_wqp	*cost_lab_ph_wqp*	*cost_lab_ortho_wqp*
	A	B	C
≤50,000	$23.92	$23.92	$49.35
50,001-100,000	$0	$23.92	$49.35
100,001-1,000,000	$0	$23.92	$49.35
>1,000,000			

Source: "Derivation of WQP Analytical Burden and Costs_Final Rule.xlsx," worksheet "Commercial WQP."
Notes:
General: The exhibit presents commercial costs for alkalinity and orthophosphate. Alkalinity costs are based on the average of quotes from six laboratories; those for orthophosphate are based on seven laboratory quotes. All NTNCWSs serving 50,000 to 1 million people are assumed to have CCT; no NTNCWS serves > 1 million people. All NTNCWSs are assumed to conduct pH analyses in-house and to use commercial laboratories for other analyses.

A: Systems without CCT will sample pH and alkalinity. EPA assumed no costs for NTNCWSs serving > 50,000 people without CCT because all NTNCWSs are assumed to have CCT. All NTNCWSs are assumed to analyze pH in-house but to use commercial laboratories for all other analyses.
B: Systems using pH adjustment for CCT sample pH and alkalinity. The commercial cost for NTNCWSs is for alkalinity analyses.
C: Systems using orthophosphate treatment sample pH, alkalinity, and orthophosphate. The commercial cost for NTNCWSs is for alkalinity and orthophosphate analyses.

r) Collect lead WQP samples from entry points (hrs_ep_wqp_op, cost_ep_wqp_material, cost_ep_wqp_ph_material, cost_ep_wqp_ortho_material). Systems will also collect WQP samples at each entry point to the distribution system. EPA assumed the burden to collect WQP samples (*hrs_ep_wqp_op*) to be:

- 0 hours for all surface water systems and 20 percent of ground water systems because they are already collecting entry point samples to comply with other drinking water regulations
- 0.5 hours for the remaining 80 percent of ground water systems.

These estimates are based on the *Disinfectants/Disinfection Byproducts, Chemical, and Radionuclides Rules ICR (Renewal)* (USEPA, 2015b).

EPA assumed that systems will analyze for the same WQPs in entry points samples as distribution samples and incur the same material costs (i.e., bottle costs) as detailed in activity p). Even though burden and costs inputs are identical, EPA used different data variable names for entry point samples for modeling flexibility in the SafeWater LCR model. The input values and corresponding data variable IDs for entry point samples are provided in Exhibit 5-33 and Exhibit 5-34 for CWSs and NTNCWSs, respectively.

Exhibit 5-33: CWS Material Costs Associated with Entry Point Sample Collection

System Size (Population Served)	Without CCT	With pH Adjustment	With Orthophosphate
	cost_ep_wqp_material	*cost_ep_wqp_ph_material*	*cost_ep_wqp_ortho_material*
	A	B	C
≤50,000	$2.15	$2.15	$2.15
50,001-100,000	$0	$2.15	$2.15
>100,000	$0	$2.32	$4.14

Source: "Derivation of WQP Analytical Burden and Costs_Final Rule.xlsx," worksheet "In-House_Bottle_$."
Notes: The input values in this exhibit are identical to Exhibit 5-25. Refer to the exhibit notes for Exhibit 5-25 for detailed assumptions.

Exhibit 5-34: NTNCWS Material Costs Associated with Entry Point Sample Collection

System Size (Population Served)	Without CCT	With pH Adjustment	With Orthophosphate
	cost_ep_wqp_material	*cost_ep_wqp_ph_material*	*cost_ep_wqp_ortho_material*
	A	B	C
≤50,000	$2.15	$2.15	$2.15
50,001-100,000	$0	$2.15	$2.15
100,001-1,000,000	$0	$1.83	$1.83
>1,000,000			

Source: "Derivation of WQP Analytical Burden and Costs_Final Rule.xlsx," worksheet "In-House_Bottle_$."
Notes: The input values in this exhibit are identical to Exhibit 5-26. Refer to the exhibit notes for Exhibit 5-26 for detailed assumptions.

s) ***Analyze entry point lead WQP samples.*** EPA assumed systems analyze the same WQPs in entry points samples as distribution system samples and incur the same in-house burden and material (i.e., bottle) cost or commercial costs as detailed in activity q). The input values with corresponding SafeWater LCR model entry point data variables are provided in the following exhibits:

- Exhibit 5-35 and Exhibit 5-36 for CWS and NTNCWS in-house analytical burden, respectively,
- Exhibit 5-37 and Exhibit 5-38 for CWS and NTNCWS in-house analytical cost, respectively, and
- Exhibit 5-39 and Exhibit 5-40 for CWS and NTNCWS commercial analyses, respectively.

Exhibit 5-35: CWS In-House WQP Analytical Burden for Entry Point Samples (hrs/sample)

System Size (Population Served)	Without CCT	With pH Adjustment	With Orthophosphate
	hrs_wqp_analyze_ep_op	*hrs_wqp_analyze_ph_ep_op*	*hrs_wqp_analyze_ortho_op*
	A	B	C
≤50,000	0.15	0.15	0.15
50,001-100,000	0	0.15	0.15
>100,000	0	0.46	1.34

Source: "Derivation of WQP Analytical Burden and Costs_Final Rule.xlsx," worksheet "In-House_Burden Quotes."
Notes: The input values in this exhibit are identical to Exhibit 5-27. Refer to the exhibit notes for Exhibit 5-27 for detailed assumptions.

Exhibit 5-36: NTNCWS In-House WQP Analytical Burden for Entry Point Samples (hrs/sample)

System Size (Population Served)	Without CCT	With pH Adjustment	With Orthophosphate
	hrs_wqp_analyze_ep_op	*hrs_wqp_analyze_ph_ep_op*	*hrs_wqp_analyze_ortho_op*
	A	B	C
≤50,000	0.15	0.15	0.15
50,001-100,000	0	0.15	0.15
100,001-1,000,000	0	0.15	0.15
>1,000,000			

Source: "Derivation of WQP Analytical Burden and Costs_Final Rule.xlsx," worksheet, "In-House_Burden Quotes."
Notes: The input values in this exhibit are identical to Exhibit 5-28. Refer to the exhibit notes for Exhibit 5-28 for detailed assumptions.

Exhibit 5-37: CWS In-House WQP Analytical Cost for Entry Point Samples ($/sample)

System Size (Population Served)	Without CCT	With pH Adjustment	With Orthophosphate
	cost_wqp_analyze_ep	*cost_lab_wqp_ph_ep*	*cost_wqp_analyze_ortho_ep*
	A	B	C
≤50,000	$0.52	$0.52	$0.52
50,001-100,000	$0	$0.52	$0.52
>100,000	$0	$0.72	$0.78

Source: "Derivation of WQP Analytical Burden and Costs_Final Rule.xlsx," "In-House_Consumables_Summary_$."
Notes: The input values in this exhibit are identical to Exhibit 5-29. Refer to the exhibit notes for Exhibit 5-29 for detailed assumptions.

Exhibit 5-38: NTNCWS In-House WQP Analytical Cost for Entry Point Samples ($/sample)

System Size (Population Served)	Without CCT	With pH Adjustment	With Orthophosphate
	cost_wqp_analyze_ep	*cost_lab_wqp_ph_ep*	*cost_wqp_analyze_ortho_ep*
	A	B	C
≤50,000	$0.52	$0.52	$0.52
50,001-100,000	$0	$0.52	$0.52
100,001-1,000,000	$0	$0.52	$0.52
>1,000,000			

Source: "Derivation of WQP Analytical Burden and Costs_Final Rule.xlsx," worksheet: "In-House_Consumables_Summary_$."
Notes: The input values in this exhibit are identical to Exhibit 5-30. Refer to the exhibit notes for Exhibit 5-30 for detailed assumptions.

Exhibit 5-39: CWS Commercial WQP Analytical Cost for Entry Point Samples ($/sample)

System Size (Population Served)	Without CCT	With pH Adjustment	With Orthophosphate
	cost_lab_wqp_ep	*cost_lab_wqp_ph_ep*	*cost_lab_wqp_ortho_ep*
	A	B	C
≤50,000	$23.92	$23.92	$49.35
50,001-100,000	$0	$23.92	$49.35
>100,000	$0	$0.00	$0.00

Source: "Derivation of WQP Analytical Burden and Costs_Final Rule.xlsx," worksheet "Commercial WQP."
Notes: The input values in this exhibit are identical to Exhibit 5-31. Refer to the exhibit notes for Exhibit 5-31 for detailed assumptions.

Exhibit 5-40: NTNCWS Commercial WQP Analytical Cost for Entry Point Samples ($/sample)

System Size (Population Served)	Without CCT	With pH Adjustment	With Orthophosphate
	cost_lab_wqp_ep	*cost_lab_wqp_ph_ep*	*cost_lab_wqp_ortho_ep*
	A	B	C
≤50,000	$23.92	$23.92	$49.35
50,001-100,000	$0	$23.92	$49.35
100,001-1,000,000	$0	$23.92	$49.35
>1,000,000			

Source: "Derivation of WQP Analytical Burden and Costs_Final Rule.xlsx," worksheet: "Commercial WQP."
Notes: The input values in this exhibit are identical to Exhibit 5-32. Refer to the exhibit notes for Exhibit 5-32 for detailed assumptions.

t) Report lead WQP sampling data and compliance with OWQPs to Primacy Agency (hrs_report_wqp_op). Systems are required to report their WQP results and for those systems where OWQPs have been set to demonstrate compliance with those OWQPs every six months. EPA estimated systems with CCT and without CCT would require 5 hours and 4 hours, respectively. The estimated reporting burden for systems with CCT is based on the WQP Reporting (Annual) burden in Appendix H, Exhibit 35 of the *Disinfectants/Disinfection Byproducts, Chemical, and Radionuclides Rules ICR (Renewal)* (USEPA, 2015b). EPA assumed systems without CCT would incur a lower burden because they would be reporting less entry point monitoring data than those with CCT that must conduct entry point monitoring biweekly. These systems without CCT are also not determining compliance with OWQPs.

Exhibit 5-41 shows the SafeWater LCR model cost estimation approach for water system lead WQP monitoring activities including additional cost inputs that are required to calculate these costs.

Exhibit 5-41: PWS Lead WQP Monitoring Cost Estimation in SafeWater LCR by Activity[1]

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
p) Collect lead WQP samples in the distribution system				
Number of samples multiplied by the total of the hours per sample times the system labor rate, plus the cost of materials per sample. *(numb_enhance_wqp*((hrs_wqp_op*rate_op)+cost_wqp_material))*	Cost applies as written to NTNCWSs.	Above AL	Model PWSs serving ≤50,000 without CCT	Twice per year
Number of samples multiplied by the total of the hours per sample times the system labor rate, plus the cost of materials per sample. *(numb_enhance_wqp*((hrs_wqp_op*rate_op)+cost_wqp_material_ph))*			Model PWSs serving ≤50,000 with pH adjustment *pbaseph*	
Number of samples multiplied by the total of the hours per sample times the system labor rate, plus the cost of materials per sample. *(numb_enhance_wqp*((hrs_wqp_op*rate_op)+cost_wqp_material_ortho))*			Model PWSs serving ≤50,000 with PO_4 or both PO_4 and pH adjustment *pbasepo4, pbasephpo4*	
Number of samples multiplied by the total of the hours per sample times the system labor rate, plus the cost of materials per sample. *(numb_enhance_wqp*((hrs_wqp_op*rate_op)+cost_wqp_material_ph))*	Cost applies as written to NTNCWSs.	All	Model PWSs serving >50,000 with pH adjustment that do not qualify for reduced WQP monitoring	Twice per year
Number of samples multiplied by the total of the hours per sample times the system labor rate, plus the cost of materials per sample. *(numb_enhance_wqp*((hrs_wqp_op*rate_op)+cost_wqp_material_ortho))*			Model PWSs serving >50,000 with PO_4 or both PO_4 and pH adjustment that do not qualify for reduced WQP monitoring *pbasepo4, pbasephpo4,* 1 – *(p_wqp_annual + p_wqp_triennial + p_wqp_six_red)*	Twice per year

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
Number of samples multiplied by the total of the hours per sample times the system labor rate, plus the cost of materials per sample. *(numb_reduced_wqp*((hrs_wqp_op*rate_op)+cost_wqp_material_ph))*	Cost applies as written to NTNCWSs.	All	Model PWSs with pH adjustment on six-month reduced WQP monitoring *pbaseph, p_wqp_six_red*	Twice a year
			Model PWSs with pH adjustment on annual WQP monitoring *pbaseph, p_wqp_annual*	Once a year
			Model PWSs with pH adjustment on triennial WQP monitoring *pbaseph, p_wqp_triennial*	Every three years
Number of samples multiplied by the total of the hours per sample times the system labor rate, plus the cost of materials per sample. *(numb_reduced_wqp*((hrs_wqp_op*rate_op)+cost_wqp_material_ortho))*	Cost applies as written to NTNCWSs.	All	Model PWSs with PO_4 or both PO_4 and pH adjustment on six-month reduced sample WQP monitoring *pbasepo4, pbasephpo4, p_wqp_six_red*	Twice a year
			Model PWSs with PO_4 or both PO_4 and pH adjustment on annual WQP monitoring *pbasepo4, pbasephpo4, p_wqp_annual*	Once a year
			Model PWSs with PO_4 or both PO_4 and pH adjustment on triennial WQP monitoring *pbasepo4, pbasephpo4, p_wqp_triennial*	Every three years

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
q) Analyze distribution system lead WQP samples				
There are different labor (burden) and material costs for a sample analyzed in house and a sample analyzed using a commercial lab. The in-house analysis costs are calculated using the number of required samples per system multiplied by the percentage of samples analyzed in house times the system labor rate, plus the material cost of the in-house analysis per sample. The commercial lab analysis costs are calculated using the number of required samples per system multiplied by the percentage of samples analyzed in a commercial lab times the system labor rate, plus the material cost of the commercial lab analysis per sample. *(((numb_enhance_wqp*pp_lab_samp)*((hrs_wqp_analyze_dist_op*rate_op)+cost_wqp_analyze))+((numb_enhance_wqp*pp_commercial_samp)*cost_lab_wqp))*	Cost applies as written to NTNCWSs.	Above AL	Model PWSs serving ≤50,000 without CCT	Twice a year
There are different labor (burden) and material costs for a sample analyzed in house and a sample analyzed using a commercial lab. The in-house analysis costs are calculated using the number of required samples per system multiplied by the percentage of samples analyzed in house times the system labor rate, plus the material cost of the in-house analysis per sample. The commercial lab analysis costs are calculated using the number of required samples per system multiplied by the percentage of samples analyzed in a commercial lab times the system labor rate, plus the material cost of the commercial lab analysis per sample. *(((numb_enhance_wqp*pp_lab_samp)*((hrs_wqp_analyze_ph_op*rate_op)+cost_wqp_ph_analyze))+((numb_enhance_wqp*pp_commercial_samp)*cost_lab_ph_wqp))*			Model PWSs serving ≤50,000 with pH adjustment *pbaseph*	
There are different labor (burden) and material costs for a sample analyzed in house and a sample analyzed using a commercial lab. The in-house analysis costs are calculated using the number of required samples per system multiplied by the percentage of samples analyzed in house times the system labor rate, plus the material cost of the in-house analysis per sample. The commercial lab analysis costs are calculated using the number of required samples per system multiplied by the percentage of samples analyzed in a commercial lab times the system labor rate, plus the material cost of the commercial lab analysis per sample. *(((numb_enhance_wqp*pp_lab_samp)*((hrs_wqp_analyze_ortho_op*rate_op)+cost_wqp_ortho_analyze))+((numb_enhance_wqp*pp_commercial_samp)*cost_lab_ortho_wqp))*			Model PWSs serving ≤50,000 with PO_4 or both PO_4 and pH adjustment *pbasepo4, pbasephpo4*	

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
There are different labor (burden) and material costs for a sample analyzed in house and a sample analyzed using a commercial lab. The in-house analysis costs are calculated using the number of required samples per system multiplied by the percentage of samples analyzed in house times the system labor rate, plus the material cost of the in-house analysis per sample. The commercial lab analysis costs are calculated using the number of required samples per system multiplied by the percentage of samples analyzed in a commercial lab times the system labor rate, plus the material cost of the commercial lab analysis per sample. *(((numb_enhance_wqp*pp_lab_samp)*((hrs_wqp_analyze_ph_op*rate_op)+cost_wqp_ph_analyze))+((numb_enhance_wqp*pp_commercial_samp)*cost_lab_ph_wqp))*	Cost applies as written to NTNCWSs.	All	Model PWSs serving >50,000 with pH adjustment that do not qualify for reduced WQP monitoring *pbaseph;* 1- *(p_wqp_annual, p_wqp_triennial, p_wqp_six_red)*	Twice a year
There are different labor (burden) and material costs for a sample analyzed in house and a sample analyzed using a commercial lab. The in-house analysis costs are calculated using the number of required samples per system multiplied by the percentage of samples analyzed in house times the system labor rate, plus the material cost of the in-house analysis per sample. The commercial lab analysis costs are calculated using the number of required samples per system multiplied by the percentage of samples analyzed in a commercial lab times the system labor rate, plus the material cost of the commercial lab analysis per sample. *(((numb_enhance_wqp*pp_lab_samp)*((hrs_wqp_analyze_ortho_op*rate_op)+cost_wqp_ortho_analyze))+((numb_enhance_wqp*pp_commercial_samp)*cost_lab_ortho_wqp))*			Model PWSs serving >50,000 with PO_4 or both PO_4 and pH adjustment that do not qualify for reduced WQP monitoring *pbasepo4; pbasephpo4;* 1 – *(p_wqp_annual, p_wqp_triennial, p_wqp_six_red)*	Twice a year

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
The number of samples multiplied by the probabilities for a sample analyzed in house and a sample analyzed in a commercial lab times the different labor and material cost burdens for each type of analysis. *(((numb_reduced_wqp*pp_lab_samp)*((hrs_wqp_analyze_ph_op*rate_op)+cost_wqp_ph_analyze))+((numb_reduced_wqp*pp_commercial_samp)*cost_lab_ph_wqp))*	Cost applies as written to NTNCWSs.	All	Model PWSs with pH adjustment on six-month reduced sample WQP monitoring *pbaseph, p_wqp_six_red*	Twice a year
			Model PWSs with pH adjustment on annual WQP monitoring *pbaseph, p_wqp_annual*	Once a year
			Model PWSs with pH adjustment on triennial WQP monitoring *pbaseph, p_wqp_triennial*	Every three years
The number of samples multiplied by the probabilities for a sample analyzed in house and a sample analyzed in a commercial lab times the different labor and material cost burdens for each type of analysis. *(((numb_reduced_wqp*pp_lab_samp)*((hrs_wqp_analyze_ortho_op*rate_op)+cost_wqp_ortho_analyze))+((numb_reduced_wqp*pp_commercial_samp)*cost_lab_ortho_wqp))*	Cost applies as written to NTNCWSs.	All	Model PWSs serving > 50,000 with PO_4 or both PO_4 and pH adjustment on six-month reduced WQP monitoring *pbasepo4, pbasephpo4, p_wqp_six_red*	Twice a year
			Model PWSs serving > 50,000 with PO_4 or both PO_4 and pH adjustment on annual WQP monitoring *pbasepo4, pbasephpo4, p_wqp_annual*	Once a year
			Model PWSs serving > 50,000 with PO_4 or both PO_4 and pH adjustment on triennial WQP monitoring *pbasepo4, pbasephpo4, p_wqp_triennial*	Every three years

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
r) Collect lead WQP samples from entry points				
The number of entry points per system multiplied by the number of samples, then multiplied by the total of the labor hours per sample times the system labor rate, plus the cost per sample. *((numb_ep*numb_ep_wqp)*((hrs_ep_wqp_op*rate_op)+cost_ep_wqp_material))*	Cost applies as written to NTNCWSs.	Above AL	Model PWSs serving ≤50,000 without CCT	Twice a year
The number of entry points per system multiplied by the number of samples, then multiplied by the total of the labor hours per sample times the system labor rate, plus the cost per sample. *((numb_ep*numb_ep_wqp)*((hrs_ep_wqp_op*rate_op)+cost_ep_wqp_ph_material))*			Model PWSs serving ≤50,000 with pH adjustment *pbaseph*	Every 2 weeks
The number of entry points per system multiplied by the number of samples, then multiplied by the total of the labor hours per sample times the system labor rate, plus the cost per sample. *((numb_ep*numb_ep_wqp)*((hrs_ep_wqp_op*rate_op)+cost_ep_wqp_ortho_material))*			Model PWSs serving ≤50,000 with PO_4 or both PO_4 and pH adjustment *pbasepo4, pbasephpo4*	
The number of entry points per system multiplied by the number of samples, then multiplied by the total of the labor hours per sample times the system labor rate, plus the cost per sample. *((numb_ep*numb_ep_wqp)*((hrs_ep_wqp_op*rate_op)+cost_ep_wqp_ph_material))*	Cost applies as written to NTNCWSs.	All	Model PWSs serving > 50,000 with pH adjustment *pbaseph*	Every 2 weeks
The number of entry points per system multiplied by the number of samples, then multiplied by the total of the labor hours per sample times the system labor rate, plus the cost per sample. *((numb_ep*numb_ep_wqp)*((hrs_ep_wqp_op*rate_op)+cost_ep_wqp_ortho_material))*			Model PWSs serving > 50,000 with PO_4 or both PO_4 and pH adjustment *pbasepo4, pbasephpo4*	

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
s) Analyze entry point lead WQP samples				
The number of samples multiplied by the probabilities for a sample analyzed in house and a sample analyzed in a commercial lab times the different labor and material cost burdens for each type of analysis. *((((numb_ep*numb_ep_wqp)*pp_lab_samp)*((hrs_wqp_analyze_ep_op*rate_op)+cost_wqp_analyze_ep))+(((numb_ep*numb_ep_wqp)*pp_commercial_samp)* cost_lab_wqp_ep))*	Cost applies as written to NTNCWSs.	Above AL	Model PWSs serving ≤50,000 without CCT	Twice a year
The number of samples multiplied by the probabilities for a sample analyzed in house and a sample analyzed in a commercial lab times the different labor and material cost burdens for each type of analysis. *((((numb_ep*numb_ep_wqp)*pp_lab_samp)*((hrs_wqp_analyze_ph_ep_op*rate_op)+cost_wqp_analyze_ph_ep))+(((numb_ep*numb_ep_wqp)*pp_commercial_samp)*cost_lab_wqp_ph_ep))*	Cost applies as written to NTNCWSs.	Above AL	Model PWSs serving ≤50,000 with pH adjustment *pbaseph*	Every two weeks
The number of samples multiplied by the probabilities for a sample analyzed in house and a sample analyzed in a commercial lab times the different labor and material cost burdens for each type of analysis. *((((numb_ep*numb_ep_wqp)*pp_lab_samp)*((hrs_wqp_analyze_ortho_ep_op*rate_op)+cost_wqp_analyze_ortho_ep))+(((numb_ep*numb_ep_wqp)*pp_commercial_samp)*cost_lab_wqp_ortho_ep))*		Above AL	Model PWSs serving ≤50,000 with PO_4 or both PO_4 and pH adjustment *pbasepo4, pbasephpo4*	
The number of samples multiplied by the probabilities for a sample analyzed in house and a sample analyzed in a commercial lab times the different labor and material cost burdens for each type of analysis. *((((numb_ep*numb_ep_wqp)*pp_lab_samp)*((hrs_wqp_analyze_ph_ep_op*rate_op)+cost_wqp_analyze_ph_ep))+(((numb_ep*numb_ep_wqp)*pp_commercial_samp)*cost_lab_wqp_ph_ep))*	Cost applies as written to NTNCWSs.	All	Model PWSs serving >50,000 with pH adjustment *pbaseph*	Every two weeks
The number of samples multiplied by the probabilities for a sample analyzed in house and a sample analyzed in a commercial lab times the different labor and material cost burdens for each type of analysis. *((((numb_ep*numb_ep_wqp)*pp_lab_samp)*((hrs_wqp_analyze_ortho_op*rate_op)+cost_wqp_analyze_ortho_ep))+(((numb_ep*numb_ep_wqp)*pp_commercial_samp)*cost_lab_wqp_ortho_ep))*			Model PWSs serving >50,000 with PO_4 or both PO_4 and pH adjustment *pbasepo4, pbasephpo4*	

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
t) Report lead WQP sampling data and compliance with OWQPs to Primacy Agency				
The labor hours for reporting per system multiplied by the labor rate. *(hrs_report_wqp_op*rate_op)*	Cost applies as written to NTNCWSs.	Above AL	Model PWSs serving ≤50,000 without CCT	Twice a year
			Model PWSs serving ≤50,000 with pH adjustment *pbaseph*	
			Model PWSs serving ≤50,000 with PO_4 or both PO_4 and pH adjustment *pbasepo4, pbasephpo4*	
		All	Model PWSs serving >50,000 with pH adjustment *pbaseph*	
			Model PWSs serving >50,000 with PO_4 or both PO_4 and pH adjustment *pbasepo4, pbasephpo4*	

Acronyms: AL = action level; CCT = corrosion control treatment; CWS = community water system; NTNCWS = non-transient non-community water system; OWQP = optimal water quality parameter; PO_4 = orthophosphate; PWS = public water system; WQP = water quality parameter.

Note:

[1] The data variables in the exhibit are defined previously in this section with the exception of:

- *numb_enhance_wqp*: number of distribution system samples for systems on routine WQP monitoring (Section 5.3.2.2.3).
- *numb_ep*: number of entry points per systems (Section 5.3.2.2.3).
- *numb_reduced_wqp*: number of distribution system samples for systems on reduced WQP monitoring (Section 5.3.2.2.3).
- *pbaseph*: likelihood a system has an existing CCT of modify pH (Section 5.3.2.2.1).
- *pbasepo4*: likelihood a system has existing CCT of adding PO_4 without pH post treatment (Section 5.3.2.2.1).
- *pbasephpo4*: likelihood a system has existing CCT of adding PO_4 with modify pH (Section 5.3.2.2.1).
- *p_wqp_annual, p_wqp_triennial, p_wqp_six_red*: likelihood a system is on reduced distribution system monitoring schedule at an semi-annual, annual, or triennial schedule, respectively (Section 5.3.2.2.2).
- *rate_op*: PWS hourly labor rate (Section 4.3.10.1).

5.3.2.3 ***PWS Copper Water Quality Parameter Monitoring***

This discussion of copper WQP monitoring costs for water systems is presented in the following subsections:

- 5.3.2.3.1: Applicability and Likelihood of a Copper ALE
- 5.3.2.3.2: Copper WQP Monitoring Activities

5.3.2.3.1 Applicability and Likelihood of a Copper ALE

The SafeWater LCR models Copper WQP Monitoring separately from the Lead WQP Monitoring. The frequency of Lead WQP Monitoring depends on the lead 90th percentile, with all systems above the AL and all systems serving more than 50,000 people[88] conducting Lead WQP Monitoring. Copper WQP Monitoring is required when a system exceeds the copper AL. To not double count the cost of WQP monitoring for systems experiencing both a copper ALE and a lead ALE simultaneously, the SafeWater LCR models the costs of Copper and Lead WQP Monitoring separately and restricts Copper WQP Monitoring to systems with a copper ALE only and lead 90th percentile not greater than the lead AL.

Note that the cost inputs used to estimate WQP costs in response to a copper ALE are identical to those incurred in response to a lead ALE with the following exceptions:

- The likelihood of a system's exceeding the copper ALE, which corresponds to *p_copper_ale,* is used in lieu of system's lead 90th percentile level.
- Systems are not assumed to be on reduced WQP distribution system monitoring in response to a copper ALE, and all systems are assumed to be on a 6-month standard monitoring schedule. Thus, the data inputs associated with reduced monitoring are not applicable. These include the reduced number of WQP monitoring samples per distribution sample site (*numb_reduced_wqp*), and the likelihood that a system will be on a 6-month *(p_wqp_six_red)* or annual *(p_wqp_annual)* WQP sampling schedule.

Exhibit 5-42 and Exhibit 5-43 provide the likelihood that a CWS and NTNCWS, respectively, will exceed the copper AL of 1.3 mg/L, but not the lead AL of 15 µg/L (*p_copper_ale*). In each exhibit, the estimated percentages are provided for each of the 9 size categories and two source water types used in the cost model. For systems without CCT, EPA derived the percentages from SDWIS/Fed 90th percentile results from 2012 – 2015 as follows:

- Step 1: For each year during 2012 – 2015, EPA identified the number of CWSs with a reported copper 90th percentile value above the copper AL and no reported lead 90th percentile above the AL for the nine size categories and two source types.

[88] All systems serving more than 50,000 people are required to have CCT and to conduct WQP monitoring with the exception of systems that have naturally non-corrosive water, i.e., "b3" systems. Refer to Chapter 4, Section 4.3.3 for EPA's approach for deriving the number of "b3" systems (assumed to be 11 CWSs).

- Step 2: EPA divided the number of systems in step 1 by the number of CWSs in each size and source strata to develop a percentage. Each percentage was divided by 100 to derive the likelihood.

EPA used the same approach to develop the estimated percent of NTNCWSs with ALEs. Chapter 4, Exhibit 4-25 and Exhibit 4-26 provide the results of this analysis for CWSs and NTNCWSs, respectively. Note that for modeling purposes, EPA assumed that no system with CCT would have a copper ALE and thus, would have a likelihood of 0 percent. EPA made this simplifying assumption because < 1 percent of CWSs and < 3.5 percent of NTNCWSs were estimated to have a copper ALE. Exhibit 5-42 and Exhibit 5-43 provide the likelihoods used in the SafeWater LCR model for the data variable *p_copper_ale*. As shown in these exhibits, no CWS or NTNCWS serving more than 50,000 people is assumed to have a copper ALE and be subject to copper WQP monitoring. However, as discussed in Section 5.3.2.2, these systems are assumed to conduct lead WQP monitoring with the exception of those designated as "b3" systems.

Exhibit 5-42: Estimated Likelihood a CWS Will Have a Copper Only ALE

System Size (Population Served)	*p_copper_ale*			
	with CCT[1]		without CCT[2]	
	Ground Water	Surface Water	Ground Water	Surface Water
≤100	0.000	0.000	0.004	0.007
101–500	0.000	0.000	0.004	0.008
501–1,000	0.000	0.000	0.004	0.006
1,001–3,300	0.000	0.000	0.005	0.005
3,301–10,000	0.000	0.000	0.003	0.003
10,001–50,000	0.000	0.000	0.002	0.003
50,001–100,000	0.000	0.000	0.000	0.000
100,001–1,000,000	0.000	0.000	0.000	0.000
>1,000,000	0.000	0.000		

Source:
SDWIS/Fed third quarter frozen data set, current through June 30, 2016. Also see "Derivation of CWS Inventory Characteristics_Final Rule.xlsx" for additional detail.
Notes:
General: EPA estimated that 11 CWSs are b3 systems, serve 50,001 – 1 million people, and have no CCT. No b3 systems serve more than 1 million people.
[1] Note that for modeling purposes, EPA assumed that no system with CCT would have a copper ALE and thus, would have a likelihood of 0 percent.
[2] For each year during 2012 - 2015, EPA identified the number of CWSs with a reported copper 90th percentile value above the copper AL and no reported lead 90th percentile values above the AL for the 9 size categories and two source types. EPA then divided the number of systems by the number of CWSs in each size and source strata to develop a percentage. Each percentage was divided by 100 to derive the likelihood. Note that all systems serving > 50,000 people without CCT (11 systems) are categorized as "b3" systems and have no copper ALEs (see Section 4.3.3 for additional detail).

Exhibit 5-43: Estimated Likelihood a NTNCWS Will Have a Copper Only ALE

System Size (Population Served)	*p_copper_ale*			
	with CCT[1]		without CCT[2]	
	Ground Water	Surface Water	Ground Water	Surface Water
≤100	0.000	0.000	0.007	0.011
101–500	0.000	0.000	0.007	0.013
501–1,000	0.000	0.000	0.007	0.016
1,001–3,300	0.000	0.000	0.008	0.008
3,301–10,000	0.000	0.000	0.010	0.000
10,001–50,000	0.000	0.000	0.000	0.000
50,001–100,000	0.000	0.000		
100,001–1,000,000	0.000	0.000		
>1,000,000				

Source:
SDWIS/Fed third quarter frozen data set, current through June 30, 2016. Also see "Derivation of NTNCWS Inventory Characteristics_Final Rule.xlsx" for additional detail.
Notes:
General: Three NTNCWSs serve 50,001 – 1 million people and each have CCT. No NTNCWS serves > 1 million people.
[1] Note that for modeling purposes, EPA assumed that no system with CCT would have a copper ALE and thus, would have a likelihood of 0 percent.
[2] For each year during 2012 - 2015, EPA identified the number of NTNCWSs with a reported copper 90th percentile value above the copper AL and no reported lead 90th percentile values above the AL for the 9 size categories and two source types. EPA then divided the number of systems by the number of NTNCWSs in each size and source strata to develop a percentage. Each percentage was divided by 100 to derive the likelihood.

5.3.2.3.2 Copper WQP Monitoring Activities

The activities, unit burden and costs, and data variables used to estimate copper WQP monitoring costs are identical to those for copper, as shown in Exhibit 5-44, with the exception that they are triggered in response to a copper ALE.

Exhibit 5-44: PWS Copper WQP Monitoring Unit Burden and Cost Estimates

Activity	Unit Burden and/or Cost	*SafeWater LCR Data Variable*
u) Collect copper WQP samples in the distribution system	*Same as Exhibit 5-24, activity p).*	
v) Analyze distribution system copper WQP samples	*Same as Exhibit 5-24, activity q).*	
w) Collect copper WQP samples from entry points	*Same as Exhibit 5-24, activity r).*	
x) Analyze entry point copper WQP samples	*Same as Exhibit 5-24, activity s).*	
y) Report copper WQP sampling data and compliance with OWQPs to Primacy Agency	*Same as Exhibit 5-24, activity t).*	

Acronyms: ALE = action level exceedance; OWQP = optimal water qualify parameter; WQP = water qualify parameter.
Source: "Derivation of WQP Analytical Burden and Costs_Final Rule.xlsx."

Exhibit 5-45 shows the SafeWater LCR model cost estimation approach for system WQP monitoring activities in response to a copper ALE including additional cost inputs that are required to calculate these costs.

Exhibit 5-45: PWS Copper WQP Monitoring Cost Estimation in SafeWater LCR by Activity[1]

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
u) Collect copper WQP samples in the distribution system				
Number of samples multiplied by the total of the hours per sample times the system labor rate, plus the cost of materials per sample. *(numb_enhance_wqp*((hrs_wqp_op*rate_op)+cost_wqp_material))*	Cost applies as written to NTNCWSs.	At or below AL	Model PWSs serving ≤50,000 without CCT and have a copper ALE *p_copper_ale*	Twice per event
Number of samples multiplied by the total of the hours per sample times the system labor rate, plus the cost of materials per sample. *(numb_enhance_wqp*((hrs_wqp_op*rate_op)+cost_wqp_material_ph))*			Model PWSs serving ≤50,000 that have pH adjustment and a copper ALE *p_copper_ale, pbaseph*	
Number of samples multiplied by the total of the hours per sample times the system labor rate, plus the cost of materials per sample. *(numb_enhance_wqp*((hrs_wqp_op*rate_op)+cost_wqp_material_ortho))*			Model PWSs serving ≤50,000 that have PO_4 or both PO_4 and pH adjustment and a copper ALE *p_copper_ale, pbasepo4, pbasephpo4*	

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
v) Analyze distribution system copper WQP samples				
The number of samples multiplied by the probabilities for a sample analyzed in house and a sample analyzed in a commercial lab times the different labor and material cost burdens for each type of analysis. *(((numb_enhance_wqp*pp_lab_samp)*((hrs_wqp_analyze_dist_op*rate_op)+cost_wqp_analyze))+((numb_enhance_wqp*pp_commercial_samp)*cost_lab_wqp))*	Cost applies as written to NTNCWSs.	At or below AL	Model PWSs serving ≤50,000 without CCT and have a copper ALE *p_copper_ale*	Twice per event
The number of samples multiplied by the probabilities for a sample analyzed in house and a sample analyzed in a commercial lab times the different labor and material cost burdens for each type of analysis. *(((numb_enhance_wqp*pp_lab_samp)*((hrs_wqp_analyze_ph_op*rate_op)+cost_wqp_ph_analyze))+((numb_enhance_wqp*pp_commercial_samp)*cost_lab_ph_wqp))*			Model PWSs serving ≤50,000 that have pH adjustment and a copper ALE *p_copper_ale, pbaseph*	
The number of samples multiplied by the probabilities for a sample analyzed in house and a sample analyzed in a commercial lab times the different labor and material cost burdens for each type of analysis. *(((numb_enhance_wqp*pp_lab_samp)*((hrs_wqp_analyze_ortho_op*rate_op)+cost_wqp_ortho_analyze))+((numb_enhance_wqp*pp_commercial_samp)*cost_lab_ortho_wqp))*			Model PWSs serving ≤50,000 that have PO_4 or both PO_4 and pH adjustment and have a copper ALE *p_copper_ale, pbasepo4, pbasephpo4*	

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
w) Collect copper WQP samples from entry points				
The number of entry points per system multiplied by the number of samples, then multiplied by the total of the labor hours per sample times the system labor rate, plus the cost per sample. *((numb_ep*numb_ep_wqp)*((hrs_ep_wqp_op*rate_op)+cost_ep_wqp_material))*	Cost applies as written to NTNCWSs.	At or below AL	Model PWSs serving ≤50,000 without CCT and have a copper ALE *p_copper_ale*	Every 2 weeks per event
The number of entry points per system multiplied by the number of samples, then multiplied by the total of the labor hours per sample times the system labor rate, plus the cost per sample. *((numb_ep*numb_ep_wqp)*((hrs_ep_wqp_op*rate_op)+cost_ep_wqp_ph_material))*			Model PWSs serving ≤50,000 that have pH adjustment and a copper ALE *p_copper_ale, pbaseph*	
The number of entry points per system multiplied by the number of samples, then multiplied by the total of the labor hours per sample times the system labor rate, plus the cost per sample. *((numb_ep*numb_ep_wqp)*((hrs_ep_wqp_op*rate_op)+cost_ep_wqp_ortho_material))*			Model PWSs serving ≤50,000 that have PO_4 or both PO_4 and pH adjustment and have a copper ALE *p_copper_ale, pbasepo4, pbasephpo4*	

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
x) Analyze entry point copper WQP samples				
The number of samples multiplied by the probabilities for a sample analyzed in house and a sample analyzed in a commercial lab times the different labor and material cost burdens for each type of analysis. *((((numb_ep*numb_ep_wqp)*pp_lab_samp)*((hrs_wqp_analyze_ep_op*rate_op)+cost_wqp_analyze_ep))+(((numb_ep*numb_ep_wqp)*pp_commercial_samp)*cost_lab_wqp_ep))*	Cost applies as written to NTNCWSs.	Above AL	Model PWSs serving ≤50,000 without CCT and have a copper ALE *p_copper_ale*	Every two weeks per event
The number of samples multiplied by the probabilities for a sample analyzed in house and a sample analyzed in a commercial lab times the different labor and material cost burdens for each type of analysis. *((((numb_ep*numb_ep_wqp)*pp_lab_samp)*((hrs_wqp_analyze_ph_ep_op*rate_op)+cost_wqp_analyze_ph_ep))+(((numb_ep*numb_ep_wqp)*pp_commercial_samp)*cost_lab_wqp_ph_ep))*			Model PWSs serving ≤50,000 that have pH adjustment and a copper ALE *p_copper_ale, pbaseph*	
The number of samples multiplied by the probabilities for a sample analyzed in house and a sample analyzed in a commercial lab times the different labor and material cost burdens for each type of analysis. *((((numb_ep*numb_ep_wqp)*pp_lab_samp)*((hrs_wqp_analyze_ortho_ep_op*rate_op)+cost_wqp_analyze_ortho_ep))+(((numb_ep*numb_ep_wqp)*pp_commercial_samp)*cost_lab_wqp_ortho_ep))*			Model PWSs serving ≤50,000 that have PO_4 or both PO_4 and pH adjustment and have a copper ALE *p_copper_ale, pbasepo4, pbasephpo4*	

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
y) Report copper WQP sampling data and compliance with OWQPs to Primacy Agency				
The labor hours for reporting per system multiplied by the labor rate. *(hrs_report_wqp_op*rate_op)*	Cost applies as written to NTNCWSs.	At or below AL	Model PWSs serving ≤50,000 without CCT and have a copper ALE *p_copper_ale*	Twice per event
			Model PWSs serving ≤50,000 that have pH adjustment and a copper ALE *p_copper_ale, pbaseph*	
			Model PWSs serving ≤50,000 that have PO_4 or both PO_4 and pH adjustment and have a copper ALE *p_copper_ale, pbasepo4, pbasephpo4*	

Acronyms: AL = action level; ALE = action level exceedance; CCT = corrosion control treatment; CWS = community water system; NTNCWS = non-transient non-community water system; PO_4 = orthophosphate; OWQP = optimal water quality parameter; PWS = public water system; WQP = water quality parameter.

Note:

[1] The data variables in the exhibit are defined previously in this section with the exception of:

- *numb_enhance_wqp*: number of distribution system samples for systems on routine WQP monitoring (Section 5.3.2.2.3).
- *numb_ep*: number of entry points per systems (Section 5.3.2.2.3).
- *numb_reduced_wqp*: number of distribution system samples for systems on reduced WQP monitoring (Section 5.3.2.2.3).
- *pbaseph*: likelihood a system has an existing CCT of modify pH (Section 5.3.2.2.1).
- *pbasepo4*: likelihood a system has existing CCT of adding PO_4 without pH post treatment (Section 5.3.2.2.1).
- *rate_op*: PWS hourly labor rate (Section 4.3.10.1).

5.3.2.4 ***PWS Source Water Monitoring***

This discussion of source water monitoring costs for water systems is presented in the following subsections:

- 5.3.2.4.1: Applicability and Required Number of Samples
- 5.3.2.4.2: Source Water Monitoring Activities

5.3.2.4.1 Applicability and Required Number of Samples

Under the LCRR, CWSs and NTNCWSs must sample at each entry point if the system experiences a significant source water change and/or has not already conducted source water monitoring for a previous lead or copper AL. The likelihood of a significant source change or ALE, as well as the required number of source water samples, are described below.

Applicability

Section 4.3.8.1 in Chapter 4 provides EPA's approach for using historical SDWIS/Fed data to estimate the likelihood that systems would have a source change in any given year (*p_source_chng*) of 0.05 for all CWSs and NTNCWSs. EPA developed a second related data input, *p_source_sig*, using the same data set to estimate the likelihood that a source change would be a significant change, i.e., one in which a system changed its primary source. EPA set *p_source_sig* to 0.01 for CWSs and NTNCWSs. The likelihoods *p_source_chng* and *p_source_sig* are multiplied to determine the joint likelihood that a system that makes a source change will be required to take additional action such as source water monitoring.

Lead and/or Copper ALE

Under the LCRR, the SafeWater LCR model assigns the source water monitoring burden and costs described in Section 5.3.2.4.2 to any system the first time they exceed the lead and/or copper AL. A discussion of EPA's approach for estimating the likelihood a system will initially have a lead ALE under the LCRR is provided in Section 4.3.5.1, with the estimated percentages provided in Exhibit 4-20. The likelihood a system will have a copper ALE is provided in Section 5.3.2.3.1. Note that this approach may result in an overestimation of cost because the LCRR allows systems to forego source water monitoring if they previously sampled source water in response to an ALE, the Primacy Agency has not required source water treatment, and they have not added any new water sources that change their primacy source type. For modeling purposes no system is assumed to have source water treatment.

Number of Samples

As described in Sections 4.2.2 and 4.3.6, EPA developed likelihoods of a CWS having 1 to 50 entry points for the eight system size categories serving 1,000,000 or fewer people and for ground water and surface water systems. Note that systems in the 9th system size category serving greater than 1 million were modeled separately using information provided by the 21 water systems in this largest population category. See the file, "Derivation of Baseline CCT Characteristics_Final Rule.xlsx," for the results. For example, ground water CWSs serving 101 to 500 people have a 72 percent chance of having one entry point, a 12 percent chance of having two entry points, and a 10 percent chance of having three entry points. EPA assumed that NTNCWSs always have one entry point since they tend to be single facilities covering a small geographical area.

The rule does not specify that systems must collect multiple samples per entry point. Thus, for the cost model the Agency assumed each system would collect one sample per entry point (*numb_st_sample*).

5.3.2.4.2 Source Water Monitoring Activities

EPA has developed system costs for three source water monitoring activities as shown in Exhibit 5-46. The exhibit provides the unit burden and/or cost for each activity. The assumptions used in the estimation of each activity follows the exhibit. The last column provides the corresponding SafeWater LCR model data variable in red/italic font. In a few instances, some of these activities are conducted by the state instead of the water system. These activities are identified in the exhibit and further explained in the exhibit notes.

Exhibit 5-46: PWS Source Monitoring Burden and Cost Estimates

Activity	Unit Burden and/or Cost	*SafeWater LCR Data Variable*
z) Collect source water sample	Burden 0.5 hrs/sample Cost $1.83/sample for CWSs serving > 100K	Burden *hrs_source_op* Cost *cost_source_material*[1]
aa) Analyze source water sample	In-House Burden 0.44 hrs/sample for CWSs serving > 100K In-House Cost $2.38/sample for CWSs serving > 100K Commercial Cost $21.58/sample for CWSs serving ≤ 100K and NTNCWSs	In-House Burden *hrs_analyze_samp_op*[1] In-House Cost *cost_source_analyze*[1] Commercial Cost *cost_source*[1]
bb) Report source water monitoring results to Primacy Agency	1 hour/report	*hrs_report_source_op*[1]

Acronyms: CWS = community water system; NTNCWS = non-transient non-community water system; PWS = public water system.
Sources:
z), bb): See *Disinfectants/Disinfection Byproducts, Chemical, and Radionuclides Rules ICR (Renewal)*, Exhibit 15 in Appendix H for burden (USEPA, 2015b); "Derivation of Lead Analytical Burden and Costs_Final Rule.xlsx," worksheet: "In-House Bottle_$" for costs.
aa): See "Derivation of Lead Analytical Burden and Costs_Final Rule.xlsx," worksheets: "In-House Burden_hrs," "In-House_Consumables_Summary_$," and "Commercial Analytical_$."
Note:
[1] The burden and costs for these activities are incurred by the state versus in Arkansas, Louisiana, Mississippi, Missouri, and South Carolina.

z) Collect source water sample (hrs_source_op, cost_source_material). CWSs and NTNCWSs with a significant source change and/or in response to their first lead or copper ALE will incur a burden of 0.5 hours to collect one source water sample at each entry point (*hrs_source_op*). This estimate is based on the system burden for source water sample collection in the *Disinfectants/Disinfection*

Byproducts, Chemical, and Radionuclides Rules ICR (Renewal), Exhibit 15 in Appendix H (USEPA, 2015b).

Based on input from laboratories, EPA assumed only CWSs serving more than 100,000 people will conduct analyses in-house, i.e., *pp_lab_samp* is 1 for CWSs serving more than 100,000 people and 0 for all other CWSs and NTNCWSs. Conversely, the assigned probability a system will use a commercial laboratory, i.e., *pp_commercial_samp* is 0 for CWSs serving more than 100,000 people and 1 for all other systems.

Commercial laboratories provide bottles as part of their services. Thus, CWSs serving 100,000 or fewer people and NTNCWSs will not incur bottle costs. *CWSs serving more than 100,000 people are assumed to purchase* a 250-ml sample bottle in bulk at a per bottle cost of $1.83 based on quotes from three vendors *(cost_source_material)*.

aa) Analyze source water samples (hrs_analyze_samp_op, cost_source_analyze, cost_source). EPA assumed only CWSs serving more than 100,000 people will conduct analyses in-house and require 0.44 hours based on quotes from three laboratories. They will also incur in-house consumable costs of $2.38 based on information from three vendors *(cost_source_analyze).* CWSs serving 100,000 or fewer people and NTNCWSs will incur a cost of $21.58 per sample to have a commercial laboratory conduct the lead analyses *(cost_source)*.

bb) Report source water monitoring results to Primacy Agency (hrs_report_source_op). Water systems are required to report their source water monitoring results to the Primacy Agency. EPA assumed that both CWSs and NTNCWSs would report electronically and would not incur costs for paper, an envelope, or postage. The Agency did not have specific data on the time it would take to develop and submit a report for the source water sampling results. Instead, in order to estimate this value, EPA employed the general assumption that a water system would require twice the time to prepare the report as that needed for the Primacy Agency to review the report. EPA used an estimate from Exhibit 48 in Appendix H of the *Disinfectants/Disinfection Byproducts, Chemical, and Radionuclides Rules ICR (Renewal)* indicating a Primacy Agency burden of 0.5 hours for review of a "Source Water Monitoring Letter" submitted from a water system (USEPA, 2015b). Therefore, EPA assumed that systems would incur an average burden of 1 hour to produce and submit this report for each monitoring period in which they conduct source water monitoring *(hrs_report_source_op)*.

Exhibit 5-47 provides the SafeWater LCR model cost estimation approach for system source water monitoring activities including additional cost inputs required to calculate these costs.

Exhibit 5-47: PWS Source Water Monitoring Cost Estimation in SafeWater LCR by Activity[1]

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions[2]	
z) Collect source water sample[3]				
The number of entry points per system multiplied by the number of samples, then multiplied by the total of the labor hours per sample times the system labor rate, plus the cost per sample. *((numb_ep*numb_st_sample)*((hrs_source_op*rate_op)+cost_source_material))*	Cost applies as written to NTNCWSs.	All	Model PWSs with a significant change in source water *p_source_chng * p_source_sig*	Once per event
		At or below AL	Model PWSs with a copper ALE but no lead ALE *p_copper_ale*	One time
		Above AL	All model PWSs	
aa) Analyze source water samples[3]				
The number of samples multiplied by the probabilities for a sample analyzed in house and a sample analyzed in a commercial lab times the different labor and material cost burdens for each type of analysis. *((pp_lab_samp*(numb_ep*numb_st_sample))*((hrs_analyze_samp_op*rate_op)+cost_source_analyze))+((pp_commercial_samp*(numb_ep*numb_st_sample))*cost_source)*	Cost applies as written to NTNCWSs.	All	Model PWSs with a significant change in source water *p_source_chng * p_source_sig*	Once per event
		At or below AL	Model PWSs with a copper ALE but no lead ALE *p_copper_ale*	One time
		Above AL	All model PWSs	
bb) Report source water monitoring results to Primacy Agency[3]				
The total reporting hours per system multiplied by the labor rate. *(hrs_report_source_op*rate_op)*	Cost applies as written to NTNCWSs.	All	Model PWSs with a significant change in source water *p_source_chng * p_source_sig*	Once per event
		At or below AL	Model PWSs with a copper ALE but no lead ALE *p_copper_ale*	One time
		Above AL	All model PWSs	

Acronyms: AL = action level; ALE = action level exceedance; CWS = community water system; NTNCWS = non-transient non-community water system; PWS = public water system.

Notes:

[1] The data variables in the exhibit are defined previously in this section with the exception of:

- *numb_ep:* number of entry points per systems (Section 5.3.2.2.3).
- *numb_st_samp:* number of samples per entry point for source water monitoring (Section 5.3.2.4.1).
- *p_copper_ale:* likelihood a system with exceed the copper action level (Section 5.3.2.3.1).
- *rate_op:* PWS hourly labor rate (Section 4.3.10.1).
- *p_source_chng:* Likelihood a system will have a source change (Section 4.3.8.1).

- *p_source_sig:* Likelihood that the system will have a significant change in which it changes its primary source, e.g., for ground water to surface water (Section 4.3.8.1).

[2] The likelihoods of *p_source_chng* and *p_source_sig* are multiplied to determine the joint likelihood that a system that makes a source change will be required to conduct source water monitoring.

[3] The burden and cost to provide sample bottles (*cost_source_material*) under activity z), conduct analyses under activity aa), and report source water sample results to the system under activity bb) are incurred by the state in Arkansas, Louisiana, Mississippi, Missouri, and South Carolina.

5.3.2.5 ***PWS School and Child Care Lead Sampling Costs***

The final LCRR requires CWSs to implement a lead in drinking water testing program at K-12 schools and licensed child cares. CWSs must collect five samples per tested school *(numb_samp_five)* and two samples at each tested child care *(numb_samp_two)*. The final rule splits this testing program into two phases. The "mandatory testing" phase occurs at elementary schools and child cares during the first 5 years of rule implementation, which is assumed to occur in years 4 through 8. Under the mandatory testing program, systems must annually conduct testing at 20 percent of eligible schools and child cares *(pp_mand_twenty_partic)* such that each would be tested once in the 5-year period. In years 9 onward, CWSs must implement an "on request" program in which they are only required to test those elementary schools and child cares that request testing. In addition, CWSs are only required to test secondary schools that request testing starting in years 4 onward. For the on request program, EPA assumed 5 percent of elementary and secondary schools and child cares would request testing each year (*pp_voluntary_partic*).

Exhibit 4-50 in Chapter 4 provides the estimated number of public elementary schools (*numb_elem_schools_pub*), public secondary schools (*numb_second_schools_pub*), private elementary schools, (*numb_elem_schools_priv*), private secondary schools (*numb_second_schools_priv*), and child cares *(numb_daycares)* served by CWSs for states, territories, and the Navajo Nation. As previously discussed in Section 4.3.9.2, states with existing lead in drinking water programs at schools and/or child cares that are at least as stringent as the LCRR requirements can waive these requirements for CWSs. EPA assumed schools and/or child cares in these states are already conducting this monitoring and that CWSs in these states would incur no additional burden or cost to implement these programs under the LCRR. Exhibit 4-52 lists the states meeting the mandatory testing program requirements for public and private schools (*p_grandfather_mand_pub* + *p_grandfather_mand_priv*) or public only (*p_grandfather_mand_pub),* and Exhibit 4-55 lists states meeting the mandatory testing requirements for child cares (*p_grandfather_mand_child*). States that meet the on request program requirements and are assumed to waive testing requirements for CWSs in years 4 onward for secondary schools and years 9 onward for elementary schools and child cares. Exhibit 4-53 provides the list of schools meeting the on request program requirements for public and private schools (*p_grandfather_opt_pub* + *p_grandfather_opt_priv*) or public only (*p_grandfather_opt_pub),* and Exhibit 4-56 lists the states meeting the on request testing requirements for child cares (*p_grandfather_opt_child*). For additional detail, refer to Chapter 4, Section 4.3.9.2 and the file, "Derivation of School_Child Care Inputs_Final Rule.xlsx" (available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov) for additional information.

The requirements and associated costing inputs are described in more detail for the mandatory testing program in Section 5.3.2.5.1 and upon request program in Section 5.3.2.5.2.

5.3.2.5.1 Mandatory Testing Program

EPA has developed system burden and costs to implement a lead in drinking water testing program at elementary schools and child cares for the first 5 years associated with the mandatory program phase as shown in Exhibit 5-48. The exhibit provides the unit burden and/or cost for each activity. The assumptions used in the estimation of each activity follows the exhibit. The last column provides the corresponding SafeWater LCR model data variable in red/italic font. In a few instances, some of these activities are conducted by the state instead of the water system. These activities are identified in the exhibit and further explained in the exhibit notes.

Exhibit 5-48: CWS Elementary School and Child Care Sampling Unit Burden and Cost Estimates for the Mandatory Program Phase (Years 4 - 8)

Activity	Unit Burden and/or Cost	*SafeWater LCR Data Variable*
cc) Create a contact list of schools and child cares served by the CWS and submit to Primacy Agency (one-time)	0.08 hrs/school or child care	*hrs_school_identify_op*
dd) Develop lead outreach materials for schools and child cares (one-time)	3.5 hrs/CWS serving ≤ people; 20 hrs/CWS serving > 50,000 people	*hrs_devel_pe_school_op*
ee) Prepare and distribute initial letter explaining the sampling program and the 3Ts Toolkit (one-time)	Burden 0.05 hrs/school or child care Cost $0.39 to $0.58/school or child care	Burden *hrs_school_letter_op* Cost *cost_school_letter*
ff) Contact school or child care to determine and finalize its sampling schedule (one-time)	School 0.5 hrs/school Child Care 1 hr/child care	School *hrs_school_call_op* Child Care *hrs_childcare_call_op*
gg) Contact school or child care to coordinate sample collection logistics	0.25 hrs/school or child care	*hrs_school_coor_sample_op*
hh) Conduct walkthrough at school or child care before the start of sampling	Burden 1.39 to 1.67 hrs/school or child care Cost $5.29 to $9.07/school or child care	Burden *hrs_walkthrough_school_op* Cost *cost_walkthrough_school*
ii) Travel to collect samples	Burden 0.39 to 0.67 hrs/school or child care Cost $5.29 to $9.07/school or child care	Burden *hrs_travel_samp_school_op* Cost *cost_travel_samp_school*

Activity	Unit Burden and/or Cost	*SafeWater LCR Data Variable*
jj) Collect samples	Burden 0.17 hrs/sample Cost $1.83/sample for CWSs serving > 100,000 people	Burden *hrs_collect_samp_school_op* Cost *cost_collect_samp_school*[1]
kk) Analyze samples	In-House Analysis (CWSs > 100K only) Burden: 0.44 hrs/sample Cost: $2.38/sample Commercial Analysis $21.58/sample	In-House Analysis *hrs_analyze_samp_op*[1] *cost_lab_lt_samp*[1] Commercial Analysis *cost_commercial_lab*[1]
ll) Provide sampling results to tested facilities	Burden 0.05 hrs/tested facility Cost $0.58/ tested facility	Burden *hrs_inform_samp_pe_school_op* Cost *cost_inform_samp_pe_school*
mm) Discuss sampling results with school and child care	1 hr/school or child care	*hrs_result_discuss_op*
nn) Conduct detailed discussion of high sampling results with school and child cares	5 hr/sample	Burden *hrs_school_help_op*
oo) Prepare and provide annual report on school and child care sampling program to the Primacy Agency	Burden 1 to 8 hrs/CWS Cost $0.58/CWS	Burden *hrs_annual_report_school_prepare_op* Cost *cost_annual_report_school_dist*

Acronyms: AL = action level; 3Ts Toolkit = "3Ts for Reducing Lead in Drinking Water Toolkit"; CWS = community water system; PWS = public water system.
Source: "Derivation of School_Child Care Inputs_Final Rule.xlsx." Other data sources are provided following this exhibit for each activity shown.
Note:
[1] The burden and costs for these activities are incurred by the state in Arkansas, Louisiana, Mississippi, Missouri, and South Carolina.

cc) Create a contact list of schools and child cares served by CWS and submit to Primacy Agency (hrs_school_identify_op). EPA assumed all CWSs would incur a one-time burden at the start of the program to create a contact list of schools and child cares in their service area and spend an average of 5 minutes (0.08 hours) per school or child care. EPA assumed a system can use its customer database and obtain needed additional information online. Although systems serving more than 10,000 people may spend less time to identify each facility, they are assumed to use additional hours to create an electronic tracking system. Thus, EPA also applied the 0.08 hours per facility to these larger systems.

dd) Develop lead outreach for schools and child cares (hrs_devel_pe_school_op). EPA assumed all CWSs would prepare outreach materials that describe the importance of lead testing and the systems lead in drinking water testing program. EPA assumed systems serving 50,000 or fewer

people will require 3.5 hours to prepare and submit these materials for Primacy Agency review and those serving more than 50,000 people will require 20 hours. Burden estimates for systems serving 50,000 or fewer people are based on tier 2 public notice (PN) preparation burden (3.5 hours), and burden estimates for systems serving more than 50,000 people are based on tier 1 PN preparation burden for systems serving more than 10,000 people (30 hours) from the *Public Water System Supervision Program Information Collection Request (ICR) (Renewal)* (USEPA, 2015a). EPA assumed that all PWSs will use an EPA-developed template. Those serving 50,000 or fewer people would not modify the content. However, systems serving more than 50,000 people would adapt the template for their use but would require 20 hours as opposed to the 30-hour estimate for Tier 1 PN.[89]

ee) Prepare and distribute the initial letter (hrs_school_letter_op, cost_school_letter). EPA assumed all CWSs would incur a one-time burden at the start of the program to prepare and distribute an initial letter explaining the sampling program and providing a link to the "3Ts for Reducing Lead in Drinking Water Toolkit" (3Ts Toolkit) (USEPA, 2018). EPA estimated on average systems would spend 1 hour per 20 letters or 0.05 hours per school or child care *(hrs_school_letter_op)*. This estimate is based on the burden for a system to inform customers of their lead testing results as documented in the *Disinfectants/Disinfection Byproducts, Chemical, and Radionuclides Rules ICR (Renewal)*, Exhibit 35 in Appendix H (USEPA, 2015b). Note that EPA conservatively assumed that systems will send letters to every school. However, the system may be able to send a letter to a single school district instead of individual schools as a cost savings.

Systems will also incur paper ($0.025), envelope ($0.067), and first class ($0.49) or bulk rate postage costs ($0.30) to distribute the letter *(cost_school_letter)*. CWSs serving 100,000 or fewer people will incur total materials cost per letter of $0.58 and those serving more than 100,000 will incur a total cost of $0.39 due to the bulk rate discount.

ff) Contact school or child care to determine and finalize its sampling schedule (hrs_school_call_op, hrs_childcare_call_op). EPA assumed systems would coordinate with each school or child care at the start of the program to plan when each facility will be sampled. EPA estimated systems would require two phone calls to reach the appropriate person at an average of 15 minutes (0.25 hours) per call for a total of 0.5 hours per school for this one-time activity.[90] EPA assumed systems would require additional time to contact the child care at the start of the program to plan when each will be sampled. Some licensed day cares are home-based facilities that may not have additional support staff and may require multiple calls to reach the needed individual. EPA estimated systems would require four calls at an average of 15 minutes per call for a total of 1 hour for this one-time activity.

gg) Contact school or child care to coordinate sample collection logistics (hrs_school_coor_sample_op). EPA assumed systems will spend an average of 15 minutes (0.25

[89] In the proposed rule analysis EPA applied the cost of developing outreach materials (hrs_devel_pe_school_op) for each school and childcare served by a modeled system. In the final rule analysis this one-time cost is applied once for each impacted system.

[90] EPA doubled the estimate burden from the proposed rule EA in response to a public comment submitted by the Environmental Defense Fund (EDF) (available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov).

hours) calling each facility to coordinate sample collection logistics including scheduling a walkthrough.[91]

hh) Conduct walkthrough at school or child care before the start of sampling (hrs_walkthrough_school_op, cost_walkthrough_school). EPA assumed systems will conduct a walkthrough with each school or child care to become familiar with the facility and to identify sampling sites. EPA assumed the following burden, which includes travel time roundtrip to each facility plus one hour spent conducting the walkthrough *(hrs_walkthrough_school_op)* given the equations below:

- CWSs serving 100,000 or fewer people: 1.39 hours = ((4.9 miles * 2)/25 miles per hr) + 1 hr
- CWSs serving 100,001 to 1,000,000 people: 1.5 hours = ((6.3 miles * 2)/25 miles per hr) + 1 hr
- CWSs serving more than 1,000,000 people: 1.67 hours = ((8.4 miles * 2)/25 miles per hr) + 1 hr.

These estimates are based on census data and zip codes from the 2006 Community Water System Survey, assumed the following one-way driving distances for CWSs: 4.9 miles for those serving ≤ 100,000 people, 6.3 miles for those serving 100,001 – 1,000,000 people, and 8.4 miles for those serving greater than 1,000,000 people. For additional detail on how these estimates were derived, see "Derivation of Estimated Driving Distances_Final Rule.xlsx" EPA assumed an average speed of 25 miles per hour.

Systems will also incur travel costs to conduct this walkthrough *(cost_walkthrough_school)* as follows:

- CWSs serving 100,000 or fewer people: $5.29 = (4.9 miles * 2) * $0.54 per mile
- CWSs serving 100,001 to 1,000,000 people: $6.80 = (6.3 miles * 2) * $0.54 per mile
- CWSs serving more than 1,000,000 people: $9.07 = (8.4 miles * 2) * $0.54 per mile.

EPA assumed a mileage cost of $0.54 per mile using the 2016 federal reimbursement rate from the United States General Services Administration (GSA) (available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov).

ii) Travel to collect samples (hrs_travel_samp_school_op, cost_travel_samp_school). Systems will incur burden to travel to a school or child care to collect samples *(hrs_travel_samp_school_op)*. EPA assumed CWSs serving 100,000 or fewer people will spend 0.39 hours traveling round trip, those serving 100,001 to 1 million people will spend 0.50 hours, and those serving more than 1 million people will spend 0.67 hours. EPA used the same assumptions as those used to develop *hrs_walkthrough_school_op* that is discussed in activity hh) above excluding the 1 hour to conduct a walkthrough.

[91] EPA increased the estimated burden from the proposed rule EA fourfold in response to a public comment submitted by EDF (available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov).

CWSs will also incur vehicle costs for this roundtrip travel *(cost_travel_samp_school)*. EPA used the same assumptions as those for *cost_walkthrough_school* that is discussed in activity hh)). EPA assumed the following costs: $5.29 for CWSs serving 100,000 or fewer people, $6.80 for those serving 100,001 to 1 million people, and $9.07 for those serving more than 1 million people.

jj) Collect samples (hrs_collect_samp_school_op, cost_collect_samp_school). The final LCRR requires systems to provide instructions to facilities on how to identify outlets for sampling at least 30 days prior to sampling. For cost modeling purposes, EPA assumed systems would collect the samples and would require 10 minutes (0.17 hours) per sample *(hrs_collect_samp_school_op*). This estimate is based on the assumption that the sample locations will be in the same building and the CWS has previously conducted a walkthrough to identify sampling locations.

Based on information from laboratories, only CWSs serving more than 100,000 people are assumed to conduct in-house analyses for lead; whereas those serving 100,000 or fewer people will use a commercial lab. Bottles are supplied by the commercial lab. Thus, CWSs serving more than 100,000 people will incur a $1.83 per 250-mL wide mouth bottle assuming a bulk discount rate of 15 percent based on three vendors.

kk) Analyze samples (hrs_analyze_samp_op, cost_lab_lt_samp, cost_commercial_lab). CWSs will incur the same burden and cost to analyze the school and child care lead samples as they do analyzing compliance lead tap samples. Therefore, EPA used the same cost data variables for both in-house and commercial laboratory analysis of lead tap samples. Specifically, CWSs serving more than 100,000 people will incur a burden of 0.44 hrs per sample (*hrs_analyze_samp_op*) and a cost of $2.38 per sample (*cost_lab_lt_samp*) to analyze lead samples in-house. For these systems the likelihood that a sample will be analyzed in-house is 1 (*pp_lab_samp_school*) and the likelihood that the sample will be analyzed commercially is 0 (*pp_commercial_samp_school*). CWSs serving 100,000 or fewer will use a commercial lab at a cost of $21.58 per sample (*cost_commercial_lab*). For these systems *pp_lab_samp_school* is 0 and *pp_commercial_samp_school* is 1. See Section 5.3.2.1.2, activity j) for additional detail.

ll) Provide sampling results to tested facilities (hrs_inform_samp_pe_school_op, cost_inform_samp_pe_school). CWSs must provide sampling results to each tested facility. EPA assumed systems will spend 0.05 hours or 1 hour per 20 letters (*hrs_inform_samp_pe_school_op*) based on the public education burden for systems to notify occupants of monitoring results from the *Disinfectants/Disinfection Byproducts, Chemical, and Radionuclides Rules ICR (Renewal)*, Exhibit 35 (USEPA, 2015b). EPA also assumed CWSs will incur a material cost of $0.58/letter *(cost_inform_samp_pe_school)*. EPA assumed information will be provided via mail (1 page of information, double-sided). Material costs include paper ($0.025), first class postage ($0.49), and an envelope ($0.067). Systems will provide the results of all testing to their Primacy Agency as part of an annual report that is discussed under activity oo). Systems must also provide results annually to state and local health officials and EPA assumed the results will be provided with the required lead outreach materials to these agencies and is captured in the data variable, *cost_hc* (see Section 5.3.6.2, activity l)).

mm) Discuss sampling results with school and child cares (hrs_result_discuss_op). EPA assumed systems will incur additional burden to discuss the sampling results with each school and child care at an average burden of 1 hour per tested facility.[92]

nn) Conduct detailed discussion of high sampling results with school and child cares (hrs_school_help_op). In response to comments received on the proposed rule EA EPA added an additional cost element designed to capture the additional burden to systems for discussing in greater detail high sampling results and the 3Ts Toolkit (USEPA, 2018) with school and child cares. EPA assumed systems will spend an additional 5 hours with each school or child care in which one or more samples are found to be high. The estimate includes time for the system to explain the relevant portions of the 3Ts Toolkit and to address any follow-up questions that school or child care might have after the initial discussion.

oo) Prepare and provide an annual report on testing program to Primacy Agencies (hrs_annual_report_school_prepare_op, cost_annual_report_school_dist). Systems are required to prepare and provide an annual report to their Primacy Agency regarding their testing program at schools and child cares. The report certifies the CWS made a good faith effort to identify all schools and child cares they serve, summarizes all sampling activities conducted at schools and child cares in a system's service area, and documents attempts that resulted in no response. Every five years, the system must include any updates to the list of schools or child cares facilities on confirmation of no change and is provided to the Primacy Agency. CWSs must keep documentation regarding schools and child cares that are non-responsive or decline to participate in the testing program. For modeling purposes, EPA assumed all schools and child cares would elect to participate in the testing program because the testing if free and they would want to better understand their potential sources of lead in drinking water.

EPA assumed systems would incur the following burden to prepare and distribute the annual report *(hrs_annual_report_school_prepare_op)*:

- CWSs serving 100,000 or fewer people will incur a burden of 1 hour to prepare this report. This effort is similar to the estimated burden for a system of this size to report lead tap results and the 90th percentile calculation.
- CWSs serving more than 100,000 people will be conducting sampling at a much larger number of schools and child cares per year than smaller systems. CWSs serving more than 100,000 people are assumed to have sophisticated tracking systems that can be used to generate their reports. EPA assumed systems serving 100,001 – 1,000,000 will require 2 hours and those serving more than 1,000,000 will require 8 hours to prepare the annual report.

Systems also will incur mailing costs for paper ($0.025), an envelope ($0.067), and first-class postage ($0.49) to send a report to the Primacy Agency *(cost_annual_report_school_dist)*. The material cost for this report is $0.58***.***

[92] EPA added burden for systems to discuss sampling results with schools and child cares in response to a public comment submitted by EDF (available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov).

Exhibit 5-49 provides the SafeWater LCR model cost estimation approach for each activity under the mandatory program phase including additional cost inputs required to calculate these costs.

Exhibit 5-49: PWS Mandatory School and Child Care Sampling Phase Cost Estimation in SafeWater LCR by Activity[1, 2]

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
cc) Create a contact list of schools and child cares and submit to Primacy Agency				
The number of public elementary schools per system population times the system population multiplied by the hours to identify each facility and the system labor rate. *numb_elem_schools_pub*pws_pop*(hrs_school_identify_op*rate_op)*	Cost does not apply to NTNCWSs.	All	Model PWS that does not meet waiver requirements for public elementary school sampling 1 - *p_grandfather_mand_pub*	One time
The number of public secondary schools per system population times the system population multiplied by the hours to identify each school and the system labor rate. *numb_second_schools_pub*pws_pop *(hrs_school_identify_op*rate_op)*			Model PWS that does not meet waiver requirements for public secondary school sampling 1 - *p_grandfather_mand_pub*	
The number of child cares per system population times the system population multiplied by the hours to identify each facility and the system labor rate. *numb_daycares*pws_pop *(hrs_school_identify_op*rate_op)*			Model PWS that does not meet waiver requirements for child care sampling 1 - *p_grand_mand_child*	
The number of private elementary schools per system population times the system population multiplied by the hours to identify each facility and the system labor rate. *numb_elem_schools_priv*pws_pop *(hrs_school_identify_op*rate_op)*			Model PWS that does not meet waiver requirements for private elementary school sampling 1 - *p_grandfather_mand_priv*	
The number of private secondary schools per system population times the system population multiplied by the hours to identify each school and the system labor rate. *numb_second_schools_priv*pws_pop *(hrs_school_identify_op*rate_op)*			Model PWS that does not meet the requirements to be grandfathered into the program for private secondary school sampling 1 - *p_grandfather_mand_priv*	

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
dd) Develop lead outreach materials for schools and child cares				
The number of public elementary schools per system population times the system population multiplied by the hours per school times the system labor rate, plus the cost of materials. *numb_elem_schools_pub*pws_pop * (hrs_devel_pe_school_op)*	Cost does not apply to NTNCWSs.	All	Model PWS that does not meet waiver requirements for public elementary school sampling 1 - *p_grandfather_mand_pub*	One time
The number of public secondary schools per system population times the system population multiplied by the hours per school times the system labor rate, plus the cost of materials. *numb_second_schools_pub*pws_pop *(hrs_devel_pe_school_op)*			Model PWS that does not meet waiver requirements for public secondary school sampling 1 - *p_grandfather_mand_pub*	
The number of child cares per system population times the system population multiplied by the hours per facility times the system labor rate, plus the cost of materials. *numb_daycares*pws_pop *(hrs_devel_pe_school_op)*			Model PWS that does not meet waiver requirements for child care sampling 1 - *p_grand_mand_child*	
The number of private elementary schools per system population times the system population multiplied by the hours per school times the system labor rate, plus the cost of materials. *numb_elem_schools_priv*pws_pop * (hrs_devel_pe_school_op)*			Model PWS that does not meet waiver requirements for private elementary school sampling 1 - *p_grandfather_mand_priv*	
The number of private secondary schools per system population times the system population multiplied by the hours per school times the system labor rate, plus the cost of materials. *numb_second_schools_priv*pws_pop v*(hrs_devel_pe_school_op)*			Model PWS that does not meet the requirements to be grandfathered into the program for private secondary school sampling 1 - *p_grandfather_mand_priv*	

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
ee) Prepare and distribute initial letter explaining the sampling program and the 3Ts Toolkit				
The number of public elementary schools per system population times the system population multiplied by the hours per school times the system labor rate, plus the cost of materials. *numb_elem_schools_pub*pws_pop*((hrs_school_letter_op*rate_op)+cost_school_letter)*	Cost does not apply to NTNCWSs.	All	Model PWS that does not meet the requirements to be grandfathered into the program for public elementary school sampling 1 - *p_grandfather_mand_pub*	One time
The number of public secondary schools per system population times the system population multiplied by the hours per school times the system labor rate, plus the cost of materials. *numb_second_schools_pub*pws_pop*((hrs_school_letter_op*rate_op)+cost_school_letter)*			Model PWS that does not meet the requirements to be grandfathered into the program for public secondary school sampling 1 - *p_grandfather_mand_pub*	
The number of child cares per system population times the system population multiplied by the hours per facility times the system labor rate, plus the cost of materials. *numb_daycares*pws_pop*((hrs_school_letter_op*rate_op)+cost_school_letter)*			Model PWS that does not meet the requirements to be grandfathered into the program for child care sampling 1 - *p_grandfather_mand_child*	
The number of private elementary schools per system population times the system population multiplied by the hours per school times the system labor rate, plus the cost of materials. *numb_elem_schools_priv*pws_pop*((hrs_school_letter_op*rate_op)+cost_school_letter)*			Model PWS that does not meet the requirements to be grandfathered into the program for private elementary school sampling 1 - *p_grandfather_mand_priv*	
The number of private secondary schools per system population times the system population multiplied by the hours per school times the system labor rate, plus the cost of materials. *numb_second_schools_priv*pws_pop*((hrs_school_letter_op*rate_op)+cost_school_letter)*			Model PWS that does not meet the requirements to be grandfathered into the program for private secondary school sampling 1 - *p_grandfather_mand_priv*	

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
ff) Contact school or child care to determine and finalize its sampling schedule				
The number of public elementary schools per system population times the system population multiplied by the hours per school times the system labor rate, plus the cost of materials. *numb_elem_schools_pub*pws_pop*(hrs_school_call_op*rate_op)*	Cost does not apply to NTNCWSs. Cost does not apply to NTNCWSs.	All All	Model PWS that does not meet the requirements to be grandfathered into the program for public elementary school sampling 1 - *p_grandfather_mand_pub*	One time
The number of public secondary schools per system population times the system population multiplied by the hours per school times the system labor rate, plus the cost of materials. *numb_second_schools_pub*pws_pop*(hrs_school_call_op*rate_op)*			Model PWS that does not meet the requirements to be grandfathered into the program for public secondary school sampling 1 - *p_grandfather_mand_pub*	
The number of child cares per system population times the system population multiplied by the hours per facility and the system labor rate. *numb_daycares *(hrs_childcare_call_op*rate_op)*			Model PWS that does not meet the requirements to be grandfathered into the program for child care sampling 1 - *p_grandfather_mand_child*	
The number of private elementary schools per system population times the system population multiplied by the hours per school times the system labor rate, plus the cost of materials. *numb_elem_schools_priv*pws_pop*(hrs_school_call_op*rate_op)*			Model PWS that does not meet the requirements to be grandfathered into the program for private elementary school sampling 1 - *p_grandfather_mand_priv*	
The number of private secondary schools per system population times the system population multiplied by the hours per school times the system labor rate, plus the cost of materials. *numb_second_schools_priv*pws_pop*(hrs_school_call_op*rate_op)*			Model PWS that does not meet the requirements to be grandfathered into the program for private secondary school sampling 1 - *p_grandfather_mand_priv*	

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
gg) Contact school or child care to coordinate sample collection logistics				
20% of public elementary schools multiplied by the hours per school and the system labor rate. *(numb_elem_schools_pub*pws_pop*pp_mand_twenty_partic)*(hrs_school_coor_sample_op*rate_op)*	Cost does not apply to NTNCWSs.	All	Model PWS that does not meet the requirements to be grandfathered into the program for public elementary school sampling 1 - *p_grandfather_mand_pub*	Once a year
20% of public secondary schools multiplied by the hours per school and the system labor rate. *(numb_second_schools_pub*pws_pop*pp_mand_twenty_partic)*(hrs_school_coor_sample_op*rate_op)*			Model PWS that does not meet the requirements to be grandfathered into the program for public secondary school sampling 1 - *p_grandfather_mand_pub*	
20% of child cares multiplied by the hours per facility and the system labor rate. *(numb_daycares*pws_pop*pp_mand_twenty_partic)*(hrs_school_coor_sample_op*rate_op)*			Model PWS that does not meet the requirements to be grandfathered into the program for child care sampling 1 - *p_grandfather_mand_child*	
20% of private elementary schools multiplied by the hours per school and the system labor rate. *(numb_elem_schools_priv*pws_pop*pp_mand_twenty_partic)*(hrs_school_coor_sample_op*rate_op)*			Model PWS that does not meet the requirements to be grandfathered into the program for private elementary school sampling 1 - *p_grandfather_mand_priv*	
20% of private secondary schools multiplied by the hours per school and the system labor rate. *(numb_second_schools_priv*pws_pop*pp_mand_twenty_partic)*(hrs_school_coor_sample_op*rate_op)*			Model PWS that does not meet the requirements to be grandfathered into the program for private secondary school sampling 1 - *p_grandfather_mand_priv*	

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
hh) Conduct walkthrough at school or child care before start of sampling				
20% of public elementary schools multiplied by the hours per school times the system labor rate, plus the cost of materials. *(numb_elem_schools_pub*pws_pop*pp_mand_twenty_partic)*((hrs_walkthrough_school_op*rate_op)+cost_walkthrough_school)*	Cost does not apply to NTNCWSs.	All	Model PWS that does not meet the requirements to be grandfathered into the program for public elementary school sampling 1 - *p_grandfather_mand_pub*	Once a year
20% of public secondary schools multiplied by the hours per school times the system labor rate, plus the cost of materials. *(numb_second_schools_pub*pws_pop*pp_mand_twenty_partic)*((hrs_walkthrough_school_op*rate_op)+cost_walkthrough_school)*			Model PWS that does not meet the requirements to be grandfathered into the program for public secondary school sampling 1 - *p_grandfather_mand_pub*	
20% of child cares multiplied by the hours per facility times the system labor rate, plus the cost of materials. *(numb_daycares*pws_pop*pp_mand_twenty_partic)*((hrs_walkthrough_school_op*rate_op)+cost_walkthrough_school)*			Model PWS that does not meet the requirements to be grandfathered into the program for child care sampling 1 - *p_grandfather_mand_child*	
20% of private elementary schools multiplied by the hours per school times the system labor rate, plus the cost of materials. *(numb_elem_schools_priv*pws_pop*pp_mand_twenty_partic)*((hrs_walkthrough_school_op*rate_op)+cost_walkthrough_school)*			Model PWS that does not meet the requirements to be grandfathered into the program for private elementary school sampling 1 - *p_grandfather_mand_priv*	
20% of private secondary schools multiplied by the hours per school times the system labor rate, plus the cost of materials. *(numb_second_schools_priv*pws_pop*pp_mand_twenty_partic)*((hrs_walkthrough_school_op*rate_op)+cost_walkthrough_school)*			Model PWS that does not meet the requirements to be grandfathered into the program for private secondary school sampling 1 - *p_grandfather_mand_priv*	

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
ii) Travel to collect samples				
20% of public elementary schools multiplied by the hours per school times the system labor rate, plus the cost of materials. *(numb_elem_schools_pub*pws_pop*pp_mand_twenty_partic)*((hrs_travel_samp_school_op*rate_op)+cost_travel_samp_school)*	Cost does not apply to NTNCWSs.	All	Model PWS that does not meet the requirements to be grandfathered into the program for public elementary school sampling 1 - *p_grandfather_mand_pub*	Once a year
20% of public secondary schools multiplied by the hours per school times the system labor rate, plus the cost of materials. *(numb_second_schools_pub*pws_pop *pp_mand_twenty_partic)*((hrs_travel_samp_school_op*rate_op)+cost_travel_samp_school)*			Model PWS that does not meet the requirements to be grandfathered into the program for public secondary school sampling 1 - *p_grandfather_mand_pub*	
20% of child cares multiplied by the hours per facility times the system labor rate, plus the cost of materials. *(numb_daycares*pp_mand_twenty_partic)*((hrs_travel_samp_school_op*rate_op)+cost_travel_samp_school)*			Model PWS that does not meet the requirements to be grandfathered into the program for child care sampling 1 - *p_grandfather_mand_child*	
20% of private elementary schools multiplied by the hours per school times the system labor rate, plus the cost of materials. *(numb_elem_schools_priv*pws_pop*pp_mand_twenty_partic)*((hrs_travel_samp_school_op*rate_op)+cost_travel_samp_school)*			Model PWS that does not meet the requirements to be grandfathered into the program for private elementary school sampling 1 - *p_grandfather_mand_priv*	
20% of private secondary schools multiplied by the hours per school times the system labor rate, plus the cost of materials. *(numb_second_schools_priv*pws_pop *pp_mand_twenty_partic)*((hrs_travel_samp_school_op*rate_op)+cost_travel_samp_school)*			Model PWS that does not meet the requirements to be grandfathered into the program for private secondary school sampling 1 - *p_grandfather_mand_priv*	

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
jj) Collect samples[3]				
20% of public elementary schools multiplied by the number of samples per school, is multiplied by the number of hours per school times the system labor rate, plus the material cost. *(numb_elem_schools_pub*pws_pop*pp_mand_twenty_partic)*numb_samp_five)*((hrs_collect_samp_school_op*rate_op)+cost_collect_samp_school)*	Cost does not apply to NTNCWSs.	All	Model PWS that does not meet the requirements to be grandfathered into the program for public elementary school sampling 1 - *p_grandfather_mand_pub*	Once a year
20% of public secondary schools multiplied by the number of samples per school, is multiplied by the number of hours per school times the system labor rate, plus the material cost. *(numb_second_schools_pub*pws_popl*pp_mand_twenty_partic)*numb_samp_five)*((hrs_collect_samp_school_op*rate_op)+cost_collect_samp_school)*			Model PWS that does not meet the requirements to be grandfathered into the program for public secondary school sampling 1 - *p_grandfather_mand_pub*	
20% of child cares multiplied by the number of samples per facility, is multiplied by the number of hours per facility times the system labor rate, plus the material cost. *(numb_daycares*pp_mand_twenty_partic)*numb_samp_two)*((hrs_collect_samp_school_op*rate_op)+cost_collect_samp_school)*			Model PWS that does not meet the requirements to be grandfathered into the program for child care sampling 1 - *p_grandfather_mand_child*	
20% of private elementary schools multiplied by the number of samples per school, is multiplied by the number of hours per school times the system labor rate, plus the material cost. *(numb_elem_schools_priv*pws_pop*pp_mand_twenty_partic)*numb_samp_five)*((hrs_collect_samp_school_op*rate_op)+cost_collect_samp_school)*			Model PWS that does not meet the requirements to be grandfathered into the program for private elementary school sampling 1 - *p_grandfather_mand_priv*	

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
20% of private secondary schools multiplied by the number of samples per school, is multiplied by the number of hours per school times the system labor rate, plus the material cost. *(numb_second_schools_priv*pws_popl*pp_mand_twenty_partic)*numb_samp_five)*((hrs_collect_samp_school_op*rate_op)+cost_collect_samp_school)*	Cost does not apply to NTNCWSs.	All	Model PWS that does not meet the requirements to be grandfathered into the program for private secondary school sampling 1 - *p_grandfather_mand_priv*	
kk) Analyze samples[3]				
The number of required samples per public elementary school multiplied by 20% of elementary schools per year times by the probabilities for a sample analyzed in house and a sample analyzed in a commercial lab times the different labor and material cost burdens for each type of analysis. *((((numb_elem_schools_pub*pws_pop*pp_mand_twenty_partic)*numb_samp_five)*pp_lab_samp_school)*((hrs_analyze_samp_op*rate_op)+cost_lab_lt_samp))+((((numb_elem_schools_pub*pws_pop*pp_mand_twenty_partic)*numb_samp_five)*pp_commercial_samp_school)*cost_commercial_lab)*	Cost does not apply to NTNCWSs.	All	Model PWS that does not meet the requirements to be grandfathered into the program for public elementary school sampling 1 - *p_grandfather_mand_pub*	Once a year
The number of required samples per public secondary school multiplied by 20% of elementary schools per year times by the probabilities for a sample analyzed in house and a sample analyzed in a commercial lab times the different labor and material cost burdens for each type of analysis. *((((numb_second_schools_*pub*pws_pop*pp_mand_twenty_partic)*numb_samp_five)*pp_lab_samp_school)*((hrs_analyze_samp_op*rate_op)+cost_lab_lt_samp))+((((numb_second_schools_*pub*pws_pop*pp_mand_twenty_partic)*numb_samp_five)*pp_commercial_samp_school)*cost_commercial_lab)*			Model PWS that does not meet the requirements to be grandfathered into the program for public secondary school sampling 1 - *p_grandfather_mand_pub*	

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
The number of required samples per day care multiplied by 20% of elementary schools per year times by the probabilities for a sample analyzed in house and a sample analyzed in a commercial lab times the different labor and material cost burdens for each type of analysis. *((((numb_daycares*pws_pop*pp_mand_twenty_partic)*numb_samp_five)*pp_lab_samp_school)*((hrs_analyze_samp_op*rate_op)+cost_lab_lt_samp))+((((numb_daycares*pws_pop*pp_mand_twenty_partic)*numb_samp_five)*pp_commercial_samp_school)*cost_commercial_lab)*	Cost does not apply to NTNCWSs.	All	Model PWS that does not meet the requirements to be grandfathered into the program for child care sampling 1 - *p_grandfather_mand_child*	
The number of required samples per private elementary school multiplied by 20% of elementary schools per year times by the probabilities for a sample analyzed in house and a sample analyzed in a commercial lab times the different labor and material cost burdens for each type of analysis. *((((numb_elem_schools_priv*pws_pop*pp_mand_twenty_partic)*numb_samp_five)*pp_lab_samp_school)*((hrs_analyze_samp_op*rate_op)+cost_lab_lt_samp))+((((numb_elem_schools_priv*pws_pop*pp_mand_twenty_partic)*numb_samp_five)*pp_commercial_samp_school)*cost_commercial_lab)*	Cost does not apply to NTNCWSs.	All	Model PWS that does not meet the requirements to be grandfathered into the program for private elementary school sampling 1 - *p_grandfather_mand_priv*	
The number of required samples per private secondary school multiplied by 20% of elementary schools per year times by the probabilities for a sample analyzed in house and a sample analyzed in a commercial lab times the different labor and material cost burdens for each type of analysis. *((((numb_second_schools_priv*pws_pop*pp_mand_twenty_partic)*numb_samp_five)*pp_lab_samp_school)*((hrs_analyze_samp_op*rate_op)+cost_lab_lt_samp))+((((numb_second_schools_priv*pws_pop*pp_mand_twenty_partic)*numb_samp_five)*pp_commercial_samp_school)*cost_commercial_lab)*			Model PWS that does not meet the requirements to be grandfathered into the program for private secondary school sampling 1 - *p_grandfather_mand_priv*	

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
II) Provide sampling results to tested facilities				
20% of public elementary schools multiplied by the hours per school times the system labor rate, plus the cost of materials. *(numb_elem_schools_pub*pws_pop*pp_mand_twenty_partic)*((hrs_inform_samp_pe_school_op*rate_op)+cost_inform_samp_pe_school)*	Cost does not apply to NTNCWSs.	All	Model PWS that does not meet the requirements to be grandfathered into the program for public elementary school sampling 1 - *p_grandfather_mand_pub*	Once a year
20% of public secondary schools multiplied by the hours per school times the system labor rate, plus the cost of materials. *(numb_second_schools_pub*pws_pop*pp_mand_twenty_partic)*((hrs_inform_samp_pe_school_op*rate_op)+cost_inform_samp_pe_school)*	Cost does not apply to NTNCWSs.	All	Model PWS that does not meet the requirements to be grandfathered into the program for public secondary school sampling 1 - *p_grandfather_mand_pub*	
20% of child cares multiplied by the hours per facility times the system labor rate, plus the cost of materials. *(numb_daycares*pws_pop*pp_mand_twenty_partic)*((hrs_inform_samp_pe_school_op*rate_op)+cost_inform_samp_pe_school)*			Model PWS that does not meet the requirements to be grandfathered into the program for child care sampling 1 - *p_grandfather_mand_child*	
20% of private elementary schools multiplied by the hours per school times the system labor rate, plus the cost of materials. (numb_elem_schools_priv*pws_pop*pp_mand_twenty_partic)*((hrs_inform_samp_pe_school_op*rate_op)+cost_inform_samp_pe_school)			Model PWS that does not meet the requirements to be grandfathered into the program for private elementary school sampling 1 - *p_grandfather_mand_priv*	
20% of private secondary schools multiplied by the hours per school times the system labor rate, plus the cost of materials. (numb_second_schools_priv*pws_pop*pp_mand_twenty_partic)*((hrs_inform_samp_pe_school_op*rate_op)+cost_inform_samp_pe_school)			Model PWS that does not meet the requirements to be grandfathered into the program for private secondary school sampling 1 - *p_grandfather_mand_priv*	

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
mm) Discuss sampling results with school and child cares				
20% of public elementary schools multiplied by the hours per school times the system labor rate. *(numb_elem_schools_pub*pws_pop*pp_mand_twenty_partic)*(hrs_result_discuss_op*rate_op)*	Cost does not apply to NTNCWSs.	All	Model PWS that does not meet the requirements to be grandfathered into the program for public elementary school sampling 1 - *p_grandfather_mand_pub*	Once a year
20% of public secondary schools multiplied by the hours per school times the system labor rate. *(numb_second_schools_pub*pws_pop*pp_mand_twenty_partic)*(hrs_result_discuss_op*rate_op)*			Model PWS that does not meet the requirements to be grandfathered into the program for public secondary school sampling 1 - *p_grandfather_mand_pub*	
20% of child cares multiplied by the hours per facility times the system labor rate. *(numb_daycares*pws_pop*pp_mand_twenty_partic)*(hrs_result_discuss_op*rate_op)*			Model PWS that does not meet the requirements to be grandfathered into the program for child care sampling 1 - *p_grandfather_mand_child*	
20% of private elementary schools multiplied by the hours per school times the system labor rate. *(numb_elem_schools_priv*pws_pop*pp_mand_twenty_partic)*(hrs_result_discuss_op*rate_op)*			Model PWS that does not meet the requirements to be grandfathered into the program for private elementary school sampling 1 - *p_grandfather_mand_priv*	
20% of private secondary schools multiplied by the hours per school times the system labor rate. *(numb_second_schools_priv*pws_pop*pp_mand_twenty_partic)*(hrs_result_discuss_op*rate_op)*			Model PWS that does not meet the requirements to be grandfathered into the program for private secondary school sampling 1 - *p_grandfather_mand_priv*	

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
nn) Conduct detailed discussion of high sampling results with school and child cares				
20% of public elementary schools multiplied by the number of required samples per system >15 µg/L multiplied by the hours per sample times the system labor rate. *numb_elem_schools_pub*pws_pop*pp_mand_twenty_partic)*((pp_above_al_bin_three*numb_samp_five)*(hrs_school_help_op*rate_op))*	Cost does not apply to NTNCWSs.	At or below the TL	Model PWS that does not meet the requirements to be grandfathered into the program for public elementary school sampling 1 - *p_grandfather_mand_pub*	
20% of public secondary schools multiplied by the number of required samples per system >15 µg/L multiplied by the hours per sample times the system labor rate. *(numb_second_schools_pub*pws_pop*pp_mand_twenty_partic)*((pp_above_al_bin_three*numb_samp_five)*(hrs_school_help_op*rate_op))*			Model PWS that does not meet the requirements to be grandfathered into the program for public secondary school sampling 1 - *p_grandfather_mand_pub*	
20% of child cares multiplied by the number of required samples per system >15 µg/L multiplied by the hours per sample times the system labor rate. *(numb_daycares*pws_pop*pp_mand_twenty_partic)*((pp_above_al_bin_three*numb_samp_five)*(hrs_school_help_op*rate_op))*			Model PWS that does not meet the requirements to be grandfathered into the program for child care sampling 1 - *p_grandfather_mand_child*	
20% of private elementary schools multiplied by the number of required samples per system >15 µg/L multiplied by the hours per sample times the system labor rate. *(numb_elem_schools_priv*pws_pop*pp_mand_twenty_partic)*((pp_above_al_bin_three*numb_samp_five)*(hrs_school_help_op*rate_op))*			Model PWS that does not meet the requirements to be grandfathered into the program for private elementary school sampling 1 - *p_grandfather_mand_priv*	
20% of private secondary schools multiplied by the number of required samples per system >15 µg/L multiplied by the hours per sample times the system labor rate. *(numb_second_schools_priv*pws_pop*pp_mand_twenty_partic)*((pp_above_al_bin_three*numb_samp_five)*(hrs_school_help_op*rate_op))*			Model PWS that does not meet the requirements to be grandfathered into the program for private secondary school sampling 1 - *p_grandfather_mand_priv*	

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
20% of public elementary schools multiplied by the number of required samples per system >15 µg/L multiplied by the hours per sample times the system labor rate. *(numb_elem_schools_pub*pws_pop*pp_mand_twenty_partic)*((pp_above_al_bin_two*numb_samp_five)*(hrs_school_help_op*rate_op))*	Cost does not apply to NTNCWSs	At or below AL and above TL	Model PWS that does not meet the requirements to be grandfathered into the program for public elementary school sampling 1 - *p_grandfather_mand_pub*	
20% of public secondary schools multiplied by the number of required samples per system >15 µg/L multiplied by the hours per sample times the system labor rate. *(numb_second_schools_pub*pws_pop*pp_mand_twenty_partic)*((pp_above_al_bin_two*numb_samp_five)*(hrs_school_help_op*rate_op))*			Model PWS that does not meet the requirements to be grandfathered into the program for public secondary school sampling 1 - *p_grandfather_mand_pub*	
20% of child cares multiplied by the number of required samples per system >15 µg/L multiplied by the hours per sample times the system labor rate. *(numb_daycares*pws_pop*pp_mand_twenty_partic)*((pp_above_al_bin_two*numb_samp_five)*(hrs_school_help_op*rate_op))*			Model PWS that does not meet the requirements to be grandfathered into the program for child care sampling 1 - *p_grandfather_mand_child*	
20% of private elementary schools multiplied by the number of required samples per system >15 µg/L multiplied by the hours per sample times the system labor rate. *(numb_elem_schools_priv*pws_pop*pp_mand_twenty_partic)*((pp_above_al_bin_two*numb_samp_five)*(hrs_school_help_op*rate_op))*			Model PWS that does not meet the requirements to be grandfathered into the program for private elementary school sampling 1 - *p_grandfather_mand_priv*	
20% of private secondary schools multiplied by the number of required samples per system >15 µg/L multiplied by the hours per sample times the system labor rate. *(numb_second_schools_priv*pws_pop*pp_mand_twenty_partic)*((pp_above_al_bin_two*numb_samp_five)*(hrs_school_help_op*rate_op))*			Model PWS that does not meet the requirements to be grandfathered into the program for private secondary school sampling 1 - *p_grandfather_mand_priv*	

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
20% of public elementary schools multiplied by the number of required samples per system >15 µg/L multiplied by the hours per sample times the system labor rate. *(numb_elem_schools_pub*pws_pop*pp_mand_twenty_partic)*((pp_above_al_bin_one*numb_samp_five)*(hrs_school_help_op*rate_op))*	Cost does not apply to NTNCWSs.	Above the AL	Model PWS that does not meet the requirements to be grandfathered into the program for public elementary school sampling 1 - *p_grandfather_mand_pub*	
20% of public secondary schools multiplied by the number of required samples per system >15 µg/L multiplied by the hours per sample times the system labor rate. *(numb_second_schools_pub*pws_pop*pp_mand_twenty_partic)*((pp_above_al_bin_one*numb_samp_five)*(hrs_school_help_op*rate_op))*			Model PWS that does not meet the requirements to be grandfathered into the program for public secondary school sampling 1 - *p_grandfather_mand_pub*	
20% of child cares multiplied by the number of required samples per system >15 µg/L multiplied by the hours per sample times the system labor rate. *(numb_daycares*pws_pop*pp_mand_twenty_partic)*((pp_above_al_bin_one*numb_samp_five)*(hrs_school_help_op*rate_op))*			Model PWS that does not meet the requirements to be grandfathered into the program for child care sampling 1 - *p_grandfather_mand_child*	
20% of private elementary schools multiplied by the number of required samples per system >15 µg/L multiplied by the hours per sample times the system labor rate. *(numb_elem_schools_priv*pws_pop*pp_mand_twenty_partic)*((pp_above_al_bin_one*numb_samp_five)*(hrs_school_help_op*rate_op))*			Model PWS that does not meet the requirements to be grandfathered into the program for private elementary school sampling 1 - *p_grandfather_mand_priv*	
20% of private secondary schools multiplied by the number of required samples per system >15 µg/L multiplied by the hours per sample times the system labor rate. *(numb_second_schools_priv*pws_pop*pp_mand_twenty_partic)*((pp_above_al_bin_one*numb_samp_five)*(hrs_school_help_op*rate_op))*			Model PWS that does not meet the requirements to be grandfathered into the program for private secondary school sampling 1 - *p_grandfather_mand_priv*	

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
oo) Prepare and provide annual report on school and child care sampling to Primacy Agencies				
The total hours per system multiplied by the system labor rate, plus the materials cost. *(hrs_annual_report_school_prepare_op*rate_op)+cost_annual_report_school_dist*	Cost does not apply to NTNCWSs.	All	All model PWSs	Once a year

Acronyms: CWS = community water system; NTNCWS = non-transient non-community water system; PWS = public water system.

Notes:

[1] The data variables in the exhibit are defined previously in this section with the exception of:

- *numb_daycares*, *numb_elem_schools_priv*, *numb_elem_school_pub*, *numb_second_schools_priv*, *numb_second_school_pub*: Number of child cares, number of private elementary schools, number of public elementary schools, number of public secondary schools, and number of private secondary schools, respectively that are served by CWSs (Section 4.3.9.1).
- *p_grandfather_mand_child*, *p_grandfather_mand_priv*, *p_grandfather_mand_pub*: States that qualify to waiver child cares, private K-12 schools, and public K-12 schools for the mandatory program (Section 4.3.9.2).
- *pp_above_al_bin_one*: Likelihood a sample will be > 15 µg/L when the system's lead 90th percentile level is > 15 µg/L (Section 5.3.3.3).
- *pp_above_al_bin_two*: Likelihood a sample will be > 15 µg/L when the system's lead 90th percentile level is above 10 µg/L but at or below 15 µg/L (Section 5.3.3.3).
- *pp_above_al_bin_three*: Likelihood a sample will be > 15 µg/L when the system's lead 90th percentile level is ≤ 10 µg/L (Section 5.3.3.3).
- *rate_op:* PWS hourly labor rate (Section 4.3.10.1).

[2] The mandatory testing phase is assumed to occur in years 4 through 8 at elementary schools and child cares.

[3] The burden and costs to provide sample bottles (*cost_collect_samp_school*) under activity kk) and conduct analyses under activity ll) are incurred by the state in Arkansas, Louisiana, Mississippi, Missouri, and South Carolina.

5.3.2.5.2 On Request Program

As stated above, under the final LCRR, CWSs can discontinue mandatory testing after they complete one 5-year cycle of testing at elementary schools and child cares. After those first 5 years of mandatory testing, CWSs would only be required to sample at those facilities that request sampling. Secondary schools are not subject to mandatory testing but CWS are required to test any secondary school that request testing. EPA assumed that five percent of elementary and secondary schools and licensed child cares per year would elect to participate in the sampling program *(pp_voluntary_partic).* This estimate is based on EPA's discussions with GCWW about their school testing program (available in the docket). GCWW indicated that they had a low response rate from schools under their initial program that involved sending out letters to school districts offering to assist schools in testing their drinking water outlets for lead, which is similar to the on request program requirements.

EPA has developed system burden and costs for ten activities the Agency has identified as necessary to implement the on request program for drinking water testing at schools and child cares as shown in Exhibit 5-50. The exhibit provides the unit burden and/or cost for each activity. The assumptions used in the estimation of each activity follows the exhibit. The last column provides the corresponding SafeWater LCR model data variable in red/italic font. In a few instances, some of these activities are conducted by the state instead of the water system. These activities are identified in the exhibit and further explained in the exhibit notes.

Exhibit 5-50: PWS School and Child Care Sampling Unit Burden and Cost Estimates under the On Request Program

Activity	Unit Burden and/or Cost	*SafeWater LCR Data Variable*
pp) Contact school and child cares to offer sampling	Burden 0.05 hrs/school or child care Cost $0.39 to $0.58	Burden *hrs_school_annual_contact_op* Cost *cost_school_annual_contact*
qq) Contact school or child care to coordinate sample collection logistics	0.25 hrs/school or child care	*hrs_school_coor_sample_op*
rr) Conduct walkthrough at school or child care before the start of sampling	Burden 1.39 to 1.67 hrs/school or child care Cost $5.29 to $9.07/school or child care	Burden *hrs_walkthrough_school_op* Cost *cost_walkthrough_school*
ss) Travel to collect samples	Burden 0.39 to 0.67 hrs/school or child care Cost $5.29 to $9.07/school or child care	Burden *hrs_travel_samp_school_op* Cost *cost_travel_samp_school*

Activity	Unit Burden and/or Cost	*SafeWater LCR Data Variable*
tt) Collect samples	Burden 0.17 hrs/sample Cost $1.83/sample for CWSs serving > 100K	Burden *hrs_collect_samp_school_op* Cost *cost_collect_samp_school*[1]
uu) Analyze samples	In-house Analysis (CWSs > 100K only) Burden: 0.44 hrs/sample Cost: $2.38/sample Commercial Analysis $21.58/sample	In-House Analysis *hrs_analyze_samp_op*[1] *cost_lab_lt_samp*[1] Commercial Analysis *cost_commercial_lab*[1]
vv) Provide sampling results to tested facilities	Burden 0.05 hrs/tested facility Cost $0.58/ tested facility	Burden *hrs_inform_samp_pe_school_op* Cost *cost_inform_samp_pe_school*
ww) Discuss sampling results with school and child care	1 hr/school or child care	*hrs_result_discuss_op*
xx) Detailed discussion of high sampling results with school and child cares	5 hr/sample	Burden *hrs_school_help_op*
yy) Prepare and provide annual report on school and child care sampling program to the Primacy Agency	Burden 1 to 8 hrs/CWS Cost $0.58/CWS	Burden *hrs_annual_report_school_prepare_op* Cost *cost_annual_report_school_dist*

Acronyms: AL = action level; CWS = community water system; PWS = public water system.
Source: "Derivation of School_Child Care Inputs_Final Rule.xlsx." Other data sources are provided following this exhibit for each activity shown.
Note:
[1] The burden and costs for these activities are incurred by the state in Arkansas, Louisiana, Mississippi, Missouri, and South Carolina.

pp) Contact schools and child cares to offer sampling (hrs_school_annual_contact_op, cost_school_annual_contact). CWSs will send a letter to public and private elementary and secondary schools and to each child care explaining the sampling program, asking if the school/child care wants to have their taps tested, and providing health information on lead and a link to the 3Ts (USEPA, 2018). EPA assumed systems would use a template letter and spend 1 hour per 20 letters or 3 minutes (0.05 hrs) per letter for all system sizes. This assumption is consistent with the burden for the letter that goes to customers to inform them of their lead testing results (*hrs_inform_samp_op*) that is discussed in 5.3.2.1.2, activity l). The estimate is based on the *Disinfectants/Disinfection Byproducts, Chemical, and Radionuclides Rules ICR (Renewal)*, Exhibit 35 (USEPA, 2015b).

CWSs will also incur costs for paper, envelope, and postage. Those serving more than 100,000 people are assumed to incur a cost of $0.58 per letter and those serving more than 100,000 people will qualify for bulk rate mail and incur a cost of $0.39 per letter.

qq) Contact school or child care to coordinate sample collection logistics (hrs_school_coor_sample_op). EPA assumed systems would incur the same average burden as under the mandatory program to call each facility to coordinate sample collection logistics including scheduling a walkthrough. The average time spent per call to coordinate sample collection logistics is 15 minutes (0.25 hours). See Section 5.3.2.5.1, activity gg) for additional detail.

rr) Conduct walkthrough at school or child care before the start of sampling (hrs_walkthrough_school_op, cost_walkthrough_school). EPA assumed systems will incur the same burden and costs as under the mandatory program to conduct a walkthrough with each school or child care to become familiar with the facility and to identify sampling sites. The burden and cost for the water system to complete this task is 1.39 hours and $5.29 for CWSs serving 100,000 or fewer people, 1.5 hours and $6.80 for those serving 100,001 to 1 million people, and 1.67 hours and $9.07 for those serving more than 1 million people. See Section 5.3.2.5.1, activity hh) for additional detail.

ss) Travel to collect samples (hrs_travel_samp_school_op, cost_travel_samp_school). EPA assumed systems will incur the same burden and costs as under the mandatory program to travel to a school or child care to collect samples of 0.39 hours and $5.29 for CWSs serving 100,000 or fewer people, 0.5 hours and $6.80 for those serving 100,001 to 1 million people, and 0.67 hours and $9.07 for those serving more than 1 million people. See Section 5.3.2.5.1, activity ii) for additional detail.

tt) Collect samples (hrs_collect_samp_school_op, cost_collect_samp_school). EPA assumed CWSs will require the same per sample burden and cost to collect samples of 10 minutes (0.17 hours) for all system sizes and bottle cost of $1.83 that applies only to CWSs serving more than 100,000 people. See activity jj) for additional detail.

uu) Analyze samples (hrs_analyze_samp_op, cost_lab_lt_samp, cost_commercial_lab). Under the on request program phase, CWSs will incur the same burden and cost to analyze lead samples in-house or to use a commercial laboratory as lead tap sampling and the mandatory school and child care sampling program phase. Specifically, CWSs serving more than 100,000 people will incur a burden of 0.44 hrs per sample (*hrs_analyze_samp_op*) and cost of $2.38 per sample (*cost_lab_lt_samp*) to analyze lead samples in-house. CWSs serving 100,000 or fewer people will use a commercial lab at a cost of $21.58 per sample (*cost_commercial_lab*). See Section 5.3.2.5.1, activity kk) for additional detail.

vv) Provide sampling results to tested facilities (hrs_inform_samp_pe_school_op, cost_inform_samp_pe_school). CWSs will incur the same burden and costs as under mandatory program phase to provide sampling results to tested facilities, Primacy Agencies, and state and local health departments. The CWS burden is 0.05 hrs and $0.58 per tested facility. See Section 5.3.2.5.1, activity ll) for additional detail.

ww) Discuss sampling results with school and child cares (hrs_result_discuss_op). CWSs will continue to incur burden to discuss the sampling results with each school and child care under the on

request program phase. EPA assumed the same average burden of 1 hour per tested facility as under the mandatory program.

xx) ***Conduct detailed discussion of high sampling results with school and child cares (hrs_school_help_op).*** EPA assumed systems would incur the same burden to work with each school or child care. EPA assumed systems will spend an additional 5 hours with each school or child care in which one or more samples are found to be high. Systems may need to explain the relevant portions of the 3Ts Toolkit and to address any follow-up questions that school or child care might have after the initial discussion. See Section 5.3.2.5.1, activity nn) for additional detail).

yy) ***Prepare and provide an annual report on testing program to Primacy Agencies (hrs_annual_report_school_prepare_op, cost_annual_report_school_dist).*** Systems must continue to prepare and distribute an annual report regarding their testing program at schools and child cares at an estimated burden of 1 hour for CWSs serving 100,000 or fewer people, 2 hours for those serving 100,001 to 1 million people, and 8 hours for CWSs serving more than 1 million people, and a cost of $0.58 for all system sizes. See Section 5.3.2.5.1, activity oo) for additional detail.

Exhibit 5-51 shows the SafeWater LCR model cost estimation approach for activities under the on request program phase including additional cost inputs required to calculate these costs.

Exhibit 5-51: PWS On Request School and Child Care Sampling Phase Cost Estimation in SafeWater LCR by Activity[1,2]

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
qq) Contact schools and child cares to offer sampling				
The number of public elementary schools per system population times the system population multiplied by the hours per school times the system labor rate, plus the cost of materials. *numb_elem_schools_pub*pws_pop* ((hrs_school_annual_contact_op *rate_op)+ cost_school_annual_contact)*	Cost does not apply to NTNCWSs.	All	Model PWS that does not meet the requirements to be grandfathered into the program for public elementary school sampling 1 - *p_grandfather_opt_pub*	Once a year
The number of public secondary schools per system population times system population multiplied by the hours per school times the system labor rate, plus the cost of materials. *numb_second_schools_pub*pws_pop* ((hrs_school_annual_contact_op *rate_op)+ cost_school_annual_contact)*			Model PWS that does not meet the requirements to be grandfathered into the program for public secondary school sampling 1 - *p_grandfather_opt_pub*	
The number of child cares per system population times the system population multiplied by the hours per facility times the system labor rate, plus the cost of materials. *numb_daycares*pws_pop* ((hrs_school_annual_contact_op *rate_op)+ cost_school_annual_contact)*			Model PWS that does not meet the requirements to be grandfathered into the program for child care sampling 1 - *p_grandfather_opt_child*	
The number of private elementary schools per system population times the system population multiplied by the hours per school times the system labor rate, plus the cost of materials. *numb_elem_schools_priv*pws_pop* ((hrs_school_annual_contact_op *rate_op)+ cost_school_annual_contact)*			Model PWS that does not meet the requirements to be grandfathered into the program for private elementary school sampling 1 - *p_grandfather_opt_priv*	
The number of private secondary schools per system population times the system population multiplied by the hours per school times the system labor rate, plus the cost of materials. *numb_second_schools_priv*pws_pop* ((hrs_school_annual_contact_op *rate_op)+ cost_school_annual_contact)*			Model PWS that does not meet the requirements to be grandfathered into the program for private secondary school sampling 1 - *p_grandfather_opt_priv*	

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
rr) Contact schools or child care to coordinate sample collection logistics				
5% of public elementary schools multiplied by the hours per school and the system labor rate. *(numb_elem_schools_pub*pws_pop*pp_voluntary_partic)*(hrs_school_coor_sample_op*rate_op)*	Cost does not apply to NTNCWSs.	All	Model PWS that does not meet the requirements to be grandfathered into the program for public elementary school sampling 1 - *p_grandfather_opt_pub*	Once a year
5% of public secondary schools multiplied by the hours per school and the system labor rate. *(numb_second_schools_pub*pws_pop*pp_voluntary_partic)*(hrs_school_coor_sample_op*rate_op)*			Model PWS that does not meet the requirements to be grandfathered into the program for public secondary school sampling 1 - *p_grandfather_opt_pub*	
5% of child cares multiplied by the hours per facility and the system labor rate. *(numb_daycares*pws_pop*pp_voluntary_partic)*(hrs_school_coor_sample_op*rate_op)*			Model PWS that does not meet the requirements to be grandfathered into the program for child care sampling 1 - *p_grandfather_opt_child*	
5% of private elementary schools multiplied by the hours per school and the system labor rate. *(numb_elem_schools_priv*pws_pop*pp_voluntary_partic)*(hrs_school_coor_sample_op*rate_op)*			Model PWS that does not meet the requirements to be grandfathered into the program for private elementary school sampling 1 - *p_grandfather_opt_priv*	
5% of private secondary schools multiplied by the hours per school and the system labor rate. *(numb_second_schools_priv*pws_pop*pp_voluntary_partic)*(hrs_school_coor_sample_op*rate_op)*			Model PWS that does not meet the requirements to be grandfathered into the program for private secondary school sampling 1 - *p_grandfather_opt_priv*	

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
ss) Conduct walkthrough at school or facility before start of sampling				
5% of public elementary schools multiplied by the hours per school times the system labor rate, plus the cost of materials. *(numb_elem_schools_pub*pws_pop*pp_voluntary_partic)*((hrs_walkthrough_school_op*rate_op)+cost_walkthrough_school)*	Cost does not apply to NTNCWSs.	All	Model PWS that does not meet the requirements to be grandfathered into the program for public elementary school sampling 1 - *p_grandfather_opt_pub*	Once a year
5% of public secondary schools multiplied by the hours per school times the system labor rate, plus the cost of materials. *(numb_second_schools_pub*pws_pop*pp_voluntary_partic)*((hrs_walkthrough_school_op*rate_op)+cost_walkthrough_school)*			Model PWS that does not meet the requirements to be grandfathered into the program for public secondary school sampling 1 - *p_grandfather_opt_pub*	
5% of child cares multiplied by the hours per facility times the system labor rate, plus the cost of materials. *(numb_daycares*pws_pop*pp_voluntary_partic)*((hrs_walkthrough_school_op*rate_op)+cost_walkthrough_school)*			Model PWS that does not meet the requirements to be grandfathered into the program for child care sampling 1 - *p_grandfather_opt_child*	
5% of private elementary schools multiplied by the hours per school times the system labor rate, plus the cost of materials. *(numb_elem_schools_priv*pws_pop*pp_voluntary_partic)*((hrs_walkthrough_school_op*rate_op)+cost_walkthrough_school)*			Model PWS that does not meet the requirements to be grandfathered into the program for private elementary school sampling 1 - *p_grandfather_opt_priv*	
5% of private secondary schools multiplied by the hours per school times the system labor rate, plus the cost of materials. *(numb_second_schools_priv*pws_pop*pp_voluntary_partic)*((hrs_walkthrough_school_op*rate_op)+cost_walkthrough_school)*			Model PWS that does not meet the requirements to be grandfathered into the program for private secondary school sampling 1 - *p_grandfather_opt_priv*	

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
tt) Travel to collect samples				
5% of public elementary schools multiplied by the hours per school times the system labor rate, plus the cost of materials. *(numb_elem_schools_pub*pws_pop*pp_voluntary_partic)*((hrs_travel_samp_school_op*rate_op)+cost_travel_samp_school)*	Cost does not apply to NTNCWSs.	All	Model PWS that does not meet the requirements to be grandfathered into the program for public elementary school sampling 1 - *p_grandfather_opt_pub*	Once a year
5% of public secondary schools multiplied by the hours per school times the system labor rate, plus the cost of materials. *(numb_second_schools_pub*pws_pop*pp_voluntary_partic)*((hrs_travel_samp_school_op*rate_op)+cost_travel_samp_school)*			Model PWS that does not meet the requirements to be grandfathered into the program for public secondary school sampling 1 - *p_grandfather_opt_pub*	
5% of child cares multiplied by the hours per facility times the system labor rate, plus the cost of materials. *(numb_daycares*pp_voluntary_partic)*((hrs_travel_samp_school_op*rate_op)+cost_travel_samp_school)*			Model PWS that does not meet the requirements to be grandfathered into the program for child care sampling 1 - *p_grandfather_opt_child*	
5% of private elementary schools multiplied by the hours per school times the system labor rate, plus the cost of materials. *(numb_elem_schools_priv*pws_pop*pp_voluntary_partic)*((hrs_travel_samp_school_op*rate_op)+cost_travel_samp_school)*			Model PWS that does not meet the requirements to be grandfathered into the program for private elementary school sampling 1 - *p_grandfather_opt_priv*	
5% of private secondary schools multiplied by the hours per school times the system labor rate, plus the cost of materials. *(numb_second_schools_priv*pws_pop*pp_voluntary_partic)*((hrs_travel_samp_school_op*rate_op)+cost_travel_samp_school)*			Model PWS that does not meet the requirements to be grandfathered into the program for private secondary school sampling 1 - *p_grandfather_opt_priv*	

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
uu) Collect samples[3]				
5% of public elementary schools multiplied by the number of samples per school, is multiplied by the number of hours per school times the system labor rate, plus the material cost. *(numb_elem_schools_pub*pws_pop*pp_voluntary_partic)*numb_samp_five)*((hrs_collect_samp_school_op*rate_op)+cost_collect_samp_school)*	Cost does not apply to NTNCWSs.	All	Model PWS that does not meet the requirements to be grandfathered into the program for public elementary school sampling 1 - *p_grandfather_opt_pub*	Once a year
5% of public secondary schools multiplied by the number of samples per school, is multiplied by the number of hours per school times the system labor rate, plus the material cost. *(numb_second_schools_pub*pws_popl*pp_voluntary_partic)*numb_samp_five)*((hrs_collect_samp_school_op*rate_op)+cost_collect_samp_school)*			Model PWS that does not meet the requirements to be grandfathered into the program for public secondary school sampling 1 - *p_grandfather_opt_pub*	
5% of child cares multiplied by the number of samples per facility, is multiplied by the number of hours per facility times the system labor rate, plus the material cost. *(numb_daycares*pp_voluntary_partic)*numb_samp_two)*((hrs_collect_samp_school_op*rate_op)+cost_collect_samp_school)*			Model PWS that does not meet the requirements to be grandfathered into the program for child care sampling 1 - *p_grandfather_opt_child*	
5% of private elementary schools multiplied by the number of samples per school, is multiplied by the number of hours per school times the system labor rate, plus the material cost. *(numb_elem_schools_priv*pws_pop*pp_voluntary_partic)*numb_samp_five)*((hrs_collect_samp_school_op*rate_op)+cost_collect_samp_school)*			Model PWS that does not meet the requirements to be grandfathered into the program for private elementary school sampling 1 - *p_grandfather_opt_priv*	
5% of private secondary schools multiplied by the number of samples per school, is multiplied by the number of hours per school times the system labor rate, plus the material cost. *(numb_second_schools_priv*pws_popl*pp_voluntary_partic)*numb_samp_five)*((hrs_collect_samp_school_op*rate_op)+cost_collect_samp_school)*			Model PWS that does not meet the requirements to be grandfathered into the program for private secondary school sampling 1 - *p_grandfather_opt_priv*	

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
vv) Analyze samples[3]				
The number of required samples per public elementary school multiplied by 5 percent of elementary schools per year times the probabilities for a sample analyzed in house and a sample analyzed in a commercial lab times the different labor and material cost burdens for each type of analysis. *((((numb_elem_schools_pub*pws_pop*pp_voluntary_partic)*numb_samp_five)*pp_lab_samp_school)*((hrs_analyze_samp_op*rate_op)+cost_lab_lt_samp))+((((numb_elem_schools_pub*pws_pop*pp_voluntary_partic)*numb_samp_five)*pp_commercial_samp_school)*cost_commercial_lab)*	Cost does not apply to NTNCWSs.	All	Model PWS that does not meet the requirements to be grandfathered into the program for public elementary school sampling 1 - *p_grandfather_opt_pub*	Once a year
The number of required samples per public secondary school multiplied by 5 percent of elementary schools per year times the probabilities for a sample analyzed in house and a sample analyzed in a commercial lab times the different labor and material cost burdens for each type of analysis. *((((numb_second_schools_*pub*pws_pop**pp_voluntary_partic)*numb_samp_five)*pp_lab_samp_school)*((hrs_analyze_samp_op*rate_op)+cost_lab_lt_samp))+((((numb_second_schools_*pub*pws_pop**pp_voluntary_partic)*numb_samp_five)*pp_commercial_samp_school)*cost_commercial_lab)*			Model PWS that does not meet the requirements to be grandfathered into the program for public secondary school sampling 1 - *p_grandfather_opt_pub*	
The number of required samples per day care multiplied by 5 percent of elementary schools per year times the probabilities for a sample analyzed in house and a sample analyzed in a commercial lab times the different labor and material cost burdens for each type of analysis. *((((numb_daycares*pws_pop*pp_voluntary_partic)*numb_samp_five)*pp_lab_samp_school)*((hrs_analyze_samp_op*rate_op)+cost_lab_lt_samp))+(((numb_daycares*pws_pop*pp_voluntary_partic)*numb_samp_five)*pp_commercial_samp_school)*cost_commercial_lab)*			Model PWS that does not meet the requirements to be grandfathered into the program for child care sampling 1 - *p_grandfather_opt_child*	

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
The number of required samples per private elementary school multiplied by 5 percent of elementary schools per year times the probabilities for a sample analyzed in house and a sample analyzed in a commercial lab times the different labor and material cost burdens for each type of analysis. *((((numb_elem_schools_priv*pws_pop*pp_voluntary_partic)*numb_samp_five)*pp_lab_samp_school)*((hrs_analyze_samp_op*rate_op)+cost_lab_lt_samp))+((((numb_elem_schools_priv*pws_pop*pp_voluntary_partic)*numb_samp_five)*pp_commercial_samp_school)*cost_commercial_lab)*	Cost does not apply to NTNCWSs.	All	Model PWS that does not meet the requirements to be grandfathered into the program for private elementary school sampling 1 - *p_grandfather_opt_priv*	
The number of required samples per private secondary school multiplied by 5 percent of elementary schools per year times the probabilities for a sample analyzed in house and a sample analyzed in a commercial lab times the different labor and material cost burdens for each type of analysis. *((((numb_second_schools_priv*pws_pop*pp_voluntary_partic)*numb_samp_five)*pp_lab_samp_school)*((hrs_analyze_samp_op*rate_op)+cost_lab_lt_samp))+((((numb_second_schools_priv*pws_pop*pp_voluntary_partic)*numb_samp_five)*pp_commercial_samp_school)*cost_commercial_lab)*			Model PWS that does not meet the requirements to be grandfathered into the program for private secondary school sampling 1 - *p_grandfather_opt_priv*	

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
ww) Provide sampling results to tested facilities				
5% of public elementary schools multiplied by the hours per school times the system labor rate, plus the cost of materials. *(numb_elem_schools_pub*pws_pop*pp_voluntary_partic)*((hrs_inform_samp_pe_school_op*rate_op)+cost_inform_samp_pe_school)*	Cost does not apply to NTNCWSs.	All	Model PWS that does not meet the requirements to be grandfathered into the program for public elementary school sampling 1 - *p_grandfather_opt_pub*	Once a year
5% of public secondary schools multiplied by the hours per school times the system labor rate, plus the cost of materials. *(numb_second_schools_pub*pws_pop*pp_voluntary_partic)*((hrs_inform_samp_pe_school_op*rate_op)+cost_inform_samp_pe_school)*			Model PWS that does not meet the requirements to be grandfathered into the program for public secondary school sampling 1 - *p_grandfather_opt_pub*	
5% of child cares multiplied by the hours per facility times the system labor rate, plus the cost of materials. *(numb_daycares*pws_pop*pp_voluntary_partic)*((hrs_inform_samp_pe_school_op*rate_op)+cost_inform_samp_pe_school)*			Model PWS that does not meet the requirements to be grandfathered into the program for child care sampling 1 - *p_grandfather_opt_child*	
5% of private elementary schools multiplied by the hours per school times the system labor rate, plus the cost of materials. (numb_elem_schools_priv*pws_pop*pp_voluntary_partic)*((hrs_inform_samp_pe_school_op*rate_op)+cost_inform_samp_pe_school)			Model PWS that does not meet the requirements to be grandfathered into the program for private elementary school sampling 1 - *p_grandfather_opt_priv*	
5% of private secondary schools multiplied by the hours per school times the system labor rate, plus the cost of materials. (numb_second_schools_priv*pws_pop*pp_voluntary_partic)*((hrs_inform_samp_pe_school_op*rate_op)+cost_inform_samp_pe_school)			Model PWS that does not meet the requirements to be grandfathered into the program for private secondary school sampling 1 - *p_grandfather_opt_priv*	

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
xx) Discuss sampling results with school and child cares				
5% of public elementary schools multiplied by the hours per school times the system labor rate. *(numb_elem_schools_pub*pws_pop*pp_voluntary_partic)*(hrs_result_discuss_op*rate_op)*	Cost does not apply to NTNCWSs.	All	Model PWS that does not meet the requirements to be grandfathered into the program for public elementary school sampling 1 - *p_grandfather_opt_pub*	Once a year
5% of public secondary schools multiplied by the hours per school times the system labor rate. *(numb_second_schools_pub*pws_pop*pp_voluntary_partic)*(hrs_result_discuss_op*rate_op)*			Model PWS that does not meet the requirements to be grandfathered into the program for public secondary school sampling 1 - *p_grandfather_opt_pub*	
5% of child cares multiplied by the hours per facility times the system labor rate. *(numb_daycares*pws_pop*pp_voluntary_partic)*(hrs_result_discuss_op*rate_op)*			Model PWS that does not meet the requirements to be grandfathered into the program for child care sampling 1 - *p_grandfather_opt_child*	
5% of private elementary schools multiplied by the hours per school times the system labor rate. *(numb_elem_schools_priv*pws_pop*pp_voluntary_partic)*(hrs_result_discuss_op*rate_op)*			Model PWS that does not meet the requirements to be grandfathered into the program for private elementary school sampling 1 - *p_grandfather_opt_priv*	
5% of private secondary schools multiplied by the hours per school times the system labor rate. (numb_second_schools_priv*pws_pop*pp_voluntary_partic)*(hrs_result_discuss_op*rate_op)			Model PWS that does not meet the requirements to be grandfathered into the program for private secondary school sampling 1 - *p_grandfather_opt_priv*	

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
yy) Conduct detailed discussion of high sampling results with school and child cares				
5% of public elementary schools multiplied by the number of required samples per system >15 µg/L multiplied by the hours per sample times the system labor rate. *numb_elem_schools_pub*pws_pop*pp_voluntary_partic)*((pp_above_al_bin_three*numb_samp_five)*(hrs_school_help_op*rate_op))*	Cost does not apply to NTNCWSs.	At or below the TL	Model PWS that does not meet the requirements to be grandfathered into the program for public elementary school sampling 1 - *p_grandfather_opt_pub*	
5% of public secondary schools multiplied by the number of required samples per system >15 µg/L multiplied by the hours per sample times the system labor rate. *(numb_second_schools_pub*pws_pop*pp_voluntary_partic)*((pp_above_al_bin_three*numb_samp_five)*(hrs_school_help_op*rate_op))*			Model PWS that does not meet the requirements to be grandfathered into the program for public secondary school sampling 1 - *p_grandfather_opt_pub*	
5% of child cares multiplied by the number of required samples per system >15 µg/L multiplied by the hours per sample times the system labor rate. *(numb_daycares*pws_pop*pp_voluntary_partic)*((pp_above_al_bin_three*numb_samp_five)*(hrs_school_help_op*rate_op))*			Model PWS that does not meet the requirements to be grandfathered into the program for child care sampling 1 - *p_grandfather_opt_child*	
5% of private elementary schools multiplied by the number of required samples per system >15 µg/L multiplied by the hours per sample times the system labor rate. *(numb_elem_schools_priv*pws_pop*pp_voluntary_partic)*((pp_above_al_bin_three*numb_samp_five)*(hrs_school_help_op*rate_op))*			Model PWS that does not meet the requirements to be grandfathered into the program for private elementary school sampling 1 - *p_grandfather_opt_priv*	
5% of private secondary schools multiplied by the number of required samples per system >15 µg/L multiplied by the hours per sample times the system labor rate. *(numb_second_schools_priv*pws_pop*pp_voluntary_partic)*((pp_above_al_bin_three*numb_samp_five)*(hrs_school_help_op*rate_op))*			Model PWS that does not meet the requirements to be grandfathered into the program for private secondary school sampling 1 - *p_grandfather_opt_priv*	

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
5% of public elementary schools multiplied by the number of required samples per system >15 µg/L multiplied by the hours per sample times the system labor rate. *(numb_elem_schools_pub*pws_pop*pp_voluntary_partic)*((pp_above_al_bin_two*numb_samp_five)*(hrs_school_help_op*rate_op))*	Cost does not apply to NTNCWS.	At or below AL and above TL	Model PWS that does not meet the requirements to be grandfathered into the program for public elementary school sampling 1 - *p_grandfather_opt_pub*	
5% of public secondary schools multiplied by the number of required samples per system >15 µg/L multiplied by the hours per sample times the system labor rate. *(numb_second_schools_pub*pws_pop*pp_voluntary_partic)*((pp_above_al_bin_two*numb_samp_five)*(hrs_school_help_op*rate_op))*			Model PWS that does not meet the requirements to be grandfathered into the program for public secondary school sampling 1 - *p_grandfather_opt_pub*	
5% of child cares multiplied by the number of required samples per system >15 µg/L multiplied by the hours per sample times the system labor rate. *(numb_daycares*pws_pop*pp_voluntary_partic)*((pp_above_al_bin_two*numb_samp_five)*(hrs_school_help_op*rate_op))*			Model PWS that does not meet the requirements to be grandfathered into the program for child care sampling 1 - *p_grandfather_opt_child*	
5% of private elementary schools multiplied by the number of required samples per system >15 µg/L multiplied by the hours per sample times the system labor rate. *(numb_elem_schools_priv*pws_pop*pp_voluntary_partic)*((pp_above_al_bin_two*numb_samp_five)*(hrs_school_help_op*rate_op))*			Model PWS that does not meet the requirements to be grandfathered into the program for private elementary school sampling 1 - *p_grandfather_opt_priv*	
5% of private secondary schools multiplied by the number of required samples per system >15 µg/L multiplied by the hours per sample times the system labor rate. *(numb_second_schools_priv*pws_pop*pp_voluntary_partic)*((pp_above_al_bin_two*numb_samp_five)*(hrs_school_help_op*rate_op))*			Model PWS that does not meet the requirements to be grandfathered into the program for private secondary school sampling 1 - *p_grandfather_opt_priv*	

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
5% of public elementary schools multiplied by the number of required samples per system >15 µg/L multiplied by the hours per sample times the system labor rate. *(numb_elem_schools_pub*pws_pop*pp_voluntary_partic)* ((pp_above_al_bin_one*numb_samp_five)*(hrs_school_help_op*rate_op))*	Cost does not apply to NTNCWS.	Above the AL	Model PWS that does not meet the requirements to be grandfathered into the program for public elementary school sampling 1 - *p_grandfather_opt_pub*	
5% of public secondary schools multiplied by the number of required samples per system >15 µg/L multiplied by the hours per sample times the system labor rate. *(numb_second_schools_pub*pws_pop*pp_voluntary_partic)* ((pp_above_al_bin_one*numb_samp_five)*(hrs_school_help_op*rate_op))*			Model PWS that does not meet the requirements to be grandfathered into the program for public secondary school sampling 1 - *p_grandfather_opt_pub*	
5% of child cares multiplied by the number of required samples per system >15 µg/L multiplied by the hours per sample times the system labor rate. *(numb_daycares*pws_pop*pp_voluntary_partic)* ((pp_above_al_bin_one*numb_samp_five)*(hrs_school_help_op*rate_op))*			Model PWS that does not meet the requirements to be grandfathered into the program for child care sampling 1 - *p_grandfather_opt_child*	
5% of private elementary schools multiplied by the number of required samples per system >15 µg/L multiplied by the hours per sample times the system labor rate. *(numb_elem_schools_priv*pws_pop*pp_voluntary_partic)* ((pp_above_al_bin_one*numb_samp_five)*(hrs_school_help_op*rate_op))*			Model PWS that does not meet the requirements to be grandfathered into the program for private elementary school sampling 1 - *p_grandfather_opt_priv*	
5% of private secondary schools multiplied by the number of required samples per system >15 µg/L multiplied by the hours per sample times the system labor rate. *(numb_second_schools_priv*pws_pop*pp_voluntary_partic)* ((pp_above_al_bin_one*numb_samp_five)*(hrs_school_help_op*rate_op))*			Model PWS that does not meet the requirements to be grandfathered into the program for private secondary school sampling 1 - *p_grandfather_opt_priv*	
zz) Prepare and provide annual report on school and child care sampling to Primacy Agencies				
The total hours per system multiplied by the system labor rate, plus the materials cost. *(hrs_annual_report_school_prepare_op*rate_op)+cost_annual_report_school_dist*	Cost does not apply to NTNCWSs.	All	All model PWSs	Once a year

Acronyms: CWS = community water system; NTNCWS = non-transient non-community water system; PWS = public water system.

Notes:

[1] The data variables in the exhibit are defined previously in this section with the exception of:

- *numb_daycares*, *numb_elem_schools_priv*, *numb_elem_school_pub*, *numb_second_schools_priv*, *numb_second_school_pub*: Number of child cares, number of private elementary schools, number of public elementary schools, number of public secondary schools, and number of private secondary schools, respectively that are served by CWSs (Section 4.3.9.1).
- *p_grandfather_opt_child p_grandfather_opt_priv*, *p_grandfather_opt_pub*: States that qualify to waiver child cares, private K-12 schools, and public K-12 schools for the on request program (Section 4.3.9.2).
- *pp_above_al_bin_one*: Likelihood a sample will be > 15 µg/L when the system's lead 90th percentile level is > 15 µg/L (Section 5.3.3.3).
- *pp_above_al_bin_two*: Likelihood a sample will be > 15 µg/L when the system's lead 90th percentile level is above 10 µg/L but at or below 15 µg/L (Section 5.3.3.3).
- *pp_above_al_bin_three*: Likelihood a sample will be > 15 µg/L when the system's lead 90th percentile level is ≤ 10 µg/L. (Section 5.3.3.3).
- *rate_op*: PWS hourly labor rate (Section 4.3.10.1).

[2] The on request testing requirements are assumed to start for secondary schools in year 4 and for elementary schools and child cares after the Mandatory testing phase has been completed and will begin in year 9.

[3] The burden and costs to provide sample bottles (*cost_collect_samp_school*) under activity uu) and conduct analyses under activity vv) are incurred by the state in Arkansas, Louisiana, Mississippi, Missouri, and South Carolina.

5.3.2.6 *Estimate of PWS National Sampling Costs*

Exhibit 5-52 and Exhibit 5-53 show the total estimated national sampling costs, under the low and high cost scenarios, discounted at 3 and 7 percent respectively, for the previous LCR, the LCRR, and the incremental cost. Note that previous LCR costs are projected over the 35-year period of analysis, like the estimated impact of the LCRR, and are affected by EPA's assumptions on five uncertainty variables which vary between the low and high cost scenarios. The low/high variable assignments for number of LSLs, CCT cost and effectiveness, LSLR costs, and the 90th percentile tap sample assignments for non-LSL systems are consistent across the previous rule and final LCRR projections. The 90th percentile tap sample assignments for LSL systems varies between the previous rule and LCRR. See Section 5.2.4.2.2 for detail. In the case of sampling costs, the 90th percentile values have the largest impact on estimated costs under the low and high scenarios for the previous rule.

Exhibit 5-52: National Annualized Sampling Costs – All PWSs at 3 Percent Discount Rate (2016$)

	Low Cost Estimate			High Cost Estimate		
	Previous LCR	**Final LCRR**	**Incremental**	**Previous LCR**	**Final LCRR**	**Incremental**
Lead Tap Sampling	$34,536,000	$46,775,000	$12,239,000	$36,604,000	$55,386,000	$18,782,000
Lead Water Quality Parameters Monitoring	$7,265,000	$8,225,000	$959,000	$8,311,000	$10,211,000	$1,900,000
Copper Water Quality Parameters Monitoring	$140,000	$152,000	$13,000	$134,000	$150,000	$16,000
Source Water Monitoring	$20,000	$9,419	$-11,000	$50,000	$31,000	$-18,000
School Sampling	$0	$12,582,000	$12,582,000	$0	$12,960,000	$12,960,000
Total Annual Sampling Costs	$41,962,000	$67,744,000	$25,782,000	$45,099,000	$78,739,000	$33,641,000

Note: Detail may not add exactly to total due to independent rounding.

Exhibit 5-53: National Annualized Sampling Costs – All PWSs at 7 Percent Discount Rate (2016$)

	Low Cost Estimate			High Cost Estimate		
	Previous LCR	**Final LCRR**	**Incremental**	**Previous LCR**	**Final LCRR**	**Incremental**
Lead Tap Sampling Monitoring	$33,746,000	$47,597,000	$13,851,000	$36,573,000	$58,566,000	$21,993,000
Lead Water Quality Parameters Monitoring	$6,986,000	$7,980,000	$995,000	$8,397,000	$10,683,000	$2,286,000
Copper Water Quality Parameters Monitoring	$133,000	$145,000	$12,000	$128,000	$143,000	$15,000
Source Water Monitoring	$25,000	$13,000	$-12,000	$66,000	$45,000	$-20,000
School Sampling	$0	$14,461,000	$14,461,000	$0	$14,969,000	$14,969,000
Total Annual Sampling Costs	$40,890,000	$70,197,000	$29,307,000	$45,164,000	$84,407,000	$39,243,000

Note: Detail may not add exactly to total due to independent rounding.

5.3.3 PWS Corrosion Control Costs

PWSs may be required to install CCT, re-optimize their existing CCT, or perform a "find-and-fix" adjustment to their CCT under the LCRR. CCT installation and re-optimization are triggered based on the system's lead 90th percentile range. EPA recognizes uncertainty in the effectiveness of CCT installation and re-optimization, especially for LSL systems, as explained in Section 5.2.4.2.3. The likelihood of a model-PWS exceeding the TL or AL following CCT installation or re-optimization for the low and high cost scenarios are in Exhibit 5-7 and Exhibit 5-8, respectively. The "find-and-fix" adjustment to CCT is triggered by a new requirement under the LCRR where systems are required to take certain actions when individual lead tap samples are greater than 15 µg/L.

Any changes to the status of a system's CCT may result in technology related costs (capital and/or O&M), as well as ancillary costs for data submission, consultation, and CCT studies. This section presents the following CCT-related costs:

- 5.3.3.1: CCT Installation
- 5.3.3.2: Re-optimization
- 5.3.3.3: Find-and-Fix Costs
- 5.3.3.4: System Lead CCT Routine Costs

Each subsection presents capital and O&M costs followed by ancillary costs. Note that PWS costs for monitoring of CCT effectiveness (i.e., lead tap and WQP monitoring) has already been presented in Sections 5.3.2.1 and 5.3.2.2, respectively. Also note that WWTP costs to address increased phosphorus loading are presented in Section 5.5.

All CCT-related capital and O&M costs are calculated using EPA's WBS cost models, which are described in Section 5.2.4 and detailed in *Technologies and Costs for Corrosion Control to Reduce Lead in Drinking Water* (USEPA, 2020). WBS capital cost equations are a function of DF, and WBS O&M cost equations are a function of average daily flow (ADF). These flows are estimated based on the system's population served. As explained in Section 4.3.6, DF and ADF for the system are divided by the average number of entry points per system to calculate flow per entry point.[93] These entry point flow values are used in the WBS cost equations. CCT-related capital and O&M costs per entry point are summed for all entry points to produce the CCT-related capital and O&M costs for the system. As noted in Section 5.2.4.2.5, EPA recognizes uncertainty in CCT capital and O&M cost equations by varying the WBS model inputs (e.g., fiberglass storage tank vs. more expensive stainless steel construction) to create "low" and "high" cost equations. Low CCT cost equations *Technologies and Costs for Corrosion Control to Reduce Lead in Drinking Water* (USEPA, 2020) are used for the low cost scenario, and high CCT cost equations are used for the high cost scenario.

[93] In the case of some very large systems (VLSs), EPA knows the flows at each of its entry points (EPs) and each EP's pH level. The SafeWater LCR model uses these data to calculate the CCT installation and O&M costs for each EP for these VLSs.

In order to estimate CCT installation, re-optimization, or find-and-fix costs,[94] the SafeWater LCR model requires an estimate of the pH of the model-PWS's pre-regulatory compliance (or baseline) finished water. Using data from the Six-Year 3 Review Information Collection Request (ICR) Dataset, EPA developed triangular distributions based on the minimum, mode, and maximum of baseline pH levels (converted to $\log_{10}$ values) for model-PWSs with and without existing pH adjustment. For each distribution, EPA estimated distribution quartile threshold pH values and quartile midpoint values. Then EPA estimated system-weighted averages of the midpoint values to derive the final set of distributions for ground water and surface water systems with and without baseline pH adjustment shown in Exhibit 5-54.

Exhibit 5-54: Distribution of Baseline Finished Water pH by Source Water Type and pH Adjustment Status

Likelihood	Finished Water pH			
	PWSs without pH Adjustment in Place		PWSs with pH Adjustment in Place	
	Groundwater	Surface Water	Groundwater	Surface Water
10%	5.1	5.6	6.3	6.3
15%	5.9	6.3	6.8	6.8
25%	6.6	6.8	7.3	7.2
25%	7.3	7.4	7.8	7.7
15%	8.0	7.9	8.3	8.3
10%	8.6	8.4	8.8	8.9

EPA then used the estimates in Exhibit 5-54 to develop the pH distribution for model-PWSs with 1) no CCT installed and 2) orthophosphate (PO_4) treatment installed. EPA assumes that model-PWSs with no CCT would have pH of at least 7.0. Therefore, EPA truncated the values for "PWSs without pH Adjustment in Place" which resulted in the distribution for the variable *baselineph_wocct*. Likewise, EPA used the estimates in Exhibit 5-54 to develop the pH distribution for model-PWSs with PO_4 in place without pH adjustment. EPA assumes that model-PWSs with only PO_4 installed would have pH of at least 6.3. Therefore, EPA truncated the values for "PWSs without pH Adjustment in Place" which resulted in the distribution for the variable *baseline_woph*. The distributions for both *baselineph_wocct* and *baselineph_woph* are provided in Exhibit 5-55.

[94] See derivation file "Derivation of Baseline CCT Characteristics_Final Rule.xlsx" for the baseline parameters and their likelihood.

Exhibit 5-55: Distribution of Finished Water pH by Source Water Type for Model-PWSs without pH Adjustment in Place by CCT Status

Probability	Finished Water pH		Probability	Finished Water pH	
	PWSs without CCT in Place *baselineph_wocct*			PWSs with just PO_4 in Place *baselineph_woph*	
	Groundwater	Surface Water		Groundwater	Surface Water
			25%	6.3	6.3
50%	7.0	7.0	25%	6.6	6.8
25%	7.3	7.4	25%	7.3	7.4
15%	8.0	7.9	15%	8.0	7.9
10%	8.6	8.4	10%	8.6	8.4

EPA then used the estimates in Exhibit 5-54 to develop the pH distribution for model-PWSs with pH adjustment in place by CCT status. EPA assumed that model-PWSs with PO_4 and pH adjustment could have any of the baseline pH levels associated with "PWSs with pH adjustment in place." Therefore, no adjustment to the pH distribution for "PWSs with pH Adjustment in Place" was required to develop the distribution for the variable *baselineph_wpo4ph*. However, EPA determined that PWSs with only pH adjustment installed would have a pH of at least 8.2. Therefore, EPA truncated the values for "PWSs with pH Adjustment in Place" which resulted in the distribution for the variable *baseline_wph*. The distributions for both *baselineph_wpo4ph* and *baselineph_wph* are provided in Exhibit 5-56.

Exhibit 5-56: Distribution of Finished Water pH by Source Water Type for Model-PWSs with pH Adjustment in Place by CCT Status

Probability	Finished Water pH		Probability	Finished Water pH	
	PWSs with PO_4 and pH Adjustment in Place *baselineph_wpo4ph*			PWSs with only pH Adjustment in Place *baselineph_wph*	
	Groundwater	Surface Water		Groundwater	Surface Water
10%	6.3	6.3			
15%	6.8	6.8			
25%	7.3	7.2			
25%	7.8	7.7	75%	8.2	8.2
15%	8.3	8.3	15%	8.3	8.3
10%	8.8	8.9	10%	8.8	8.9

In order to determine the cost of re-optimizing CCT or undertaking pH adjustment triggered by find-and-fix requirements, for model-PWSs with existing PO_4 treatment installed, the SafeWater LCR model needs an estimate of the model-PWS's baseline dose of PO_4. Using data from the Six-Year Review ICR Dataset, EPA developed a triangular distribution based on the minimum (0.05 mg/L), mode (1.4 mg/L), and maximum (4 mg/L) of reported baseline PO_4 doses. For ease of modeling CCT unit costs, EPA limited the number of potential baseline PO_4 doses to four ranges and represented each range by its median as shown in Exhibit 5-57, columns (a), (b), and (c). Using the triangular distribution, EPA determined the

likelihood of a model-PWS having a baseline PO_4 dose in each range as shown in column (d). EPA assumed this likelihood applied to model-PWSs serving 50,000 or fewer people with no LSLs. EPA then assumed that these smaller systems, that have LSLs, will be less likely than same size systems without LSLs to have PO_4 doses in the lowest of the four ranges, since LSLs, when present, represent the greatest contributor of lead in a home's drinking water. A study published by the American Water Works Association (AWWA) Research Foundation ''Contributions of Service Line and Plumbing Fixtures to Lead and Copper Rule Compliance Issues'' (Sandvig et al., 2008) estimates that 50 percent to 75 percent of lead in drinking water comes from LSLs. Since LSLs represent a more significant lead challenge, it is expected that systems would need higher orthophosphate doses to reduce lead levels. EPA modeled this assumption by decreasing the likelihood of having a dose of 0.525 mg/L by 50 percent and increasing the likelihood of having the next highest dose, 1.5 mg/L, by an equivalent amount (see column (e)).

EPA also made adjustments to implement its assumption that larger systems have a higher probability of higher doses than small systems with similar LSL status (see columns (f) and (g)), since the distribution systems are larger and more complex. Finally, EPA assumed, for modeling purposes, that a dose of 3.2 mg/L will result in optimized CCT and that no model-PWS in the baseline has fully optimized CCT as a conservative estimate. Therefore, the likelihood of a model-PWS having a baseline dose of 3.2 mg/L is set to zero and the likelihoods of the other doses is normalized so that the sum of the percentage values equal 100 percent. The final baseline PO_4 doses, and their likelihoods, are provided in Exhibit 5-58.

Exhibit 5-57: Derivation of Baseline PO_4 Dose by System Size and LSL Status

PO_4 Dose Range Minimum (mg/L) (a)	PO_4 Dose Range Maximum (mg/L) (b)	PO_4 Dose Range Median (mg/L) (c)	Likelihood ≤50,000 people No LSL (d)	Likelihood ≤50,000 people LSL (e)	Likelihood > 50,000 people No LSL (f)	Likelihood >50,000 people LSL (g)
0.05	<1	0.525	7.9%	4.0%	4.0%	0%
≥ 1	<2	1.5	48.1%	52.1%	28.0%	32.0%
≥2	≤3.2	2.65	38.6%	38.6%	43.4%	43.4%
≥3.2	4	3.6	5.4%	5.4%	24.7%	24.7%

Exhibit 5-58: Baseline PO_4 Doses by System Size and LSL Status Used in Cost Modeling

PO_4 Dose Range Median (mg/L)	Normalized Likelihood ≤50,000 people No LSL	Normalized Likelihood ≤50,000 people LSL	Normalized Likelihood > 50,000 people No LSL	Normalized Likelihood >50,000 people LSL
0.525	8%	4%	5%	0%
1.5	51%	55%	37%	42%
2.65	41%	41%	58%	58%

5.3.3.1 ***CCT Installation***

PWSs without CCT may be required to install CCT under the LCRR if they exceed the lead AL.[95] Costs related to CCT installation are categorized as follows:

- Capital and operations and maintenance costs (see Section 5.3.3.1.1).
- Ancillary costs (see Section 5.3.3.1.2).

5.3.3.1.1 Capital and Operation and Maintenance CCT Installation Costs

Under the final LCRR, a PWS that installs CCT (listed as activity b) in Exhibit 5-10) will choose among three technology options.

- Add PO_4 and pH post-treatment
- Add PO_4 and modify pH
- Modify pH

EPA assumed that model-PWSs with a baseline pH (*baselineph_wocct*) equal to or greater than 7.2, but less than 8.4, will choose to add PO_4 and conduct pH post-treatment, while those with pH below 7.2 will choose to add PO_4 and modify pH. For model PWSs that add PO_4 with pH post-treatment, EPA assumed that the PO_4 dose is equal to 3.2 mg/L and post-treatment will maintain the current pH level (*baselineph_wocct*).[96] For model-PWSs that add PO_4 and adjust pH, EPA assumes the same PO_4 dose of 3.2 mg/L. In addition, EPA assumes the model PWS will adjust their pH from their starting pH (*baselineph_wocct*) to 7.2. EPA assumes that model-PWSs with a baseline pH greater that 8.4 will choose to modify pH and not add PO_4.

The SafeWater LCR model uses the WBS unit cost functions (see *Technologies and Costs for Corrosion Control to Reduce Lead in Drinking Water* (USEPA, 2020), along with the EP flow values, to calculate the capital and O&M costs for CCT installation at each entry point to the distribution system (EP). All of the WBS capital cost equations are a function of DF, and all WBS O&M costs are a function of ADF.[97] Since CCT is conducted at the model-PWS's EPs, the SafeWater LCR model calculates the DF and ADF of each EP. For all model-PWSs except some very large systems[98] (see Section 5.2.4.3), EPA does not know the number of people, and hence, flow, associated with individual EPs. Therefore, in the absence of this information, the SafeWater LCR model calculates the EPs flows assuming they are equal to:

[95] EPA assumed that CWSs serving 50,000 or more people will have already installed CCT except for a very small number of "b3" systems (11), which are assumed to have naturally non-corrosive water and never be required to install CCT. The LCRR provides flexibility to CWSs serving 3,300 or fewer people and all NTNCWSs by allowing them to choose among replace all LSLs, install POU treatment, install/re-optimize CCT, or replace all lead bearing plumbing if they exceed the lead AL.

[96] The addition of PO_4 lowers pH levels so post-treatment is conducted to maintain pH levels.

[97] See Section 4.2.3 for a description of how EPA estimates PWS design and ADFs.

[98] In the case of some very large systems (VLSs), EPA collected additional EP level data on flows and pH level (See Appendix B, Section B.2.1.1). The SafeWater LCR model uses these data to calculate the CCT installation and O&M costs for each EP for these VLSs.

Entry Point Design Flow = PWS Design Flow / PWS Number of EPs

Entry Point Average Daily Flow = PWS Average Daily Flow / PWS Number of EPs

The model-PWS capital and O&M cost of CCT installation at each EP is then multiplied by the number of EPs. The cost models, and their inputs, for calculating the capital and O&M cost of CCT installation are:

- PO4 and pH post-treatment

  PO_4 dose = 3.2
  Current pH: = *baselineph_wocct*
  Ending pH = *baselineph_wocct*

- Add PO_4 and modify pH

  PO_4 dose = 3.2
  Current pH = *baselineph_wocct*
  Ending pH = 7.2

- Modify pH

  PO_4 dose = 3.2
  Current pH = *baselineph_wocct*
  Ending pH = 9.2

In addition to the capital and O&M cost of CCT installation, model-PWSs also face an ancillary CCT study cost associated with CCT installation. This cost is discussed in the next section.

5.3.3.1.2 Ancillary CCT Installation Costs

EPA has developed system costs for an ancillary activity associated with CCT installation as shown in Exhibit 5-59. The exhibit provides the unit burden and/or cost for the activity. The assumptions used in the estimation of the unit burden and cost follow the exhibit. The last column provides the corresponding SafeWater LCR model data variable in red/italic font.

Exhibit 5-59: PWS CCT Installation-Related Unit Burden and Cost Estimates

Activity	Unit Burden and/or Cost	*SafeWater LCR Data Variable*
a) Conduct a study	Study • No LSLs (coupon testing): $7,205 • With LSLs (harvested pipe loop testing): $276,249 for ≤ 50,000 people; $342,475 for > 50,000 people	*cost_cct_study_dem*

Acronyms: CCT = corrosion control treatment; LSL = lead service line.
Note: Activity b), "Install CCT Treatment (PO_4, PO_4 with post treatment, pH adjustment, or modify pH)" was previously discussed in Section 5.3.3.1.1.

a) Conduct a Study (cost_cct_study_dem). EPA assumed Primacy Agencies will require all systems to conduct either harvested pipe loop testing or a coupon study prior to CCT installation. The SafeWater LCR model uses the following set of assumptions:

- S*ystems required* to conduct a CCT study will use a contractor.
- Systems without LSLs will use a coupon study at an estimated cost of $7,205 for systems of all sizes.
- Systems with LSLs will incur a cost of $276,249 for those serving 50,000 or fewer and $342,476 for those serving more than 50,000 people for harvested pipe loop testing.

The development of harvested pipe loop and coupon test study costs are detailed in *Technologies and Costs for Corrosion Control to Reduce Lead in Drinking Water* (USEPA, 2020).

Exhibit 5-60 details how the data variables are used to estimate system ancillary activities related to CCT Installation.

Exhibit 5-60: PWS Ancillary CCT Installation Cost Estimation in SafeWater LCR by Activity[1]

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
a) Conduct a CCT study				
Material cost per system for the marginal contractor cost, with the difference between coupon testing and harvested pipe loop testing reflected in the stratification of the data by system LSL status. ***cost_cct_study_dem***	Cost applies as written to NTNCWSs.	Above AL	Model PWSs without CCT that conducts a study on CCT installation	One time

Acronyms: AL = action level; CCT = corrosion control treatment; CWS = community water system; LSL = lead service line; NTNCWS = non-transient non-community water system; PWS = public water system.

Notes:

[1] The data variables in the exhibit are defined previously in this section with the exception of:

- *rate_op:* PWS hourly labor rate (Section 4.3.10.1).

5.3.3.2 *Re-optimization of Existing Corrosion Control Treatment*

PWSs that have previously implemented CCT may be required to re-optimize their treatment if they exceed the lead TL. Costs related to CCT re-optimization are categorized as follows:

- Capital and operations and maintenance costs (see Section 5.3.3.2.1).
- Ancillary costs (see Section 5.3.3.2.2).

5.3.3.2.1 Capital and Operation and Maintenance CCT Re-optimization Costs

Estimating the cost of existing CCT

While EPA knows which model-PWSs currently have CCT installed, EPA does not know which CCT technology they have installed. Therefore, when the SafeWater LCR model develops the model-PWSs, it assigns a CCT technology to each model PWS known to have CCT in place.[99] These CCT technologies, and their input parameters used in the WBS models, to calculate existing CCT O&M costs, are:

- Add PO_4 with PH Post Treatment.
  - PO_4 Dose = *baselinepo4dose*
  - Starting pH: *baselineph_woph*
  - Ending pH: *baselineph_woph*

- Modify pH.
  - Starting pH: *baselineph_wph* – 0.5
  - Ending pH: pH: *baselineph_wph*

- Technology: Add PO4 and Modify PH.
  - PO_4 Dose = *baselinepo4dose*
  - Starting pH: *baselineph_wpo4ph*- 0.5
  - Ending pH: *baselineph_wpo4ph*

Estimating the cost of re-optimizing existing CCT

EPA assumed that if a model-PWS must re-optimize its CCT under the final LCRR (listed as activity d) in Exhibit 5-10), it will achieve the following standards based on its existing CCT technology (which was described above):

- Add PO_4 and pH post-treatment.
  - Increase PO_4 dose to 3.2 mg/L.
  - Maintain existing pH.
- Add PO_4 and modify pH.
  - Increase PO_4 dose of 3.2 mg/L.
  - Maintain pH at a minimum of 7.2.
- Modify pH.
  - Maintain pH at 9.2.

To calculate the cost to re-optimize CCT, the SafeWater LCR model first calculates the annual O&M cost of treating to the above assumed standards (PO_4 dose and/or pH level) as if no CCT was installed. To do so, the SafeWater LCR model uses the following parameters and WBS cost functions:

[99] See derivation file "Derivation of Baseline CCT Characteristics_Final Rule.xlsx" for the baseline parameters and their likelihoods.

- Add PO_4 and pH post-treatment.

  PO_4 Dose = 3.2 mg/L
  Beginning pH = *baselineph_woph*
  Ending pH = *baselineph_woph*

- Add PO_4 and modify pH.

  PO_4 Dose = 3.2 mg/L
  Beginning pH = *baselineph_wpo4ph*- 0.5
  Ending pH = the greater of *baselineph_wpo4ph* or 7.2

- Modify pH.

  Beginning pH = *baselineph_wph* -0.5
  Ending pH = 9.2

The SafeWater LCR model then subtracts the model PWS's existing CCT annual O&M cost from the new annual O&M cost to calculate the share of the model PWS's annual CCT O&M costs attributable to the final LCRR CCT requirements. These O&M costs, combined with the annualized capital cost to retrofit the CCT system based on the new parameters, described above, equal the model PWS's total annual capital and O&M cost for CCT adjustment. The following section discusses additional ancillary costs associated with CCT adjustment.

5.3.3.2.2 Ancillary CCT Re-optimization Costs

EPA has developed system ancillary costs for an ancillary activity associated with CCT re-optimization as shown in Exhibit 5-61. The exhibit provides the unit burden and/or cost for the activity. The assumptions used in the estimation of the unit burden follow the exhibit. The last column provides the corresponding SafeWater LCR model data variable in red/italic font.

Exhibit 5-61: PWS CCT Ancillary Re-optimization Unit Burden and Cost Estimates

Activity	Unit Burden and/or Cost	*SafeWater LCR Data Variable*
c) Revise CCT study	Systems with TLE but no ALE $5,651 to $10,872/system Systems with ALE No LSLs: $7,205 with LSLs: $276,249 to $342,476	*cost_revise_cct* *cost_cct_study_dem*

Acronyms: ALE = action level exceedance, CCT = corrosion control treatment; LSL = lead service line; TLE = trigger level exceedance.
Source: Technologies and Costs for Corrosion Control to Reduce Lead in Drinking Water (USEPA, 2020).
Note: Activity d), "Reoptimize existing CCT" was previously discussed in Section 5.3.3.2.1.

c) Revise CCT study (cost_revise_cct; cost_cct_study_dem). EPA assumed Primacy Agencies will require all systems to conduct a study prior to CCT re-optimization.

- Systems will use a contractor to conduct a study.
- Systems with a TLE but no ALE will revise their existing CCT (*cost_revise_cct*) that is estimated at $5,651 for systems serving 3,300 or fewer people, $8,046 for systems serving 3,301 to 50,000 people, and $10,872 for systems serving more than 50,000 people. Note that this may overestimate costs because the final LCRR gives Primacy Agencies discretion to allow these systems to re-optimize without first conducting a study.
- Systems with an ALE will conduct a demonstration study (*cost_cct_study_dem*). Specifically, systems:
    - Without LSLs will do a coupon study at an estimated cost of $7,205 for all sizes.
    - With LSLs will do a harvested pipe loop at an estimated cost of $276,249 for systems serving 50,000 or fewer people and $342,476 for those serving more than 50,000 people.

The development of harvested pipe loop and coupon test study costs are detailed in *Technologies and Costs for Corrosion Control to Reduce Lead in Drinking Water* (USEPA, 2020).

Exhibit 5-62 shows the SafeWater LCR model cost estimation approach for system ancillary CCT re-optimization study activities including additional cost inputs required to calculate these costs.

Exhibit 5-62: PWS CCT Ancillary Re-optimization Cost Estimation in SafeWater LCR by Activity[1]

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
c) Revise CCT study				
Material cost per system for the marginal contractor cost for revision of CCT study. *cost_revise_cct*	Cost applies as written to NTNCWSs.	At or below AL and above TL	Model PWS re-optimizing CCT	One time
Material cost per system for the marginal contractor cost, with the difference between coupon testing and harvested pipe loop testing reflected in the stratification of the data by system LSL status. *cost_cct_study_dem*	Cost applies as written to NTNCWSs.	Above AL	Model PWS re-optimizing CCT	One time

Acronyms: AL = action level; CCT = corrosion control treatment; CWS = community water system; LSL = lead service line; NTNCWS = non-transient non-community water system; PWS = public water system; TL = trigger level.

Notes:

[1] The data variables in the exhibit are defined previously in this section with the exception of:

- *rate_op:* PWS hourly labor rate (Section 4.3.10.1).

5.3.3.3 *Find-and-Fix Costs*

Under the final LCRR, PWSs must take find-and-fix corrective actions whenever an individual tap water sample exceeds 15 µg/L. The likelihood that a sample would exceed 15 µg/L is provided in Exhibit 5-63.

Exhibit 5-63: Likelihood of an Individual Lead Sample Result Above 15 µg/L

LSL Status	ALE (P90 >15 µg/L)	TLE (10 µg/L < P90 ≤15 µg/L)	No TLE/ALE (P90 ≤10 µg/L)
	pp_above_al_bin_one	*pp_above_al_bin_two*	*pp_above_al_bin_three*
Has LSLs	25.4%	6.1%	1.2%
No LSLs	22.7%	15.4%	0.3%

Acronyms: ALE = action level exceedance; LSL = lead service line; TLE = trigger level exceedance.
Source: Total rows in Columns G through I in Exhibit 4-24 Exhibit 4-24: Percent of Individual Lead Sample Result Above 15 µg/L Based on Michigan CWSs with Known LSL Status for Final LCRRin Chapter 4.

EPA assumed in the SafeWater LCR model that in response to individual tap water samples above 15 µg/L, model-PWSs will take progressively more stringent corrective actions. These assumed actions are:

1. First sampling period with one or more individual tap water samples above 15 µg/L – model-PWS will investigate the cause but not take any corrective action.
2. Second sampling period with one or more individual tap water samples above 15 µg/L – model-PWS will perform spot flushing once in the distribution system.
3. Third sampling period with one or more individual tap water samples above 15 µg/L – model-PWS will increase the pH level at one EP.
4. Fourth sampling period with one or more individual tap water samples above 15 µg/L – model-PWS will increase the pH at all other EPs (if more than one).

These corrective actions are not meant to encompass the entire suite of find-and-fix compliance options but rather provide a representation of typical actions a PWS might take to correct reoccurring individual tap samples over 15 µg/L.

5.3.3.3.1 Cost of Spot Flushing an Entry Point

In response to a second sampling period with at least one lead tap sample greater than 15 µg/L, EPA assumed, in the Safe Water LCR model, that systems will perform spot flushing. Spot flushing involves crews opening hydrants in the area of the tap monitoring result to bring in fresh water and eliminate potential issues with elevated water age, which could cause the water to be more corrosive. The assumptions for spot flushing are consistent with the *Technology and Cost Document for the Revised Total Coliform Rule* (USEPA, 2012a). See Exhibit 5-64 for the PWS unit burden and cost for spot flushing with detailed assumptions in the notes.

Exhibit 5-64: *PWS Burden and Cost to Flush as Find-and-Fix Response*

System Size (Population Served)	Burden (hrs per system) (*hrs_flush_wqp_op*)	Cost ($ per system) (*cost_flush_wqp*)
	A	B
≤1,000	4	$121.80
1,001-3,300	4	$182.08
3,301-100,000	8	$182.08
>100,000	8	$242.37

Source: *Technology and Cost Document for the Revised Total Coliform Rule* (USEPA, 2012a; "Derivation of Initial P90 Categorization_Final Rule.xlsx.").

Notes:

A: Assumes that each spot flushing response is a one-half day event. Assumes 1-person crew for systems serving 3,300 or fewer people and 2-person crew for those serving > 3,300 people.

B: Estimate is based on value of flushed water and cost of flushed water disposal, i.e., dichlorination. Where LCRR system size categories do not match those used in the technology and cost document for the *Revised Total Coliform Rule* (RTCR), EPA used the closest category.

5.3.3.3.2 Cost of pH Adjustment

In response to a third sampling period with at least one lead tap sample greater than 15 µg/L, EPA assumed, in the Safe Water LCR model, that a model-PWS will increase its pH at one EP if it has optimized CCT in place. EPA assumed the model-PWS will achieve the following standards:

- If model-PWS has used PO_4 for its corrosion inhibitor, then the system will maintain its pH at a minimum of 7.5 instead of 7.2.
- If a model-PWS modified pH for corrosion control, it will maintain its pH at 9.4 instead of 9.2.

To calculate the cost to increase pH in response to individual tap samples above 15 µg/L, the SafeWater LCR model first calculates the total annual O&M cost for treating to the find-and-fix standards listed above as if no CCT was installed. The SafeWater LCR model also calculates the capital cost to retrofit the CCT system for additional pH adjustment. To do so, the SafeWater LCR model uses the following parameters and WBS cost functions:

- If the model-PWS has PO_4 treatment installed and its *baselineph_woph* < 7.5:
  Add PO_4 and Modify pH
  PO_4 Dose = 3.2
  Starting pH: *baselineph_woph*
  Ending pH: 7.5

- If the model-PWS has PO_4 treatment installed and its *baselineph_woph* ≥ 7.5:
  Add PO_4 with pH Post Treatment
  PO_4 Dose = 3.2
  Starting pH: *baselineph_woph*
  Ending pH: *baselineph_woph*

- If the model-PWS has pH adjustment installed:
  Modify pH

Starting pH: = *baselineph_woph* – 0.5
Ending pH: 9.4

The SafeWater LCR model then subtracts the model-PWS's current CCT annual O&M cost from the new find-and-fix annual O&M cost to calculate the share of model-PWS's annual CCT O&M costs attributable to find-and-fix actions. These O&M costs combined with the annualized capital cost to retrofit the CCT system based on the new parameters, described above, equal the model-PWS's total annual capital and O&M cost of find-and-fix. Additional ancillary costs associated with find-and-fix are discussed in the following section.

In the fourth sampling period with one or more individual tap water samples above 15 µg/L, the model-PWS will increase the pH at all other EPs (if the model-PWS has more than one EP). This calculation is the same as described for the year 3 find-and-fix pH adjustment except that the calculation is made for all entry points.

5.3.3.3.3 Ancillary Find-and-Fix Costs

EPA developed ancillary costs associated with of a system's find-and-fix responses to a lead tap result above 15 µg/L as shown in Exhibit 5-65. The exhibit provides the unit burden and/or cost for each activity. The assumptions used in the estimation of each activity follows the exhibit. The last column provides the corresponding SafeWater LCR model data variable in red/italic font. In a few instances, some of these activities are conducted by the state instead of the water system. These activities are identified in the exhibit and further explained in the exhibit notes.

Exhibit 5-65: PWS Ancillary Find-and-Fix Unit Burden and Cost Estimates

Activity	Unit Burden and/or Cost	*SafeWater LCR Data Variable*
e) Contact customers and collect follow-up tap sample	Burden per sample CWSs: 3.4 to 3.7 hrs NTNCWSs: 0.5 hrs Costs per sample CWSs: $5.29 to $12.43 NTNCWSs: $0	Burden *hrs_samp_above_al_op* Cost *cost_samp_above_al*
f) Analyze follow-up lead tap sample	In-house Analysis (CWSs > 100K only) Burden: 0.44 hrs/sample Cost: $2.38 Commercial Analysis $21.58	In-house Analysis *hrs_analyze_samp_op*[1] *cost_lab_lt_samp*[1] Commercial Analysis *cost_commercial_lab*[1]

Activity	Unit Burden and/or Cost	*SafeWater LCR Data Variable*
g) Collect distribution system WQP sample	Burden per sample per PWS 0.5 hrs Cost for per sample No CCT: $2.15 (CWS & NTNCWS) pH adjustment: • $2.15 to $2.32 (CWS); • $1.83 to $2.15 (NTNCWS) Orthophosphate: • $2.15 to $4.14 (CWS) • $1.83 to $2.15 (NTNCWS)	Burden *hrs_wqp_find_fix_op* Cost No CCT: *cost_wqp_material* pH: *cost_wqp_material_ph* Orthophosphate: *cost_wqp_material_ortho*
h) Analyze distribution system WQP sample	In-House Burden per sample No CCT: 0.15 hrs (CWS & NTNCWS) pH adjustment: • 0.15 to 0.46 hrs (CWS) • 0.15 hrs (NTNCWS) Orthophosphate: • 0.15 to 1.34 hrs (CWS) • 0.15 hrs (NTNCWS) In-House cost per sample No CCT: $0.52 (CWS & NTNCWS) pH adjustment: • $0.52 to $0.72 (CWS) • $0.52 (NTNCWS) Orthophosphate: • $0.52 to $0.78 (CWS) • $0.52 (NTNCWS) Commercial cost per sample No CCT: $23.92 (CWS & NTNCWS) pH adjustment: $23.92 (CWS & NTNCWS) Orthophosphate: $49.35 (CWS & NTNCWS)	In-House Burden No CCT: *hrs_wqp_analyze_dist_op* pH adjustment: *hrs_wqp_analyze_ph_op* Orthophosphate: *hrs_wqp_analyze_ortho_op* In-House Cost No CCT: *cost_wqp_analyze* pH adjustment: *cost_wqp_ph_analyze* Orthophosphate: *cost_wqp_ortho_analyze* Commercial Cost No CCT: *cost_lab_wqp* pH: *cost_lab_ph_wqp* Orthophosphate: *cost_lab_ortho_wqp*
i) Review incidents of system-wide event and other system conditions	CWSs: 4 to 30 hrs/system NTNCWSs: 1 to 14 hrs/system	*hrs_events_deter_find_fix_op*
j) Consult with Primacy Agency prior to making CCT changes	2 hrs per system with CCT	*hrs_consult_find_fix_op*
k) Report follow-up sample results and overall "find-and-fix" responses to Primacy Agency	2 hrs/PWS serving ≤ 50,000 people; 4 hrs/PWS serving > 50,000 people	*hrs_comp_report_find_fix_op*

Acronyms: CCT = corrosion control treatment; CWS = community water system; NTNCWS = non-transient non-community water system; PWS = public water system; WQP = water quality parameter.
Sources: Data sources for each activity are provided following this exhibit.
Note:

[1] In Arkansas, Louisiana, Mississippi, Missouri, and South Carolina, the state pays for the cost of bottles, shipping, analysis, and providing sample results to the system. Thus, the state will incur the burden and cost for these activities in lieu of the system.

e) Contact customers and collect follow-up tap samples (hrs_samp_above_al_op, cost_samp_above_al). CWSs and NTNCWSs will incur burden and costs to contact customers and collect a follow-up tap sample at each compliance sampling location[100] that had a result above 15 µg/L. Exhibit 5-63 in Section 5.3.3.3 provides the likelihood a system will have a single sample above 15 µg/L for each of the three lead 90th percentile classifications (*pp_above_al_bin_one*, *pp_above_al_bin_two*, and *pp_above_al_bin_three*). Also refer to Chapter 4, Section 4.3.5.2 for a detailed discussion of EPA's approach for developing these percentages. For modeling purposes, EPA assumed all customers would respond to the water system and agree to have a follow-up sample collected.

Exhibit 5-66 provides the burden or labor associated with these activities for CWSs and Exhibit 5-67 provides the associated costs. Burden and cost estimates for NTNCWSs follow the exhibits.

Note that the required notification to the customer of the original sample result above 15 µg/L that triggered the additional sampling is captured under the public education requirements in Section 5.3.6.1 using input *hrs_pe_above_al_prep_op*. EPA assumed CWSs will call customers and incur a burden of 0.25 hours per call as opposed to mailing. EPA also assumed NTNCWSs will use the same mechanism they currently use to inform their customers of sample results via posting and electronic notification but would provide this information within 3 calendar days. To avoid double counting, EPA did not assign any additional burden or costs to NTNCWSs for this 3 calendar day notification but included the burden and costs as part of the Lead Tap Sampling Costs using *hrs_NTNCWS_inform_samp_op* and *cost_NTNCWS_inform_lt.* See Section 5.3.2.1.2, activity l).

Exhibit 5-66: *Burden (hours) for CWSs to Contact Customers and Collect Tap Samples for Locations with a Lead Tap Sample > 15 µg/L (hrs_samp_above_al_op)*

System Size (Population Served)	Phone Call	Site Visit			Total
		Travel (Round-Trip)	Look for Lead Sources	Sample Collection	
	A	B	C	D	E=A:D
≤100,000	0.5	0.39	2	0.5	**3.4**
100,001-1,000,000	0.5	0.50	2	0.5	**3.5**
>1,000,000	0.5	0.67	2	0.5	**3.7**

Source: "Derivation of Probability of Sample_Above_15_Final Rule.xlsx."

Notes:

General: This requirement applies to all CWSs that have any sample > 15 µg/L.

A: Assumed systems would spend 0.5 hours to contact customer to coordinate site visit and to discuss possible causes of the high tap sample value.

B: Based on census data and zip codes from the 2006 Community Water System Survey, assumed the following one-way driving distances for CWSs: 4.9 miles for those serving ≤ 100,000 people, 6.3 miles for those serving

[100] Some systems conduct free lead testing at the request of the customer. EPA encourages, but does not require, systems to conduct find-and-fix activities if a customer requested tap sample results exceeds 15 µg/L.

100,001 – 1,000,000, and 8.4 miles for those serving > 1,000,000. See file, "Derivation of Estimated Driving Distances_Final Rule.xlsx," available in the docket under EPA-HQ-OW-2017-0300 at www.regulations.gov," for additional detail. EPA assumed an average speed of 25 miles per hour and two times distance for round-trip travel.
C: Assumed systems will spend 2 hours on average to look for lead sources in premise plumbing and service line.
D: Assumed same burden as used for systems to collect a lead and copper source water sample, see Section 5.3.2.4.2, activity z) for detail.

Exhibit 5-67: *Costs for CWSs to Contact Customers and Collect Tap Samples for Locations with a Lead Tap Sample > 15 µg/L (cost_samp_above_al)*

System Size (Population Served)	Phone Call	Site Visit			Total
		Travel (Round-Trip)	Look for Lead Sources	Sample Collection	
	A	B	C	D	E=A:D
≤100,000	$0.00	$5.29	$0.00	$0.00	**$5.29**
100,001-1,000,000	$0.00	$6.80	$0.00	$3.36	**$10.16**
>1,000,000	$0.00	$9.07	$0.00	$3.36	**$12.43**

Source: "Derivation of Probability of Sample_Above_15_Final Rule.xlsx."
Notes:
General: This requirement applies to all CWSs that have any sample > 15 µg/L.
A&C: Assumed to have no non-labor costs.
B: Based on census data and zip codes from the 2006 Community Water System Survey, assumed the following one-way driving distances for CWSs: 4.9 miles for those serving ≤ 100,000 people, 6.3 miles for those serving 100,001 – 1,000,000, and 8.4 miles for those serving > 1,000,000. See file, "Derivation of Estimated Driving Distances_Final Rule.xlsx," available in the docket under EPA-HQ-OW-2017-0300 at www.regulations.gov," for additional detail. Assumed cost of $0.54 per mile using the 2016 reimbursement rate from at https://www.gsa.gov/travel/plan-book/per-diem-rates.
D: Based on information from laboratories, only CWSs serving > 100,000 people are assumed to conduct in-house analyses for lead whereas those serving ≤ 100,000 people will use a commercial lab and bottles are supplied by the commercial lab. The average cost of a 1-liter wide mouth bottle assuming a bulk discount rate of 15 percent based on three sources is $3.36. See "Derivation of Lead Analytical Burden and Costs_Final Rule.xlsx", worksheet": In-House_Bottle_$" for additional information.

NTNCWSs will also be required to collect a follow-up sample but will incur a different burden and cost from CWSs because they do not serve homeowners and thus, are not required to conduct a separate site visit. EPA assumed NTNCWSs will incur a burden 0.5 hours per follow-up sample (*hrs_samp_above_al_op*), which is the same burden as that used to collect a lead and copper source water sample and is based on the *Disinfectants/Disinfection Byproducts, Chemical, and Radionuclides Rules ICR (Renewal)*, Exhibit 15 (USEPA, 2015b). In addition, NTNCWSs will incur no bottle costs to collect the sample because EPA assumed all NTNCWSs will use a commercial lab in which bottles are included as part of the laboratory fee. Thus, *cost_samp_above_15* is $0.

f) Analyze follow-up tap samples (hrs_analyze_samp_op, cost_lab_lt_samp, cost_commercial_lab). As previously presented in Section 5.3.2.1.2, activity j), EPA assumed CWSs serving more than 100,000 people will conduct lead analyses in-house and require 0.44 hours per sample based on estimates provided by three laboratories (*hrs_analyze_samp_op*). These systems will also incur consumable costs of $2.38 per sample based on information from three vendors (*cost_lab_lt_samp*).

The remaining CWSs and all NTNCWSs are assumed to use a commercial laboratory and incur a cost of $21.58 per lead sample based on quotes from six laboratories (*cost_commercial_lab*). See "Derivation of Lead Analytical Burden and Costs_Final Rule.xlsx," "worksheet Commercial Analytical_$" for additional information.

g) Collect distribution system WQP sample (hrs_wqp_find_fix_op, cost_wqp_material, cost_wqp_material_ph, cost_wqp_material_ortho). Systems must collect one distribution sample at or near the site where the high lead sample was collected within five days of learning of the lead results. Thus, EPA assumed the timing of this monitoring may not coincide with their Total Coliform Rule (TCR) samples and systems would incur a burden of 0.5 hours to collect the WQP sample (*hrs_wqp_find_fix_op*). EPA uses the same SafeWater LCR model data variables and input values for the burden and cost associated with WQP distribution system sample collection as described in Section 5.3.2.2.4 and Exhibit 5-25 (CWSs) and Exhibit 5-26 (NTNCWSs) for this activity.

If an existing WQP site does not meet these criteria, the system must identify a new monitoring site. Systems with CCT only must use it for future WQP distribution system sampling. In the final rule, EPA has capped the additional number of WQP sample sites that must be added in response to find-and-fix to twice the standard number of required WQP sample sites. For example, as discussed in Section 5.3.2.2.3, systems serving 10,001 to 50,000 people must conduct monitoring from 10 sites if they are on routine monitoring (*numb_enhance_wqp*). For find-and-fix distribution monitoring, no more than 10 additional sites would be added for systems on routine or reduced monitoring.[101]

NTNCWSs have limited distribution systems and EPA assumed these systems with CCT will not add new WQP sites. For CWSs, EPA estimated the likelihood a WQP site will need to be added (*pp_overlap_find_fix*) in Exhibit 5-68. This likelihood is used to determine the number of sites added to a CWS's WQP sample collection and analysis each year *(numb_wqp_sites_added)*.

Exhibit 5-68: Likelihood a CWS Will Add a WQP Sampling Site in Response to Find-and-Fix

System Size (Population Served)	Tap Samples sites (routine number)	WQP sites (routine number)	Percent of WQPs compared to Tap Sites	Likelihood a CWS will add a WQP site
				pp_overlap_find_fix
	A	B	C = B/A*100	D
≤100	5	1	20.0%	0.0%
101-500	10	1	10.0%	0.0%
501-1,000	20	2	10.0%	0.0%
1,001-3,300	20	2	10.0%	20.0%
3,301-10,000	40	3	7.5%	20.0%
10,001-100,000	60	10	16.7%	20.0%
>100,000	100	25	25.0%	10.0%

[101] Systems subject to lead or copper WQP monitoring as discussed in Sections 5.3.2.2 and 5.3.2.3, respectively, must collect two samples from the number of sites specified in the rule. As discussed in Section 5.3.2.2.3, *numb_enhance_wqp* represents the standard number of WQP tap samples that must be collected at each site for systems on routine monitoring. In the SafeWater LCR, ½ *numb_enhance_wqp* represents the maximum number of samples that could be added under the find-and-fix requirements for systems with CCT because only one sample would be required at each site. This applies to systems with CCT on routine or reduced WQP tap monitoring.

Source: "Derivation of Probability_Sample_Above_15_Final Rule.xlsx."
Notes:
A: See Exhibit 5-13.
B: See Exhibit 5-23.
D: EPA assumed for CWSs with CCT serving:

- ≤1,000 people, the distribution system is not extensive and the WQP sampling location would be at or near the sampling site with the lead result above 15 µg/L. Thus, these systems would have a zero likelihood of adding a new WQP site.
- > 1,000 people, EPA divided the minimum required number of WQP sites (Column B) by the number of tap sites (Column A). EPA assumed the higher the ratio, the more likely a system would be to have a WQP sampling site at or near a required tap sampling site with lead values greater than 15 ug/L and the lower the likelihood a system would add a new WQP sampling site. Specifically, EPA assumed those with a ratio of ≤ 20 percent (those serving 1,001 - 100,000 people) would have a 0.2 likelihood of adding a new WQP site. EPA assumed those with a ratio of > 20 percent would have a lower likelihood of 0.1 of adding a new WQP site (those serving > 100,000 people).

h) Analyze distribution system WQP sample. Systems must collect the same WQPs as discussed in Section 5.3.2.2.4 for lead WQP monitoring. Specifically, systems without CCT and those using pH adjustment must sample for pH and alkalinity, those using orthophosphate treatment must sample for pH, alkalinity, and orthophosphate. Thus, EPA used the same SafeWater LCR model data variables and input values for WQP sample analysis as described in Section 5.3.2.2.4 for lead WQP monitoring. See Exhibit 5-27 and Exhibit 5-28 for the analytical burden for CWSs and NTNCWSs to conduct in-house analyses, respectively (hrs_wqp_analyze_dist_op, hrs_wqp_analyze_ph_op, hrs_wqp_analyze_ortho_op). See Exhibit 5-29 and Exhibit 5-30 for the in-house analytical costs for CWSs and NTNCWSs, respectively (cost_wqp_analyze, cost_wqp_ph_analyze, cost_wqp_ortho_analyze). See Exhibit 5-31 and Exhibit 5-32 for the commercial costs per sample for CWSs and NTNCWSs, respectively (cost_lab_wqp, cost_lab_ph_wqp, cost_lab_ortho_wqp).

i) Review incidents of system-wide events and other system conditions (hrs_events_deter_find_fix_op). Under the LCRR, systems must determine if a CCT "fix" is needed following lead tap sample result(s) above 15 µg/L. For the purposes of this cost analysis, EPA assumed that systems will assess distribution system operations and determine if there could have been factors that contributed to deteriorating water quality and elevated lead levels. Exhibit 5-69 provides the estimated burden for CWSs and NTNCWSs to conduct this assessment. The estimates are based on comparable activities and burden estimates for CWSs and NTNCWSs to conduct level 1 assessments following non-acute TCR violations. Additional detail on the derivation of these burdens is provided in "Derivation of Probability_Sample_Above_15_Final Rule.xlsx," in worksheet, "Distribution_System_Assessment."

Exhibit 5-69: *PWS Burden to Conduct Distribution System Assessment*

System Size (Population Served)	CWS Burden to Conduct Assessment (hrs/system)	NTNCWS Burden to Conduct Assessment (hrs/system)
	hrs_events_deter_find_fix_op	
≤1,000	4	1
1,001-3,300	6	1
3,301-10,000	8	4
10,001-50,000	10	5

System Size (Population Served)	CWS Burden to Conduct Assessment (hrs/system)	NTNCWS Burden to Conduct Assessment (hrs/system)
	hrs_events_deter_find_fix_op	
50,001-100,000	13	6
>100,000	30	14

Source: *Technology and Cost Document for the Final Revised Total Coliform Rule* (USEPA, 2012a); *Economic Analysis for the Final Revised Total Coliform Rule* (USEPA, 2012b) (available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov). Derived in "Derivation of Probability_Sample_Above_15_Final Rule.xlsx," worksheet, "Distribution_System_Assessment."

j) ***Consult with Primacy Agency prior to making CCT changes (hrs_consult_find_fix_op).*** Systems with CCT that have at least one sample > 15 µg/L must consult with their Primacy Agency prior to making any CCT changes. EPA assumed a 2 hour consultation burden that is consistent with other types of consultations and is based on the estimated burden for systems to consult with their Primacy Agency on public education activities from pg. 60 of the Economic and Supporting Analyses: Short-Term Regulatory Changes to the Lead and Copper Rule (USEPA, 2007).

k) ***Report to Primacy Agency on find-and-fix activities (hrs_comp_report_find_fix_op).*** PWSs will incur burden to provide the results of tap and WQP monitoring results, and any distribution system management actions or CCT adjustments made to fix the cause of sample results above 15 µg/L to their Primacy Agency. EPA assumed the systems will require 2 hours and 4 hours to prepare the annual report for systems serving 50,000 or fewer and those serving more than 50,000 people, respectively. EPA assumed systems would not incur a separate cost for generating a physical report because systems would provide this information electronically to their Primacy Agency. Systems must also provide this information to the health departments. EPA assumed that systems would incorporate the find-and-fix results into a larger report that includes outreach information and school sampling results (CWSs only). The material cost of the report is captured under the cost to distribute the outreach, which corresponds to data input cost_hc. See Section 5.3.6.2, activity l).

Exhibit 5-70 provides the SafeWater LCR model cost estimation approach for system ancillary find-and-fix activities including additional cost inputs that are required to calculate the total costs.

Exhibit 5-70: PWS Ancillary Find-and-Fix Cost Estimation in SafeWater LCR by Activity[1,2]

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th – Range	Other Conditions	
e) *Contact customers and collect follow-up tap samples[3]*				
The number of required samples per system >15 µg/L multiplied by the total of the hours per sample times the system labor rate, plus the cost of materials per sample. *(pp_above_al_bin_three*numb_samp_customer)*((hrs_samp_above_al_op*rate_op)+cost_samp_above_al)*	Cost applies as written to NTNCWSs.	At or below TL	PWSs not on reduced tap sampling and not doing POU sampling 1 – *(p_tap_annual + p_tap_triennial + p_tap_nine)*	Twice a year
The number of required samples per system >15 µg/L multiplied by the total of the hours per sample times the system labor rate, plus the cost of materials per sample. *(pp_above_al_bin_three*numb_reduced_tap)*((hrs_samp_above_al_op*rate_op)+cost_samp_above_al)*			PWSs on annual reduced tap sampling and not doing POU sampling *p_tap_annual*	Once a year
			PWSs on triennial reduced tap sampling and not doing POU sampling *p_tap_triennial*	Every 3 years
The number of required samples per system >15 µg/L multiplied by the total of the hours per sample times the system labor rate, plus the cost of materials per sample. *(pp_above_al_bin_two*numb_samp_customer)*((hrs_samp_above_al_op*rate_op)+cost_samp_above_al)*	Cost applies as written to NTNCWSs.	At or below AL and above TL	All PWSs with at least one sample > 15 µg/L	Once a year
The number of required samples per system >15 µg/L multiplied by the total of the hours per sample times the system labor rate, plus the cost of materials per sample. *(pp_above_al_bin_one*numb_samp_customer)*((hrs_samp_above_al_op*rate_op)+cost_samp_above_al)*		Above AL	All PWSs with at least one sample > 15 µg/L	Twice a year

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th – Range	Other Conditions	
f) Analyze follow-up lead tap sample[3]				
The number of samples multiplied by the likelihoods for a sample analyzed in house and a sample analyzed in a commercial lab times the different labor and material cost burdens for each type of analysis. *(((pp_above_al_bin_three*numb_samp_customer)*pp_lab_samp)*((hrs_analyze_samp_op*rate_op)+cost_lab_lt_samp))+(((pp_above_al_bin_three*numb_samp_customer)*pp_commercial_samp)*cost_commercial_lab)*	Cost applies as written to NTNCWSs.	At or below TL	PWSs is not on reduced tap sampling and not doing POU sampling 1 – *(p_tap_annual + p_tap_triennial + p_tap_nine)*	Twice a year
The number of samples multiplied by the likelihoods for a sample analyzed in house and a sample analyzed in a commercial lab times the different labor and material cost burdens for each type of analysis. *(((pp_above_al_bin_three*numb_reduced_tap)*pp_lab_samp)*((hrs_analyze_samp_op*rate_op)+cost_lab_lt_samp))+(((pp_above_al_bin_three*numb_reduced_tap)*pp_commercial_samp)*cost_commercial_lab)*			PWSs on annual reduced tap sampling and not doing POU sampling *p_tap_annual*	Once a year
			PWSs on triennial reduced tap sampling and not doing POU sampling *p_tap_triennial*	Every 3 years
The number of samples multiplied by the likelihoods for a sample analyzed in house and a sample analyzed in a commercial lab times the different labor and material cost burdens for each type of analysis. *(((pp_above_al_bin_two*numb_samp_customer)*pp_lab_samp)*((hrs_analyze_samp_op*rate_op)+cost_lab_lt_samp))+(((pp_above_al_bin_two*numb_samp_customer)*pp_commercial_samp)*cost_commercial_lab)*	Cost applies as written to NTNCWSs.	At or below AL and above TL	All PWSs with at least one sample > 15 µg/L	Once a year

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th – Range	Other Conditions	
The number of samples multiplied by the likelihoods for a sample analyzed in house and a sample analyzed in a commercial lab times the different labor and material cost burdens for each type of analysis. *(((pp_above_al_bin_one*numb_samp_customer)*pp_lab_samp)*((hrs_analyze_samp_op*rate_op)+cost_lab_lt_samp))+(((pp_above_al_bin_one*numb_samp_customer)*pp_commercial_samp)*cost_commercial_lab)*	Cost applies as written to NTNCWSs.	Above AL	All PWSs with at least one sample > 15 µg/L	Twice a year
g) Collect distribution system WQP sample				
The number of required samples per system >15 µg/L multiplied by the total of hours per sample times the system labor rate, plus the material cost per sample. A system only needs to collect an additional WQP monitoring sample if there is not existing WQP monitoring done near the site of the >15 µg/L tap sample. *numb_wqp_sites_added *((hrs_wqp_find_fix_op*rate_op)+cost_wqp_material_ph)*	Cost does not apply to NTNCWSs.	All	PWSs with existing CCT of pH and not doing POU sampling *pbaseph*	Once per event
The number of required samples per system >15 µg/L multiplied by the total of hours per sample times the system labor rate, plus the material cost per sample. A system only needs to collect an additional WQP monitoring sample if there is not existing WQP monitoring done at or near the site of the >15 µg/L tap sample. *numb_wqp_sites_added*((hrs_wqp_find_fix_op*rate_op)+cost_wqp_material_ortho)*	Cost does not apply to NTNCWSs.	All	PWSs with existing CCT of PO_4 or both PO_4 and pH adjustment and not doing POU sampling *pbasepo4, pbasephpo4,*	Once per event

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th – Range	Other Conditions	
h) Analyze distribution system WQP sample				
The number of samples multiplied by the likelihoods for a sample analyzed in house and a sample analyzed in a commercial lab times the different labor and material cost burdens for each type of analysis. A system only needs to collect an additional WQP monitoring sample if there is not existing WQP monitoring done near the site of the >15 µg/L tap sample. *((numb_wqp_sites_added*pp_lab_samp)*((hrs_wqp_analyze_ph_op*rate_op)+cost_wqp_ph_analyze))+((numb_wqp_sites_added*pp_commercial_samp)*cost_lab_ph_wqp)*	Cost does not apply to NTNCWS	All	PWS with existing CCT of pH and not doing POU sampling *pbaseph*	Once per event
The number of samples multiplied by the likelihoods for a sample analyzed in house and a sample analyzed in a commercial lab times the different labor and material cost burdens for each type of analysis. A system only needs to collect an additional WQP monitoring sample if there is not existing WQP monitoring done near the site of the >15 µg/L tap sample. *((numb_wqp_sites_added*pp_lab_samp)*((hrs_wqp_analyze_ortho_op*rate_op)+cost_wqp_ortho_analyze))+((numb_wqp_sites_added*pp_commercial_samp)*cost_lab_ortho_wqp)*	Cost does not apply to NTNCWS	All	PWSs with existing CCT of PO_4 or both PO_4 and pH adjustment and not doing POU sampling *pbasepo4, pbasephpo4*	Once per event
i) Review incidents of system-wise event and other system conditions				
The labor hours for review per system multiplied by the system labor rate. *(hrs_events_deter_find_fix_op*rate_op)*	Cost applies as written to NTNCWSs.	All	All PWSs with at least one sample > 15 µg/L	Once per event
j) Consult with Primacy Agency prior to making CCT changes				
The labor hours per system multiplied by the system labor *(hrs_consult_find_fix_op*rate_op)*	Cost applies as written to NTNCWSs.	All	All PWSs where a second sampling period has at least one sample > 15 µg/L	Once per event

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th – Range	Other Conditions	
k) Report follow-up sample results and overall "find-and-fix" responses				
Hours for reporting multiplied by the system labor rate. *(hrs_comp_report_find_fix_op*rate_op)*	Cost applies as written to NTNCWSs.	All	All PWSs with at least one sample > 15 µg/L	Once per event

Acronyms: AL = action level; CCT = corrosion control treatment; CWS = community water system; NTNCWS = non-transient non-community water system; PO_4 = orthophosphate; POU = point-of-use; PWS = public water system; TL = trigger level; WQP = water quality parameter.

Notes:

[1] The data variables in the exhibit are defined previously in this section with the exception of:

- *pbaseph, pbasepo4, and pbasephpo4:* Likelihood system has pH adjustment, orthophosphate, or pH adjustment and orthophosphate for their CCT (Section 5.3.2.2.1).
- *pp_lab_samp* and *pp_commercial_samp*: Likelihood that system will use in-house laboratory or commercial laboratory, respectively (Section 5.3.2.1.2).
- *rate_op:* PWS hourly labor rate (Section 4.3.10.1).

[2] Systems on 9-year monitoring schedules cannot have any lead or copper in their entire distribution system including all buildings they serve and thus, none should have any samples above 15 µg/L and be subject to find-and-fix requirements.

[3] The burden and costs to provide sample bottles (*cost_samp_above_al*) under activity e) and conduct analyses under activity f) are incurred by the state in Arkansas, Louisiana, Mississippi, Missouri, and South Carolina.

5.3.3.4 *System Lead CCT Routine Costs*

EPA developed routine costs associated with CCT as shown in Exhibit 5-71. The exhibit provides the unit burden each activity. The assumptions used in the estimation of each activity follows the exhibit. The last column provides the corresponding SafeWater LCR model data variable in red/italic font.

Exhibit 5-71: PWS CCT Routine Unit Burden and Cost Estimates

Activity	Unit Burden and/or Cost	*SafeWater LCR Data Variable*
l) Review CCT guidance	• 1 hr/system with CCT serving > 50K/update[1]	*hrs_rev_cct_op*
m) Provide water quality data to Primacy Agency and discuss during sanitary survey	• 1.5 to 3 hrs/system with CCT per sanitary survey[2]	*hrs_sanit_surv_op*
n) Notify and consult with Primacy Agency if CCT actions are required in response to source water change	• 10 to 22 hrs/system on reduced tap monitoring • 6 to 12 hrs/system on routine tap monitoring	*hrs_coop_source_chng_red_op* *hrs_coop_source_chng_rout_op*
o) Notify and consult with Primacy Agency if CCT actions are required in response to treatment change	• 4 to 82 hrs/system on reduced tap monitoring • 3 to 42 hrs/system on routine tap monitoring	*hrs_coop_treat_chng_red_op* *hrs_coop_treat_chng_rout_op*

Acronyms: CCT = corrosion control treatment.
Sources:
[1]Frequency of CCT guidance updates is assumed to be every 5 years.
[2]Sanitary surveys are conducted at least every 5 years for NTNCWSs and every 3 years for CWSs except where ground water CWSs meet special performance criteria and are permitted to conduct sanitary surveys every 5 years *(p_spec_req)*.
l) & m): **"**Derivation of CCT Study and Review Costs_Final Rule.xlsx."
n): **"**Derivation of Probability_SourceChange_Final Rule.xlsx."
o): **"**Derivation of Probability_TreatmentChange_Final Rule.xlsx."

l) Review CCT guidance (hrs_rev_cct_op). EPA assumed that Primacy Agencies will review new guidance and determine applicability for systems serving 50,000 or fewer people.[102] However, EPA assumed that systems serving more than 50,000 people will review the new CCT guidance themselves to determine if CCT adjustment is needed and spend 1 hour on this review. EPA assumed a relatively small burden because the revised guidance is expected to include an executive summary that can be used by large systems to quickly assess if new information is applicable to their system. EPA also assumed that the burden for systems to discuss updated guidance with the Primacy Agency is already accounted for in the estimated burden to review CCT during the sanitary survey *(hrs_sanit_surv_op)*. See section m) below.

m) Provide water quality data to Primacy Agency and discuss during sanitary survey (hrs_sanit_surv_op). Systems will incur burden to gather and submit non-compliance data (e.g.,

[102] See data input *hrs_cct_review_js* in Section 5.4.4.4, activity g).

process control data, other WQP data) and meet with their Primacy Agency during the sanitary survey to determine if CCT is still optimized. EPA assumed that documents are submitted electronically or provided on-site. EPA assume 0.5 – 2 hours depending on system size for gathering and submitting data to the Primacy Agency, and 1 hour to discuss this information as well as any relevant updated CCT guidance during the sanitary survey, as shown in Exhibit 5-72.

Exhibit 5-72: Estimated PWS Burden to Gather Data and Review CCT-Related Data during Sanitary Survey to Determine if CCT Is Still Optimized

System Size (Population Served)	*SafeWater LCR Data Variable: hrs_sanit_surv_op*
≤1,000	1.5
1,001-10,000	2.0
10,001-100,000	2.5
>100,000	3.0

Source: "Derivation of CCT Study and Review Costs_Final Rule.xlsx.

In addition to the unit costs, the SafeWater LCR model requires the frequency of the sanitary survey as an input to calculate total costs for this activity. The required frequency of sanitary surveys is based on system size and water type as follows:

- The minimum frequency for all NTNCWSs is once every 5 years.
- The minimum frequency for surface water CWSs is once every 3 years.
- The minimum frequency for ground water CWSs is 3 years but can be extended to 5 years if systems provide 4-log treatment of viruses (using inactivation, removal, or a Primacy Agency-approved combination of these technologies) before or at the first customer or have an outstanding performance record (e.g., past sanitary surveys with no significant deficiencies).

To determine the percent of ground water systems that meet the criteria for a minimum frequency of 5 years (*p_spec_req*), EPA used Exhibit 5-73 from the *Economic Analysis for the Final Ground Water Rule* (USEPA, 2006a) that provides the estimated percentage of ground water systems meeting the 4-log removal criteria. These may be an underestimation because this approach does not capture systems with outstanding performance that would also qualify for a 5-year sanitary survey frequency.

Exhibit 5-73: Estimated Percent of Ground Water CWSs Achieving 4-log Virus Inactivation

System Size (Population Served)	Data from the *Economic Analysis for the Final Ground Water Rule* (USEPA, 2006a)			Estimated GW CWSs getting 4-Log In at all Entry Points	**Percent of GW CWSs getting 4-log** *(p_spec_req)*
	Total No. of GW CWSs	Total No. of Entry Points with 4-log Inactivation	Average No. of Entry points per system		
	A	B	C	D = B/C	**E = D/A**
≤100	12,843	3,996	1.3	3,074	**23.9%**

System Size (Population Served)	Data from the *Economic Analysis for the Final Ground Water Rule* (USEPA, 2006a)			Estimated GW CWSs getting 4-Log In at all Entry Points	**Percent of GW CWSs getting 4-log** *(p_spec_req)*
	Total No. of GW CWSs	Total No. of Entry Points with 4-log Inactivation	Average No. of Entry points per system		
	A	B	C	D = B/C	**E = D/A**
101-500	14,358	8,873	1.6	5,546	**38.6%**
501-1,000	4,649	3,547	2	1,774	**38.2%**
1,001-3,300	5,910	5,378	2.4	2,241	**37.9%**
3,301-10,000	2,884	3,547	3.2	1,108	**38.4%**
10,001-50,000	1,445	3,856	5.6	689	**47.7%**
50,001-100,000	168	583	11.3	52	**31.0%**
100,001-1,000,000	103	545	12.4	44	**42.7%**
> 1,000,000	3	34	11.4	3	**100.0%**
Total	42,363	30,359		14,531	34.3%

Acronyms: CWS = community water system; GW = ground water.
Source: "Derivation of CCT Study and Review Costs_Final Rule.xlsx."
Notes:
A: *Economic Analysis for the Final Ground Water Rule*, Exhibit 4.2, Columns F plus K (USEPA, 2006a).
B: *Economic Analysis for the Final Ground Water Rule*, Exhibit 4.3, Column H (USEPA, 2006a).
C: *Economic Analysis for the Final Ground Water Rule*, Exhibit 4.3, Column A (USEPA, 2006a).
D: Assumed that systems that provide 4-log inactivation do so at all entry points in their system, and these systems have the same number of entry points as other systems.

n) Notify and Consult with Primacy Agency on Required Actions in Response to Source Water Change (hrs_coop_source_chng_red_op, hrs_coop_source_chng_rout_op). Systems are required to seek prior approval before making any source water changes and to consult with the Primacy Agency on needed responses including the possibility of CCT installation. The likelihood of a system changing source (*p_source_chng*) is discussed in Section 4.3.8.1 with estimated percentages for CWSs and NTNCWSs presented in Exhibit 4-46 and Exhibit 4-47, respectively. Exhibit 5-74 below provides the estimated system burden to report the source change and consult with the Primacy Agency for systems on reduced and routine tap monitoring. Note that EPA estimated fewer hours for consultation for systems on routine monitoring because they are in more frequent contact with the Primacy Agency compared to those on reduced monitoring.

Exhibit 5-74: Estimated Hours per System to Report and Consult on Source Water Change

Hrs for systems on *reduced* monitoring to report a source change (*hrs_coop_source_chng_red_op*)			Hrs for systems on *routine* monitoring to report a source change (*hrs_coop_source_chng_rout_op*)		
A			B		
Minimum	**Maximum**	**Most Likely**	**Minimum**	**Maximum**	**Most Likely**
10	22	10	6	12	6

Source: "Derivation of Probability_SourceChange_Final Rule.xlsx."

Notes:

A: Applies to systems that are conducting reduced lead tap monitoring less frequently than every 6 months. The estimates are based on input received from North Carolina and Indiana in response to a 2016 ASDWA questionnaire regarding potential LCRR requirements. A copy of the questionnaire and each state's responses are available in the docket under EPA-HQ-OW-2017-0300 at www.regulations.gov. North Carolina estimated 2 hours to review a change in source from ground water to another ground water source and 3 hours for surface water source changes or surface water/ground water mixing. Indiana estimated 6 hours to review a change to a similar source and 20 hours to review a change to a dissimilar source. EPA used the average of the two state estimates of 2 and 6 hours (4 hours), doubled to 8 hours for systems, for the minimum and most likely value. EPA set the most likely equal to the minimum because fewer than 1 percent of systems made more significant sources changes during 2013 - 2016. For the maximum, EPA assumed the 20 hours were more reflective of the system burden to prepare needed documentation. To each estimate, EPA assumed an additional 2 hours for consultation with the Primacy Agency on needed action in response to the source change.

B: Applies to systems conducting routine lead tap monitoring every six months under the LCRR. Because these systems are in more frequent contact with the Primacy Agency, EPA assumed 50 percent of the burden estimated to prepare and submit the documentation for *hrs_coop_source_chng_red_op* or 50 percent of 8 hours for the minimum and most likely and 50 percent of 20 hours for the maximum plus an additional 2 hours for consultation. This equals a total burden of 6 hours for the minimum and most likely and 12 hours for the maximum.

o) Notify and Consult with Primacy Agency on Required Actions in Response to Treatment Change (hrs_coop_treat_chng_red_op, hrs_coop_treat_chng_rout_op). Systems are required to seek prior approval before making any long-term treatment changes and to consult with the Primacy Agency on needed responses including the possibility of CCT installation. The likelihood of a system changing treatment (*p_treat_chng*) is discussed in Section 4.3.8.3 with estimated percentages for CWSs and NTNCWSs presented in Exhibit 4-48 and Exhibit 4-49, respectively. Exhibit 5-75 below provides the estimated system burden for this review and consultation for systems on reduced and routine monitoring. Consistent with activity n) above, EPA estimates fewer hours for systems on routine monitoring as opposed to those on reduced monitoring because they are in contact with their Primacy Agency more frequently.

Exhibit 5-75: Estimated Hours per System to Report and Consult on Treatment Change

System Size (Population Served)	Hrs for systems on *reduced* monitoring to report a treatment change *(hrs_coop_treat_chng_red_op)*	Hrs for systems on routine monitoring to report a treatment change *(hrs_coop_treat_chng_rout_op)*
	A	B
<=100	4	3
101-500	8	5
501-1,000	12	7
1,001-3,300	22	12
3,301-50,000	42	22
>50,000	82	42

Source: "Derivation of Probability_TreatmentChange_Final Rule.xlsx."

Notes:

A: Applies to systems that are conducting reduced lead tap monitoring less frequently than every six months. The estimates are based on input received from North Carolina in response to a 2016 ASDWA questionnaire regarding potential LCRR requirements. A copy of the questionnaire and each state's responses are available in the docket under EPA-HQ-OW-2017-0300 at www.regulations.gov. North Carolina estimated 1-2 hours for small systems and 80 hours for systems serving more than 50,000 people to review a change in treatment. EPA assumed the same hours for systems to report on the change in treatment and assumed an incremental increase from 2 hours at the smallest system size up to 80 hours for systems serving more than 50,000 people. EPA assumed an additional 2 hours for consultation with the Primacy Agency to discuss required actions in response to the treatment change. Indiana also responded to the questionnaire and provided an estimated burden of 6 to 10 hours but did not provide detail on system size.

B: Applies to systems conducting routine lead tap monitoring every six months under the LCRR. Because these systems are in more frequent contact with the Primacy Agency, EPA assumed 50 percent of the burden estimated to prepare and submit documentation for *hrs_coop_treat_chng_red_op* and an additional 2 hours for consultation.

Exhibit 5-76 details how the data variables are used to estimate routine system activities related to CCT.

Exhibit 5-76: PWS Lead CCT Routine Cost Estimation in SafeWater LCR by Activity[1]

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
l) Review CCT guidance				
Hours per system multiplied by the system labor rate. *(hrs_rev_cct_op * rate_op)*	Cost applies as written to NTNCWSs.	All	Model PWSs with CCT serving >50,000 people	Once per Sanitary Survey[2]
m) Provide water quality data to Primacy Agency and discuss during sanitary survey[2]				
Hours per system multiplied by the system labor rate. *(hrs_sanit_surv_op * rate_op)*	Cost applies as written to NTNCWSs.	All	Model PWSs with CCT	Once per Sanitary Survey[2]

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
n) Notify and consult with Primacy Agency on response to a change in source water				
The total hours per system multiplied by the system labor rate. *(hrs_coop_source_chng_rout_op*rate_op)*	Cost applies as written to NTNCWSs.	At or below TL	Model PWS that is not on reduced tap sampling with a change in source water 1 - *(p_tap_annual + p_tap_triennial + p_tap_nine) * p_source_chng*	Once per event
		Above TL	Model PWSs with a change in source water *p_source_chng*	
The total hours per system multiplied by the system labor rate. *(hrs_coop_source_chng_red_op*rate_op)*		At or below TL	Model PWS that is on reduced tap sampling with a change in source water *(p_tap_annual + p_tap_triennial + p_tap_nine) * p_source_chng*	
o) Notify and consult with Primacy Agency on response to a change in water treatment				
The total hours per system multiplied by the system labor rate. *(hrs_coop_treat_chng_rout_op*rate_op)*	Cost applies as written to NTNCWSs.	At or below TL	Model PWS that is not on reduced tap sampling with a change in treatment 1 - *(p_tap_annual + p_tap_triennial + p_tap_nine) * p_treat_change*	Once per Event
		Above TL	Model PWSs with a change in treatment *p_treat_change*	
The total hours per system multiplied by the system labor rate. *(hrs_coop_treat_chng_red_op*rate_op)*		At or below TL	Model PWS that is on reduced tap sampling with a change in treatment *(p_tap_annual + p_tap_triennial + p_tap_nine) * p_treat_change*	

Acronyms: CCT = corrosion control treatment; CWS = community water system; NTNCWS = non-transient non-community water system; PWS = public water system; TL = trigger level.

Notes:

[1] The data variables in the exhibit are defined previously in this section with the exception of:

- *p_tap_annual*, *p_tap_triennial*, and *p_tap_nine*: Likelihood a system will qualify to collect the reduced number of lead tap samples at an annual, triennial, and nine-year frequency, respectively (Section 4.3.7.1).
- *p_source_chng*: Likelihood that a system will change sources in a given year (Section 4.3.8.1).

- *p_treat_chng:* Likelihood that a system will change treatment in a given year (Section 4.3.8.3).
- *rate_op:* PWS hourly labor rate (Section 4.3.10.1).

5.3.3.5 ***Estimate of PWS National Corrosion Control Treatment Costs***

Exhibit 5-77 and Exhibit 5-78 show the estimated national costs of CCT under the low and high cost scenarios, for the previous LCR, the LCRR, and the incremental cost, discounted at 3 and 7 percent, respectively. The CCT Operation and Maintenance (Existing) category in these exhibits are EPA's estimate of the ongoing cost of operating corrosion control at PWSs where CCT was in place at the beginning of the period of analysis. Also, note that incremental CCT cost are negative due to the LCRR compliance flexibilities for CWSs serving 10,000 or fewer people and all NTNCWSs. EPA predicts, based on the modeling assumption that systems will select the least costly compliance alternative, that some systems are selecting to conduct LSLR and POU in place of the more costly adjustment to CCT.

Exhibit 5-77: National Annualized Corrosion Control Technology Costs – All PWSs at 3 Percent Discount Rate (2016$)

	Low Cost Estimate			High Cost Estimate		
	Previous LCR	**Final LCRR**	**Incremental**	**Previous LCR**	**Final LCRR**	**Incremental**
CCT Operations and Maintenance (Existing)	$327,171,000	$327,171,000	$0	$327,490,000	$327,490,000	$0
CCT Related Sanitary Survey and Source or Treatment Change Notification Activities	$1,356,000	$1,735,000	$379,000	$1,355,000	$1,719,000	$363,000
CCT Installation	$13,424,000	$7,138,000	$-6,286,000	$41,261,000	$19,392,000	$-21,869,000
CCT Installation Ancillary Activities	$43,000	$122,000	$80,000	$119,000	$754,000	$635,000
CCT Re-Optimization (Due to ALE)	$2,479,000	$6,575,000	$4,096,000	$15,374,000	$33,425,000	$18,051,000
CCT Re-Optimization Ancillary Activities (Due to ALE)	$11,000	$1,449,000	$1,438,000	$81,000	$27,261,000	$27,180,000
CCT Re-Optimization (Due to TLE)	$0	$5,452,000	$5,452,000	$0	$20,724,000	$20,724,000
CCT Re-Optimization Ancillary Activities (Due to TLE)	$0	$98,000	$98,000	$0	$444,000	$444,000
Find-and-Fix Installation	$0	$8,271,000	$8,271,000	$0	$31,688,000	$31,688,000
Find-and-Fix Ancillary Activities	$0	$5,884,000	$5,884,000	$0	$8,190,000	$8,190,000
Total Annual Corrosion Control Technology Costs	$344,483,000	$363,894,000	$19,412,000	$385,681,000	$471,087,000	$85,407,000

Note: Detail may not add exactly to total due to independent rounding.

Exhibit 5-78: National Annualized Corrosion Control Technology Costs – All PWSs at 7 Percent Discount Rate (2016$)

	Low Cost Estimate			High Cost Estimate		
	Previous LCR	**Final LCRR**	**Incremental**	**Previous LCR**	**Final LCRR**	**Incremental**
CCT Operations and Maintenance (Existing)	$306,521,000	$306,521,000	$0	$306,822,000	$306,822,000	$0
CCT Related Sanitary Survey and Source or Treatment Change Notification Activities	$1,293,000	$1,662,000	$368,000	$1,293,000	$1,641,000	$348,000
CCT Installation	$12,499,000	$6,623,000	$-5,876,000	$40,703,000	$18,919,000	$-21,783,000
CCT Installation Ancillary Activities	$57,000	$168,000	$111,000	$160,000	$1,034,000	$875,000
CCT Re-Optimization (Due to ALE)	$2,299,000	$5,664,000	$3,365,000	$15,724,000	$33,041,000	$17,317,000
CCT Re-Optimization Ancillary Activities (Due to ALE)	$15,000	$1,913,000	$1,898,000	$107,000	$35,996,000	$35,888,000
CCT Re-Optimization (Due to TLE)	$0	$4,784,000	$4,784,000	$0	$20,888,000	$20,888,000
CCT Re-Optimization Ancillary Activities (Due to TLE)	$0	$140,000	$140,000	$0	$633,000	$633,000
Find-and-Fix Installation	$0	$6,986,000	$6,986,000	$0	$29,911,000	$29,911,000
Find-and-Fix Ancillary Activities	$0	$5,848,000	$5,848,000	$0	$8,668,000	$8,668,000
Total Annual Corrosion Control Technology Costs	$322,684,000	$340,307,000	$17,623,000	$364,809,000	$457,554,000	$92,745,000

Note: Detail may not add exactly to total due to independent rounding.

5.3.4 PWS Lead Service Line Inventory and Replacement Costs

The LCRR requires all systems to develop a service line inventory and, for those systems with LSLs, to develop a replacement plan and undertake certain outreach activities to educate consumers about lead and LSLR opportunities. Physical replacement of LSLs is required based on the systems' lead 90th percentile range as follows:

- Goal-Based program: CWSs serving more than 10,000 people that have a TLE must implement a goal-based LSLR program in which they replace LSLs at a rate approved by the Primacy Agency. Systems must continue replacing LSLs until they no longer exceed the TL for two consecutive annual periods of tap sampling.

- Mandatory program: CWSs serving more than 10,000 that have a lead ALE must fully replace LSLs on a rolling 2 year average of 3% per year using a baseline number of LSLs equal to the number of LSLs and galvanized requiring replacement service lines at the time the system first exceeds the lead trigger or action level plus the number of unknowns at the beginning of each year of the system's LSLR program. The mandatory program also requires that a cumulative number of replacements be reached equal to 3% of the sum of known lead, galvanized requiring replacement, and lead status unknown service lines in the initial inventory, times the number of years that elapsed between the system's first ALE and the date on which the system's 90th percentile lead levels are at or below the action level for two years (four consecutive 6-month monitoring periods). CWSs serving 10,000 or fewer people and NTNCWSs with LSLR as their approved compliance option must replace LSLs at a schedule set by the Primacy Agency not to exceed 15 years and must replace all LSLs regardless of their subsequent lead 90th percentile value. As noted previously, the LCRR provides small system flexibility by allowing CWSs serving 10,000 or fewer people and NTNCWSs to choose among four compliance options if they exceed the AL: 1) Replace all LSLs, 2) install POU treatment, 3) install/re-optimize CCT, or 4) replace all lead-bearing plumbing material. For modeling purposes, EPA assigns a compliance cost to all systems that exceed the ALE in the SafeWater LCR model. EPA uses a cost minimization assumption in the model, and assigns the least cost alternative between the LSLR, CCT, and POU compliance alternatives. EPA lacks the system characteristic data that would allow the Agency to determine a small system's cost for replacement of lead-bearing plumbing materials because of the significant variability among systems and the plumbing materials in the buildings they serve. EPA assumed a system would only select the replacement of lead-bearing plumbing materials compliance option if it cost less than the three other alternative compliance options. By selecting the least cost of the three other options EPA has accounted for the costs that small water systems would incur but may be overestimating the costs for those systems that find the cost of lead-bearing plumbing replacement to be less than the other three options.

- Customer-initiated program: All PWSs are required to replace the system-owned portion of an LSL if they become aware that a customer has replace their portion of the line. In the cost model, PWSs not performing goal-based or mandatory LSLR[103] must still replace their portion of an LSL if a customer notifies them or, through the normal course of business, the system

[103] Specifically, all systems at or below the TL and CWSs serving 3,300 or fewer people and NTNCWSs with 90th percentile lead levels above the AL that *did not* select LSLR as their compliance option.

becomes aware that he/she is replacing his/her side. EPA estimated the likelihood of these replacements to be 0.05 percent of LSLs per year (*p_cust_init_lslr)* based on a 2020 report titled *Lead Pipes and Environmental Justice: A Study of Lead Pipe Replacement in Washington, DC* (Environmental Defense Fund and American University School of Public Affairs, 2020). The report includes a graph (Figure 7) showing the number of customer-initiated LSLRs each year from 2009 to 2018. The rate was approximately 25 LSLs per year (out of approximately 48,000 LSLs in DC Water's system[104]) from 2009 through 2013. The rate jumped in 2014 to nearly 200 replacements per year, likely because of a new incentive for home renovators to participate in the program before applying for a permit. The number jumped again in 2017 to more than 300 replacements after the highly publicized elevated lead issues in Flint, Michigan and DC Water launched a new online interactive online map which made it easier for customers to see which properties had LSLs. EPA used the customer-initiated replacement rate from 2009 to 2013 (25 / 48,000 = 0.05 percent) to represent a typical system, although EPA recognizes that this value may be high for some systems because of the highly publicized case of elevated lead in Washington, D.C.'s water in 2004.

Under all programs, an LSL is counted toward a system's replacement rate if the entire LSL is replaced. This includes replacement of both the system-and customer- side of the LSL or removing the remaining portion of the LSL (assumed to be the customer's portion).

Costs for system LSLR-related activities are grouped into four subsections:

- 5.3.4.1: Lead Service Line Inventory-Related Activities
- 5.3.4.3: Lead Service Line Replacements
- 5.3.4.4: Ancillary Lead Service Line Replacement Activities
- 5.3.4.5: Failure to Meet Goal-based Replacement Rate Activities.

National annualized LSLR-related costs are presented at 3 percent and 7 percent discount rates in Section 5.3.4.6.

A key input for LSLR-related costs is the ***baseline LSL inventory***. For CWSs, EPA used results from two surveys to develop low and high estimates of 1) the percent of systems with LSLs (*p_lsl*) as shown in Exhibit 4-11 and Exhibit 4-14, and 2) the percent of service connections in LSL systems that are made of lead (*perc_lsl)* as shown in Exhibit 4-10 and Exhibit 4-13. See Section 4.3.4.1 for detailed assumptions and methodology. Note that where available, EPA used system-specific information on number of LSLs for PWSs serving greater than 1 million people.[105] For NTNCWSs, EPA assumed that 2.5 percent have LSLs based on results from a 2017 EPA questionnaire. Exhibit 4-17 shows EPA's estimate of the percent of service connections in NTNCWSs that are lead. See Section 4.3.4.2 for additional detail.

[104] The 48,000 LSL estimate is from a September 26, 2018 memorandum from Jeffrey S. DeWitt, Government of the District of Columbia Chief Financial Officer to the Phil Mendelson, Chairman of the Council of the District of Columbia. http://lims.dccouncil.us/Download/38916/B22-0507-Fiscal-Impact-Statement1.pdf.
[105] See "VLSSystemData.xlsx" (available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov).

5.3.4.1 *Lead Service Line Inventory-Related Activities*

EPA has developed system costs for activities associated with the LSL inventory as shown in Exhibit 5-79. The exhibit provides the unit burden and/or cost for each activity. The assumptions used in the estimation of the unit burden and cost following the exhibit. The last column provides the corresponding SafeWater LCR model data variable in red/italic font.

Exhibit 5-79: PWS LSL Inventory-Related Unit Burden and Cost Estimates

Activity	Unit Burden and/or Cost	*SafeWater LCR Data Variable*
a) Create initial LSL inventory and submit to Primacy Agency (one-time)	20 to 400 hrs/CWS; 7 to 28 hrs/NTNCWS	*hrs_inventory_op*
b) Submit documentation of no LSLs to Primacy Agency (one-time)	10 to 40 hrs/CWS; 5 to 20 hrs/NTNCWS	*hrs_nolsl_op*
c) Develop general LSL outreach materials and submit to Primacy Agency for review (one-time)	3.5 hrs/PWS serving ≤ 50,000 people 20 hrs/PWS serving > 50,000 people	*hrs_pe_lsl_gen_develop_op*
d) Distribute general LSL outreach materials	CWSs 0.0026 to 0.4553 hrs/household; $0.23 to $0.33/household NTNCWSs 1 hr/system $0.025/system	CWSs *hrs_pe_lsl_gen_dist_op* *cost_pe_lsl_gen* NTNCWSs *hrs_ntncws_pe_lsl_gen_dist_op* *cost_ntncws_pe_lsl_gen*
e) Submit annual or triennial LSL inventory update to Primacy Agency	1 hour	*hrs_report_inv_op*

Acronyms: CWS = community water system; LSL = lead service lines; NTNCWS = non-transient non-community water system.
Sources: Data sources for each activity are provided following this exhibit.

a) Create initial LSL Inventory and submit to Primacy Agency (hrs_inventory_op). As discussed in Chapter 3, Section 3.5.1.2, all systems must complete an inventory of their service lines within the first three years after final rule promulgation. Systems will incur one-time burden to develop their initial LSL inventory that meets the requirements of the LCRR). EPA used information from two states and one system to inform the estimate, as presented in Exhibit 5-80.

Exhibit 5-80: One-Time Burden to Create LSL Inventory (hrs/system)

System size (Population Served)	CWSs	NTNCWSs
	hrs_inventory_op	
	A	B
≤1,000	20	7
1,001-3,300	40	7
3,301-10,000	80	12
10,001-50,000	100	12
50,001-100,000	200	28
100,001-1,000,000	300	28
>1,000,000	400	

Source: "Derivation of LSLR Ancillary Costs_Final Rule.xlsx."
Notes:
A: For CWSs, EPA used the LSL inventory burden estimates provided by Indiana, Ohio, and Green Bay Water Utility to calculate the relationship of inventory burden per population served. EPA used these hours to inform the estimated burden, assuming increasing hours with increasing system size.
B: For NTNCWSs, EPA assumed systems should have the necessary documentation onsite to determine if a service line is lead or not because NTNCWSs own their own service lines. EPA assumed systems would incur the same burden to demonstrate the presence or absence of LSLs (see activity b) below) but those with LSLs would incur additional burden to develop a tracking system. Note that no NTNCWS serves more than 1 million people.

EPA also estimated the likelihood that systems with LSLs have already prepared their initial inventory and submitted it to their Primacy Agency (*p_inventory*) and would incur no burden for this activity under the LCRR. To estimate the likelihood that systems with LSLs have already prepared and submitted their inventory (*p_inventory*), EPA conducted the following steps separately for CWSs and NTNCWSs:

- Step 1: Estimated the percent and number of systems with LSLs using information from Section 4.3.4.1 for CWSs and Section 4.3.4.2 for NTNCWS. For CWSs, used an average of the low and high estimates.
- Step 2: Reviewed state programs to determine how many states already require systems to submit LSL inventory information that meets the requirements of the final rule. As of 2019, Illinois, Michigan, and Wisconsin required systems to complete LSL inventories that include the identification of galvanized service lines. In addition, Washington, D.C. has been active for a number of years in identifying its LSL inventory. Thus, EPA also assumed Washington, D.C. would complete its inventory in advance of the rule.
- Step 3: Estimated the number of systems with LSLs in these states that completed their inventory by multiplying the number of systems in each state and Washington, D.C. based on SDWIS/Fed 2016 data by the estimated percent of systems with LSLs as presented in Section 4.3.4.

- Step 4: For the remaining systems with LSLs in other states, assume that 5 percent voluntarily submitted information to their Primacy Agency that meets the LCRR requirements.[106]
- Step 5: Added the number of systems in Steps 3 and 4 to determine the total number of systems with LSLs that completed their inventory that would meet the LCRR inventory requirements.
- Step 6: Divided the number of systems in Step 5 by the total number of systems with LSLs to produce a likelihood that systems with LSLs would submit their inventory in advance of the rule (*p_inventory*) and not incur burden to develop an inventory under the LCRR.

See Exhibit 5-81 for results of this analysis.

Exhibit 5-81: Estimated Likelihood that Systems with LSLs Completed Their Inventory In Advance of the Rule *(p_inventory)*

System Size (Population Served)	CWSs	NTNCWSs
	A	B
≤100	11.3%	5.0%
101-500	11.8%	5.0%
501-1,000	14.9%	5.1%
1,001-3,300	14.5%	5.0%
3,301-10,000	14.2%	5.0%
10,001-50,000	15.6%	5.0%
50,001-100,000	13.8%	5.0%
100,001-1,000,000	9.9%	5.0%
>1,000,000	9.5%	

Source: "Derivation of LSLR Ancillary Costs_Final Rule.xlsx."
Notes:
A,B: Based on review of states with LSL inventory requirements and assumption that 5 percent of LSL systems in other states without requirements will have completed their inventories in advance of the LCRR.

b) Submit Documentation of No LSLs to Primacy Agency (hrs_nolsl_op). PWSs without LSLs will incur burden to develop and submit documentation to the Primacy Agency that none of their service lines are lead. CWSs without LSLs will incur additional burden to submit a request to omit LSL-specific information in their consumer confidence report (CCR) (note that the burden to update the CCR language itself is included with public education costs in Section 5.3.6.2, activity c)). The estimated burdens for CWSs and NTNCWSs are provided in Exhibit 5-82.

[106] EPA assumed some systems would take voluntary action in response to a February 29, 2016 letter from Joel Beauvais, Deputy Assistant Administrator of Water to State Environmental and Public Health Commissioners encouraging them to work with their water systems to make the materials evaluation completed under the original LCR (including the location of LSLs and any updated inventory information) publicly available (USEPA, 2016a).

Exhibit 5-82: One-Time Burden to Submit Documentation of No LSLs and Request to Omit LSL-Specific Information in the CCR (hrs/system)

System size (Population Served)	CWSs	NTNCWSs
	hrs_nolsl_op	
	A	B
≤3,300	10	5
3,301-50,000	20	10
>50,000	40	20

Source: "Derivation of LSLR Ancillary Costs_Final Rule.xlsx."
Notes:
A,B: EPA assumed systems that have no LSLs already have documentation but will require time to gather the information and prepare a package for their Primacy Agency. Larger systems will require more documentation and thus have a higher corresponding burden. NTNCWSs will spend less time providing supporting documentation because they own the entirety of their service line and should have available records on-site, as well as have fewer service lines than CWSs.

EPA assumed that some systems without LSLs completed their inventory and submitted documentation to their Primacy Agency in advance of the rule and will not incur any burden for this activity under the LCRR. To estimate the likelihood that systems without LSLs have already prepared and submitted their inventory (*p_inventory*) for the subset of systems without LSLs, EPA followed a similar approach as described in activity (a) as follows:

- Step 1: Estimated the percent and number of systems without LSLs using information from Sections 4.3.4.1 for CWSs and Section 4.3.4.2 for NTNCWSs. For CWSs used an average of the low and high estimates.
- Step 2: Multiplied the number of systems in Illinois, Michigan, and Wisconsin and the District of Columbia by the percentages of systems without LSLs in Step 1.
- Step 3: Estimated the number of systems in states/territories with no LSLs (American Samoa, Guam, Hawaii, and Nevada) using SDWIS/Fed 2016 data.
- Step 4: Added the results of Steps 2 and 3 to estimate the total number of systems without LSLs that would have either met the inventory requirements or are located in states/territories without LSLs. For the remaining systems without LSLs, assume that 5 percent voluntarily submitted information to their Primacy Agency that meets the LCRR requirements.
- Step 5: Divided the number of systems without LSLs from Step 4 by the total number of systems without LSLs to produce a likelihood that systems without LSLs would submit their inventory in advance of the rule (*p_inventory*) and not incur burden to develop an inventory under the LCRR. See Exhibit 5-83 for results of this analysis.

Exhibit 5-83: Estimated Likelihood that Systems without LSLs Completed Their Inventory In Advance of the Rule *(p_inventory)*

System size (Population Served)	CWSs	NTNCWSs
	A	B
≤100	12.1%	5.6%
101-500	12.5%	5.9%
501-1,000	15.8%	5.7%
1,001-3,300	15.3%	6.8%
3,301-10,000	15.5%	13.6%
10,001-50,000	16.6%	5.0%
50,001-100,000	15.5%	5.0%
100,001-1,000,000	13.0%	5.0%
>1,000,000	20.9%	

Acronyms: CWS = community water system; NTNCWS = non-transient non-community water system.
Source: "Derivation of LSLR Ancillary Costs_Final Rule.xlsx."
Notes:
A,B: Based on analysis of CWSs and NTNCWSs in states that already require systems to submit an LSL inventory and states and territories that have no LSLs. Assumed 5 percent of remaining systems without LSLs voluntarily submitted inventory information that met the requirements of the LCRR.
B: No NTNCWS serves more than 1 million people.

c) ***Develop general LSL outreach materials and submit to Primacy Agency for review (hrs_pe_lsl_gen_develop_op).*** Systems with LSLs must provide notification to customers with LSLs, galvanized requiring replacement, or that are served by lines of unknown material, with information on the health effects and sources of lead in drinking water (including LSLs), how to have water tested for lead, actions customers can take to reduce exposure to lead, and information about the opportunities for LSLR. Systems will incur a one-time burden to develop these materials and submit them to the Primacy Agency. EPA assumed systems serving 50,000 or fewer people will require 3.5 hours to prepare and submit these materials and those serving more than 50,000 people will require 20 hours. Burden estimates for systems serving 50,000 or fewer people are based on tier 2 PN preparation burden (3.5 hours), and burden estimates for systems serving more than 50,000 people are based on tier 1 PN preparation burden for systems serving more than 10,000 people (30 hours) from the *Public Water System Supervision Program Information Collection Request (ICR) (Renewal)* (USEPA, 2015a). EPA assumed that all PWSs use an EPA-developed template. Those serving 50,000 or fewer people would not modify the content. However, systems serving more than 50,000 people would adapt the template for their use but would require 20 hours as opposed to the 30-hour estimate for Tier 1 PN.

d) ***Distribute general LSL outreach materials (hrs_pe_lsl_gen_dist_op, cost_pe_lsl_gen, hrs_ntncws_pe_lsl_gen_dist_op, cost_ntncws_pe_lsl_gen).*** Systems with LSLs are required to distribute the general LSL outreach materials annually to customers served by an LSL or service line of unknown material. Exhibit 5-84 and Exhibit 5-85 provide the estimated burden and costs, respectively, for this activity per household for CWSs. A discussion of the burden and costs for NTNCWSs follow these exhibits.

Exhibit 5-84: Annual Burden (per household) to Distribute General LSL Notification

System Size (Population Served)	Separate mailing (hrs per CWS)	Bill Stuffer (hrs per CWS)	Average per CWS	Number of HH per system *(numb_hh)*	Separate/ Bill Stuffer (hrs per HH)	Production (hrs per HH)	Total (hrs per HH) *(hrs_pe_lsl_gen_dist_op)*
	A	B	C = (A+B)/2	D	E = C/D	F	G =E+F
≤100	15	6	10.5	23	0.4528	0.0025	**0.4553**
101-500	15	6	10.5	98	0.1072	0.0025	**0.1097**
501-1,000	25	10	17.5	285	0.0613	0.0025	**0.0638**
1,001-3,300	25	10	17.5	736	0.0238	0.0025	**0.0263**
3,301-10,000	120	30	75	2,257	0.0332	0.0025	**0.0357**
10,001-50,000	120	30	75	8,446	0.0089	0.0025	**0.0114**
50,001-100,000	120	30	75	26,770	0.0028	0.0025	**0.0053**
100,001-1,000,000	120	30	75	93,467	0.0008	0.0025	**0.0033**
>1,000,000	120	30	75	772,999	0.0001	0.0025	**0.0026**

Acronyms: CWS = community water system; HH = household.
Source: "Derivation of Public Education Inputs_CWS_Final Rule.xlsx."
Notes:
A: EPA assumption regarding the burden per system to conduct separate mailings.
B: EPA assumption regarding the burden per system to mail materials with the water bill.
C: EPA assumed that half of systems will conduct separate mailings and the other half will include targeted outreach materials with the water bill.
D: See Exhibit 5-123. Estimated as 2.59 people per household (*numb_hh*) for the year 2010 (United States Census Bureau, 2010). Table AVG1. Average Number of People Per Household, By Race and Hispanic Origin, Marital Status, Age, And Education Of Householder. Available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov.
F: EPA assumed 0.25 hours per 100 brochures for production. Estimate is based on assumptions for production labor used in the *Economic and Supporting Analyses: Short-Term Regulatory Changes to the Lead and Copper Rule* (Exhibit 17) (USEPA, 2007).

Exhibit 5-85: Annual Cost (per household) to Distribute General LSL Notification

System Size (Population Served)	Cost per HH If In Water Bill	Cost per HH If Mailed Separately	Average ($/HH) *(cost_pe_lsl_gen)*
	A	B	C = (A + B)/2
≤ 500	$0.05	$0.61	$0.33
> 500	$0.05	$0.42	$0.23

Source: "Derivation of Public Education Inputs_CWS_Final Rule.xlsx."
Notes:
A: Estimate includes cost for cover letter (paper cost of $0.025) and brochure (paper cost of $0.025). See "General Cost Model Inputs_Final Rule.xlsx" for additional information about costs for paper EPA assumed that the weight of the cover letter and brochure would not result in additional postage being needed to mail the water bill.
B: Estimate includes cost for cover letter (paper cost of $0.025), brochure (paper cost of $0.025), envelope ($0.067), and postage ($0.49). EPA assumed that systems serving > 500 people will use the bulk rate for postage ($0.301). See "General Cost Model Inputs_Final Rule.xlsx" for additional information about costs for paper, envelopes, and postage.
C: EPA assumed that 50 percent of systems will mail published materials separately and 50 percent will include materials with the water bill.

NTNCWSs are assumed to provide information on the LSLR program via e-mail and public posting. EPA assumed a burden of 0.5 hour to develop/send e-mail for all system size categories and an additional 0.5 hours to post the notification publicly for a total of 1 hour *(hrs_ntncws_pe_lsl_gen_dist_op)*. EPA also assumed that NTNCWSs will provide electronic notification and post a notification publicly when LSLR is taking place. Material costs are for paper only of $0.025 *(cost_ntncws_pe_lsl_gen)*. See file, "General Cost Model Inputs_Final Rule.xlsx" for more detail.

In addition to the unit burden and cost estimates, EPA estimated the number of households to which outreach materials are distributed (those served by LSLs or those with unknown material) to calculate the total costs for this activity. The baseline percent of service lines that are lead (*perc_lsl*) for the low and high cost estimates for CWSs are shown in Exhibit 4-10, Exhibit 4-13, and Section 4.3.4.1. The SafeWater LCR model tracks changes in the number of LSLs per system (and the number of households served by LSLs) over the 35-year rule period of analysis period with the data variable *hh_remain_lsl*. To account for the service lines of unknown material, EPA increases the baseline LSL count for each system by 28 percent[107] using the data variable (*pp_lslr_paper*). Note that inventory does not include service lines that are galvanized requiring replacement and the model does not capture outreach to households served by these service lines that will result in an underestimation of cost.

e) Submit annual or triennial LSL inventory update to Primacy Agency (hrs_report_inv_op). Systems with LSLs must report updated inventory information within 30 days of the end of each tap sampling monitoring period or annually for those on semi-annual monitoring. EPA assumed systems will require 1 hour to report this update electronically to the Primacy Agency. EPA assumed a relatively small burden because the time to maintain and update the LSL inventory information is accounted for under the LCRR requirement that system make their LSL information publicly available (*hrs_access_lsl_op* and *hrs_maint_lsl_op*; see Section 5.3.6.2, activities f) and g)). Also, those systems subject to the goal-based or mandatory LSLR programs must provide a separate detailed annual report to their Primacy Agency (*hrs_report_lcr_op;* see activity r) in Section 5.3.4.4 below).

Exhibit 5-86 provides the SafeWater LCR model costing approach for these activities including additional cost inputs that are required to calculate the total costs.

[107] EPA assumed that 28 percent of LSLs above the estimated LSL inventory will be found in the field not to be lead (i.e., require only a "paper" replacement in the system's inventory). This percentage is based on the average number of unknown and unknown not likely lead divided by the number of service connections for Illinois, Indiana, and Michigan. See Section 5.3.4.4, activity **Error! Reference source not found.** for additional discussion of this data variable and "Derivation of LSLR Ancillary Costs_Final Rule.xlsx" for additional detail.

Exhibit 5-86: Lead Service Line Inventory Cost Estimation in SafeWater LCR by Activity[1]

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
a) Create initial LSL inventory and submit to Primacy Agency				
The total system hours multiplied by the system labor rate. *(hrs_inventory_op*rate_op)*	Cost applies as written to NTNCWSs.	All	Model PWS with LSLs *p_lsl* *1-p_inventory*	One time
b) Submit documentation of no LSLs to Primacy Agency				
Likelihood that system has not developed an inventory in advance of the rule times hours per system multiplied by the system labor rate. *(hrs_nolsl_op*rate_op)*	Cost applies as written to NTNCWSs.	All	Model PWSs without LSLs *1-p_lsl* *1-p_inventory*	One time
c) Develop general LSL outreach materials and submit to Primacy Agency for review				
The total hours per system multiplied by the system labor rate. *(hrs_pe_lsl_gen_develop_op*rate_op)*	Cost applies as written to NTNCWSs.	All	Model PWS with LSLs *p_lsl*	One time
d) Distribute general LSL outreach materials				
The number of remaining households with LSLs or an unknown line (calculated using the ratio of a possible "paper" replacement to known LSL) multiplied by the hours per household and the system labor rate, plus the material cost per household. *(hh_remain_lsl+num_paper_remain)*((hrs_pe_lsl_gen_dist_op*rate_op)+cost_pe_lsl_gen)*	The total hours per system multiplied by the system labor rate, plus the material cost per system. *(hrs_ntncws_pe_lsl_gen_dist_op*rate_op)+cost_ntncws_pe_lsl_gen*	All	Model PWS with LSLs *p_lsl*	Once a year
e) Submit annual or triennial LSL inventory update to Primacy Agency				
The total hours for reporting per system multiplied by the system labor rate. *(hrs_report_inv_op*rate_op)*	Cost applies as written to NTNCWSs.	All	Model PWS with LSLs *p_lsl*	Per monitoring period or not less frequently than once per year

Acronyms: CWS = community water system; LSL = lead service line; NTNCWS = non-transient non-community water system; PWS = public water system.

Notes:

[1] The data variables in the exhibit are defined previously in this section with the exception of:

- *p_lsl:* Probability of having LSLs (Section 4.3.4).
- *rate_op:* PWS hourly labor rate (Section 4.3.10.1).

5.3.4.2 *LSLR Plan*

This section summarizes EPA's cost estimate for the LSLR plan that must be completed by all systems with LSLs at the start of the rule. Exhibit 5-87 provides the unit burden and/or cost for the activity. The assumptions used in the estimation of the unit burden and cost following the exhibit. The last column provides the corresponding SafeWater LCR model data variable in red/italic font.

Exhibit 5-87: PWS LSLR Plan Unit Burden and Cost Estimates

Activity	Unit Burden and/or Cost	*SafeWater LCR Data Variable*
f) Develop LSLR plan and submit to Primacy Agency for review (one-time)	12 to 52 hrs/CWS; 12 hrs/NTNCWS	*hrs_lslr_plan_op*

Acronyms: CWS = community water system; LSLR = lead service line replacement; NTNCWS = non-transient non-community water system.
Sources: Data sources for each activity are provided following this exhibit.

f) Develop LSLR Plan and submit to Primacy Agency for review (hrs_lslr_plan_op). All systems with LSLs must develop a plan for their LSLR program that includes the following elements:

- A strategy for determining the composition of lead status unknown service lines in its inventory.
- A strategy for informing customers before a full or partial LSLR.
- Procedures for coordinating the full LSLR.
- A funding strategy for conducting LSLR that includes ways to accommodate customers that are unable to pay to replace the portion they own.
- A procedure for customers to flush service lines and premise plumbing of particulate lead post-replacement.

For CWSs serving more than 10,000 people, the plan also includes a recommended goal should the system be triggered into the goal-based program if they have a TLE. The estimated burden is provided in Exhibit 5-88. EPA assumed systems would require twice the burden to prepare the plan as for the Primacy Agency to review it. The Primacy Agency burden (*hrs_lslr_plan_js*) is based on the ASDWA CoSTS model that assumes 6 hrs for states to review the plan for small CWSs and NTNCWSs, 10 for medium CWSs, and 18 for large CWSs (ASDWA, 2020a).[108] The model also assumed 8 hours to negotiate the goal. EPA assumed that the 8 hours would also be doubled for the system burden because the system would provide justification on why they recommended a certain goal rate. See data variable *hrs_lslr_plan_js* in Section 5.4.4.2, activity f) for assumptions used to derive that input.

[108] EPA assumed large, medium, and small systems corresponded to those size categories defined in the previous rule as systems serving more than 50,000 people, 3,301 to 50,000 people, and 3,300 or fewer people, respectively.

Exhibit 5-88: Estimated Burden for Systems with LSL to Develop an LSLR Plan

System Size (Population Served)	*hrs_lslr_plan_op*	
	CWSs	NTNCWSs
≤3,300	12	12
3,301-10,000	20	12
10,001-50,000	36	12
>50,000	52	12

Source: "Derivation of LSLR Ancillary Costs_Final Rule.xlsx."

Exhibit 5-89 provides the SafeWater LCR model costing approach for this activity including additional cost inputs that are required to calculate the total costs.

Exhibit 5-89: LSLR Plan Cost Estimation in SafeWater LCR by Activity[1]

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
f) Develop LSLR plan and submit to Primacy Agency for review				
The total hours per system multiplied by the system labor rate. *(hrs_lslr_plan_op*rate_op)*	Cost applies as written to NTNCWSs.	All	Model PWS with LSLs *p_lsl*	One time

Acronyms: CWS = community water system; LSL = lead service line; LSLR = lead service line replacement; NTNCWS = non-transient non-community water system; PWS = public water system.

Notes:

[1] The data variables in the exhibit are defined previously in this section with the exception of:

- *p_lsl:* Probability of having LSLs (Section 4.3.4).
- *rate_op:* PWS hourly labor rate (Section 4.3.10.1).

5.3.4.3 *Lead Service Line Replacements*

This section summarizes EPA's cost estimates for physical replacement of LSLs. The detailed methodology is provided in Appendix A, Section A.2. EPA recognizes uncertainty in LSLR unit costs by having a low and high cost estimate that are used in the low and high costing scenario, respectively, as described in Section A.2 and summarized in Section 5.2.4.2.5.

The costs are divided into two activities as shown in Exhibit 5-90. This division is based on if the system or the customer is assigned the cost for replacement in Safe Water LCR and EPA's cost estimates in general. The exhibit provides the range of unit costs for five different replacement types (utility-side, utility-side planned, full replacement, full replacement planned, and customer side) and three replacement programs that were described in Section 5.3.4, with assumptions following the exhibit. Additional detail is also provided in Section A.2. The last column in Exhibit 5-90 provides the corresponding SafeWater LCR model data variable in red/italic font.

Exhibit 5-90: PWS LSL Replacement Unit Cost Estimates

Activity	Unit Cost	*SafeWater LCR Data Variable*
g) Systems replace LSLs	Utility Side for Goal Based and Customer-initiated Only $2,449 to $5,689/replacement for goal-based or customer-initiated programs $1,959 to $4,551/replacement (planned for goal-based program only) Full Replacement for Mandatory Only $3,953 to $6,024/replacement $3,163 to $4,819/replacement (planned) Customer-side for Mandatory Program Only $2,514 to $3,929/replacement[1]	Utility Side *cost_lslr_system_volun* *cost_lslr_planned_volun* Full Replacement *cost_lslr_system_mand* *cost_lslr_planned_mand* Customer Side *cost_lslr_hh*
h) Households replace privately-owned portion of LSLs if under goal-based or customer-initiated program	Customer-side for Goal Based and Customer-initiated Only $2,514 to $3,929/replacement for goal-based or customer-initiated programs only	Customer Side *cost_lslr_hh*

Acronyms: LSL = lead service lines.
Source: Data sources for each activity are provided following this exhibit.
Note:
[1] Paid for by utility to complete a prior partial to achieve full replacement for Mandatory Program only.

g) Systems replace LSLs (cost_lslr_system_volun, cost_lslr_planned_volun, cost_lslr_system_mand cost_lslr_planned_mand, cost_lslr_hh). EPA reviewed news reports, press releases, and utility websites to estimate the unit costs of utility-side, full, and customer-side LSLR. EPA used a unit cost for "planned" utility-side and full replacements that are done as part of infrastructure or capital improvement projects to reflect savings that the utility will experience from already being in the area, coordinating with other utilities and doing hard surface removal to access the water main near the LSLs (estimated as 20 percent savings). See Exhibit 5-91 for low and high unit cost estimates for these types of replacements. See Appendix A, Section A.2 for detailed information on the derivation of LSLR unit costs.

Exhibit 5-91: Estimated System Unit Costs for LSLR ($2016)

Type of LSLR	Cost Input (2016$)[1, 2]		*SafeWater LCR Data Variable*	Applicability
	Low (25th percentile)	High (75th percentile)		
Utility-Side	$2,449	$5,689	*cost_lslr_system_volun*	**Goal-based and Customer-initiated Programs**, cost for CWS to replace its portion.

Type of LSLR	Cost Input (2016$)[1, 2]		*SafeWater LCR Data Variable*	Applicability
	Low (25th percentile)	High (75th percentile)		
Utility-Side (Planned)	$1,959	$4,551	*cost_lslr_planned_volun*	**Goal-based Programs**, cost for CWS to replace its portion when part of an emergency or infrastructure replacement.
Full Replacement	$3,953	$6,024	*cost_lslr_system_mand*	**Mandatory Program**, cost for CWSs to replace system and customer side. *For NTNCWSs, this is the only input used under the previous rule and LCRR.*
Full Replacement (Planned)	$3,163	$4,819	*cost_lslr_planned_mand*	**Mandatory Program,** cost for CWSs to replace system and customer side associated with an emergency or infrastructure replacement.
Customer-Side	$2,514	$3,929	*cost_lslr_hh*	**Mandatory Program,** cost for CWS to replace the customer side to complete a prior partial.[3]

Source: Exhibit A-3 in Appendix A and "Derivation of LSLR Costs_Final Rule.xlsx."
Notes:
[1] LSLR costs are based on information for 38 systems that conducted LSLR between 2000 and 2019, with most projects occurring between 2015 and 2019 (note that all costs were converted to $2016). The planned costs in the second and fourth rows are further adjusted downward by 20 percent to represent savings that systems experience when replacing LSLs as part of planned capital improvements. See Section A.2 for details on derivation of each unit cost.
[2]The Low value is the 25th percentile of the system estimates and the High value is the 75th percentile. The Low and High values are used as inputs for the SafeWater LCR model.
[3]The unit cost for customer-side replacement is also used when the customer pays for their portion of the LSLR under the Goal-Based and Customer-Initiated programs.

Exhibit 5-92 provides the estimated likelihood of each type of LSLR under each program as follows:

- For the goal-based program: EPA assumed that CWSs will only incur costs for the utility side of the LSLR, and that customers will pay for their portion to achieve full replacements.
- For the mandatory program: EPA assumed that the systems will pay to replace the utility-side as well as the private-side (i.e., Full LSLR). Note that this is a *modeling assumption only* and the rule does not require the system to pay for replacement of the private side. EPA assumed that systems might bear the full cost of the replacement to meet the mandatory replacement rate, recognizing that this might result in an overestimate in LSLR costs borne by systems. EPA recognizes that many systems have been replacing LSLs as part of infrastructure improvement programs and that some LSLs remaining may be only the customer side. For modeling purposes, EPA assumed that systems have been replacing the utility-side of LSLs at an average rate of 1 percent per year from 1991 when the original LCR was promulgated to 2020 (29 years) when the LCRR is anticipated to become final with approximately 72 percent of those being partial replacements. This translates to

approximately 20 percent (0.29*0.72) of LSLR can be accomplished by replacing only the customer's side (i.e., "completing a prior partial"). Note that the unit cost to replace the customer side is the same regardless of whether the system performs the replacement or the customer.

- For both the goal-based and mandatory programs: EPA recognizes the cost savings that can be realized when replacements occur during planned infrastructure/capital improvement programs. In these cases, crews will already be in the area coordinating with other utilities and doing hard surface removal to access the water main near the LSLs. EPA estimated a 20 percent savings based on detailed cost information from Flint, Michigan (available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov). EPA assumed that this lower LSLR unit cost applies to approximately 1 percent of replacements each year.
- For the customer-initiated program: Systems must replace their portion of the LSL when a customer has replaced his/her portion and notified the water system. CWSs will only incur costs for the utility side of the LSLR.

Exhibit 5-92: Likelihood of LSLR Type of Systems by Program

Type of Replacement	Likelihood under Goal-Based Program	Likelihood under Mandatory Program	Likelihood under Customer-Initiated	*SafeWater LCR Data Variable*
Utility-Side (Planned)	1%			*pp_lslr_cap_emerg*
Utility-Side	99%		100%	Customer-Initiated *pp_cust_init_lslr* Goal-based 1 - *pp_lslr_cap_emerg*
Full Replacement (Planned)		1%		*pp_lslr_cap_emerg*
Full Replacement		79%		1 - (*pp_lslr_cap_emerg* - *pp_lslr_partial*)
Customer-Side (i.e., completing a prior partial)		20%		*pp_lslr_partial*

Source: Exhibit A-5 in Appendix A and Derivation of LSLR Costs_Final Rule.xlsx."

In addition to the unit cost and likelihood of the type of LSLR under each program, EPA needs the total ***number of LSLs replaced each year*** (*num_lsl_replace*) to estimate LSLR costs under the rule. The number of LSLs replaced is calculated as the number of LSLs for a system multiplied by the replacement rate per year. EPA assumed the following replacement rates for each program:

- For the goal-based program, EPA assumed for modeling purposes that Primacy Agencies would set an average replacement rate goal of 2 percent per year (*pp_lsl_replaced_vol_goal*). To recognize that this is a goal and not a requirement, EPA modeled a range of actual replacement rates of 1 to 5 percent with a most likely value of 2.5 percent (*pp_lsl_replaced_vol_pct*).

- For the mandatory program, EPA assumed the required rate of full LSLR of 3 percent per year. Note that the Final LCRR provides compliance flexibility to water systems that are implementing a mandatory LSLR program by requiring replacements to be based on a rolling 2 year average of 3% per year using a baseline number of LSLs equal to the number of LSLs and galvanized requiring replacement service lines at the time the system first exceeds the lead trigger or action level plus the number of unknowns at the beginning of each year of the system's LSLR program. This rolling average allows systems that experience LSLR rate fluctuation to still meet a 3% replacement rate on average for the prior two-year period every year the water system is required to implement the LSLR program. The regulation also requires that a cumulative number of replacements be reached equal to 3% of the sum of known lead, galvanized requiring replacement, and lead status unknown service lines in the initial inventory, times the number of years that elapsed between the system's first ALE and the date on which the system's 90th percentile lead levels are at or below the action level for 2 years (four consecutive 6-month monitoring periods). EPA does not have information on the annual variation in replacement rates which systems may experience when required to conduct mandatory replacement, therefore, the Agency has assumed an annual replacement rate of 3% (which equals a 3% rolling average value across all two-year time periods). EPA's costs capture all estimated replacements required under the rule, but because the assumed 3% annual rate may not capture the year to year variation in LSL replacement rate. Therefore, EPA's estimated discounted costs may be under or over estimated.

- For the customer-initiated program, EPA estimated the likelihood of these replacement to be 0.05 percent of LSLs per year (*pp_cust_init_lslr*) based on the average of these types of replacements conducted by DC Water from 2008 through 2013 (Environmental Defense Fund and American University School of Public Affairs, 2020). Note that EPA applied this percentage to systems that are not replacing LSLs as part of the goal-based or mandatory replacement programs because the Agency assumed any customer-initiated replacements would be included as part of those programs.

The number of LSLRs required in a year (*numb_lsl_replace*) is the product of the PWS's replacement rate multiplied by the baseline number of LSLs (which is the number of connections per system from SDWIS/Fed multiplied by *perc_lsl* for the low and high cost scenario, see Exhibit 5-4) plus the number of service lines of unknown material (which is the number of connections per system from SDWIS/Fed multiplied by *pp_lslr_partial* as described in Section 5.3.4.1 activity d)). As LSLs are replaced and service lines of unknown material are removed from the inventory, the number of LSLRs required each year will decrease. Note that EPA's analysis does not include per system estimates of the number of LSLs replaced over the period from the completion of the initial inventory to a system's first ALE. Therefore, EPA's estimated replacement costs for the mandatory program may be overestimated.

h) Households replace privately-owned portion of LSLs if goal-based program (cost_lslr_hh). As discussed in the section above, EPA assumed for the goal-based program, customers will incur the cost of replacing the portion of the service line they own. This cost ranges from a low estimate of

$2,514 and a high estimate of $3,929 (same estimated cost that is incurred by PWSs for customer-side replacements under the mandatory LSLR program).

Exhibit 5-93 provides the SafeWater LCR model cost estimation approach for systems and households to replace LSLs including additional cost inputs required to calculate these costs.

Exhibit 5-93: Lead Service Line Replacement Cost Estimation in SafeWater LCR by Activity[1]

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
g) Systems replace LSLs				
The sum of the number of lines replaced for each category of possible types of replacement (capital project, emergency replacement, or in response to the rule) multiplied by the costs per type of replacement. *((num_lsl_replace*pp_lslr_cap_emerg)*cost_lslr_planned_volun)+((num_lsl_replace*(1-(pp_lslr_cap_emerg +pp_lslr_partial)))*cost_lslr_system_volun)*	Cost does not apply to NTNCWSs.	At or below AL and above TL	Model PWS participating in the goal-based LSLR program *p_lsl*	Once a year
The sum of the number of lines replaced for each category of possible types of replacement (capital project, emergency replacement, or in response to the rule) multiplied by the costs per type of replacement. *((num_lsl_replace*pp_lslr_cap_emerg)*cost_lslr_planned_mand)+((num_lsl_replace*(1-(pp_lslr_cap_emerg)))*cost_lslr_system_mand)+((num_lsl_replace*pp_lslr_partial)*cost_lslr_hh)*	Cost applies as written to NTNCWSs which conduct LSLRs under the small system flexibility program.	Above AL	Model PWS participating in the mandatory LSLR program *p_lsl*	Once a year
The number of customer-initiated partial line replacements multiplied but the cost of a partial utility side replacement. *(num_lsl_requested)*cost_lslr_system_volun*	Cost does not apply to NTNCWSs.	At or below the TL	Model PWS not participating in the goal-based or mandatory LSLR programs *p_lsl*	Once a year
h) Households replace privately-owned portion of LSLs if goal-based program				
The number of customer-side LSLs replaced as part of goal-based program each year times the unit cost. *(num_lsl_replace * cost_lslr_hh)*	Cost does not apply to NTNCWSs.	At or below AL and above TL	Households served by systems participating in the goal-based LSLR program *p_lsl*	Once a year

Acronyms: AL = action level; CWS = community water system; LSL = lead service line; LSLR = lead service line replacement; NTNCWS = non-transient non-community water system; PWS = public water system; TL = trigger level.

Notes:
[1] The data variables in the exhibit are defined previously in this section with the exception of:

- *p_lsl*: Likelihood a system had LSLs (see Section 4.3.4).

5.3.4.4 *Ancillary Lead Service Line Replacement Activities*

EPA has developed system costs for ancillary activities associated with LSLR, as shown in Exhibit 5-94. The exhibit provides the unit burden and/or cost for each activity. The assumptions used in the estimation of each activity follows the exhibit. The last column provides the corresponding SafeWater LCR model data variable in red/italic font. In a few instances, some of these activities are conducted by the state instead of the water system. These activities are identified in the exhibit and further explained in the exhibit notes.

Exhibit 5-94: PWS LSL Replacement Ancillary Unit Burden and Cost Estimates

Activity	Unit Burden and/or Cost	*SafeWater LCR Data Variable*
i) Conduct planning and identify financial options for LSLRs and submit to Primacy Agency (one-time)	400 to 1,100 hrs/CWS	*hrs_fin_op_op*
j) Consult with Primacy Agency and develop targeted LSLR program outreach materials (one-time)	5.5 hrs/CWS with TLE serving 10,001 to 50,000 22 hrs/CWS with TLE serving > 50,000	*hrs_lslr_out_op*
k) Distribute targeted LSLR program outreach materials	CWSs serving >10,000 with TLE 0.0026 to 0.0357 hrs/HH; $0.23/HH	*hrs_dist_lslr_out_op*; *cost_lslr_out*
l) Contact customers and conduct site visits prior to LSLR	<u>Burden per replaced LSL</u> 1.69 to 1.97 hrs <u>Cost per replaced LSL</u> $10.67 to $14.45/replaced LSL	<u>Burden</u> *hrs_replaced_lsl_contact_op* <u>Cost</u> *cost_replaced_lsl_contact*
m) Inspect and test lines to confirm if they are not lead	Burden 1 to 2 hr/paper replacement <u>Cost</u> $109 to $328/paper replacement	<u>Burden</u> *hrs_lslr_paper_op* <u>Cost</u> *cost_lslr_paper*
n) Deliver filters and cartridges at time of LSLR and maintain them for 6 months	$44.00/replaced LSL	*cost_filter_hh*
o) Collect tap sample post-LSLR	<u>Burden per sample</u> CWSs: 0.9 to 1.2 hrs NTNCWSs: 0.5 hrs <u>Cost per sample per CWS</u> Travel: $5.29 to $9.07 Bottle: $0 to $3.36	<u>Burden</u> *hrs_collect_lsl_lslr_op* <u>Cost</u> *cost_pickup_samp* *cost_other_lt_samp*[1]

Activity	Unit Burden and/or Cost	*SafeWater LCR Data Variable*
p) Analyze post-LSLR tap sample	In-house Analysis (CWSs > 100K only) Burden: 0.44 hrs/sample Cost: $2.38 Commercial Analyses $21.58/sample	In-house Analysis *hrs_analyze_lsl_lslr_op*[1] *cost_lab_lsl_lslr*[1] Commercial Analysis *cost_commercial_lsl_lslr*[1]
q) Inform customers of tap sample result	Burden CWSs: 0.05 hrs/sample NTNCWSs: 1 hr/system Cost CWSs: $0.58/sample NTNCWSs: $0.025/system	Burden *hrs_inform_samp_op* *hrs_ntncws_cust_lslr_op* Cost *cost_cust_lslr* *cost_ntncws_cust_lslr*
r) Submit annual report on LSLR program to Primacy Agency	1 to 8 hrs/CWS 1 hr/NTNCWS	*hrs_report_lcr_op*

Acronyms: CWS = community water system; HH = household; LSL = lead service lines; LSLR = lead service line replacement; NTNCWS = non-transient non-community water system; TLE = trigger level exceedance.
Sources: Data sources for each activity are provided following this exhibit.
Note:
[1] The burden and costs for these activities are incurred by the state in Arkansas, Louisiana, Mississippi, Missouri, and South Carolina.

i) Conduct planning and identify financial options for LSLRs and submit to Primacy Agency (hrs_fin_op_op). CWSs subject to the goal-based or mandatory LSLR program will incur one-time burden to conduct a study including developing an LSLR financing plan. This plan does not apply to NTNCWSs because EPA assumed that they own their entire service line(s). Exhibit 5-95 provides the detailed assumptions used to develop these estimates for three CWS size categories.

Exhibit 5-95: PWS Burden to Conduct LSLR Study Including Financing Plan

Planning Activity	Estimated Burden		
	CWSs serving:		
	≤10,000	10,001-100,000	>100,000
Legal considerations for funding options. • Determine if statutes/regulations prohibit/restrict a public system from paying for LSLRs on private property (i.e., using public funds for private purposes). • Determine statutes/regulations prohibit/ restrict type of funding used for LSLRs and if so, do they apply to system type (public vs. private) and LSLR type (on public or private property).	8	16	20
Identify potential funding sources. • Consider grants, loans, or bonds or a combination; also consider other govt. support for low income homeowner-owned segments (e.g., HUD). Assume small systems have assistance identifying options.	40	60	100

Planning Activity	Estimated Burden		
	CWSs serving:		
	≤10,000	10,001-100,000	>100,000
• Include state-specific options (such as MA's interest-free LSLR program through their state revolving fund (SRF)).			
Evaluate funding sources. Determine if project meets criteria, funding and project timeline are compatible, impact on user charges, additional engineering or special studies required, affordability for users.	80	100	200
Meet with potential funding sources on requirements and project-specific details. Include preparation and meeting by phone or in-person as applicable.	40	60	80
Compile preliminary financing plan. Include options considered and selected, funding amounts for each source, utility-owned and homeowner-owned LSL funding sources.	60	100	300
Conduct public meetings and outreach. Review project details and financing plan; assumed at least 2 meetings.	80	120	200
Conduct consumer income survey (if applicable for funding source). Assume needed for funding options for CWSs serving ≤100,000 people.	40	60	0
Submit pre-applications to funding sources. Assume single funding source for CWSs serving <10,000; two for those serving 10,000 to 100,000; and three for those serving > 100,000.	60	120	200
Totals	408	636	1100
Round to hundreds.	**400**	**600**	**1100**

Source: "Derivation of LSLR Ancillary Costs_Final Rule.xlsx."

j) Consult with Primacy Agency and develop targeted LSLR program outreach materials (hrs_lslr_out_op). CWSs serving more than 10,000 people with a TLE will incur burden to consult with their Primacy Agencies and develop outreach materials on their LSLR program that invite customers to participate in their goal-based LSLR program. EPA assumed that all CWSs will use an EPA-developed template. EPA assumed that those systems serving 10,001 to 50,000 people will require 3.5 hours to develop these materials and an additional 2 hours to consult with the Primacy Agency for a total of 5.5 hours. Those serving more than 50,000 people will adapt the template and require 20 hours to develop the materials and an additional 2 hours to consult with the Primacy Agency for a total of 22 hours. The estimates for systems serving 50,000 or fewer people are based on tier 2 PN preparation burden (3.5 hours), and burden estimates for systems serving more than 50,000 people are based on tier 1 PN preparation burden for systems serving more than 10,000 people (30 hours) in the Public Water System Supervision Program Information Collection Request (ICR) (Renewal) (USEPA, 2015a). EPA assumed that systems serving more than 50,000 people would require 20 hours to develop the materials as opposed to the 30-hour estimate for Tier 1 PN.

k) Distribute targeted LSLR program outreach materials (hrs_dist_lslr_out_op, cost_lslr_out). CWSs with LSLs that serve more than 10,000 people and have a TLE will incur burden to distribute targeted LSLR program outreach materials to households with LSL, galvanized service lines, and those of unknown material. The estimated burden and costing assumptions are provided in Exhibit 5-96. The rule allows CWSs to discontinue distribution of this outreach material after two consecutive monitoring periods at or below the TL.

Exhibit 5-96: Estimated Annual Burden (per household) to Distribute Targeted Outreach Materials about LSLR Program for CWSs with LSLs and a TLE that Serve > 10,000 People *(hrs_dist_lslr_out_op)*

System Size (Population Served)	Separate mailing (hrs per CWS)	Bill Stuffer (hrs per CWS)	Average (hrs per CWS)	HH per CWS *(numb_hh)*	Separate/ Bill Stuffer (hrs per HH)	Production (hrs per HH)	Total (hrs/HH)
	A	B	C = (A+B)/2	D	E = C / D	F	G = D + F
10,001-50,000	120	30	75	8,446	0.0089	0.0025	**0.0114**
50,001-100,000	120	30	75	26,770	0.0028	0.0025	**0.0053**
100,001-1,000,000	120	30	75	93,467	0.0008	0.0025	**0.0033**
>1,000,000	120	30	75	772,999	0.0001	0.0025	**0.0026**

Acronyms: CWS = community water system; HH = household.
Source: "Derivation of Public Education Inputs_CWS_Final Rule.xlsx."
Notes:
A: EPA assumption regarding the burden per system to prepare separate mailings.
B: EPA assumption regarding the burden per system to mail materials with the water bill.
C: EPA assumed that half of systems will conduct separate mailings and the other half will include targeted outreach materials with the water bill.
D: See Exhibit 5-123. Estimated as 2.59 people per household (*numb_hh*) for the year 2010 (United States Census Bureau, 2010). Table AVG1. Average Number of People Per Household, By Race and Hispanic Origin, Marital Status, Age, And Education Of Householder. Available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov.
F: EPA assumed 0.25 hours per 100 brochures for production. Estimate is based on assumptions for production labor used in the *Economic and Supporting Analyses: Short-Term Regulatory Changes to the Lead and Copper Rule* (Exhibit 17) (USEPA, 2007).

These systems will also incur costs to distribute these materials. EPA assumed:

- Systems providing the materials in the water bill will incur a cost for a cover letter (paper cost of $0.025) and brochure (paper cost of $0.025) for a total cost of $0.05 per household. See "General Cost Model Inputs_Final Rule.xlsx" for additional information about costs for paper. EPA assumed that the weight of the cover letter and brochure would not result in additional postage being needed to mail the water bill.
- Systems distributing the materials in a separate mailing will also incur the cost of an envelope ($0.067), and bulk rate postage ($0.301) since systems will be sending out more than 200 mailings. This equals a total per household cost of $0.43 ($0.025 + $0.05 + $0.067 + $0.301). See "General Cost Model Inputs_Final Rule.xlsx" for additional information about costs for paper, envelopes, and postage.
- Half of these systems will include the materials in the water bill and another will mail them separately. Thus, the estimated cost is the average of $0.05 and $0.43 or $0.23 per household for data variable *cost_lslr_out*.

l) Contact customers and conduct site visits prior to LSLR (hrs_replaced_lsl_contact_op, cost_replaced_lsl_contact). CWSs will incur burden and costs to coordinate with customers prior to replacing the LSLs. The estimated burden and costs are provided in Exhibit 5-97 and Exhibit 5-98, respectively.

Exhibit 5-97: Estimated Burden Associated with Contacting Customers and Site Visit Prior to LSLR (hrs/replaced LSL) *(hrs_replaced_lsl_contact_op)*

System Size (Population Served)	Upfront Contact		Site Visit Travel			On-Site Review	Total Burden
	Phone Call	Prepare Letter	Miles one way	Time one way (hrs)	Time Roundtrip (hrs)		
	A	B	C	D	E = D*2	F	G = A+B+E+F
≤100,000	0.25	0.05	4.9	0.196	0.392	1	**1.69**
100,001-1,000,000	0.25	0.05	6.3	0.252	0.504	1	**1.80**
> 1,000,000	0.25	0.05	8.4	0.336	0.672	1	**1.97**

Source: "Derivation of LSLR Ancillary Costs_Final Rule.xlsx."
Notes:
A & B: For each LSLR, EPA assumed a system will first contact customers twice. These contacts are to coordinate a site visit to confirm the presence of an LSL prior to the actual replacement of the line that are found to be lead. EPA assumed the system first calls the customer (15 minutes per customer) and then sends a certified letter. Burden to prepare the letter is 20 letters per hour based on the *Disinfectants/Disinfection Byproducts, Chemical, and Radionuclides Rules ICR (Renewal)*, Exhibit 35 in Appendix H (USEPA, 2015b).
C - E: Based on census data and zip codes from the 2006 Community Water System Survey. See file, "Derivation of Estimated Driving Distances_Final Rule.xlsx." EPA assumed an average speed of 25 miles per hour, round trip.
F: Includes 1 hour for on-site visual inspection. Assumed no testing.

Exhibit 5-98: Estimated Costs Associated with Contacting Customers and Site Visit Prior to LSLR ($/replaced LSL) *(cost_replaced_lsl_contact)*

System Size (Population Served)	Mailing Costs			Vehicle O&M			Total Burden
	Certified Mail	Paper	Envelopes	Miles Roundtrip	2016 Mileage Rate	Cost per Trip	
	A	B	C	D	E	F = D * E	G = A+B+C+F
≤100,000	$5.29	$0.03	$0.07	9.8	$0.54	$5.29	**$10.67**
100,001-1,000,000	$5.29	$0.03	$0.07	12.6	$0.54	$6.80	**$12.19**
> 1,000,000	$5.29	$0.03	$0.07	16.8	$0.54	$9.07	**$14.45**

Source: "Derivation of LSLR Ancillary Costs_Final Rule.xlsx."
Notes:
A: Certified mail with electronic return receipt, single piece. Includes certified mail cost ($3.35), emailed signature receipt ($1.45), and first class postage ($0.49).
B&C: Based on quotes from 3 vendors. See file, "General Cost Model Inputs_Final Rule.xlsx" for additional detail.
D: Based on census data and zip codes from the 2006 Community Water System Survey, assumed the following one-way driving distances for CWSs: 4.9 serving ≤ 100,000 people, 6.3 miles serving 100,001 – 1,000,000 people, and 8.4 miles for serving > 1,000,000 people. These distances were doubled to estimate roundtrip mileage. See file, "Derivation of Estimated Driving Distance_Final Rule.xlsx" for additional detail on how these estimates were derived.
E: Federal reimbursement rate of $0.54 (2016 mileage rate) based on GSA information (available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov).

m) Inspect and test lines to confirm they are not lead (hrs_lslr_paper_op, cost_lslr_paper). EPA estimated that CWSs will incur burden and costs each year when they find that service lines are not

lead in the field.[109] These are also referred to as "paper replacements." EPA assumed that paper replacements occur in two ways: Site visits (no digging) and field testing (digging) as follows:

- **Site visit (*hrs_lslr_paper_op*):** System coordinates the site visit to visually confirm the service line type by looking at a meter pit or where the plumbing enters the home. For the customer-side, the site visit may require coordination with the resident in cases where the system representative needs to look at plumbing inside the home. EPA assumed that
  - Pipe material can be verified through scratch testing and use of a magnet as described by the LSLR Collaborative in "Identifying Service Line Material" (LSLR Collaborative, n.d.). No digging is necessary.
  - System operators can conduct up to 8 inspections per day. To account for the range of time that might be spent onsite, EPA estimated that between 0.5 and 1.5 hours would be needed per site. The Agency also added 0.5 hours for travel time to obtain a total estimated range of between 1 to 2 hours per site visit with a most likely value of 1.5 hours.
- **Field Testing (*cost_lslr_paper*)**: EPA recognizes that there is a range of field testing methods including test pitting, potholing, and curb inspection. For the purposes of costing, however, EPA selected the typical method of hydrovacing to estimate field testing costs. EPA assumed that water systems would use a contractor and developed costs based on information provided by Green Bay, Pittsburgh, and DC Water (see the Derivation file, "Derivation of LSLR Ancillary Costs_Final Rule.xlsx," sheet "Paper Replacement Approach" for details).Based on this information, EPA estimated an average cost of $219 and calculated a low cost of $109 (50 percent of $219), and a high cost of $328 (150 percent of $219) for cost modeling purposes.

For modeling purposes and to recognize uncertainty in this input, EPA assumed that the percent of inspections that could be visual (*p_lslr_visual_inspection*) is 0 percent (minimum) to 100 percent (maximum), with a most likely value of 50 percent. The remaining inspections are assumed to be completed using field testing.

EPA estimated total costs of paper replacements by applying a likelihood that for each line physically replaced, another will be proven not to be lead (*pp_lslr_paper).* This likelihood is based on the assumption that systems will confirm that unknown service lines are not lead for an additional 28 percent over their estimated LSL inventory. Refer to Section 5.3.4.1, activity d) for detailed assumptions.

n) Deliver filters and cartridges at time of LSLR and maintain them for 6 months (cost_filter_hh). Systems must provide a pitcher filter (i.e.*,* pour through filter) that is certified to remove lead to each resident following any LSLR. EPA assumed that the pitchers and filters delivered to each resident to use for six months following LSLR will cost $44 on average (including shipping and filter replacement). Although many pitchers come with filters that will provide lead removal for more

[109] EPA assumed that NTNCWSs will not incur this burden/cost because they should be familiar with their service line materials.

than six months, the average cost includes a filter replacement cost for those that do not last six months.

o) ***Collect tap sample post-LSLR (hrs_collect_lsl_lslr_op, cost_pickup_samp, cost_other_lt_samp).*** All systems participating in the goal-based or mandatory LSLR program must collect one sample following replacement of each LSL (*numb_samp_lslr*). Burden and costs for this activity are different than mandatory tap sampling because the system collects the sample after replacement as opposed to the customers collecting the sample under tap sampling. Exhibit 5-99 and Exhibit 5-100 provide the estimated CWS burden and cost to collect these samples. A discussion of the burden and costs to NTNCWSs follow these exhibits.

Exhibit 5-99: CWS Unit Burden to Collect Post-LSLR Tap Sample

System Size (Population Served)	Burden (hrs/Sample)		
	Round-trip travel to customer's home	Sample Collection Burden	Total Sample Collection Burden
			hrs_collect_lsl_lslr_op
	A	B	C = A+B
≤100,000	0.39	0.5	**0.9**
100,001-1,000,000	0.50	0.5	**1.0**
>1,000,000	0.67	0.5	**1.2**

Source: "Derivation of Lead Analytical Burden and Costs_Final Rule.xlsx"
Notes:
A: Based on census data and zip codes from the 2006 Community Water System Survey, assumed the following one-way driving distances for CWSs: 4.9 serving ≤ 100,000 people, 6.3 miles serving 100,001 – 1,000,000, and 8.4 miles for > 1,000,000. These distances were doubled to estimate roundtrip mileage. See file, "Derivation of Estimated Driving Distance_Final Rule.xlsx" for additional detail on how these estimates were derived. Assumed an average speed of 25 miles per hour.
B: Assumed the system would require the same burden to collect the sample following LSLR as required to collect a source water sample. Source water burden is from the *Disinfectants/Disinfection Byproducts, Chemical, and Radionuclides Rules ICR (Renewal)*, Exhibit 15 in Appendix H (USEPA, 2015b).

Exhibit 5-100: CWS Unit Cost to Collect Post-LSLR Tap Sample

System Size (Population Served)	Cost (hrs/Sample)	
	Round-trip travel to customer's home	Bottle Cost
	cost_pickup_samp	*cost_other_lt_samp*
	A	B
≤100,000	$5.29	$0.00
100,001-1,000,000	$6.80	$3.36
>1,000,000	$9.07	$3.36

Source: "Derivation of Lead Analytical Burden and Costs_Final Rule.xlsx."
Notes:
A: Based on census data and zip codes from the 2006 Community Water System Survey, assumed the following one-way driving distances for CWSs: 4.9 serving ≤ 100,000 people, 6.3 miles serving 100,001 – 1,000,000, and 8.4 miles for > 1,000,000. These distances were doubled to estimate roundtrip mileage. See file, "Derivation of Estimated Driving Distance_Final Rule.xlsx" for additional detail on how these estimates were derived. Assumed an average speed of 25 miles per hour. Used the Federal reimbursement rate of $0.54 (2016 mileage rate).

B: Bottles are included as part of the commercial laboratory fee. Only CWSs serving more than 100,000 people are assumed to conduct analyses in-house for lead. For a detailed discussion of the assumptions used to estimate bottle costs, see "Derivation of Lead Analytical Burden and Costs_Final Rule.xlsx," worksheet, "In-House_Bottle_$."

NTNCWSs will not incur the burden or costs to travel to a customer's house to collect a sample. In addition, NTNCWSs do not incur bottle costs because laboratories provide the 1-liter bottle as part of their commercial laboratory fee. Thus, they will only incur a burden of 0.5 hours per sample and $0 costs associated with sample collection.

p) Analyze post-LSLR tap sample (hrs_analyze_lsl_lslr_op, cost_lab_lsl_lslr, cost_commercial_lsl_lslr). As previously discussed in Section 5.3.2.1.2, activity j), EPA assumed CWSs serving more than 100,000 people will conduct lead analyses in-house and require 0.44 hours per sample based on estimates provided by three laboratories (*hrs_analyze_lsl_lslr_op*). These systems will also incur consumable costs of $2.38 per sample based on information from three vendors (*cost_lab_lsl_lslr*). The remaining CWSs and all NTNCWSs are assumed to use commercial laboratories and incur a cost of $21.58 per lead sample based on quotes from six laboratories (*cost_commercial_lsl_lslr*). Note that although the data variable names are different, the unit costs for lead sample analysis are the same as for lead tap sampling as presented in Section 5.3.2.1.2.

q) Inform customers of tap sample result (hrs_inform_samp_op, cost_cust_lslr, hrs_ntncws_cust_lslr_op, cost_ntncws_cust_lslr). Systems must notify their customers of their lead analytical results from the sample collected following LSLR. EPA made the following assumptions regarding the burden and/or costs for this notification:

- CWSs of all sizes will send the results to their customers at a burden of 0.05 hours *(hrs_inform_samp_op)* and a cost of $0.58 *(cost_cust_lslr)*. These inputs are the same as those used for the tap sampling program. The burden estimate of 1 hour per 20 letters for all systems sizes is based on the public education burden for systems to notify occupants of results estimated in the (2015 Disinfectants and Disinfection Byproducts, Chemical, and Radionuclides Rules ICR, Exhibit 35 in Appendix H). Systems are also assumed to mail the post-LSLR sample results. The cost consists of postage ($0.49), paper ($0.025), and envelope ($0.067) for a total cost of $0.58/sample. See file, "General Cost Model Inputs_Final Rule.xlsx" for additional information on the sources of these estimates.
- NTNCWSs are assumed to notify the people they serve electronically and through posting. EPA assumed all NTNCWSs of all size categories will spend 0.5 hours to develop/send e-mail and an additional 0.5 hours to post the notification publicly for a total of burden 1 hour per system (*hrs_ntncws_cust_lslr_op)*. In addition, NTNCWSs will incur material costs for paper posting of $0.025 based on quotes from three vendors *(cost_ntncws_cust_lslr)*. See derivation file, "General Cost Model Inputs_Final Rule.xlsx" for quotes.

r) Submit annual report on LSLR program to Primacy Agency (hrs_report_lcr_op). Systems that are subject to the goal-based or mandatory LSLR program must submit an annual report to their Primacy Agency. EPA estimated that burden would be higher as system size increases to account for larger number of LSLs replaced. EPA estimated the following burden for CWSs to prepare and submit their annual report:

- CWSs serving 3,300 or fewer and NTNCWSs: 1 hour.
- CWSs serving 3,301 to 10,000 people: 2 hours.
- CWSs serving 10,001 to 100,000 people: 4 hours.
- CWSs serving more than 100,000 people: 8 hours.

Exhibit 5-101 provides the SafeWater LCR model cost estimation approach for PWS ancillary LSLR activities including additional cost inputs that are required to calculate these costs.

Exhibit 5-101: Lead Service Line Inventory Ancillary Cost Estimation in SafeWater LCR by Activity[1]

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
i) Conduct planning and identify financial options for LSLRs and submit to Primacy Agency				
The total hours per system multiplied by the system labor rate. *(hrs_fin_op_op*rate_op)*	Cost does not apply to NTNCWSs.	All	Model PWSs with LSLs conducting goal-based or mandatory LSLR *p_lsl*	One time
j) Consult with Primacy Agency and develop targeted LSLR program outreach material				
The total consulting hours per system multiplied by the system labor rate. *(hrs_lslr_out_op*rate_op)*	Cost does not apply to NTNCWSs.	At or below AL and above TL	Model PWS participating in goal-based LSLR program *p_lsl*	One time
k) Distribute targeted LSLR program outreach materials				
The number of households with remaining LSLs multiplied by the total of the hours per household times the system labor rate, plus the materials cost. *hh_remain_lsl * (hrs_dist_lslr_out_op * rate_op + cost_lslr_out)*	Cost does not apply to NTNCWSs.	At or below AL and above TL	Model PWS participating in the goal-based LSLR program *p_lsl*	Once a year

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
l) Contact customers and conduct site visits prior to LSLR				
The number of lines replaced multiplied by the total of the hours per lead line replacement times the system labor rates, plus the material cost. *num_lsl_replace * (hrs_replaced_lsl_contact_op * rate_op + cost_replaced_lsl_contact)*	Cost does not apply to NTNCWSs.	At or below AL and above TL	Model PWS participating in the goal-based LSLR program *p_lsl*	Once a year
		Above AL	Model PWS participating in the mandatory LSLR program *p_lsl*	
m) Inspect and test lines to confirm they are not lead				
Because of uncertainty during the development of the initial LSL inventory systems may test some lines to determine if they are in fact lead and in need of replacement. If the line is visually inspected there is a labor burden per line times the system labor rate. If the line is field tested there is a material cost burden that represents the work conducted by a contractor. *(((num_lsl_replace*pp_lslr_paper)*p_lslr_visual_inspection)*(hrs_lslr_paper_op*rate_op))+(((num_lsl_replace*pp_lslr_paper)*(1-p_lslr_visual_inspection))*cost_lslr_paper)*	Cost does not apply to NTNCWSs.	At or below AL and above TL	Model PWS participating in the goal-based LSLR program *p_lsl*	Once a year
		Above AL	Model PWS participating in the mandatory LSLR program *p_lsl*	
n) Deliver filters and cartridges at time of LSLR and maintain them for 6 months				
The number of lines replaced multiplied by the material cost. *num_lsl_replace*cost_filter_hh*	Cost does not apply to NTNCWSs.	At or below AL and above TL	Model PWS participating in the goal-based LSLR program *p_lsl*	Once a year
	Cost applies as written to NTNCWSs.	Above AL	Model PWS participating in the mandatory LSLR program *p_lsl*	

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
o) Collect tap sample post-LSLR[2]				
The number of samples per replaced lead line multiplied by the number of lines replaced, multiplied by the total of the hours per lead line replacement times the system labor rates, plus the material cost. *(numb_samp_lslr*num_lsl_replace)*((hrs_collect_lsl_lslr_op*rate_op)+cost_other_lt_samp+cost_pickup_samp)*	Cost does not apply to NTNCWSs.	At or below AL and above TL	Model PWS participating in the goal-based LSLR program *p_lsl*	Once a year
	Cost applies as written to NTNCWSs.	Above AL	Model PWS participating in the mandatory LSLR program *p_lsl*	
p) Analyze post-LSLR tap sample[2]				
The number of samples multiplied by the probabilities for a sample analyzed in house and a sample analyzed in a commercial lab times the different labor and material cost burdens for each type of analysis. *(((numb_samp_lslr*num_lsl_replace)*pp_lab_samp)*((hrs_analyze_lsl_lslr_op*rate_op)+cost_lab_lsl_lslr))+(((numb_samp_lslr*num_lsl_replace)*pp_commercial_samp)*cost_commercial_lsl_lslr)*	Cost does not apply to NTNCWSs.	At or below AL and above TL	Model PWS participating in the goal-based LSLR program *p_lsl*	Once a year
	Cost applies as written to NTNCWSs.	Above AL	Model PWS participating in the mandatory LSLR program *p_lsl*	
q) Inform customers of the tap sample result				
The number of lines replaced multiplied by the total of the hours per lead line replacement times the system labor rates, plus the material cost. *num_lsl_replace*((hrs_inform_samp_op*rate_op)+cost_cust_lslr)*	Cost does not apply to NTNCWSs.	At or below AL and above TL	Model PWS participating in the goal-based LSLR program *p_lsl*	Once a year
	The total hours per system times the system labor rates, plus the material cost. *(hrs_ntncws_cust_lslr_op*rate_op)+cost_ntncws_cust_lslr)*	Above AL	Model PWS participating in the mandatory LSLR program *p_lsl*	

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
r) Submit annual report on LSLR program to Primacy Agency				
The total hours for reporting per system multiplied by the system labor rate. *(hrs_report_lcr_op*rate_op)*	Cost applies as written to NTNCWSs.	Above TL	Model PWS participating in either the goal-based or mandatory LSLR program *p_lsl*	Once a year

Acronyms: AL = action level; CWS = community water system; LSL = lead service line; LSLR = lead service line replacement; NTNCWS = non-transient non-community water system; PWS = public water system; TL = trigger level.

Notes:

[1] The data variables in the exhibit are defined previously in this section with the exception of:

- *p_lsl*: Likelihood a system has LSLs (Section 4.3.4).
- *pp_lab_samp*: Likelihood of in-house analysis (Section 5.3.2.1.2, activity j)).
- *pp_commercial_samp*: Likelihood of commercial lab analysis (Section 5.3.2.1.2, activity j)).
- *rate_op*: PWS hourly labor rate (Section 4.3.10.1).

[2] The burden and costs to provide sample bottles (*cost_other_lt_samp*) under activity o) and conduct analyses under activity p) are incurred by the state in Arkansas, Louisiana, Mississippi, Missouri, and South Carolina.

5.3.4.5 *Failure to Meet Goal-based Replacement Rate Activities*

Exhibit 5-102 shows EPA's estimated burden and/or costs for three ongoing outreach activities that CWSs serving more than 10,000 people must undertake if they fail to meet their goal-based replacement rate. The assumptions used in the estimation of the unit burden and costs follow the exhibit. The last column provides the corresponding SafeWater LCR model data variable in red/italic font. Systems must continue the activities in this exhibit until: 1) the goal is met, 2) the system is at or below the TL for two consecutive one-year monitoring periods, or 3) the system has made at least two good faith efforts to contact all customers served by an LSL or galvanized requiring replacement about the LSLR program.

Exhibit 5-102: Failure to Meet Goal-based Replacement Rate Activities Unit Burden and Cost Estimates

Activity	Unit Burden and/or Cost	*SafeWater LCR Data Variable*
s) Consult with Primacy Agency on activities to satisfy additional goal-based LSLR program outreach requirements	2 hrs/CWS serving > 10,000 people	*hrs_consult_fail_op*
t) Conduct activities in response to the first failure to meet LSLR goal	Burden per HH per CWS serving > 10,000 people 0.23 to 0.32 hrs Cost per HH per CWS serving > 10,000 people $3.63 to $4.89	Burden *hrs_fail_hh_op* Cost *cost_fail_hh*

Activity	Unit Burden and/or Cost	*SafeWater LCR Data Variable*
u) Conduct activities in response to each additional failure to meet LSLR goal	Burden per CWS serving > 10,000 people 122 to 241 hrs Cost per CWS serving > 10,000 people $2,651 to $24,918	Burden *hrs_fail_sys_op* Cost *cost_fail_sys*

Acronyms: CWS = community water system; HH = household; LSLR = lead service line replacement.
Sources: Data sources for each activity are provided following this exhibit.
Note: The system cannot discontinue the activities in this exhibit until: 1) the goal is met, 2) the system is at or below the TL for two consecutive one-year monitoring periods, or 3) the system has made at least two good faith efforts to contact all customers served by an LSL or galvanized requiring replacement about the LSLR program.

In addition to unit and burden costs, another important input is the likelihood that a system fails to meet its replacement goal. The SafeWater LCR model calculates this as the difference between the goal set by the Primacy Agency and the system's actual replacement rate. As described previously in Section 5.3.4.3, activity i), EPA assumed that Primacy Agencies would set an average replacement rate goal of 2 percent per year (*pp_lsl_replaced_vol_goal*). To recognize that this is a goal and not a requirement, EPA modeled a range of actual replacement rates from 1 to 5 percent with a most likely value of 2.5 percent (*pp_lsl_replaced_vol_pct*). For each CWSs serving 10,000 or more people in the goal-based program, the SafeWater LCR model randomly selects a replacement rate from this distribution. When the rate is less than 2 percent, the system incurs burden and costs for additional outreach activities described in s) through u) below.

s) Consult with Primacy Agency on activities to satisfy additional goal-based LSLR program outreach requirements (hrs_consult_fail_op). EPA estimates CWSs serving 10,000 people or more that fail to meet their replacement goal will incur an annual burden of 2 hours to consult with their Primacy Agency on needed outreach activities to consumers[110] to promote LSLR and encourage consumers to participate in the replacement program. This estimate is based on the burden for systems to consult with their Primacy Agency on public education activities from pg. 60 of the Economic and Supporting Analyses: Short-Term Regulatory Changes to the Lead and Copper Rule (USEPA, 2007).

t) Conduct activities in response to the first failure to meet LSLR goal (hrs_fail_hh_op, cost_fail_hh). CWSs serving more than 10,000 people that fail to meet their goal must select one of three outreach activities in the first year in which they miss their goal. These activities include: 1) certified mail to customers with lead or galvanized requiring replacement, 2) town hall meeting, 3) community event and provide lead outreach materials and information on LSLR program, 4) contact customers via phone, text message, email, or door hanger, or 5) other Primacy Agency approved methods. To estimate the burden and cost for the initial failure, EPA:

- Developed separate costs for contacting customers by phone and using doorhangers.

[110] Systems must provide materials to consumers in which the water system and/or customer's portion of the service line is lead, galvanized requiring replacement, or lead status unknown. See Chapter 3, Section 3.5 for a more detailed discussion of these types of service lines.

- Assumed systems will have an equal probability of picking one of the three outreach activities in Columns A - C are presented in Exhibit 5-103.
- Assumed systems would not select a community event or town hall meeting during the first year as a simplifying assumption because this activity is expressed on a per system basis, whereas the other activities are expressed on a per household basis and apply to those with LSLs or galvanized service lines. Instead as described in activity u), systems would elect to hold a town hall meeting as one of their activities during those years in which they continue to fail to meet their LSL goal.

As shown in Column D of Exhibit 5-103, EPA estimated the average burden per household for *hrs_fail_hh_op*. The burden is applied to *hh_remain_lsl*, which is the number of households served by LSLs in the current year.[111]

Exhibit 5-103: Burden to Conduct Additional Outreach in Response to First Failure to Meet LSLR Goal (hrs/household)

System Size (Population Served)	Send certified mail to contact customers (per HH)	Contact customers by phone (per HH)	Contact customers using door hangers (per HH)	Annual burden (per HH)
				hrs_fail_hh_op
	A	B	C	D=(A+B+C)/3
10,001-50,000	0.1	0.25	0.39	0.23
50,001-100,000	0.1	0.25	0.39	0.23
100,001-1,000,000	0.1	0.25	0.50	0.27
>1,000,000	0.1	0.25	0.67	0.32

Acronyms: HH = household; LSLR = lead service line replacement.
Source: "Derivation of Failure to Meet LSLR Goal_Final Rule.xlsx."
Notes:
A: Assumed burden of 1 hour per 20 letters for all system size categories. Burden to prepare the letter is 20 letters per hour based on *Disinfectants/Disinfection Byproducts, Chemical, and Radionuclides Rules ICR (Renewal)*, Exhibits 35. Costs are associated with a certified letter (See worksheet, "Support Tables," Table S-2.) (USEPA, 2015b).
B: Assumed systems will spend 15 minutes (0.25 hours) discussing program with customers. This burden is consistent with that used for other contacts with customers, e.g., contact with customers who have a sample > 15 µg/L to arrange follow-up sample and discuss possible causes for elevated lead levels.
C: EPA assumed systems will use same doorhangers as used following disturbances (see "Derivation of Public Education Inputs_CWS_Final Rule.xlsx," worksheet Water_Related Work for specific quotes).The burden includes the time to travel to the customer's home to deliver the door hangers. The Geographic extent of water systems from the 2006 Community Water Systems Survey, and Census Data. See "Derivation of Estimated Driving Distances_Final Rule.xlsx" for derivation of mileage. To develop the costs, the one-way driving distances of 4.9 miles for systems serving 10,001 to 100,000 people, 6.3 miles for systems serving 100,001 – 1,000,000 people, and 8.4 miles for those serving > 1,000,000 are divided by the assumed travel speed of 25 mph and multiplied by 2 to get the round-trip burden.

[111] The burden is likely underestimated as the model does not include additional outreach to households with service lines of unknown material.

Exhibit 5-104 shows how EPA derived the cost for the required outreach for the first annual goal failure. The annual cost per household, *cost_fail_hh*, is provided in Column D. The cost is also multiplied by *hh_remain_lsl*.

Exhibit 5-104: Costs to Conduct Outreach in Response to First Failure to Meet LSLR Annual Goal ($/system)

System Size (Population Served)	Send certified mail to contact customers (per HH)	Contact customers by phone (per HH)	Contact customers using door hangers (per HH)	Annual cost (per HH)
				cost_fail_hh
	A	B	C	D
10,001-50,000	$5.38	$0	$5.50	$3.63
50,001-100,000	$5.38	$0	$5.50	$3.63
100,001-1,000,000	$5.38	$0	$7.01	$4.13
>1,000,000	$5.38	$0	$9.28	$4.89

Acronyms: HH = household.
Source: "Derivation of Failure to Meet LSLR Goals_Final Rule.xlsx."
Notes:
A: Certified mail with electronic return receipt, single piece. Includes certified mail cost ($3.35), emailed signature receipt ($1.45), and first class postage ($0.49). (https://pe.usps.com/text/dmm300/Notice123.htm#_c109).
B: Systems will not incur any material costs for a phone call.
C: Includes $0.21 for the material costs of door hangers based on quotes from three vendors plus the round trip vehicle costs of $5.29 for systems serving 10,001 to 50,000 people, $6.80 for systems serving 100,001 to 1,000,000 people, and $9.07 for systems serving more than 1,000,000 people. For more information on door hanger costs see "Derivation of Public Education Inputs_CWS_Final Rule.xlsx," worksheet, "Service Line Disturbances." For assumptions related to roundtrip travel see note C under Exhibit 5-103.

u) Conduct activities in response to each additional failure to meet LSLR goal (hrs_fail_sys_op, cost_sys_hh). Systems that continue to fail to meet their goal in any subsequent concurrent year must select one of the three initial outreach activities and two additional activities. The additional outreach activities include: 1) social media campaign, 2) distribute information via mail to organizations representing plumbers and contractors, and 3) outreach to newspaper, television (TV), or radio. To estimate the burden and cost for the additional failures, EPA assumed systems:

- Would select the town hall meeting from the initial outreach activity list.
- Would have an equal probability of selecting a social media campaign, coordination with plumbing and contactor organization, and outreach to a newspaper.
- Would not select visiting targeted customers to discuss the LSLR program and opportunities for replacement as one of the methods for subsequent goal-based failures. This is a simplifying assumption because this activity is expressed on a per household basis, whereas all other activities for subsequent failures to meet the goal or expressed on a per system basis.

Exhibit 5-105 shows how EPA derived the annual burden for each subsequent failure to meet the annual goal. The annual burden per system, *hrs_fail_sys_op*, is provided in Column E.

Exhibit 5-105: Burden to Conduct Additional Outreach in Response to Subsequent Failure(s) to Meet LSLR Goal (hrs/system)

System Size (Population Served)	Townhall Meeting (per system)	Social Media Campaign (per system)	Coordinate with organizations representing plumbers and contractors (per system)	Outreach to newspaper, television, or radio (per system)	Annual Burden (per system)
					hrs_fail_sys_op
	A	B	C	D	E=A+[(B+C+D)/3)*2]
10,001-50,000	68.0	76.0	4.0	0.5	122
50,001-100,000	88.0	136.0	33.0	0.5	201
100,001-1,000,000	128.0	136.0	33.0	0.5	241
>1,000,000	128.0	136.0	33.0	0.5	241

Source: "Derivation of Failure to Meet LSLR Goals_Final Rule.xlsx."
Notes:
A: See file, "Derivation of Public Education Inputs_CWS_Final Rule.xlsx," worksheet, "Pb ALE_Other Activity Detail," Table 1: System Burden for Public Meetings and Table 4: System Burden for Additional PE Activities after a Lead ALE.
B: See file, "Derivation of Failure to Meet LSLR Goals_Final Rule.xlsx," worksheet, "Social Media Campaign" for detailed assumptions.
C: EPA assumed systems reach out to four groups. Assumes systems serving 10,001 to 50,000 people reach out via email (0.5 hrs) and phone (0.5 hrs), and large system reach out via email (0.5 hrs) and webinar (0.25 to post material and 1 hours to schedule webinar).
D: Assumed systems will pay for an ad in the newspaper. The burden is the same as that used for other outreach activities that are required for CWSs that exceed the lead AL. See "Derivation of Public Education Inputs_CWS_Final Rule.xlsx," worksheet "Pb ALE_Other Activity Detail," Table 4.

Exhibit 5-106 shows how EPA derived the annual cost for the required outreach for each subsequent failure to meet the goal-based replacement rate. The annual cost per system, *cost_fail_sys*, is provided in Column E.

Exhibit 5-106: Cost to Conduct Additional Outreach in Response to Subsequent Failure(s) to Meet LSLR Goal (hrs/system)

System Size (Population Served)	Townhall Meeting (per system)	Social Media Campaign (per system)	Coordinate with organizations representing plumbers and contractors (per system)	Outreach to newspaper, television, or radio (per system)	Annual Cost (per system)
					cost_fail_sys
	A	B	C	D	E=A+[(B+C+D)/3)*2]
10,001-50,000	$211	$0	$0	$3,660	$2,651
50,001-100,000	$669	$300	$0	$8,090	$6,263
100,001-1,000,000	$2,337	$300	$0	$8,090	$7,930
>1,000,000	$19,325	$300	$0	$8,090	$24,918

Source: "Derivation of Failure to Meet LSLR Goals_Final Rule.xlsx."
Notes:

A: See file, "Derivation of Public Education Inputs_CWS_Final Rule.xlsx," worksheet, "Pb ALE_Other Activity Detail," Table 5: System Cost for Additional PE Activities after a Lead ALE.
B: See "Derivation of Failure to Meet LSLR Goals_Final Rule.xlsx," worksheet, "Social Media Campaign" for detailed assumptions.
C: EPA assumed systems reach out to four groups via phone and email and would not incur any non-labor costs.
D: Assumed systems will pay for an ad in the newspaper. The cost is the same as that used for other outreach activities that are required for CWSs that exceed the lead AL. See "Derivation of Public Education Inputs_CWS_Final Rule.xlsx," worksheet "Pb ALE_Other Activity Detail," Table 5.

Exhibit 5-107 provides the SafeWater LCR model costing approach for LSL activities associated with failure to meet the goal-based replacement rate including additional cost inputs that are required to calculate these costs.

Exhibit 5-107: Failure to Meet Goal-based Replacement Rate Activities Cost Estimation in SafeWater LCR by Activity[1,2]

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
s) Consult with Primacy Agency on activities to satisfy additional goal-based LSLR program outreach requirements				
The total consulting hours per system multiplied by the system labor rate. *(hrs_consult_fail_op*rate_op)*	Cost does not apply to NTNCWSs.	At or below AL and above TL	Model PWS that does not meet its goal-based LSLR rate *(num_lslr_replace / num_lsl_base) < pp_lsl_replaced_vol_goal*	Once a year
t) Conduct activities in response to the first failure to meet LSLR goal				
The number of households with remaining LSLs multiplied by the total of the hours per household times the system labor rate, plus the material cost per household. *hh_remain_lsl*((hrs_fail_hh_op*rate_op)+ cost_fail_hh)*	Cost does not apply to NTNCWSs.	At or below AL and above TL	Model PWS that does not meet its goal-based LSLR rate for the first time *(num_lslr_replace / num_lsl_base) < pp_lsl_replaced_vol_goal*	Once a year
u) Conduct activities in response to each additional failure to meet LSLR goal				
The hours per system multiplied by the system labor rate, plus the material cost per system. *((hrs_fail_sys_op*rate_op)+cost_fail_sys)*	Cost does not apply to NTNCWSs.	At or below AL and above TL	Model PWS that does not meet its goal-based LSLR rate for two or more times *(num_lslr_replace / num_lsl_base) < pp_lsl_replaced_vol_goal*	Once a year

Acronyms: AL = action level; CWS = community water system; LSL = lead service line; LSLR = lead service line replacement; NTNCWS = non-transient non-community water system; PWS = public water system; TL = trigger level.
Notes:
[1] The data variables in this exhibit are defined previously in this section with the exception of:

- *rate_op*: PWS hourly labor rate (Section 4.3.10.1).

[2] The system can discontinue the activities in this exhibit if: 1) the goal is met, 2) the system no longer exceeds the TL for two consecutive one-year tap sampling monitoring periods, or 3) the system has made at least two good faith efforts to contact all customers served by an LSL or galvanized requiring replacement about the LSLR program.

5.3.4.6 *Estimate of national lead service line testing and replacement costs*

Exhibit 5-108 and Exhibit 5-109 show the estimated annualized national cost, under the low and high cost scenarios, of developing the LSL inventory, and conducting the customer-initiated, and goal-based and mandatory LSLR programs under the previous LCR, the LCRR, and the incremental cost discounted at 3 and 7 percent, respectively. Note that mandatory program costs may be overestimated because the EPA analysis does not account for LSL replacements (from voluntary programs or emergency repair) that occur between a system's initial inventory and the date the system has its first ALE. If replacements occur during this time period that are not captured in the EPA analysis the model estimated annual number of LSL replacement required under the system's mandatory program will be too high. The discounted mandatory program costs also do not capture the year to year variation that can occur under the two-year rolling average replacement criterion and therefore may over or under estimate discounted costs.

Exhibit 5-108: National Annualized Lead Service Line Replacement Costs – All PWSs at 3 Percent Discount Rate

	Low Cost Estimate			High Cost Estimate		
	Previous LCR	**Final LCRR**	**Incremental**	**Previous LCR**	**Final LCRR**	**Incremental**
LSL Inventory	$0	$6,318,000	$6,318,000	$0	$10,109,000	$10,109,000
System LSLR Plan	$0	$304,000	$304,000	$0	$395,000	$395,000
System LSLR (Mandatory)	$600,000	$15,550,000	$14,950,000	$26,777,000	$62,417,000	$35,641,000
LSLR Ancillary Activities (Mandatory)	$27,000	$1,087,000	$1,060,000	$500,000	$3,383,000	$2,882,000
System LSLR (Goal Based)	$0	$6,298,000	$6,298,000	$0	$22,580,000	$22,580,000
LSLR Ancillary Activities (Goal Based)	$0	$755,000	$755,000	$0	$1,524,000	$1,524,000
Activities Triggered by Not Meeting Goal	$0	$6,087,000	$6,087,000	$0	$19,663,000	$19,663,000
System LSLR (Customer-initiated)	$0	$6,943,000	$6,943,000	$0	$18,946,000	$18,946,000
LSLR Ancillary Activities (Customer-initiated)	$0	$1,030,000	$1,030,000	$0	$1,224,000	$1,224,000
Total Annual PWS Lead Service Replacement Costs	$628,000	$44,372,000	$43,744,000	$27,277,000	$140,242,000	$112,965,000
Household LSLR (Mandatory)	$182,000	$0	$-182,000	$5,466,000	$0	$-5,466,000
Household LSLR (Goal based)	$0	$8,100,000	$8,100,000	$0	$19,542,000	$19,542,000
Total Annual Lead Service Replacement Costs	$810,000	$52,472,000	$51,662,000	$32,743,000	$159,784,000	$127,041,000

Acronyms: LSL = lead service line; LSLR = lead service line replacement; PWS = public water system.
Note: Detail may not add exactly to total due to independent rounding.

Exhibit 5-109: National Annualized Lead Service Line Replacement Costs – All PWSs at 7 Percent Discount Rate

	Low Cost Estimate			High Cost Estimate		
	Previous LCR	**Final LCRR**	**Incremental**	**Previous LCR**	**Final LCRR**	**Incremental**
LSL Inventory	$0	$6,863,000	$6,863,000	$0	$10,593,000	$10,593,000
System LSLR Plan	$0	$467,000	$467,000	$0	$607,000	$607,000
System LSLR (Mandatory)	$638,000	$16,681,000	$16,044,000	$37,623,000	$79,869,000	$42,246,000
LSLR Ancillary Activities (Mandatory)	$29,000	$1,249,000	$1,220,000	$704,000	$4,438,000	$3,734,000
System LSLR (Goal Based)	$0	$6,676,000	$6,676,000	$0	$28,204,000	$28,204,000
LSLR Ancillary Activities (Goal Based)	$0	$824,000	$824,000	$0	$1,956,000	$1,956,000
Activities Triggered by Not Meeting Goal	$0	$6,636,000	$6,636,000	$0	$25,589,000	$25,589,000
System LSLR (Customer-initiated)	$0	$6,442,000	$6,442,000	$0	$17,189,000	$17,189,000
LSLR Ancillary Activities (Customer-initiated)	$0	$965,000	$965,000	$0	$1,118,000	$1,118,000
Total Annual PWS Lead Service Replacement Costs	$667,000	$46,803,000	$46,136,000	$38,327,000	$169,562,000	$131,235,000
Household LSLR (Mandatory)	$193,000	$0	$-193,000	$7,681,000	$0	$-7,681,000
Household LSLR (Goal based)	$0	$8,587,000	$8,587,000	$0	$24,409,000	$24,409,000
Total Annual Lead Service Replacement Costs	$860,000	$55,389,000	$54,529,000	$46,008,000	$193,971,000	$147,963,000

Acronyms: LSL = lead service line; LSLR = lead service line replacement; PWS = public water system.

Note: Detail may not add exactly to total due to independent rounding.

5.3.5 PWS POU-Related Costs

As discussed in Section 3.2.2.2, CWSs serving 10,000 or fewer people and NTNCWSs with a lead 90th percentile above the TL must evaluate and recommend to their Primacy Agency which compliance alternative they would implement if they have a future lead ALE from among: 1) LSLR, 2) CCT installation/re-optimization, 3) POU device installation and maintenance, or 4) replacement of lead-bearing materials. For modeling purposes, EPA assumed that systems would choose the least costly option from among the first three alternatives. EPA did not evaluate the cost of replacing lead-bearing materials. The SafeWater LCR model calculates the annualized cost the system will face under each of these three options and selects the least costly alternative.

Those approved for the POU provision must develop a plan and implement the program if they have a future lead ALE. Note that once the POU option is started, the system must continue to implement this program regardless of their subsequent lead 90th percentile levels.

In addition to the cost to provide and maintain POU devices and educate customers on them, systems have associated ancillary public education and sampling costs. POU-related costs are grouped into two subsections:

- 5.3.5.1: POU Device Installation and Maintenance
- 5.3.5.2: POU Ancillary Activities

In addition, Section 5.3.5.3 provides the national annualized POU costs under the low cost and high cost scenarios at a 3 and 7 percent discount rate.

5.3.5.1 *POU Device Installation and Maintenance*

All costs in this category are grouped into one activity: a) provide, monitor, and maintain POU devices.

a) Provide, monitor, and maintain POU devices (annual_pou_cost_hh). CWSs approved for the POU program must provide one POU device at each household they serve and continue to maintain the device. EPA determined the average number of households per system, which is equivalent to the number of POU devices by dividing the retail population served by all systems in each of the five size categories serving 10,000 people or fewer people (*pws_pop*) by the average number of people per household of (2.59 *(numb_hh*)) and then dividing by the number of systems per size category, as shown in Exhibit 5-110.

Exhibit 5-110: Average Number of Households and POU Devices per CWS

System Size (Population Served)	# of Systems	Retail Population	Households (HH) per System Size Category	Average HH per System (Equals Number of POU Devices)
		pws_pop		
	A	B	C = B/2.59	D = C/A
≤100	12,046	723,487	279,339	**23**
101-500	15,307	3,884,780	1,499,915	**98**
501-1,000	5,396	3,989,089	1,540,189	**285**

System Size (Population Served)	# of Systems	Retail Population	Households (HH) per System Size Category	Average HH per System (Equals Number of POU Devices)
		pws_pop		
	A	B	C = B/2.59	D = C/A
1,001-3,300	8,035	15,312,930	5,912,328	**736**
3,301-10,000	4,974	29,070,747	11,224,227	**2,257**

Acronyms: HH = household; POU = point-of-use.
Notes:
A,B: SDWIS/Fed third quarter 2016 "frozen" data set that includes information reported through June 30, 2016.
C: 2.59 is the average number of people per household for the year 2011 (United States Census Bureau, 2010). Table AVG1. Average Number Of People Per Household, By Race And Hispanic Origin, Marital Status, Age, And Education Of Householder: 2010. This corresponds to SafeWater data variable: *numb_hh*.

NTNCWSs must provide a POU device on each tap used for drinking water consumption. Exhibit 5-111 provides the estimated number of POU devices per NTNCWSs based on 11 types of NTNCWS service categories classified under five Internal Plumbing Code (IPC) categories (business, industrial, residential, daycare, and school). Two estimates are provided, a minimum that excludes the installation of POU on bathroom taps and a maximum that includes bathroom taps. Additional detail on EPA's approach is provided in "Derivation of POU Inputs_Final Rule.xlsx."

Exhibit 5-111: Minimum and Maximum Estimated Number of Taps Requiring POU Devices per NTNCWS

System Size (Population Served)	Minimum Number of POU Devices	Maximum Number of POU Devices
	numb_pou	
	A	B
≤100	3	9
101-500	5	23
501-1,000	10	56
1,001-3,300	16	117
3,301-10,000	41	482
10,001-50,000	207	2,910
50,001-100,000	73	366
100,001-1,000,000	276	1,636
> 1,000,000		

Source: "Derivation of POU Inputs_Final Rule.xlsx."
Notes:
A: The minimum number of POU devices is based on the weighted average of number of taps excluding bathrooms. See Table A-1 in "Derivation of POU Inputs_Final Rule.xlsx," worksheet "NTNCWS_Cost Model_Inputs_Final Rule.xlsx."
B: The maximum number of POU devices is based on the weighted average of number of taps including bathrooms. See Table A-2 in "Derivation of POU Inputs_Final Rule.xlsx," worksheet "NTNCWS_Cost Model_Inputs_Final Rule.xlsx."

The number of POU devices *(numb_pou)* is multiplied by the unit cost of the POU device installation and maintenance (*annual_pou_cost_hh*) to produce the total cost. EPA used a modified version of the WBS model to calculate unit costs for POU devices that specifically remove lead. The WBS model includes the following cost components of a complete POU program:

- POU device purchase, and scheduling and installation labor;
- Labor for POU device maintenance; and
- Materials (replacement filters) for POU device maintenance.

EPA assumed 25 percent of households receive countertop units and 75 percent receive faucet mount units. The resulting estimated annual average cost ranges between $113 - $116 per household per year depending on the discount rate (3 percent or 7 percent) used. The derivation of this unit cost (*annual_pou_cost_hh*) is shown in detail in *Technologies and Costs for Corrosion Control to Reduce Lead in Drinking Water* (USEPA, 2020).

Exhibit 5-112 provides the SafeWater LCR model costing approach for installation and maintenance of POU devices including additional cost inputs that are required to calculate these costs.

Exhibit 5-112: Point-of-Use Device Installation and Maintenance Cost Estimation in SafeWater LCR by Activity[1]

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th – Range[1]	Other Conditions	
a) Provide, monitor, and maintain POU devices				
Households per system multiplied by the unit cost of the POU device installation and maintenance. *(pws_pop/numb_hh)*annual_pou_cost_hh*	The number of POU devices per system multiplied by the unit cost of the POU device installation and maintenance. *numb_pou*annual_pou_cost_hh*	All	Model PWS installing a POU device	Once per year

Acronyms: CWS = community water system; NTNCWS = non-transient non-community water system; POU = point-of-use; PWS = public water system.

Notes:

[1] Once the POU option is started in response to exceeding the lead AL, systems must continue to implement this program regardless of their subsequent lead 90th percentile levels. POU installation occurs once with O&M costs continuing annually.

5.3.5.2 *POU Ancillary Activities*

EPA has developed costs for one-time ancillary PWS activities related to POU program development and on-going ancillary activities as shown in Exhibit 5-113. The exhibit provides the unit burden and/or cost for each activity. The assumptions used in the estimation of each activity follows the exhibit. The last column provides the corresponding SafeWater LCR model data variable in red/italic font. In a few

instances, some of these activities are conducted by the state instead of the water system. These activities are identified in the exhibit and further explained in the exhibit notes.

Exhibit 5-113: PWS Ancillary POU-Related Burden and Cost Estimates[1]

Activity	Unit Burden and/or Cost	*SafeWater LCR Data Variable*
b) Develop POU plan and submit to Primacy Agency (one-time)[2]	178 to 328 hrs for CWSs; 148 to 388 hrs for NTNCWSs	*hrs_pou_plan_dev_op*
c) Develop PE materials and submit to Primacy Agency (one-time)	3.5 hrs per CWS 3.5 to 20 hrs for NTNCWSs	*hrs_pe_pou_op*
d) Print POU education materials	Burden 0.0025 hrs/sample per CWS 1 hr/NTNCWS Cost $0.025 sample per CWS $0.025 per NTNCWS	Burden *hrs_print_pe_pou_op* *hrs_ntncws_distr_pe_pou_op* Cost *cost_print_pe_pou* *cost_ntncws_distr_pe_pou*
e) Obtain households for POU monitoring	0.5 hrs per sample for CWSs only	*hrs_samp_volunt_pou_op*
f) Deliver POU monitoring materials and instructions to participating households	Burden 0.25 hrs/sample per CWS Cost $6.85 sample per CWS $0.025 per NTNCWS	Burden *hrs_discuss_samp_op* Cost *cost_pou_samp*[3]
g) Collect tap samples after POU installation	CWS Burden: 0.39 hrs/sample Cost: $5.29 NTNCWS 0.5 hrs/sample	CWS *hrs_pickup_samp_op* *cost_pickup_*samp NTNCWS *hrs_source_op*
h) Determine if sample should be rejected and not analyzed	0.25 hrs/rejected sample for CWSs only	*hrs_samp_reject_op*
i) Analyze POU tap samples	In-House Burden N/A In-House Cost N/A Commercial Analysis $21.58/ sample per CWS and NTNCWSs	In-House Burden *hrs_analyze_samp_op*[3] In-House Cost *cost_lab_lt_samp*[3] Commercial Analysis *cost_commerical_lab*[3]
j) Prepare and submit sample invalidation request to Primacy Agency	2 hrs per sample per CWS and NTNCWS	*hrs_samp_invalid_op*

Activity	Unit Burden and/or Cost	*SafeWater LCR Data Variable*
k) Inform customers of POU tap sample results	CWS Burden: 0.05 hrs/sample Cost: $0.58/sample NTNCWS Burden: 1 hr/sample Cost: $0.025/sample	CWS *hrs_inform_samp_op* *cost_cust_lt* NTNCWS *hrs_ntncws_inform_samp_op* *cost_ntncws_cust_lt*
l) Certify to Primacy Agency that POU tap results were reported to customers	0.66 to 1 hr/year per CWS and NTNCWS	*hrs_cert_cust_lt_op*
m) Prepare and submit annual report on POU program to Primacy Agency	1 to 2 hrs per CWS; 1 to 8 hrs per NTNCWS	*hrs_pou_report_ann_prep_op*

Acronyms: CWS = community water system; NTNCWS = non-transient non-community water system; PE = public education; POU = point-of-use.
Source: Data sources for each activity are provided following this exhibit.
Notes:
[1] Requirements apply only to CWSs serving 10,000 or fewer people and NTNCWS that exceed the AL and have POU provision and maintenance as their approved compliance option.
[2] The rule does not explicitly include a POU plan. However, EPA assumed most systems would prepare this plan prior to implementing a POU program. This assumption may overestimate costs during the first year the program is implemented.
[3] In Arkansas, Louisiana, Mississippi, Missouri, and South Carolina, the state pays for the cost of bottles, shipping, analysis, and providing sample results to the system. Thus, the state will incur the burden and cost for these activities in lieu of the system.

b) Develop POU plan and submit to Primacy Agency (hrs_pou_plan_dev_op). Although not required under the LCRR, EPA assumed that systems (i.e., CWSs serving 10,000 or fewer people and NTNCWSs without CCT[112]) above the TL that select the POU option would develop a plan to provide and maintain POU devices for lead removal. EPA assumed the POU plan would include gathering background information and identifying plan elements, customer participation (CWSs only), installation, monitoring and maintenance, and logistics and administration. Each of these plan elements are included in the overall burden estimate and provided in Exhibit 5-114 and Exhibit 5-115 for CWSs and NTNCWSs, respectively.

Additional detail on each of these plan elements is provided in the file, "Derivation of POU Inputs_Final Rule.xlsx."

[112] The LCRR does not prohibit systems with CCT from selecting the POU option. However, EPA assumed systems would re-optimize their CCT.

Exhibit 5-114: CWS Burden to Develop a POU Plan (hrs/system)
hrs_pou_plan_dev_op

System Size (Population Served)	Gather Background Information	Plan for Customer Participation	Plan for Installation	Plan for Monitoring & Maintenance	Plan for Logistics & Administration	Total
	A	B	C	D	E	F=A:E
≤100	58	30	30	50	10	**178**
101-500	58	30	30	50	10	**178**
501-1,000	108	60	60	100	0	**328**
1,001-10,000	108	60	60	100	0	**328**
>10,000	N/A	N/A	N/A	N/A	N/A	**N/A**

Source: "Derivation of POU Inputs_Final Rule.xlsx." This file provides the associated burden for the activities listed in Notes A through E.

Notes:

General: With the exception of reading the guidance (see note A) and planning for logistics and administration (see note E), CWSs serving more than 500 people are assumed to incur twice the burden than those serving 500 or fewer people.

A: Includes read and understand POU or point of entry (POE) Treatment Options for Small Drinking Water Systems (USEPA, 2006b) and identify considerations and options for their appropriate system type; prepare a draft outline of plan elements and submit for management and state approval, as applicable; present a draft outline of plan elements to system board/management bodies and incorporate feedback; and consult with a legal expert on property liability and additional insurance.

B: Includes identifying in the plan the types of customer access and maintenance agreements needed and their schedule for development; includes 2 hours of legal consultation.

C: Includes identifying the number of taps to treat and the schedule and customer priority for installation; identifying whether vendors or licensed plumbers, and certified operators will install the units and how they will be managed and tracked; and how and when arrangements for access to installation sites will occur and how they will be managed and tracked.

D: Includes description of vendor responsibilities and utility responsibilities for monitoring and maintenance of the POU units; unit maintenance frequencies and checklist for maintenance inspections; POU unit routine replacement frequencies and protocol for emergency reporting of problems and response; and incorporation of rule-specific monitoring requirements into the plan.

E: Includes description of contractual agreements and oversight responsibilities for lease agreements. Assumed this primarily affects CWSs serving 500 and fewer people because they would not have available staff for maintenance and monitoring of these units.

Exhibit 5-115: NTNCWS Burden to Develop a POU Plan (hrs/system)
hrs_pou_plan_dev_op

System Size (Population Served)	Gather Background Information	Plan for Customer Participation	Plan for Installation	Plan for Monitoring & Maintenance	Plan for Logistics & Administration	Total
	A	B	C	D	E	F=A:E
≤500	58	0	30	50	10	**148**
501-10,000	108	0	60	50	10	**228**
10,001-50,000	208	0	120	50	10	**388**
50,001- 1,000,000	108	0	60	50	10	**228**

Source: "Derivation of POU Inputs_Final Rule.xlsx."

Notes:
General: No NTNCWS serves more than 1 million people. Three NTNCWSs serve 50,001 – 1,000,000 people. These systems have fewer taps than the average estimated number for those serving 10,001 - 50,000 people. Thus, EPA assumed a similar burden for these three largest NTNCWSs as those serving 3,301 - 10,000 people. No NTNCWS serves > 1,000,000 people.
A: Includes read and understand POU or POE Treatment Options for Small Drinking Water Systems (USEPA, 2006b) and identify considerations and options for their appropriate system type; prepare a draft outline of plan elements and submit for management and Primacy Agency approval, as applicable; present a draft outline of plan elements to governing bodies and incorporate feedback; and consult with a legal expert on property liability and additional insurance.
B: Does not apply to NTNCWSs.
C: Includes identifying the number of taps to treat and the schedule for installation; identifying whether vendors or licensed plumbers, and electricians will install the units and how these services will be provided; and how and when arrangements for access to installation sites will occur and how they will be managed and tracked.
D: Includes description of vendor responsibilities for monitoring and maintenance of the POU units; unit maintenance frequencies and checklist for maintenance inspections; POU unit routine replacement frequencies and protocol for emergency reporting of problems and response; and incorporation of rule-specific monitoring requirements into the plan.
E: Includes description of contractual agreements and oversight responsibilities for lease agreements.

c) ***Develop PE materials and submit to Primacy Agency (hrs_pe_pou_op).*** CWSs serving 10,000 or fewer people and NTNCWSs with a lead ALE that choose the POU option must implement the POU program including providing public education on the maintenance and use of POU device to all households they serve. EPA assumed systems serving 50,000 or fewer people and those serving more than 50,000 people will incur a one-time burden of 3.5 hours and 20 hours, respectively, to develop these PE materials and submit them to the Primacy Agency for review *(hrs_pe_pou_op*). Burden estimates are similar to those related to the development of other PE materials (e.g., general LSL information, educational materials for service line disturbances, etc.) and are based on tier 2 PN preparation burden (USEPA, 2015a).

d) ***Print POU education materials (hrs_print_pe_pou_op, cost_print_pe_pou, hrs_ntncws_distr_pe_pou, cost_ntncws_distr_pe_pou).*** EPA estimated CWSs serving 10,000 or fewer people will require 0.0025 hours per household to print POU public education materials based on assumptions for production labor used in the *Economic and Supporting Analyses: Short-Term Regulatory Changes to the Lead and Copper Rule*, Exhibit 17 (USEPA, 2007). EPA assumed that this material would be provided in addition to the manufacturer's information that comes with the POU device. The estimated cost for systems to print POU PE material per household is $0.025 that is the cost of paper. EPA assumed that there will be no envelope or mailing costs because PE materials will be provided when the system provides the POU device. See "General Cost Model Inputs" for specific vendor paper quotes. EPA assumed NTNCWSs would provide materials via email and post materials publicly with an estimated burden of 0.5 hours to develop/send e-mail and an additional 0.5 hours to post the materials, for a total of 1 hour (*hrs_ntncws_distr_pe_pou_op*). NTNCWSs will also incur a cost for PE posted materials (*cost_ntncws_distr_pe_pou*) that will include paper costs of $0.025 based on costs from 3 vendors (see file "General Cost Model Inputs_Final Rule.xlsx" for more detail).

e) ***Obtain households for POU monitoring (hrs_samp_volunt_pou_op).*** Under the POU program, systems must sample one-third of locations with POU devices annually. For CWSs, EPA assumed customers can collect these samples. EPA estimated that a CWSs will incur a burden of 0.5 hours to

obtain customers for POU sampling. EPA also applied the same inflation percentages, from the assumption associated with lead tap sampling, to the number of required POU samples to account for the likelihood a customer does not collect the sample (10 percent, 1 - *pp_hh_return_samp*), the sample is rejected (5 percent, *pp_samp_reject*), or invalidated (0.6 percent, *pp_samp_invalid*). Refer to Section 5.3.2.1.2, activity e) for additional detail.

f) Deliver POU monitoring materials and instructions to participating households (hrs_discuss_samp_op, cost_pou_samp). EPA used the same data variables and inputs for CWSs to discuss proper sampling procedures with customers of 0.25 hours per sample (*hrs_discuss_samp_op*) as under the lead tap program. EPA also assumed systems will incur the same non-labor costs to provide a test kit (including bottles and instruction) and the kits to customers (*cost_pou_samp*) of $6.85 for CWSs serving 10,000 or fewer people as used for systems without LSLs under the tap sampling program (*cost_5_lt_samp*). EPA also applied the same inflation percentages to the number of samples to account for the likelihood a customer does not collect the sample (1 - *pp_hh_return_samp*), the sample is rejected (*pp_samp_reject*), or invalidated (*pp_samp_invalid*). Refer to Section 5.3.2.1.2, activities e) and g) for additional detailed assumptions.

g) Collect tap samples after POU installation (hrs_pickup_samp_op, cost_pickup_samp, hrs_source_op). EPA uses the same data variable and input for the burden and O&M cost for CWSs serving 10,000 or fewer to travel to a customer's home to pick-up the collected sample of 0.39 hours (*hrs_pickup_samp*) and $5.29 (*cost_pickup_samp*). Refer to Section 5.3.2.1.2, activity h) for additional detailed assumptions. EPA also applied the same inflation percentages to the number of samples to account for the likelihoods a customer would not collect the sample (1 - *pp_hh_return_samp*), the sample is rejected (*pp_samp_reject*), or invalidated (*pp_samp_invalid*).

For NTNCWSs, EPA uses the same data variable and input for the burden to collect POU sample as a source water sample of 0.5 hours/sample (*hrs_source_op*). Refer to Section 5.3.2.4.2, activity z) for additional detailed assumptions. EPA also inflated the number of samples to account for invalidated samples (*pp_samp_invalid*).

CWSs and NTNCWSs must collect tap samples at one-third of the households or taps with POU devices, respectively. See Exhibit 5-110 and Exhibit 5-111 for the estimated number of POU devices for CWSs and NTNCWSs, respectively.

h) Determine if samples should be rejected and not analyzed (hrs_samp_reject_op). EPA used the same data variable and input, of 0.25 hours per sample (*hrs_samp_reject_op*), for the CWS's burden to review samples collected by customers to determine if they were collected properly or should be rejected and not submitted for analysis. EPA also applied the same inflation percentage of 5 percent to the number of samples to account for the likelihood a sample is rejected (*pp_samp_reject*).

i) Analyze POU tap samples (hrs_analyze_samp_op, cost_lab_lt_samp, cost_commercial_lab). Based on input from laboratories, EPA assumed CWSs serving 10,000 or fewer people and all NTNCWSs will use commercial labs for sample analysis; therefore, these systems will not incur any in-house analytical burden (*hrs_analyze_samp_op*) or cost (*cost_lab_lt_samp*). Instead these systems will incur a cost of $21.58 per sample (*cost_commercial_lab*) to have their POU tap samples analyzed for lead by a commercial lab. That cost corresponds to the same cost input used for systems without

LSLs under the lead tap sampling program (*cost_5_commercial_lab*). Refer to Section 5.3.2.1.2, activity j) for additional detail. EPA also applied the same inflation percentage of 0.6 percent to the number of samples to account for the likelihood a sample is invalidated (*pp_samp_invalid*).

j) ***Prepare and submit sample invalidation request to Primacy Agency (hrs_samp_invalid_op).*** EPA used the lead tap sampling data variable and input of 2 hours per request (*hrs_samp_invalid_op*) for the burden for CWSs and NTNCWSs to prepare and submit a sample invalidation request to their Primacy Agency. EPA assumed that Primacy Agencies will approve sample invalidation requests for the 0.6 percent of samples for which systems will submit these requests (*pp_samp_invalid*).

k) ***Inform customers of POU tap sample results (hrs_inform_samp_op, cost_cust_lt, hrs_ntncws_inform_samp_op, cost_ntncws_cust_lt).*** EPA uses the same data variables and inputs for systems to provide the sampling results collected from POU taps as the lead tap sampling program. CWSs must report individual lead sample results to customers who participated in the sampling pool. EPA estimates that systems will require an average of 0.05 hours per customer (*hrs_inform_samp_op*). Systems are also assumed to mail these results at a cost of $0.58 (*cost_cust_lt*). For NTNCWSs, EPA assumed the systems will deliver materials via email to all customers and post in a public location at a burden of 1 hour for all system sizes (*hrs_ntncws_inform_samp_op*). EPA assumed NTNCWSs will incur paper costs of $0.025 (*cost_ntncws_cust_lt*) to post the flyer. Refer to Section 5.3.2.1.2, activity l) for additional detailed assumptions regarding these four data variables.

l) ***Certify to Primacy Agency that POU tap monitoring results were reported to customers (hrs_cert_cust_lt_op).*** For both the lead tap and POU monitoring programs, systems must prepare and submit an annual certification to their Primacy Agencies that they informed customers of their monitoring results. For the POU certification, EPA used the same data variable and input as used for the lead tap sampling program. EPA assumed a burden of 0.66 hours per year for CWSs and NTNCWSs serving 50,000 or fewer people and 1 hour for those serving more than 50,000 people. Refer to Section 5.3.2.1.2, activity m) for additional detailed assumptions.

m) ***Prepare and submit annual POU program Report to Primacy Agency (hrs_pou_report_ann_prep_op).*** Systems must prepare and submit a report of their POU program that includes monitoring results, any corrective actions if the TL was exceeded, and if requested by the Primacy Agency, any maintenance activities. The estimated burden and assumptions for CWSs and NTNCWSs are provided in Exhibit 5-116. EPA assumed systems would submit this report electronically to the Primacy Agency and thus would incur no paper or mailings costs.

Exhibit 5-116: PWS Annual POU Program Report Preparation and Submission Burden

System size (Population Served)	CWSs	NTNCWSs
	hrs_pou_report_ann_prep_op	
	A	B
≤3,300	1	1
3,301-10,000	2	2
10,001-50,000	N/A	4
50,001-100,000	N/A	4

System size (Population Served)	CWSs	NTNCWSs
	hrs_pou_report_ann_prep_op	
	A	B
100,001-1,000,000	N/A	8
>1,000,000	N/A	

Source: "Derivation of POU Inputs_Final Rule.xlsx."
Notes:
A, B: Assume reporting and recording keeping is similar to April 2006 EPA guidance on POU/POE devices (USEPA, 2006b).
B: No NTNCWSs serves more than 1 million people. Thus, the burden for this size category is 0.

Exhibit 5-117 provides the SafeWater LCR model cost estimation approach for system ancillary POU system cost inputs including additional cost inputs that are required to calculate these costs.

Exhibit 5-117: PWS Point-of-Use Ancillary Costing Estimation in SafeWater LCR by Activity[1, 2, 3]

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range[2]	Other Conditions	
b) Develop POU plan and submit to Primacy Agency				
The total hours per system multiplied by the system labor rate. *(hrs_pou_plan_dev_op*rate_op)*	Cost applies as written to NTNCWSs.	Above TL	Model PWS selecting POU installation and maintenance as their compliance option	One time
c) Develop PE materials and submit to Primacy Agency for review				
The total hours per system multiplied by the system labor rate. *(hrs_pe_pou_op*rate_op)*	Cost applies as written to NTNCWSs.	Above AL	Model PWS installing POU device	One time
d) Print POU education material				
The hours per household multiplied by the system labor rate and the material cost. *(pws_pop/numb_hh)* ((hrs_print_pe_pou_op*rate_op)+ cost_print_pe_pou)*	The hours per system multiplied by the system labor rate and the material cost. *((hrs_ntncws_distr_pe_pou_op*rate_op)+cost_ntncws_distr_pe_pou)*	Above TL	Model PWS installing POU device	Once a year

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range[2]	Other Conditions	
e) Obtain households for POU Monitoring				
One third of households per system multiplied by the hours per sample and the system labor rate. The number of required samples (assumed to be one per household) is inflated to include those unreturned, invalidated, and rejected to ensure that the cost reflects the additional burden that must occur to meet the sampling requirement. *(((1/3)*(pws_pop/numb_hh))+(((1/3)*(pws_pop/numb_hh))*(1-pp_hh_return_samp))+(((1/3)*(pws_pop/numb_hh))*pp_samp_invalid)+(((1/3)*(pws_pop/numb_hh))*pp_samp_reject))*(hrs_samp_volunt_pou_op*rate_op)*	Cost does not apply to NTNCWSs.	All	Model PWS installing POU device	Once a year
f) Deliver POU monitoring materials and instructions to participating households[4]				
One third of households per system multiplied by the total of the hours per sample to provide instructions times the system labor rate, plus the cost of materials per sample. The number of required samples (assumed to be one per household) is inflated to include those unreturned, invalidated, and rejected, to ensure that the cost reflects the additional burden that must occur to meet the sampling requirement. *((((1/3)*(pws_pop/numb_hh)))+(((1/3)*(pws_pop/numb_hh))*pp_samp_invalid)+(((1/3)*(pws_pop/numb_hh))*(1-pp_hh_return_samp))+(((1/3)*(pws_pop/numb_hh))*pp_samp_reject))*((hrs_discuss_samp_op*rate_op)+cost_pou_samp)*	Cost does not apply to NTNCWSs.	All	Model PWS installing POU device	Once a year

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range[2]	Other Conditions	
g) Collect tap samples after POU installation				
One third of households per system multiplied by the hours per sample and the system labor rate. The number of required samples (assumed to be one per household) is inflated to include those unreturned, invalidated and rejected to ensure that the cost reflects the additional burden that must occur to meet the sampling requirement. *((((1/3)*(pws_pop/numb_hh)))+(((1/3)*(pws_pop/numb_hh))*pp_samp_invalid)+(((1/3)*(pws_pop/numb_hh))*(1-pp_hh_return_samp))+(((1/3)*(pws_pop/numb_hh))*pp_samp_reject))*((hrs_pickup_samp_op*rate_op)+cost_pickup_samp)*	One third of the number of POU devices per system multiplied by the total of the hours per system times the system labor rate, plus the material cost. The number of required samples is inflated to include those invalidated to ensure that the cost reflects the additional burden that must occur to meet the sampling requirement. *(((1/3)*numb_pou)+(((1/3)*numb_pou)*pp_samp_invalid))*((hrs_source_op*rate_op)+cost_pou_samp)*	All	Model PWS installing POU device	Once a year
h) Determine if samples should be rejected and not analyzed				
One third of households per system with a sample expected to be rejected (calculated by multiplying the total number of required samples by the likelihood of rejection) multiplied by the hours per sample and the system labor rate. *(((1/3)*(pws_pop/numb_hh))*pp_samp_reject)*(hrs_samp_reject_op*rate_op)*	Cost does not apply to NTNCWSs.	All	Model PWS installing POU device	Once a year

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range[2]	Other Conditions	
i) Analyze POU tap samples[3]				
1/3 of households per system multiplied by the material cost of the commercial lab analysis per sample. All systems installing POUs are assumed to use commercial labs for sample analysis. The number of samples (assumed to be one per HH) is inflated to include those invalidated, to ensure that the cost reflects the additional burden that must occur to meet the sampling requirement. *((((1/3)*(pws_pop/numb_hh))+(((1/3)*(pws_pop/numb_hh))*pp_samp_invalid))*cost_commercial_lab)*	1/3 of the number of POU devices per system multiplied by the material cost of the commercial lab analysis per sample. All systems installing POUs are assumed to use commercial labs for sample analysis. The number of required samples is inflated to include those invalidated to ensure that the cost reflects the additional burden that must occur to meet the sampling requirement. Systems will collect one sample per POU device. *(((1/3)*numb_pou)+(((1/3)*numb_pou)*pp_samp_invalid))*cost_commercial_lab*	All	Model PWS installing POU device	Once a year
j) Prepare and submit sample invalidation request to Primacy Agency				
1/3 of HHs per system where a sample is expected to be invalid (calculated by multiplying the total number of required samples by the likelihood of invalidation) multiplied by the hours per sample and the system labor rate. *(((1/3)*(pws_pop/numb_hh))*pp_samp_invalid)*(hrs_samp_invalid_op*rate_op)*	1/3 of the number of POU devices per system where a sample is expected to be invalid (calculated by multiplying the total number of required samples by the likelihood of invalidation) multiplied by the hours per sample and the system labor rate. *((1/3)*numb_pou)*pp_samp_invalid)*(hrs_samp_invalid_op*rate_op)*	All	Model PWS installing POU device	Once a year

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range[2]	Other Conditions	
k) Inform customers of POU tap sample results				
1/3 of HHs per system multiplied by the total of the hours per sample times the system labor rate plus the material cost per sample. *((1/3)*(pws_pop/numb_hh))*((hrs_inform_samp_op*rate_op)+cost_cust_lt)*	The hours per system multiplied by the system labor rate, plus the material cost. *(hrs_ntncws_inform_samp_op*rate_op)+ cost_ntncws_cust_lt*	All	Model PWS installing POU device	Once a year
l) Certify to Primacy Agency that POU tap sample results were reported to customers				
The total hours per system to submit certification multiplied by the system labor rate. *(hrs_cert_cust_lt_op*rate_op)*	Cost applies as written to NTNCWSs.	All	Model PWS installing POU device	Once a year
m) Prepare and submit annual POU program report to Primacy Agency				
The total hours reporting cost per system multiplied by the system labor rate. *(hrs_pou_report_ann_prep_op*rate_op)*	Cost applies as written to NTNCWSs.	All	Model PWS installing POU device	Once a year

Acronyms: AL = action level; CWS = community water system; HH = household; NTNCWS = non-transient non-community water system; PE = public education; POU = point-of-use; PWS = public water system; TL = trigger level.

Notes:

[1] The data variables in this exhibit are defined previously in this section with the exception of:

- *numb_pou*: Number of POU devices per PWSs that elects POU option (Section 5.3.5.1).
- *pp_commercial_samp*: Likelihood a sample will be analyzed by a commercial laboratory (Section 5.3.2.1.2, activity J)).
- *pp_lab_samp*: Likelihood a sample will be analyzed in-house (Section 5.3.2.1.2, activity j)).
- *rate_op*: PWS hourly labor rate (Section 4.3.10.1).

[2] Once the POU program is started in response to a lead ALE, systems must continue to implement this program regardless of their subsequent lead 90th percentile levels.

[3] For CWSs, the number of POU devices equals the number of households.

[4] The burden and costs to provide sample bottles (*cost_pou_samp*) under activity f) and conduct analyses under activity i) are incurred by the state in Arkansas, Louisiana, Mississippi, Missouri, and South Carolina.

5.3.5.3 *Estimate of PWS National Point-of-Use Device Installation and Maintenance Costs*

The estimated national annualized POU device installation and maintenance costs for the final rule, under the low cost scenario, are $3,418,000 at a 3 percent discount rate and $3,308,000 at a 7 percent discount rate. The POU impacts of the final rule for the high cost scenario are $20,238,000 discounted at 3 percent and $19,928,000 discounted at 7 percent. Since POU costs are zero under the previous LCR, the incremental costs range from $3,418,000 to $20,238,000 at a 3 percent discount rate and from $3,308,000 to $19,928,000 at a 7 percent discount rate, under the low and high cost scenarios respectively (see Exhibit 5-1 and Exhibit 5-2).

5.3.6 PWS Lead Public Education and Outreach Costs

Systems will incur labor and non-labor costs to provide consumer notice in response to a single lead sample above 15 µg/L, to conduct public education requirements in response to a lead 90th percentile level, and to conduct additional education and outreach regardless of their lead 90th percentile level. These activities and associated costs are detailed in Sections 5.3.6.1 through 5.3.6.3, respectively. Exhibit 5-133 provides the SafeWater LCR model cost estimation approach for system lead public education and outreach costs for these three subsections and is located at the end of Section 5.3.6.3. Section 5.3.6.4 provides the national annualized lead public education and outreach costs at a 3 and 7 percent discount rate.

Note that public education requirements for systems with LSLs that pertain to general LSL outreach that is provided to customers with LSLs, galvanized requiring replacement, or that are served by lines of unknown material and targeted outreach that is required when they exceed the TL were previously discussed in Section 5.3.4.4 in activity k). Public education requirements for systems implementing a POU program were previously discussed in Section 5.3.5.2 in activities d), e), and f).

5.3.6.1 *Consumer Notice in Response to a Lead Sample > 15 µg/L*

EPA has developed costs for consumer notice in response to a lead sample above 15 µg/L, as shown in Exhibit 5-118. The exhibit provides the unit burden and/or cost for each activity. The assumptions used in the estimation of the unit burden follow the exhibit. The last column provides the corresponding SafeWater LCR model data variable in red/italic font.

Exhibit 5-118: PWS Burden for Consumer Notification When Sample is > 15 µg/L

Activity	Unit Burden and/or Cost	*SafeWater LCR Data Variable*
a) Provide notice to customers with lead tap samples > 15 µg/L	0.25 hrs/customer contact	*hrs_pe_above_al_prep_op*
b) Provide a copy of the 3 calendar day notice to the Primacy Agency	0.08 hrs/customer contact	*hrs_above_15_notice_op*

Source: "Derivation of Public Education Inputs_CWS_Final Rule.xlsx."

a) Provide notice to customers with lead tap samples > 15 µg/L (hrs_pe_above_al_prep_op). Under the LCRR, systems must notify any customer with a sample result above 15 µg/L as soon as practicable but no later than 3 days after learning of the results. Exhibit 5-63 in Section 5.3.3.3 provides the likelihood a system will have a single sample above 15 µg/L for each of the three lead 90th percentile classifications (*pp_above_al_bin_one*, *pp_above_al_bin_two*, and *pp_above_al_bin_three*). Also refer to Chapter 4, Section 4.3.5.2 for a detailed discussion of EPA's approach for developing these percentages.

Systems that choose to mail the notification must have the letters postmarked within three days. EPA assumed CWSs would elect to call customers and would incur a burden of 15 minutes or 0.25 hours per call (*hrs_pe_above_al_prep_op*). EPA assumed that NTNCWSs would use the same mechanism they currently use to inform their customers of sample results via posting and electronic

notification but would provide this information sooner. To avoid double counting, EPA did not assign any additional burden or costs to NTNCWSs for this quicker notification but included the burden and costs as part of the Lead Tap Sampling Costs using *hrs_NTNCWS_inform_samp_op* and *cost_NTNCWS_inform_lt.*

b) Provide a copy of the 3 calendar day notice to the Primacy Agency (hrs_above_15_notice_op). Systems must submit a copy of the 3 calendar day notification to their Primacy Agencies. EPA assumed systems would require 5 minutes or 0.083 hours to submit an electronic copy ($0) of this notice to the Primacy Agency (*hrs_above_15_notice_op*). EPA assumed a lower burden to provide this notice than required to notify the customer of their results of 0.25 hours via a phone call (*hrs_pe_above_al_prep_op*) discussed in activity a).

5.3.6.2 *Activities Regardless of Lead 90th Percentile Level*

EPA has developed CWS costs for activities associated with new public education requirements under the LCRR that are independent of a system's lead 90th percentile range, as provided in Exhibit 5-119. The exhibit provides the unit burden and/or cost for each activity. The assumptions used in the estimation of the unit burden and/or cost follow the exhibit. The last column provides the corresponding SafeWater LCR model data variable in red/italic font.

Exhibit 5-119: PWS Burden and Cost for Public Education Activities that Are Independent of Lead 90th Percentile Levels

Activity	Unit Burden and/or Cost	*SafeWater LCR Data Variable*
c) Update CCR language (one-time)	0.5 hrs/CWS serving ≤3,300 people; 1 hr/CWS serving > 3,300 people	*hrs_update_ccr_op*
d) Develop new customer outreach plan (one-time)	4 hrs/CWS with LSLs serving ≤50,000 people; 8 hr/CWS with LSLs serving > 50,000 people	*hrs_cust_plan_op*
e) Develop approach for improved public access to lead health-related information and tap sample results (one-time)	10 to 40 hours/CWS	*hrs_pub_access_op*
f) Establish a process for public access to information on LSL locations (one-time)	5 to 10 hours/CWS with LSLs	*hrs_access_lsl_op*
g) Maintain a process for public access to lead health information, LSL locations, and tap sample results	<u>No LSLs</u> 2 hrs/CWS serving ≤ 3,300 people 4 hrs/CWS serving > 3,300 people <u>With LSLs</u> 6 hrs/CWS serving ≤ 3,300 people 12 hrs/CWS serving > 3,300 people	*hrs_maint_lsl_op*
h) Respond to customer request for LSL information	0.05 hrs/request; $0/request	*hrs_hh_request_op;* *cost_hh_request*

Activity	Unit Burden and/or Cost	*SafeWater LCR Data Variable*
i) Respond to requests from realtors, home inspectors, and potential home buyers for LSL information	0.05 hrs/request; $0/request	*hrs_other_request_op;* *cost_other_request*
j) Develop list of state and local health agencies	CWSs 0.08 hrs/state and local health agency	*hrs_hc_list_op*
k) Develop lead outreach materials for state and local health agencies	3.5 hrs/CWS serving ≤50,000 people; 20 hrs/CWS serving > 50,000 people	*hrs_pub_devel_hc_op*
l) Deliver lead outreach materials for state and local health agencies	CWSs 2 to 42 hrs/state and local health agency; $5.29/ state and local health agency	*hrs_hc_op;* *cost_hc*
m) Develop PE for disturbances and submit to Primacy Agency (one-time)	3.5 hrs/CWS with LSLs serving ≤50,000 people; 20 hrs/CWS with LSLs serving > 50,000 people	*hrs_pub_devel_wtr_op*
n) Deliver PE during disturbances	0.083 hours/delivery; $0.21/delivery	*hrs_pub_deliv_wtr_op;* *cost_pub_deliv_wtr_ed*
o) Deliver filters and cartridges during disturbances and maintain them for 6 months	$44.00/household	*cost_filter_hh*

Acronyms: CCR = consumer confidence report; CWS = community water system; LSL = lead service lines; PE = public education.
Sources:
c) - n):"Derivation of Public Education Inputs_CWS_Final Rule.xlsx." and USEPA. 2020.
o): Technologies and Costs for Corrosion Control to Reduce Lead in Drinking Water. July 2020. Office of Water.

c) Update CCR language (hrs_update_ccr_op). EPA is requiring CWSs to update information about lead in the CCR. CWSs will incur a one-time burden (*hrs_update_ccr_op*) to update their CCR with the revised lead health effects language and for systems with LSLs to further update their materials to include information about a system's LSLR program and opportunities to replace LSLs.[113] Systems with LSLs must also include information on how to access the LSL inventory and how to access the results of all tap sampling in the CCR. EPA assumed for:

- CWSs serving 3,300 or fewer, 50 percent will use CCRiWriter[114] or a similar program to update their CCR and will incur no additional burden because the standard text will already be in the program. This percentage is based on current CCRiWriter users who are generally small systems. All other CWSs serving 3,300 or fewer are assumed to incur 1 hour, giving an average burden of 0.5 hours across all systems in this size category.
- CWSs serving more than 3,300 people will not use CCRiWriter and will incur a burden of 1 hour.

[113] As previously discussed in Section 5.3.4.1 in activity b), CWSs without LSLs can request to omit this information from their CCR. The associated burden with the request is assumed to be included in the estimated burden for submitting with their documentation that they have no LSLs (*hrs_nolsl_op*).
[114] The CCRiWriter is a web-based program that allows water systems to enter data and generate their annual CCR.

d) ***Develop new customer outreach plan (hrs_cust_plan_op).*** In response to LCRR requirements, CWSs with LSLs will develop a new customer outreach plan. EPA estimated that systems serving 50,000 or fewer people will incur 4 hours of burden and those systems serving more than 50,000 people will take 8 hours to develop the plan.

e) ***Develop approach for improved public access to lead health-related information and tap sample results (hrs_pub_access_op).*** CWSs will incur a one-time burden to develop improved public access to lead data that includes lead health-related data and tap monitoring results. EPA assumed that systems serving 3,300 or fewer people with no existing system website will make data available for the public in hard copy form at the system office. Systems serving more than 3,300 will update their existing websites. The one-time burden estimates are included in Exhibit 5-120.

Exhibit 5-120: One-Time Burden (per CWS) to Develop Approach for Improved Access to Lead Information

System Size (Population Served)	Hours to Develop Approach for Improved Public Access to Lead Data (all CWSs)
	hrs_pub_access_op
≤3,300	10
3,301-10,000	20
10,001-50,000	25
50,001-100,000	30
100,001-1,000,000	35
>1,000,000	40

Acronyms: CWS = community water system.
Source: "Derivation of Public Education Inputs_CWSs_Final Rule.xlsx."

f) ***Establish a process for public access to information on LSL locations (hrs_access_lsl_op).*** Under the LCRR, CWSs must establish a way for customers and the public to access information on LSLs. EPA assumed that this will be a one-time burden that applies to all CWSs with LSLs regardless of lead 90th percentile level. EPA assumed systems serving 3,300 or fewer with no existing system website will make the information available in hard copy form at the system office and incur 5 hours to print materials and set up a viewing location. EPA assumed systems serving more than 3,300 people will provide access to information about lead line locations and the replacement program by adding content to an already existing website with links to materials and incur a burden of 10 hours per system. Note that the hours associated with determining locations of LSLs and establishing a replacement outreach program are described in Section 5.3.4.1.

g) ***Maintain a process for public access to health information, LSL locations, and tap sample results (hrs_maint_lsl_op).*** CWSs with LSLs would also incur an annual burden to maintain a way for the public to access lead health and LSL information. EPA assumed that:

- CWSs serving 3,300 or fewer people have no existing system website. Those without LSLs will require 2 hours to maintain lead-related data in hard copy files. Those systems with LSLs take an additional 4 hours to provide updated LSL locational information for a total annual burden of 6 hours.

- Systems serving more than 3,300 people will require 2 hours and 10 hours to update their website annually with health information and new LSL locational information, respectively, for a total annual burden of 12 hours.

h) Respond to customer requests for LSL information (hrs_hh_request_op, cost_hh_request). CWSs will incur a per household burden to respond to LSL information requests from homeowners and residents (*hrs_hh_request_op*). EPA assumed CWSs with LSLs will respond by phone and spend an average of 3 minutes (0.05 hours) per request. EPA assumed systems without LSLs may still get inquiries, but the burden to be negligible. EPA assumed systems will not provide printed materials in response to these inquiries. Therefore, the cost to respond to request from households (*cost_hh_request)* is $0.

EPA estimated the likelihood that that a particular household in a system with LSLs will request information about LSLs to be 0.0036 each year (*pp_hh_request_lslr*). This was computed as a weighted average over the 32-year period from year 4 through year 35 of the analysis, as shown in Exhibit 5-121. Underlying this estimate are the assumptions that these requests would come from 10 percent of households having young children (under six years of age) present in each year in those systems having LSLs. As shown in Exhibit 5-121, EPA estimated that in year 4, the likelihood that a household already has children under the age of six is 0.1156 (Column C, based on Columns A and B). EPA also estimated that the likelihood a new child will be born at a household each year for years 5 through 35 is 0.0337 (Column E, based on Columns D and A). Column F (using the results in Columns C and E) shows the calculation of the weighted average likelihood of a child under six being present in a given household in each of the 32 years of the analysis period. Lastly, Column G applies the assumption that only 10 percent of those households will request LSL information.

Exhibit 5-121: Likelihood that a Resident Will Request Information about LSLs

Total Households in the United States	Households with Children under Six Years Old	Likelihood a Household Has Children under Six Years Old in Year 4	Births per year	Likelihood of a Birth per Household per Year in Years 5 to 35	32-Year Weighted Average Likelihood a Household has Children under Six Years Old Each Year	Likelihood that a Household Having Children under Six Will Request LSL Information Each Year
A	B	C = (B/A)	D	E = (D/A)	F = (C+(31*E))/32	G = F*0.1
						pp_hh_request_lslr
118,208,250	13,661,829	0.1156	3,988,076	0.0337	0.0363	0.0036

Acronyms: LSL = lead service line.

Sources:

A-C: Derived from United States Census Bureau, 2015 American Community Survey 1-Year Estimates. Available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov.

D: A total of 3,988,076 births were registered in the United States in 2014, up 1 percent from 2013. The number of births rose among each of the largest race and Hispanic origin groups (non-Hispanic white, non-Hispanic black, and Hispanic women) from 2013 to 2014. Available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov.

i) ***Respond to other requests for LSL information (hrs_other_request_op, cost_other_request).*** CWSs with LSLs must also respond to requests for LSL information from other parties (e.g., realtors, home inspectors, and potential homebuyers). EPA assumed the same burden of 0.5 hours to respond to these requests by phone as assumed for responding to a request from a homeowner (*hrs_hh_request_op*). EPA assumed systems without LSLs may still get inquiries, but that the burden will be negligible. EPA assumed systems will not provide printed materials in response to these inquiries. Therefore, the material cost to respond to other LSL information requests (*cost_other_request)* is $0.

EPA conducted the following steps to determine the estimated number of requests that systems will receive each year from other parties (*numb_other_request*).

1. Determined the percentage of households with children under the age of 6 that moved using United States Census Bureau data from 2014, as shown in Exhibit 5-122.

Exhibit 5-122: Households (HHs) with Children under 6 and That Moved

Total number of HHs	Total number of HHs that moved	Total HHs with any children under 6	Total HHs with any children under 6 that moved	Percent of all HHs that moved	Percent of HHs with any children under 6 that moved
A	B	C	D	E = (B/A)*100%	F = (D/A)*100%
50,730	6,549	14,759	2,788	12.91%	5.50%

Source: United States Census Bureau, Current Population Survey, 2014 Annual Social and Economic Supplement, Table 8. Available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov.

2. Multiplied the percentage of households with children under the age of 6 that moved by the number of households per system (*numb_hh*). EPA assumed that other parties would request LSL information on 10 percent of the resulting number of households. The resulting number of requests (*numb_other_request*) is provided in Exhibit 5-123.

Exhibit 5-123: Number of LSLR Information Requests from Realtors, Home Inspectors, and Potential Home Buyers

System Size (Population Served)	Number of CWSs	Total Population Served	Average Population per CWS	Average Households per CWS	Number of requests per CWS
	A	B	C = B/A	D=C/2.59	E=D*5.50%*0.1%
			pws_pop	*numb_hh*	*numb_other_request*
≤100	12,046	723,487	60	23	0
101-500	15,307	3,884,780	254	98	1
501-1,000	5,396	3,989,089	739	285	2
1,001-3,300	8,035	15,312,930	1,906	736	4
3,301-10,000	4,974	29,070,747	5,845	2,257	12
10,001-50,000	3,331	72,870,205	21,876	8,446	46
50,001-100,000	550	38,134,020	69,335	26,770	147
100,001-1,000,000	407	98,526,569	242,080	93,467	514

System Size (Population Served)	Number of CWSs	Total Population Served	Average Population per CWS	Average Households per CWS	Number of requests per CWS
	A	B	C = B/A	D=C/2.59	E=D*5.50%*0.1%
			pws_pop	*numb_hh*	*numb_other_request*
>1,000,000	21	42,043,440	2,002,069	772,999	4,248

Notes:
A, B: SDWIS/Fed third quarter 2016 frozen data set, current through June 30, 2016.
D: Estimated as 2.59 people per household *(numb_hh)* for the year 2010 (United States Census Bureau, 2010). Table AVG1. Average Number of People Per Household, By Race and Hispanic Origin, Marital Status, Age, And Education Of Householder: 2010. Available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov.
E: Assumed 10 percent of households with children ages 6 and under that moved from Col F, Exhibit 5-122 (or 5.5 percent) would request information.

j) Develop list of state and local health agencies (hrs_hc_list_op). All CWSs must conduct annual outreach to state and local health agencies to discuss the sources of lead in drinking water, health effects of lead, steps to reduce exposure to lead in drinking water, and information on find-and-fix activities. EPA expects CWSs will work with their Primacy Agencies to conduct increased lead outreach to health care agencies. Systems will incur a one-time upfront burden to develop an initial list of state and local health departments in their service area. EPA assumed systems would require 5 minutes for each health agency or 0.08 hours per agency, which is the same burden the Agency used to estimate the burden to develop an initial contact list of schools and child cares for the lead in drinking water testing program (*hrs_school_identify_op*) in activity cc) of Section 5.3.2.5.1. The burden per health agency is multiplied by the number of health agencies (*numb_ha +1*), shown in Exhibit 5-124, to develop the unit cost.

Exhibit 5-124: Estimated *Number of Health Agencies*

System Size (Population served)	# of Organizations per system
	numb_ha +1
≤100,000	2
100,001 – 1,000,000	4
>1,000,000	20

Source: "Derivation of Public Education Inputs_CWS_Final Rule.xlsx," worksheet, Pb ALE_Recipients, Table 1a, Column E. EPA assumed each system would contact one additional state health agency.

k) Develop lead outreach materials for state and local health agencies (hrs_pub_devel_hc_op). All CWSs are assumed to incur burden to develop lead outreach materials that will be distributed to state and local health agencies. EPA assumed systems will incur the same burden to develop these materials as other outreach materials. The burden estimate is 3.5 hours for systems serving 50,000 or fewer people and 20 hours for those serving more than 50,000 people, e.g., LSL general outreach materials (*hrs_pe_lsl_gen_develop_op*; Section 5.3.4.1, activity c)).

l) Deliver lead outreach to state and local health agencies (hrs_hc_op, cost_hc). EPA assumed CWSs would incur an annual burden to produce and distribute a report that includes a cover letter, the

outreach materials developed under activity k), and the results of any school testing and find-and-fix activities in response to a sample above 15 µg/L (as previously discussed in Section 5.3.2.5 and Section 5.3.3.3.3, respectively). Systems will also incur annual burden to make any necessary updates to the list of organizations. The resulting annual burden estimates for conducting outreach to health care agencies are provided in Exhibit 5-125.

Exhibit 5-125: Annual CWS Burden (per system) to Conduct Outreach to State and Local Health Agencies

System Size (Population served)	# of Organizations per system	Production Time per organization	Distribute Letters	Update List of Organizations	Total
	A	B	C = A*B	D	E = C+D
	numb_ha + 1				*hrs_hc_op*
≤3,300	2	1	2	0	2
3,301-100,000	2	1	2	1	3
100,001-1,000,000	4	1	4	2	6
>1,000,000	20	2	40	2	42

Notes
A: See Exhibit 5-124.
B: EPA assumed systems would require 1 hour and 2 hours to prepare a cover letter and assemble outreach materials to health agencies, and the results of any school testing and find-and-fix activities in response to a sample above 15 µg/L for systems serving 1 million people or fewer and more than 1 million people, respectively.
D: EPA assumed zero burden for systems serving 3,300 or fewer people. For CWSs serving 3,301 to 100,000 people, EPA assumed an annual burden of 1 hour per system to update the list of organizations. For systems serving more than 100,000 people, EPA assumed an annual burden of 2 hours per system.

EPA assumed systems will deliver the information to state and local health departments via certified mail at an estimated cost of $5.38 per organization (*cost_hc*) that includes paper ($0.025), envelope ($0.067), and certified mail ($5.29).

m) Develop PE materials for disturbances of service lines and submit to Primacy Agency (hrs_pub_devel_wtr_op). CWSs with LSLs must send public education to customers when there is scheduled water-related work that could result in disturbances of service lines and will incur a one-time burden to develop materials. EPA assumed:

- All CWSs with LSLs will develop these materials.
- The development of PE materials is similar across all types of public education because systems will use EPA-developed templates (see activity i) above for a more detailed discussion).
- Systems serving 50,000 people or fewer will incur a one-time burden of 3.5 hours.
- Systems serving more than 50,000 people will adapt the templates and incur a one-time burden of 20 hours.

n) Deliver PE materials during disturbances of service lines (hrs_pub_deliv_wtr_op, cost_pub_deliv_wtr_ed). CWSs that cause disturbances to a lead, galvanized requiring replacement, or lead status unknown service line will also incur an annual burden to deliver public education to

impacted households about the potential for elevated lead levels in drinking water as a result of the disturbance. The annual burden to deliver public education (*hrs_pub_deliv_wtr_op*) is assumed to be 5 minutes per delivery (0.083 hours). Systems are assumed to provide the messaging on door hangers that they will distribute when they are in the area conducting work. The average cost of doorhangers is $0.21 based on quotes from three vendors (*cost_pub_deliv_wtr_ed*). See "Derivation of Public Education Inputs_CWS_Final Rule.xlsx," worksheet "Water_Related Work" for specific quotes.

EPA assumed that 5.9 percent of households will be impacted annually by disturbances and would receive this public education (*perc_hh_water_wrk*) based on the estimated life of a water main, meter, and other service line replacements provided by Massachusetts Water Resources Authority. Utilizing these data, EPA assumed an average 17-year life of a meter. CWSs would replace a meter at an annual rate of 5.9 percent.

o) Deliver filters and cartridges during disturbances of service lines and maintain them for 6 months (cost_filter_hh). Systems are required to provide these filters whenever there is a physical disturbance of an LSL, galvanized requiring replacement, or lead status unknown systems that involves replacement of a meter, gooseneck, pigtail, or other connector that entails disconnecting on and reconnecting the LSL. EPA assumes the likelihood of these disturbances to be 5.9 percent (*perc_hh_water_wrk*).

EPA assumes that the pitchers and POU filters delivered to each resident to use for six months following LSLR will cost $44 on average (including shipping and filter replacement). Although many pitchers come with filters that will provide lead removal for more than six months, the average cost includes a filter replacement cost for those that do not last six months.

5.3.6.3 *Public Education Activities in Response to Lead ALE*

The LCRR retains the public education requirements of the previous rule for systems that exceed the lead AL and adds a requirement for systems to update their mandatory PE language. EPA has developed system costs for these activities, as provided in Exhibit 5-126. The exhibit provides the unit burden and/or cost for each activity. The assumptions used in the estimation of the unit burden follow the exhibit. The last column provides the corresponding SafeWater LCR model data variable in red/italic font.

Exhibit 5-126: PWS PE Burden in Response to Lead ALE

Activity	Unit Burden and/or Cost	*SafeWater LCR Data Variable*
p) Update mandatory language for lead ALE PE and submit to Primacy Agency for review (one-time)	3.5 hrs/PWS serving ≤50,000 people; 20 hrs/PWS serving > 50,000 people	*hrs_pe_al_devel_op*

Activity	Unit Burden and/or Cost	*SafeWater LCR Data Variable*
q) Deliver lead ALE PE materials to all customers	CWSs 0.0025 hours/household; $0.21 to $0.30/CWS NTNCWSs 1 hr/NTNCWS $0.025/NTNCWS	CWSs *hrs_distr_edu_op;* *cost_pe_lcr_delivery* NTNCWSs *hrs_ntncws_distr_edu_op;* *cost_ntncws_pe_lcr_delivery*
r) Contact public health agencies to obtain additional organizations and update recipient list	0.5 hrs/CWSs serving ≤3,300 people; 1.5 hrs/CWS serving 3,301 to 100,000 people; 2.5 hrs/CWS serving > 100,000 people	*hrs_ha_op*
s) Notify public health agencies and other organizations	0.0025 hours/organization; $5.38/organization	*hrs_distr_agencies_pe_op;* *cost_pe_lead_ale*
t) Post notice to website	0.5 hrs/CWSs serving > 100,000 people	*hrs_web_op*
u) Consult with Primacy Agency on other PE activities	2 hrs/CWS	*hrs_ale_consult_op*
v) Implement other PE activities	1.9 to 1,037 hrs/CWS; $24.64 to $159,000/CWS	*hrs_ale_other_op;* *cost_ale_other*
w) Prepare press release	10 hrs/press release per CWS serving > 3,300 people; $0/press release	*hrs_*pr_op; *cost_pr*
x) Certify to Primacy Agency that lead outreach was completed	CWSs 2 hrs/CWS serving ≤50,000 people; 3 hrs/CWS serving > 50,000 people NTNCWSs 0.66 hrs/NTNCWS serving ≤50,000 people; 1 hr/NTNCWS serving > 50,000 people	CWSs *hrs_pe_certify_quarterly_op* NTNCWSs *hrs_cert_outreach_annual_op*

Acronyms: ALE = action level exceedance; CWS = community water system; NTNCWS = non-transient non-community water system; PE = public education; PWS = public water system.
Sources:
p), q) & x): "Derivation of Public Education Inputs_CWS_Final Rule.xlsx"; "Derivation of Public Education Inputs_NTNCWS_Final Rule.xlsx."
r)-w) : "Derivation of Public Education Inputs_CWS_Final Rule.xlsx."

p) Update mandatory language for lead ALE PE (hrs_pe_al_devel_op). Under the LCRR, CWSs and NTNCWSs with lead ALEs must update their mandatory health effects language, and those that also have LSLs must include information about their LSLR program and opportunities to replace LSLs. EPA assumed a one-time burden of 3.5 hours for systems serving 50,000 or fewer and 20 hours per systems serving more than 50,000 people to update these materials. These values are the same as used for other types of PE material updates, e.g., CCR language updates. See Section 5.3.6.2, activity j) above for an outline of the rationale for the burden estimates.

q) Deliver lead ALE PE materials to all customers (hrs_distr_edu_op, cost_pe_lcr_delivery, hrs_ntncws_distr_edu_op, cost_ntncws_pe_lcr_delivery). The LCRR retains the prior PE

requirements for CWSs to distribute PE to all households they serve (see Exhibit 5-123 for the estimated number of households (*numb_hh*). EPA estimates CWSs would require 15 minutes per 100 copies (0.0025 hours/household) to distribute PE materials (*hrs_distr_edu_op*). The estimate is based on assumptions for production labor used in the Economic and Supporting Analyses: Short-Term Regulatory Changes to the Lead and Copper Rule, Exhibit 17 (USEPA, 2007). CWSs will also incur the following material cost associated with delivery of annual lead PE in the water bill.[115] EPA assumed 50 percent of systems will include lead public education in the water bill and only incur an additional cost for paper ($0.025). The other 50 percent will mail a pamphlet and incur costs for paper ($0.025), envelope ($0.067), and postage ($0.49). Systems serving more than 500 people will deliver more than 200 pamphlets and qualify for bulk-rate postage ($0.30). Thus, the average annual delivery cost per household (*cost_pe_lcr_delivery*) is $0.30 for CWSs serving 500 or fewer people and $0.21 for CWSs serving more than 500 people. The cost formula is shown below for:

- CWSs serving ≤ 500 people = ($0.025*50%) + (($0.025 + $0.067 + $0.49) * 50%) = $0.30.
- CWSs serving > 500 people = ($0.025*50%) + (($0.025 + $0.067 + $0.30) * 50%) = $0.21.

The LCRR also retains the prior public education requirements for NTNCWSs following a lead ALE. NTNCWSs are subject to different requirements for public education delivery than a CWS. NTNCWSs are subject to annual requirements and can deliver material via email and public posting, and, therefore, incur a different burden than CWSs. EPA assumed that NTNCWSs will deliver materials via email and post materials publicly with an estimated burden of 0.5 hours to develop/send e-mail and an additional 0.5 hours to post the materials, for a total of 1 hour (*hrs_ntncws_distr_edu_op*). NTNCWSs will also incur a cost for public education posted materials (*cost_ntncws_pe_lcr_delivery*) that will include paper costs of $0.025 based on costs from 3 vendors (see file "General Cost Model Inputs_Final Rule.xlsx" for more detail).

r) ***Contact public health agencies to obtain additional organizations and update recipient list (hrs_ha_op).*** CWSs must contact local health care agencies to obtain a list of additional organizations that serve at-risk populations. The estimated number of health agencies (*numb_ha*) is provided in Exhibit 5-124. EPA assumed that systems on average spend 30 minutes (0.5 hours) per health agency by phone or person to obtain a list of additional community-based organization that should be contacted in response to a lead ALE (*hrs_ha_op*). EPA assumed this contact would result in additional burden to update the list of organizations for systems serving more than 3,300 people. Specifically:

- Systems serving 3,301 to 100,000 people would incur an additional annual burden requirement of 1 hour per system to update the list of organizations for a total annual burden of 1.5 hours.
- Systems serving more than 100,000 people would incur an additional burden of 2 hours per system to update the list of organizations for a total of 2.5 hours.

[115] CWSs are also required to include a brief lead informational statement on or in each water bill. EPA assumed systems would incur negligible burden and no costs for this activity.

These estimates are based on Appendix H-3 in the *Economic and Supporting Analyses: Short-Term Regulatory Changes to the Lead and Copper Rule* (USEPA, 2007).

s) ***Notify public health agencies and other organizations (hrs_distr_agencies_pe_op, cost_pe_lead_ale).*** CWSs must provide public education materials to facilities that include but are not limited to local health departments, schools, child cares, and medical providers that offer services to pregnant women, children, and infants to better reach these at-risk populations and their caregivers (*numb_lcr_other_org*). This input is provided in Exhibit 5-127.

- **Estimated hours to conduct outreach per organization.** EPA assumed systems would require 15 minutes per 100 copies (0.0025 hours/organization) to produce the outreach for public health agencies and other organizations in response to a lead ALE (*hrs_distr_agencies_pe_op*). This estimate is based on assumptions for production labor used in the *Economic and Supporting Analyses: Short-Term Regulatory Changes to the Lead and Copper Rule* (Exhibit 17) (USEPA, 2007).

- **Notify public health agencies and other organizations.** EPA assumed CWSs will send one pamphlet per health agency and other organizations and ask these organization to make copies. EPA assumed the information is delivered via certified mail at an estimated cost of $5.38 per organization. This total unit cost includes paper ($0.025), envelope ($0.067), and certified mail ($5.29) (*cost_pe_lead_ale*).

Exhibit 5-127: Number of Local Health Agencies, Schools, Child Cares, and Targeted Medical Providers Proportionally Distributed by CWS Population Served

System Size (Population Served)	# of Systems	Population Served	Number of Agencies Proportionally Distributed	Number of Agencies per System	Number of Agencies per System (Rounded Up to Nearest Whole Number)
	A	B	C	D = C/A	E *numb_lcr_other_org*
≤100	12,046	723,487	2,207	0.2	1
101-500	15,307	3,884,780	11,853	0.8	1
501-1,000	5,396	3,989,089	12,171	2.3	2
1,001-3,300	8,035	15,312,930	46,721	5.8	6
3,301-10,000	4,974	29,070,747	88,697	17.8	18
10,001-50,000	3,331	72,870,205	222,332	66.7	67
50,001-100,000	550	38,134,020	116,350	211.5	212
100,001-1,000,000	407	98,526,569	300,612	738.6	739
>1,000,000	21	42,043,440	128,278	6108.5	6,109
Total	50,067	304,555,267	929,220		

Source: "Derivation of Public Education Inputs_CWS_Final Rule.xlsx," worksheet, "Pb ALE_Recipient," Table 2a.
Notes:
General: Under the previous rule and final LCRR, CWSs must provide lead public education materials to facilities that include but are not limited to local health departments, schools, child cares, and medical providers that offer

services to pregnant women, children, and infants to better reach these at-risk populations and their caregivers. The estimates do not explicitly include all groups that are required to receive PE, i.e., the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) and Head Start, and public and private hospitals and clinics, family planning centers, local welfare agencies. Note the omission of some of the organizations that receive PE will not impact the incremental costs of the final LCRR because this requirement is the same under the previous rule and final LCRR.
A&B: From SDWIS/Fed, current through June 30, 2016.
C: Assumes the 2,800 local health agencies; 127,233 elementary and secondary schools; and 673,648 child cares are proportionally distributed across the size categories.

t) ***Post notice to website (hrs_web_op).*** Each CWSs serving more than 100,000 with a lead ALE must post PE materials on their website at an estimated annual burden of 0.5 hours per system. This estimate is based on the burden to post a notice on a website used in the *Economic and Supporting Analyses: Short-Term Regulatory Changes to the Lead and Copper Rule* (page 57) (USEPA, 2007). Systems serving 100,000 or fewer people are not subject to this requirement.

u) ***Consult with Primacy Agency on other PE activities (hrs_ale_consult_op).*** CWSs will consult with their Primacy Agency on other required PE activities conducted in response to a lead ALE and will incur a burden of 2 hours per CWS. This assumption is based on the estimate to consult with the Primacy Agency on public education activities used in the *Economic and Supporting Analyses: Short-Term Regulatory Changes to the Lead and Copper Rule*, page 60 (USEPA, 2007).

v) ***Implement other PE activities (hrs_ale_other_op, cost_ale_other).*** CWSs with a lead ALE will also incur burden to implement other PE activities that use other delivery methods to inform consumers about the health effects of lead and ways to mitigate their exposure. Specifically, CWSs that exceed the lead ALE and serve more than 3,300 people must conduct additional annual PE activities from a list specified in the rule in consultation with the Primacy Agency until the system no longer has a lead ALE. CWSs serving 3,300 or fewer people must select one activity. These activities and EPA's burden assumptions are as follows:

- **Public Service Announcements (PSAs):** Systems will require 5 hours to prepare and e-mail a notification to newspapers and radio and TV stations.
- **Paid Ads:** Systems will require 30 minutes to coordinate paid advertisements.
- **Public Display**: Systems will post notices at local grocery stores, laundromats, or similar establishments. Systems serving 500 or fewer people would need 5 such postings, and systems serving between 501 and 10,000 people need 20 postings. Those serving 10,001 to 50,000 people need 100 postings, 50,001 to 100,000 need 200 postings, and 100,001 to 1,000,000 need 500 postings. It is assumed that it will take a system 1 hour to complete 5 postings.
- **Email Notification**: Systems will have a preexisting list of customer e-mail addresses and incur a burden of 1 hour.
- **Public Meetings**: Systems will incur burden for pre-meeting logistical arrangements, preparation of presentation/talking points, attending meeting, post-meeting activities (e.g., develop and post meeting minutes). Estimates for each of these meeting components and the total estimated burden are included in Exhibit 5-128, Column E.

- **Material to Multifamily homes and institutions**: Systems will require 0.0025 hours/household, which is 15 minutes per 100 copies. This is multiplied by the average number of households per CWS (*numb_hh*) and the percentage of total occupied housing units that are multi-family units (13.1 percent).

EPA assumed that each activity has an equal likelihood of being selected and thus, the average burden is used for *hrs_ale_other_op*. Burden estimates for systems serving more than 3,300 are multiplied by three because the rule requires these systems to conduct three activities whereas CWSs serving 3,300 or fewer people are required to conduct one activity. Burden estimates are included in Exhibit 5-129.

Exhibit 5-128: System Burden for Public Meetings

System Size (Population Served)	Pre-meeting logistical arrangements	Preparation of presentation/ talking points	Attend meeting	Post meeting, including notes	Total
	A	B	C	D	E = A:D
≤3,300	2	2	2	0	**6**
3,301-10,000	6	14	6	0	**26**
10,001-50,000	10	38	12	8	**68**
50,001-100,000	20	50	12	6	**88**
>100,000	20	50	30	28	**128**

Source: "Derivation of Public Education Inputs_CWS_Final Rule.xlsx."
Notes:
EPA based estimates on the *Economic and Supporting Analyses: Short-Term Regulatory Changes to the Lead and Copper Rule* (USEPA, 2007), Appendix Exhibits H-14 through H-17. This EA did not provide estimates for systems serving ≤3,300 people so EPA adjusted the burden used for systems serving 3,301 to 10,000 people downward to develop the burden estimates for system serving ≤ 3,300 people. See notes A - D for additional detail..
A: Includes burden to select date, research and select site, negotiate with site for use, publicize meeting, set up room including electronics (microphones, sound system, and presentation).
B: Includes burden to prepare a 30-minute presentation (30-50 slides) including consultation with health experts and technical personnel as necessary, to receive feedback from management, and to practice presentation.
C: Estimate is based on DC Water (formerly called DC WASA): 1.5 hour open house, one hour presentation/Q&A, 15 minutes before and after, for a total of three hours, attended by two system representatives.
D: Includes burden to prepare and review meeting transcript or notes and follow up with attendees as appropriate.

Exhibit 5-129: System Burden for Additional PE Activities after a Lead ALE

System Size (Population Served)	PSA	Paid Ads	Public Display	Email Notification	Public Meetings	Delivery to all Households	Material to Multifamily homes and institutions	Average Burden for Additional Activities (per system)
	A	B	C	D	E	F	G	H *hrs_ale_other_op*
≤100	5	0.5	1	1	6	0.1	0.01	1.94
101-500	5	0.5	1	1	6	0.2	0.03	1.97
501-1,000	5	0.5	4	1	6	1	0.1	2.47
1,001-3,300	5	0.5	4	1	6	2	0.2	2.65
3,301-10,000	5	0.5	4	1	26	6	1	18.38
10,001-50,000	5	0.5	20	1	68	21	3	50.74
50,001-100,000	5	0.5	40	1	88	67	9	90.08
100,001-1,000,000	5	0.5	100	1	128	234	31	213.76
> 1,000,000	5	0.5	100	1	128	1932	253	1,037.21

Sources/Assumptions:

Notes:

*t General: The targeted customer contact is listed in the rule but was assumed not to be selected because those subsets of the population (e.g., pregnant women and children) are contacted through other public education recipients, such as doctors, schools, and child cares.

A: Based on the *Disinfectants/Disinfection Byproducts, Chemical, and Radionuclides Rules ICR (Renewal)* (Exhibit 31 (Labor Hours per PSA)) (USEPA, 2015b).

B: EPA assumed a half hour to develop ad material with assistance from news outlet.

C: EPA assumed systems will provide an increasingly larger number of postings per systems size and each would require one hour per five postings.

D: *Based on the Economic and Supporting Analyses: Short-Term Regulatory Changes to the Lead and Copper Rule* (Appendix Exhibit H-12) (USEPA, 2007).

E: See Exhibit 5-128.

F: Estimate is based on assumptions for production labor used in the *Economic and Supporting Analyses: Short-Term Regulatory Changes to the Lead and Copper Rule* (Exhibit 17) (USEPA, 2007).

G: Includes multi-family unit burden and not institutions. The USEPA (2008a) CWS public education guidance does not discuss distributing information to institutions. Also, other public education requirements already include distribution to several organizations (e.g., WIC, hospitals, medical clinics, pediatricians, family planning centers, etc.). Multi-family units (in buildings with 10 or more units) represent 13.1 percent of the total occupied housing units according to the 2015 American Community Survey (United States Census Bureau, 2016) .

These other public education activities have associated non-labor costs:

- **Paid Ads:** See estimates in Exhibit 5-130 and Exhibit 5-131.
- **Public Meetings:** Includes the cost of a single-page handout ($0.025) multiplied by the average number of households per system (*numb_hh*).
- **Delivery to all households**: Includes the cost of postage ($0.49 for ≤ 200 mailings) or ($0.30 for bulk rate of > 200 mailing), paper ($0.025), and envelopes ($0.067). These costs are multiplied by the average number of households per CWS (*numb_hh*).
- **Material to Multifamily homes and institutions:** Includes postage ($0.49), paper ($0.025), and envelopes ($0.067) per multifamily home. The bulk postage rate ($0.30) is used for systems mailing more than 200 pieces. These costs are multiplied by the average number of households per CWS and percentage of total occupied housing units that are multi-family units (13.1 percent).

Exhibit 5-130: Cost for Paid Ads

Newspaper	Circulation	1 column inch
Bozeman Daily Chronicle (Bozeman, MT)	15,000	$18.00
Wayne Independent (Honesdale, PA)	4,000	$14.00
Daily Astorian (Astoria, OR)	8,000	$15.00
Milwaukee Journal Sentinel	230,000	$337.00
Star Tribune (Minneapolis, MN)	345,000	$303.00
Miami Herald	272,000	$458.00
Chicago Tribune	566,000	$755.00
LA Times	699,000	$807.00
Washington Post	815,000	$865.00

Note: Circulation and rate information from (http://www.gaebler.com/Newspaper-Ad-Rates.htm).

Exhibit 5-131: Average cost for 10 column inches (about 1/8 of a page) for three system sizes

Size	Average Cost
Small	$157
Medium	$3,660
Large	$8,090

Note: EPA assumed that the newspaper develops advertisement based on base content provided by system. Costs reflect current costs per inch for 2017. EPA also assumed that smaller systems will use small, local newspaper, whereas larger systems will use newspapers with wider circulation. See the *Economic and Supporting Analyses: Short-Term Regulatory Changes to the Lead and Copper Rule* (USEPA, 2007).

To estimate the costs for the other required activities in response to a lead ALE (*cost_ale_other)*, EPA assumed that each of the seven activities had an equal likelihood of being selected and summed the costs for each including those with $0 and divided by seven to get an average activity cost. EPA

multiplied the average activity cost by three for CWSs serving more than 3,300 people because the rule requires them to conduct three activities as opposed to one for CWSs serving 3,300 or fewer people. The resulting inputs for *cost_ale_othe*r are included in Exhibit 5-132.

Exhibit 5-132: System Cost for Additional Public Education Activities after a Lead ALE

System Size (Population Served)	PSA	Paid Ads	Public Display	Email Notification	Public Meetings	Delivery to all HHs	Material to Multifamily homes and institutions	Average Costs for Additional Activities (per system)
	A	B	C	D	E	F	G	H
								cost_ale_other
<=100	$0	$157	$0	$0	$0.58	$13.50	$1.77	$24.64
101-500	$0	$157	$0	$0	$2	$57.03	$7.47	$31.95
501-1,000	$0	$157	$0	$0	$7	$166.12	$21.76	$50.24
1,001-3,300	$0	$157	$0	$0	$18	$289.18	$56.10	$74.33
3,301-10,000	$0	$3,660	$0	$0	$56	$886.84	$172.05	$2,046.56
10,001-50,000	$0	$3,660	$0	$0	$211	$3,319.47	$434.85	$3,268.06
50,001-100,000	$0	$8,090	$0	$0	$669	$10,520.65	$1,378.21	$8,853.48
100,001-1,000,000	$0	$8,090	$0	$0	$2,337	$36,732.61	$4,811.97	$22,273.40
> 1,000,000	$0	$8,090	$0	$0	$19,325	$303,788.78	$39,796.33	$159,000.04

Sources/Assumptions:

Notes:

General: The targeted customer contact is listed in the rule but was not included because EPA assumed that subsets of the population (e.g., pregnant women and children) are contacted through other public education recipients, such as doctors, schools, and child cares.

A: EPA assumed that systems will deliver public education materials as a public service announcement (PSA), free of charge.

B: Exhibit 5-131.

C, D: No additional cost expected.

E: Estimate includes the cost of a single-page handout ($0.025) multiplied by the average number of households per system. See "General Cost Model Inputs_Final Rule.xlsx" for additional information about costs for paper.

F: Estimate includes the cost of postage ($0.49), paper ($0.025), and envelopes ($0.067) multiplied by the average number of households per system. The bulk rate for postage ($0.301) is used when a system mails more than 200 pieces. See "General Cost Model Inputs_Final Rule.xlsx" for additional information.

G: See "General Cost Model Inputs_Final Rule.xlsx" for additional information about costs for postage, paper, and envelopes. Estimate includes multi-family unit cost and not institutions. The USEPA (2008a) CWS public education guidance does not discuss distributing information to institutions. Also, other public education requirements already include distribution to several organizations (e.g., WIC, hospitals, medical clinics, pediatricians, family planning centers, etc.). Multi-family units (in buildings with 10 or more units) represent 13.1 percent of the total occupied housing units according to the 2015 American Community Survey (United States Census Bureau, 2016). Available at EPA-HQ-OW-2017-0300 at www.regulations.gov.

w) Prepare press release (hrs_pr_op, cost_pr). EPA assumed systems serving 3,300 or fewer will not prepare a press release because they deliver notices to all households individually as allowed under the rule. Systems serving more than 3,300 are estimated to require 5 hours per public education event (two per year) for preparation and delivery to a total of 8 newspapers, radio stations, or TV stations for a total burden of 10 hours. EPA assumed systems will not incur any material costs associated with these activities. For press releases (cost_pr), EPA assumed that newspapers, radio stations, or TV stations will run the press release materials as a PSA, free of charge. In addition, systems are assumed to provide the press release and certification electronically. For additional information, see the Disinfectants/Disinfection Byproducts, Chemical, and Radionuclides Rules ICR (Renewal) (Exhibit 31 (Labor Hours per PSA)) (USEPA, 2015b).

x) Certify to Primacy Agency that lead outreach was completed (hrs_pe_certify_quarterly_op, hrs_cert_outreach_annual_op). CWSs have quarterly, semi-annual, and annual public education requirements in response to a lead ALE (see Section 3.8.1 for detailed requirements). Thus, CWSs must report the certification on a quarterly basis. EPA estimated an average 0.33 and 0.5 hours to review public education certifications under the previous rule based on data from North Carolina and Indiana, respectively. These are two states that responded to an ASDWA survey about LCR implementation. EPA took these estimates to review a public education certification and doubled them because systems are expected to incur a larger burden for developing the materials than Primacy Agencies to review them.[116] These estimates were then multiplied by 0.75 to account for quarters in which there is less information to report on the self-certification. Then the numbers were multiplied by four to account for the quarterly frequency of the self-certification letter. EPA assumed that each certification for systems serving 50,000 or fewer people would require 0.5 hours or 2 hours annually (based on the lower burden reported from North Carolina) and 0.75 hours/certification or 3 hours annually for CWSs serving more than 50,000 people (based on the higher burden reported from Indiana).

NTNCWSs will also incur burden to certify to the Primacy Agency that they met their annual PE and outreach requirements (*hrs_cert_outreach_annual_op)*. EPA assumed that NTNCWSs will submit an annual certification to the Primacy Agency electronically and incur a burden of 0.66 hours for systems serving 50,000 or fewer people and 1 hour for those serving more than 50,000 people. Estimates are based on input from North Carolina (0.33 hours) and Indiana (0.5 hours), respectively, for the burden to review the system's PE certification in response to a 2016 ASDWA survey about LCR implementation. Estimates were doubled since systems are expected to incur a larger burden to prepare the certification than needed for the Primacy Agencies' review. A copy of the questionnaire and each state's responses are available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov.

Note that EPA did not include a separate certification for the consumer notice discussed in Section 5.3.6.1 and those activities described in Section 5.3.6.2 that are independent of a system's lead 90th

[116] Based Appendix H, Exhibits 35 and 48 of the *Disinfectants/Disinfection Byproducts, Chemical, and Radionuclides Rules ICR (Renewal)* (USEPA, 2015b), the system burden to prepare the public education certification (referred to as the Public Education letter) was 1 hour compared to 0.5 hours for the Primacy Agency review. EPA increased the estimated burden based on input from North Carolina and Indiana but retained the relationship that systems would incur double the burden than the Primacy Agency.

percentile level. Instead, the Agency assumed the certification would include all outreach and public education described in Section 5.3.6.

Exhibit 5-133 provides details on how costs are calculated for PWS public education activities a) through x) including additional cost inputs that are required to calculate these costs.

Exhibit 5-133: PWS Lead Public Education Unit Costing Approach in SafeWater LCR by Activity[1]

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
a) Provide notice to customers with lead tap samples > 15 µg/L[2]				
The number of required samples >15 µg/L per system multiplied by the hours per sample and the system labor rate. The likelihood of a Lead Tap Sample Monitoring being > 15 µg/L is estimated separately for each system 90th percentile category. The marginal cost for delivering this material quickly is provided here. The material cost of the printing of the public education is assumed to be covered under the material cost applied to informing customers of the result of the tap samples. *(pp_above_al_bin_three*numb_samp_customer)*(hrs_pe_above_al_prep_op*rate_op)*	Cost does not apply to NTNCWSs.	At or below TL	Model PWS is not on reduced tap sampling and not doing POU sampling 1 – *(p_tap_annual + p_tap_triennial + p_tap_nine)*	Twice a year
The number of required samples >15 µg/L per system multiplied by the hours per sample and the system labor rate. The likelihood of a Lead Tap Sample Monitoring being > 15 µg/L is estimated separately for each system 90th percentile category. The marginal cost for delivering this material quickly is provided here. The material cost of the printing of the public education is assumed to be covered under the material cost applied to informing customers of the result of the tap samples. (pp_above_al_bin_three*numb_reduced_tap)*(hrs_pe_above_al_prep_op*rate_op)			Model PWS on annual reduced tap sampling and not doing POU sampling *p_tap_annual*	Once a year
			Model PWS on triennial reduced tap sampling and not doing POU sampling *p_tap_triennial*	Every 3 years
The number of required samples >15 µg/L per system multiplied by the hours per sample and the system labor rate. The likelihood of a Lead Tap Sample Monitoring being > 15 µg/L is estimated separately for each system 90th percentile category. The marginal cost for delivering this material quickly is provided here. The material cost of the printing of the public education is assumed to be covered under the material cost applied to informing customers of the result of the tap samples. *(pp_above_al_bin_two*numb_samp_customer)*(hrs_pe_above_al_prep_op*rate_op)*		At or below AL and above TL	All model PWSs	Once a year

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
The number of required samples >15 µg/L per system multiplied by the hours per sample and the system labor rate. The likelihood of a Lead Tap Sample Monitoring being > 15 µg/L is estimated separately for each system 90th percentile category. The marginal cost for delivering this material quickly is provided here. The material cost of the printing of the public education is assumed to be covered under the material cost applied to informing customers of the result of the tap samples. *(pp_above_al_bin_one*numb_samp_customer) *(hrs_pe_above_al_prep_op*rate_op)*	Cost does not apply to NTNCWSs.	Above AL	All model PWSs	Once a year
b) Provide a copy of the 3 calendar day notice to the Primacy Agency[2]				
The total hours per system multiplied by the system labor rate. (hrs_*above_15_notice*_op*rate_op)	Cost applies as written to NTNCWS	All	All model PWSs with at least one sample > 15 µg/L	Once per event
c) Update CCR language				
The total hours per system multiplied by the system labor rate. *(hrs_update_ccr_op*rate_op)*	Cost does not apply to NTNCWSs.	All	All model PWSs	One time
d) Develop new customer outreach plan				
The total hours per system multiplied by the system labor rate. *(hrs_cust_plan_op*rate_op)*	Cost does not apply to NTNCWSs.	All	All model PWSs with LSLs *p_lsl*	One time
e) Develop approach for improved public access to lead health-related information and tap sample results				
The total hours per system multiplied by the system labor rate. *(hrs_pub_access_op*rate_op)*	Cost does not apply to NTNCWSs.	All	All model PWSs	One time
f) Establish a process for public access information on LSL locations				
The total hours per system multiplied by the system labor rate. *(hrs_access_lsl_op*rate_op)*	Cost does not apply to NTNCWSs.	All	Model PWS with LSLs *p_lsl*	One time
g) Maintain a process for public access on lead health information, LSL locations, and tap sample results				
The total hours per system multiplied by the system labor rate. *(hrs_maint_lsl_op*rate_op)*	Cost does not apply to NTNCWSs.	All	All model PWSs	Once a year

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
h) Respond to customer requests for LSL information				
The number of requests from homeowners and residents multiplied by the total of the hours per request times the system labor rate, plus the material cost. *(pp_hh_request_lslr*(pws_pop/numb_hh))*((hrs_hh_request_op*rate_op)+cost_hh_request)*	Cost does not apply to NTNCWSs.	All	Model PWS with LSLs *p_lsl*	Once a year
i) Respond to requests from realtors, home inspectors, and potential home buyers for LSL information				
The number of requests from realtors, home inspectors, and potential homebuyers multiplied by the total of the hours per request times the system labor rate, plus the material cost. *numb_other_request*((hrs_other_request_op*rate_op)+cost_other_request)*	Cost does not apply to NTNCWSs.	All	Model PWS with LSLs *p_lsl*	Once a year
j) Develop list of state and local health agencies				
The number of state and local health agencies per system times the total hours per health agency multiplied by the system labor rate. *(numb_ha+1)*(hrs_hc_list_op*rate_op)*	Cost applies as written to NTNCWSs.	All	All model PWSs	One time
k) Develop lead outreach materials for state and local health agencies				
The total hours per system multiplied by the system labor rate. *(hrs_pub_devel_hc_op*rate_op)*	Cost applies as written to NTNCWSs.	All	All model PWSs	One time
l) Deliver lead outreach to state and local health agencies				
The number of state and local health agencies per system times the total hours per health agency multiplied by the system labor rate. *(numb_ha+1)*((hrs_hc_op*rate_op)+cost_hc)*	Cost applies as written to NTNCWSs.	All	All model PWSs	Once a year
m) Develop PE material for disturbances of service lines and submit to Primacy Agency				
The total hours per system multiplied by the system labor rate. *(hrs_pub_devel_wtr_op*rate_op)*	Cost does not apply to NTNCWSs.	All	Model PWS with LSLs *p_lsl*	One time
n) Deliver PE during disturbances of service lines				
The percentage of the households in the system having water work done multiplied by the total of the hours per household times the system labor rate, plus the material cost. *((hh_remain_lsl+num_paper_remain)*perc_hh_water_wrk)*((hrs_pub_deliv_wtr_op*rate_op)+cost_pub_deliv_wtr_ed)*	Cost does not apply to NTNCWSs.	All	Model PWS with LSLs *p_lsl*	Once a year

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
o) Deliver pitcher filters and cartridges during disturbances of service lines and maintain them for 6 months				
The percentage of the households in the system having water work done multiplied by the total material cost. *((hh_remain_lsl+num_paper_remain)*perc_hh_water_wrk)*cost_filter_hh*	Cost does not apply to NTNCWSs.	All	Model PWS with LSLs *p_lsl*	Once a year
p) Update mandatory language for lead ALE PE and submit to Primacy Agency for review				
The total hours per system multiplied by the system labor rate. *(hrs_pe_al_devel_op*rate_op)*	Cost applies as written to NTNCWSs.	Above AL	All model PWSs	One time
q) Deliver lead ALE PE materials to customers to all customers				
The number of households per system multiplied by the total of the hours per household times the system labor rate, plus the material cost. *(pws_pop/numb_hh)*((hrs_distr_edu_op*rate_op)+cost_pe_lcr_delivery)*	The hours per system multiplied by the system labor rate, plus the material cost. *((hrs_ntncws_distr_edu_op*rate_op)+cost_ntncws_pe_lcr_delivery)*	Above AL	All model PWSs	Once a year[3]
r) Contact public health agencies to obtain additional organizations and update recipient list				
The number of health agencies per system multiplied by the hours per health agency and the system labor rate. *numb_ha*(hrs_ha_op*rate_op)*	Cost does not apply to NTNCWSs.	Above AL	All model PWSs	Once a year[3]
s) Notify public health agencies and other organizations				
The number of public health agencies and other organizations per system multiplied by the total of the hours per agency and organization times the system labor rate, plus the material cost. *numb_lcr_other_org * (hrs_distr_agencies_pe_op * rate_op + cost_pe_lead_ale)*	Cost does not apply to NTNCWSs.	Above AL	All model PWSs	Once a year[3]
t) Post lead notice on website				
The total hours per system multiplied by the system labor rate. *(hrs_web_op*rate_op)*	Cost does not apply to NTNCWSs.	Above AL	All model PWSs serving > 100,000 people	Once a year[3]

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
u) Consult with Primacy Agency on other PE activities				
The total consultation hours per system multiplied by the system labor rate. *(hrs_ale_consult_op*rate_op)*	Cost does not apply to NTNCWSs.	Above AL	All model PWSs	Once a year[3]
v) Implement other PE activities				
The total hours per system multiplied by the system labor rate, plus the material cost. *(hrs_ale_other_op*rate_op)+cost_ale_other*	Cost does not apply to NTNCWSs.	Above AL	All model PWSs serving > 3,300 people	Once a year[3]
w) Prepare a press release				
The total hours per system multiplied by the system labor rate, plus the material cost. *hrs_pr_op * rate_op + cost_pr*	Cost does not apply to NTNCWSs.	Above AL	All model PWSs serving > 3,300 people	Twice a year[3]
x) Certify to Primacy Agencies that lead outreach was completed				
The total hours per system multiplied by the system labor rate. *(hrs_pe_certify_quarterly_op*rate_op)*	The total hours per system multiplied by the system labor rate. *(hrs_cert_outreach_annual_op*rate_op)*	All	All model PWSs	Once a year[3,4]

Acronyms: AL = action level; ALE = action level exceedance; CCR = consumer confidence report; CWS = community water system; LSL = lead service line; NTNCWS = non-transient non-community water system; PE = public education; POU = point-of-use; PWS = public water system; TL = trigger level.

Notes:

[1] The data variables in the exhibit are defined previously in Section 5.3.6.3 with the exception of:

- *rate_op:* PWS hourly labor rate (Section 4.3.10.1).

[2] The likelihood of a single lead tap sample being > 15 µg/L is estimated for three lead 90th percentile ranges (Section 5.3.3.3):

- *pp_above_al_bin_three* when lead 90th range is at or below the TL.
- *pp_above_al_bin_two* when lead 90th range is at or below AL and above TL.
- *pp_above_al_bin_one* when lead 90th range is above the AL.

See Section 4.3.5.2 for the derivation of the likelihoods and Exhibit 4-24: Percent of Individual Lead Sample Result Above 15 µg/L Based on Michigan CWSs with Known LSL Status for Final LCRRfor the values used in the SafeWater LCR model). These likelihoods are applied separately to all required lead tap samples. The required number of samples (either *numb_samp_customer* for systems on routine monitoring or *numb_reduced_tap* for systems on reduced monitoring) is based on the system's monitoring schedule. See Section 5.3.2.1.1 for details on how the SafeWater LCR model determines monitoring schedule and lead tap sampling requirements.

[3] A system can discontinue this requirement after it no longer exceeds the lead AL.

[4] CWSs that are providing PE in response to a lead ALE will be submitting a certification quarterly. For modeling purposes, the CWS burden is estimated on an annual basis.

5.3.6.4 *Estimate of National Lead Public Education and Outreach Costs*

The estimated national annualized lead public education and outreach costs for the final rule, under the low cost scenario, are $37,207,000 at a 3 percent discount rate and $36,555,000 at a 7 percent discount rate. The public education impacts of the final rule for the high cost scenario are $45,461,000 discounted at 3 percent and $45,628,000 discounted at 7 percent. The incremental costs range from $36,861,000 to $43,994,000 at a 3 percent discount rate and from $36,084,000 to $43,612,000 at a 7 percent discount rate, under the low and high cost scenarios respectively (see Exhibit 5-1and Exhibit 5-2).

5.3.7 **Summary of PWS Costs**

This section summarizes the PWS impacts and costs of the major rule components of the LCRR, including:

- PWS counts and population affected by rule components;
- national PWS costs by system category; and
- household costs by CWS size and source water type.

5.3.7.1 *PWS counts and population affected by rule components*

Exhibit 5-134 shows the number of PWSs and the population affected by each major rule requirement under the low and high cost scenarios, for the previous LCR, LCRR, and the increment. The table also shows the number of LSLs that are expected to be replaced.

Exhibit 5-134: System Counts and Population Impacted (Over 35 Year Period of Analysis)

	Low Cost Estimate			High Cost Estimate		
	Previous LCR	**Final LCRR**	**Incremental**	**Previous LCR**	**Final LCRR**	**Incremental**
PWS Count	67,656	67,656	0	67,656	67,656	0
PWSs with LSLR (Mandatory)	140	959	819	1,398	786	-611
PWSs with LSLR (Goal Based)	0	231	231	0	369	369
PWSs with LSLR (Customer-Initiated)	0	11,137	11,137	0	14,085	14,085
Population impacted by LSLR (Mandatory)	25,930	435,964	410,035	360,929	940,404	579,474
Population impacted by LSLR (Goal Based)	0	314,810	314,810	0	417,332	417,332
Population impacted by LSLR (Customer-Initiated)	0	242,065	242,065	0	290,552	290,552
LSLR (Mandatory)	8,770	138,344	129,575	126,292	302,263	175,972
LSLR (Goal Based)	0	105,838	105,838	0	138,923	138,923
LSLR (Customer-Initiated)	0	94,815	94,815	0	114,279	114,279
PWSs that Install CCT	1,741	644	-1,097	3,833	1,241	-2,592
Population Affected by CCT Installation	1,855,948	1,645,916	-210,032	4,282,170	3,718,430	-563,740
PWSs that Re-Optimize CCT due to ALE	345	908	563	1,538	3,379	1,840
PWSs that Re-Optimize CCT due to TLE	0	1,284	1,284	0	2,411	2,411
Population Affected by CCT Re-Optimization due to ALE	4,279,122	14,756,895	10,477,773	17,625,585	43,292,372	25,666,787

Exhibit 5-134: System Counts and Population Impacted (Over 35 Year Period of Analysis)

	Low Cost Estimate			High Cost Estimate		
	Previous LCR	**Final LCRR**	**Incremental**	**Previous LCR**	**Final LCRR**	**Incremental**
Population Affected by CCT Re-Optimization due to TLE	0	12,193,778	12,193,778	0	26,361,290	26,361,290
PWSs that Conduct Find-and-Fix of CCT	0	2,312	2,312	0	6,149	6,149
Population Affected by Find-and-Fix of CCT	0	27,051,528	27,051,528	0	70,601,260	70,601,260
PWSs that Install POU	0	1,207	1,207	0	3,914	3,914
Population Affected by POU Installation	0	238,278	238,278	0	770,531	770,531

Acronyms: ALE = action level exceedance; CCT = corrosion control treatment; LSL = lead service line; LSLR = lead service line replacement; POU = point-of-use; TLE = trigger level exceedance.

5.3.7.2 *National PWS Costs by System Category*

Exhibit 5-135 shows the estimated annualized national PWS low cost scenario estimates for the previous LCR and the LCRR, and the incremental costs by system type, primary source water, and system size category at a 3 percent discount rate. The high cost scenario estimates at a 3 percent discount rate are shown in Exhibit 5-136. The same information for the low and high cost scenarios at a 7 percent discount rate are provided in Exhibit 5-137 and Exhibit 5-138, respectively.

Exhibit 5-135: National Annualized PWS Costs by System Category – Low Cost Scenario – at 3 Percent Discount Rate (2016$)

Funding	Type	Source Water	Size	Previous LCR	Final LCRR	Incremental
Private	CWS	Ground	Less than 100	$7,752,000	$11,502,000	$3,750,000
Private	CWS	Ground	100 to 500	$10,074,000	$14,654,000	$4,580,000
Private	CWS	Ground	500 to 1,000	$2,660,000	$3,691,000	$1,031,000
Private	CWS	Ground	1,000 to 3,300	$2,383,000	$3,258,000	$875,000
Private	CWS	Ground	3,300 to 10,000	$2,679,000	$3,392,000	$713,000
Private	CWS	Ground	10,000 to 50,000	$2,885,000	$4,367,000	$1,482,000
Private	CWS	Ground	50,000 to 100,000	$2,103,000	$2,452,000	$348,000
Private	CWS	Ground	100,000 to 1,000,000	$3,038,000	$3,592,000	$553,000
Private	CWS	Surface	Less than 100	$769,000	$1,078,000	$308,000
Private	CWS	Surface	100 to 500	$1,641,000	$2,394,000	$753,000
Private	CWS	Surface	500 to 1,000	$597,000	$894,000	$297,000
Private	CWS	Surface	1,000 to 3,300	$1,124,000	$1,531,000	$407,000
Private	CWS	Surface	3,300 to 10,000	$1,627,000	$2,112,000	$485,000
Private	CWS	Surface	10,000 to 50,000	$3,994,000	$6,959,000	$2,965,000
Private	CWS	Surface	50,000 to 100,000	$2,946,000	$3,847,000	$902,000
Private	CWS	Surface	100,000 to 1,000,000	$11,291,000	$14,478,000	$3,188,000
Private	CWS	Surface	Greater than 1,000,000	$190,000	$355,000	$165,000
Public	CWS	Ground	Less than 100	$1,268,000	$1,930,000	$662,000
Public	CWS	Ground	100 to 500	$6,888,000	$10,163,000	$3,275,000
Public	CWS	Ground	500 to 1,000	$7,162,000	$9,915,000	$2,753,000
Public	CWS	Ground	1,000 to 3,300	$15,758,000	$20,506,000	$4,748,000
Public	CWS	Ground	3,300 to 10,000	$19,176,000	$24,335,000	$5,159,000

Exhibit 5-135: National Annualized PWS Costs by System Category – Low Cost Scenario – at 3 Percent Discount Rate (2016$)

Funding	Type	Source Water	Size	Previous LCR	Final LCRR	Incremental
Public	CWS	Ground	10,000 to 50,000	$26,304,000	$36,405,000	$10,101,000
Public	CWS	Ground	50,000 to 100,000	$19,053,000	$21,906,000	$2,853,000
Public	CWS	Ground	100,000 to 1,000,000	$15,198,000	$17,790,000	$2,592,000
Public	CWS	Ground	Greater than 1,000,000	$2,008,000	$2,415,000	$407,000
Public	CWS	Surface	Less than 100	$902,000	$1,252,000	$350,000
Public	CWS	Surface	100 to 500	$2,745,000	$4,088,000	$1,343,000
Public	CWS	Surface	500 to 1,000	$2,691,000	$3,883,000	$1,192,000
Public	CWS	Surface	1,000 to 3,300	$8,803,000	$12,073,000	$3,271,000
Public	CWS	Surface	3,300 to 10,000	$20,007,000	$25,910,000	$5,904,000
Public	CWS	Surface	10,000 to 50,000	$44,577,000	$74,338,000	$29,762,000
Public	CWS	Surface	50,000 to 100,000	$27,361,000	$36,011,000	$8,650,000
Public	CWS	Surface	100,000 to 1,000,000	$63,191,000	$81,152,000	$17,961,000
Public	CWS	Surface	Greater than 1,000,000	$32,818,000	$38,711,000	$5,893,000
Total Annual CWS National Costs				**$373,663,000**	**$503,338,000**	**$129,675,000**
Public	NTNCWS	Ground	Less than 100	$4,132,000	$4,539,000	$407,000
Public	NTNCWS	Ground	100 to 500	$4,316,000	$5,077,000	$761,000
Public	NTNCWS	Ground	500 to 1,000	$1,495,000	$1,874,000	$379,000
Public	NTNCWS	Ground	1,000 to 3,300	$1,038,000	$1,293,000	$254,000
Public	NTNCWS	Ground	3,300 to 10,000	$341,000	$419,000	$77,000
Public	NTNCWS	Ground	10,000 to 50,000	$119,000	$134,000	$15,000
Public	NTNCWS	Ground	50,000 to 100,000	$57,000	$59,000	$1,524

Exhibit 5-135: National Annualized PWS Costs by System Category – Low Cost Scenario – at 3 Percent Discount Rate (2016$)

Funding	Type	Source Water	Size	Previous LCR	Final LCRR	Incremental
Public	NTNCWS	Surface	Less than 100	$379,000	$413,000	$35,000
Public	NTNCWS	Surface	100 to 500	$403,000	$454,000	$52,000
Public	NTNCWS	Surface	500 to 1,000	$203,000	$230,000	$27,000
Public	NTNCWS	Surface	1,000 to 3,300	$368,000	$409,000	$40,000
Public	NTNCWS	Surface	3,300 to 10,000	$452,000	$496,000	$44,000
Public	NTNCWS	Surface	10,000 to 50,000	$233,000	$253,000	$19,000
Public	NTNCWS	Surface	50,000 to 100,000	$66,000	$67,000	$1,424
Public	NTNCWS	Surface	100,000 to 1,000,000	$152,000	$155,000	$2,579
Total Annual NTNCWS National Costs				**$13,755,000**	**$15,872,000**	**$2,117,000**
Total Annual Private PWS National Costs				**$57,754,000**	**$80,555,000**	**$22,801,000**
Total Annual Public PWS National Costs				**$329,664,000**	**$438,655,000**	**$108,991,000**
Total Annual PWS National Costs				**$387,417,000**	**$519,210,000**	**$131,792,000**

Notes: System Category rows are not included for system categories that contain zero systems. Detail may not add exactly to total due to independent rounding.

Exhibit 5-136: National Annualized PWS Costs by System Category – High Cost Scenario – at 3 Percent Discount Rate (2016$)

Funding	Type	Source Water	Size	Previous LCR	Final LCRR	Incremental
Private	CWS	Ground	Less than 100	$11,950,000	$13,684,000	$1,734,000
Private	CWS	Ground	100 to 500	$14,763,000	$22,388,000	$7,625,000
Private	CWS	Ground	500 to 1,000	$3,759,000	$7,017,000	$3,258,000
Private	CWS	Ground	1,000 to 3,300	$3,660,000	$6,099,000	$2,439,000
Private	CWS	Ground	3,300 to 10,000	$3,269,000	$5,053,000	$1,784,000
Private	CWS	Ground	10,000 to 50,000	$3,622,000	$5,951,000	$2,329,000
Private	CWS	Ground	50,000 to 100,000	$2,265,000	$2,895,000	$630,000
Private	CWS	Ground	100,000 to 1,000,000	$3,395,000	$5,275,000	$1,880,000
Private	CWS	Surface	Less than 100	$926,000	$1,390,000	$464,000
Private	CWS	Surface	100 to 500	$2,025,000	$4,061,000	$2,036,000
Private	CWS	Surface	500 to 1,000	$809,000	$1,816,000	$1,007,000
Private	CWS	Surface	1,000 to 3,300	$1,472,000	$2,981,000	$1,509,000
Private	CWS	Surface	3,300 to 10,000	$2,049,000	$3,487,000	$1,438,000
Private	CWS	Surface	10,000 to 50,000	$4,862,000	$10,010,000	$5,148,000
Private	CWS	Surface	50,000 to 100,000	$3,114,000	$4,602,000	$1,488,000
Private	CWS	Surface	100,000 to 1,000,000	$12,819,000	$23,449,000	$10,630,000
Private	CWS	Surface	Greater than 1,000,000	$190,000	$389,000	$199,000
Public	CWS	Ground	Less than 100	$1,780,000	$2,375,000	$595,000
Public	CWS	Ground	100 to 500	$9,905,000	$16,581,000	$6,676,000
Public	CWS	Ground	500 to 1,000	$9,646,000	$18,828,000	$9,182,000
Public	CWS	Ground	1,000 to 3,300	$20,390,000	$36,360,000	$15,970,000
Public	CWS	Ground	3,300 to 10,000	$23,655,000	$37,473,000	$13,818,000

Exhibit 5-136: National Annualized PWS Costs by System Category – High Cost Scenario – at 3 Percent Discount Rate (2016$)

Funding	Type	Source Water	Size	Previous LCR	Final LCRR	Incremental
Public	CWS	Ground	10,000 to 50,000	$30,836,000	$50,523,000	$19,688,000
Public	CWS	Ground	50,000 to 100,000	$20,108,000	$25,591,000	$5,483,000
Public	CWS	Ground	100,000 to 1,000,000	$16,661,000	$26,176,000	$9,515,000
Public	CWS	Ground	Greater than 1,000,000	$2,010,000	$2,506,000	$496,000
Public	CWS	Surface	Less than 100	$1,055,000	$1,580,000	$525,000
Public	CWS	Surface	100 to 500	$3,468,000	$7,117,000	$3,649,000
Public	CWS	Surface	500 to 1,000	$3,578,000	$7,927,000	$4,349,000
Public	CWS	Surface	1,000 to 3,300	$11,233,000	$22,669,000	$11,436,000
Public	CWS	Surface	3,300 to 10,000	$24,631,000	$42,013,000	$17,382,000
Public	CWS	Surface	10,000 to 50,000	$51,622,000	$101,573,000	$49,951,000
Public	CWS	Surface	50,000 to 100,000	$29,651,000	$43,977,000	$14,326,000
Public	CWS	Surface	100,000 to 1,000,000	$72,390,000	$135,513,000	$63,123,000
Public	CWS	Surface	Greater than 1,000,000	$32,891,000	$40,827,000	$7,936,000
Total Annual CWS National Costs				**$440,459,000**	**$740,155,000**	**$299,696,000**
Public	NTNCWS	Ground	Less than 100	$6,412,000	$4,984,000	$-1,428,000
Public	NTNCWS	Ground	100 to 500	$6,210,000	$5,826,000	$-384,000
Public	NTNCWS	Ground	500 to 1,000	$2,029,000	$2,258,000	$229,000
Public	NTNCWS	Ground	1,000 to 3,300	$1,350,000	$1,592,000	$242,000
Public	NTNCWS	Ground	3,300 to 10,000	$411,000	$532,000	$121,000
Public	NTNCWS	Ground	10,000 to 50,000	$134,000	$164,000	$30,000
Public	NTNCWS	Ground	50,000 to 100,000	$59,000	$63,000	$3,933

Exhibit 5-136: National Annualized PWS Costs by System Category – High Cost Scenario – at 3 Percent Discount Rate (2016$)

Funding	Type	Source Water	Size	Previous LCR	Final LCRR	Incremental
Public	NTNCWS	Surface	Less than 100	$436,000	$444,000	$7,724
Public	NTNCWS	Surface	100 to 500	$463,000	$504,000	$41,000
Public	NTNCWS	Surface	500 to 1,000	$221,000	$261,000	$40,000
Public	NTNCWS	Surface	1,000 to 3,300	$396,000	$470,000	$74,000
Public	NTNCWS	Surface	3,300 to 10,000	$477,000	$570,000	$93,000
Public	NTNCWS	Surface	10,000 to 50,000	$244,000	$284,000	$41,000
Public	NTNCWS	Surface	50,000 to 100,000	$67,000	$72,000	$4,825
Public	NTNCWS	Surface	100,000 to 1,000,000	$155,000	$165,000	$9,180
Total Annual NTNCWS National Costs				**$19,064,000**	**$18,188,000**	**$-876,000**
Total Annual Private PWS National Costs				**$74,950,000**	**$120,546,000**	**$45,596,000**
Total Annual Public PWS National Costs				**$384,573,000**	**$637,797,000**	**$253,224,000**
Total Annual PWS National Costs				**$459,523,000**	**$758,343,000**	**$298,820,000**

Notes: System Category rows are not included for system categories that contain zero systems. Detail may not add exactly to total due to independent rounding.

Exhibit 5-137: National Annualized PWS Costs by System Category – Low Cost Scenario – at 7 Percent Discount Rate (2016$)

Funding	Type	Source Water	Size	Previous LCR	Final LCRR	Incremental
Private	CWS	Ground	Less than 100	$7,440,000	$11,616,000	$4,177,000
Private	CWS	Ground	100 to 500	$9,681,000	$14,636,000	$4,955,000
Private	CWS	Ground	500 to 1,000	$2,558,000	$3,654,000	$1,096,000
Private	CWS	Ground	1,000 to 3,300	$2,282,000	$3,185,000	$903,000
Private	CWS	Ground	3,300 to 10,000	$2,573,000	$3,308,000	$735,000
Private	CWS	Ground	10,000 to 50,000	$2,760,000	$4,357,000	$1,597,000
Private	CWS	Ground	50,000 to 100,000	$2,008,000	$2,378,000	$370,000
Private	CWS	Ground	100,000 to 1,000,000	$2,899,000	$3,474,000	$575,000
Private	CWS	Surface	Less than 100	$736,000	$1,072,000	$335,000
Private	CWS	Surface	100 to 500	$1,569,000	$2,394,000	$825,000
Private	CWS	Surface	500 to 1,000	$573,000	$893,000	$320,000
Private	CWS	Surface	1,000 to 3,300	$1,076,000	$1,502,000	$425,000
Private	CWS	Surface	3,300 to 10,000	$1,558,000	$2,060,000	$503,000
Private	CWS	Surface	10,000 to 50,000	$3,815,000	$6,914,000	$3,099,000
Private	CWS	Surface	50,000 to 100,000	$2,813,000	$3,722,000	$909,000
Private	CWS	Surface	100,000 to 1,000,000	$10,775,000	$13,999,000	$3,224,000
Private	CWS	Surface	Greater than 1,000,000	$151,000	$315,000	$164,000
Public	CWS	Ground	Less than 100	$1,217,000	$1,939,000	$722,000
Public	CWS	Ground	100 to 500	$6,599,000	$10,146,000	$3,547,000
Public	CWS	Ground	500 to 1,000	$6,870,000	$9,829,000	$2,959,000
Public	CWS	Ground	1,000 to 3,300	$15,079,000	$20,136,000	$5,057,000
Public	CWS	Ground	3,300 to 10,000	$18,411,000	$23,759,000	$5,349,000

Exhibit 5-137: National Annualized PWS Costs by System Category – Low Cost Scenario – at 7 Percent Discount Rate (2016$)

Funding	Type	Source Water	Size	Previous LCR	Final LCRR	Incremental
Public	CWS	Ground	10,000 to 50,000	$25,164,000	$35,703,000	$10,540,000
Public	CWS	Ground	50,000 to 100,000	$18,192,000	$21,178,000	$2,986,000
Public	CWS	Ground	100,000 to 1,000,000	$14,505,000	$17,187,000	$2,682,000
Public	CWS	Ground	Greater than 1,000,000	$1,592,000	$1,998,000	$407,000
Public	CWS	Surface	Less than 100	$863,000	$1,246,000	$383,000
Public	CWS	Surface	100 to 500	$2,627,000	$4,086,000	$1,459,000
Public	CWS	Surface	500 to 1,000	$2,577,000	$3,860,000	$1,283,000
Public	CWS	Surface	1,000 to 3,300	$8,428,000	$11,896,000	$3,468,000
Public	CWS	Surface	3,300 to 10,000	$19,191,000	$25,307,000	$6,116,000
Public	CWS	Surface	10,000 to 50,000	$42,566,000	$73,051,000	$30,485,000
Public	CWS	Surface	50,000 to 100,000	$26,114,000	$34,894,000	$8,780,000
Public	CWS	Surface	100,000 to 1,000,000	$60,309,000	$78,570,000	$18,262,000
Public	CWS	Surface	Greater than 1,000,000	$26,000,000	$31,264,000	$5,264,000
Total Annual CWS National Costs				**$351,570,000**	**$485,530,000**	**$133,960,000**
Public	NTNCWS	Ground	Less than 100	$3,955,000	$4,628,000	$673,000
Public	NTNCWS	Ground	100 to 500	$4,124,000	$5,068,000	$944,000
Public	NTNCWS	Ground	500 to 1,000	$1,426,000	$1,846,000	$419,000
Public	NTNCWS	Ground	1,000 to 3,300	$988,000	$1,262,000	$274,000
Public	NTNCWS	Ground	3,300 to 10,000	$326,000	$405,000	$79,000
Public	NTNCWS	Ground	10,000 to 50,000	$113,000	$128,000	$15,000
Public	NTNCWS	Ground	50,000 to 100,000	$55,000	$56,000	$1,508

Exhibit 5-137: National Annualized PWS Costs by System Category – Low Cost Scenario – at 7 Percent Discount Rate (2016$)

Funding	Type	Source Water	Size	Previous LCR	Final LCRR	Incremental
Public	NTNCWS	Surface	Less than 100	$362,000	$404,000	$42,000
Public	NTNCWS	Surface	100 to 500	$385,000	$443,000	$58,000
Public	NTNCWS	Surface	500 to 1,000	$194,000	$223,000	$29,000
Public	NTNCWS	Surface	1,000 to 3,300	$352,000	$394,000	$42,000
Public	NTNCWS	Surface	3,300 to 10,000	$431,000	$476,000	$44,000
Public	NTNCWS	Surface	10,000 to 50,000	$222,000	$241,000	$19,000
Public	NTNCWS	Surface	50,000 to 100,000	$63,000	$64,000	$1,430
Public	NTNCWS	Surface	100,000 to 1,000,000	$145,000	$148,000	$2,509
Total Annual NTNCWS National Costs				**$13,141,000**	**$15,786,000**	**$2,645,000**
Total Annual Private PWS National Costs				**$55,267,000**	**$79,479,000**	**$24,212,000**
Total Annual Public PWS National Costs				**$309,445,000**	**$421,837,000**	**$112,393,000**
Total Annual PWS National Costs				**$364,711,000**	**$501,316,000**	**$136,605,000**

Notes: System Category rows are not included for system categories that contain zero systems. Detail may not add exactly to total due to independent rounding.

Exhibit 5-138: National Annualized PWS Costs by System Category – High Cost Scenario – at 7 Percent Discount Rate (2016$)

Funding	Type	Source Water	Size	Previous LCR	Final LCRR	Incremental
Private	CWS	Ground	Less than 100	$11,908,000	$13,808,000	$1,900,000
Private	CWS	Ground	100 to 500	$14,808,000	$22,440,000	$7,632,000
Private	CWS	Ground	500 to 1,000	$3,795,000	$7,314,000	$3,519,000
Private	CWS	Ground	1,000 to 3,300	$3,686,000	$6,394,000	$2,708,000
Private	CWS	Ground	3,300 to 10,000	$3,260,000	$5,127,000	$1,867,000
Private	CWS	Ground	10,000 to 50,000	$3,581,000	$6,247,000	$2,666,000
Private	CWS	Ground	50,000 to 100,000	$2,207,000	$2,914,000	$708,000
Private	CWS	Ground	100,000 to 1,000,000	$3,358,000	$5,527,000	$2,169,000
Private	CWS	Surface	Less than 100	$915,000	$1,386,000	$471,000
Private	CWS	Surface	100 to 500	$2,047,000	$4,077,000	$2,029,000
Private	CWS	Surface	500 to 1,000	$845,000	$1,945,000	$1,100,000
Private	CWS	Surface	1,000 to 3,300	$1,522,000	$3,184,000	$1,662,000
Private	CWS	Surface	3,300 to 10,000	$2,098,000	$3,594,000	$1,496,000
Private	CWS	Surface	10,000 to 50,000	$4,906,000	$10,758,000	$5,852,000
Private	CWS	Surface	50,000 to 100,000	$3,022,000	$4,658,000	$1,636,000
Private	CWS	Surface	100,000 to 1,000,000	$12,767,000	$24,757,000	$11,990,000
Private	CWS	Surface	Greater than 1,000,000	$151,000	$343,000	$191,000
Public	CWS	Ground	Less than 100	$1,770,000	$2,405,000	$636,000
Public	CWS	Ground	100 to 500	$9,937,000	$16,954,000	$7,018,000
Public	CWS	Ground	500 to 1,000	$9,840,000	$19,786,000	$9,947,000
Public	CWS	Ground	1,000 to 3,300	$20,368,000	$38,156,000	$17,788,000
Public	CWS	Ground	3,300 to 10,000	$23,623,000	$38,224,000	$14,602,000

Exhibit 5-138: National Annualized PWS Costs by System Category – High Cost Scenario – at 7 Percent Discount Rate (2016$)

Funding	Type	Source Water	Size	Previous LCR	Final LCRR	Incremental
Public	CWS	Ground	10,000 to 50,000	$30,304,000	$52,801,000	$22,496,000
Public	CWS	Ground	50,000 to 100,000	$19,474,000	$25,635,000	$6,161,000
Public	CWS	Ground	100,000 to 1,000,000	$16,351,000	$27,209,000	$10,858,000
Public	CWS	Ground	Greater than 1,000,000	$1,593,000	$2,073,000	$480,000
Public	CWS	Surface	Less than 100	$1,038,000	$1,602,000	$564,000
Public	CWS	Surface	100 to 500	$3,526,000	$7,402,000	$3,877,000
Public	CWS	Surface	500 to 1,000	$3,707,000	$8,475,000	$4,769,000
Public	CWS	Surface	1,000 to 3,300	$11,544,000	$24,156,000	$12,612,000
Public	CWS	Surface	3,300 to 10,000	$25,105,000	$43,289,000	$18,184,000
Public	CWS	Surface	10,000 to 50,000	$51,264,000	$108,013,000	$56,749,000
Public	CWS	Surface	50,000 to 100,000	$28,957,000	$44,680,000	$15,723,000
Public	CWS	Surface	100,000 to 1,000,000	$72,265,000	$144,758,000	$72,492,000
Public	CWS	Surface	Greater than 1,000,000	$26,074,000	$32,870,000	$6,796,000
Total Annual CWS National Costs				**$431,615,000**	**$762,963,000**	**$331,348,000**
Public	NTNCWS	Ground	Less than 100	$6,350,000	$5,125,000	$-1,225,000
Public	NTNCWS	Ground	100 to 500	$6,109,000	$5,869,000	$-240,000
Public	NTNCWS	Ground	500 to 1,000	$1,982,000	$2,250,000	$268,000
Public	NTNCWS	Ground	1,000 to 3,300	$1,306,000	$1,572,000	$266,000
Public	NTNCWS	Ground	3,300 to 10,000	$397,000	$522,000	$124,000
Public	NTNCWS	Ground	10,000 to 50,000	$127,000	$157,000	$29,000
Public	NTNCWS	Ground	50,000 to 100,000	$56,000	$60,000	$3,836

Exhibit 5-138: National Annualized PWS Costs by System Category – High Cost Scenario – at 7 Percent Discount Rate (2016$)

Funding	Type	Source Water	Size	Previous LCR	Final LCRR	Incremental
Public	NTNCWS	Surface	Less than 100	$424,000	$439,000	$15,000
Public	NTNCWS	Surface	100 to 500	$451,000	$498,000	$47,000
Public	NTNCWS	Surface	500 to 1,000	$214,000	$257,000	$43,000
Public	NTNCWS	Surface	1,000 to 3,300	$381,000	$460,000	$79,000
Public	NTNCWS	Surface	3,300 to 10,000	$459,000	$556,000	$97,000
Public	NTNCWS	Surface	10,000 to 50,000	$232,000	$272,000	$40,000
Public	NTNCWS	Surface	50,000 to 100,000	$64,000	$69,000	$4,657
Public	NTNCWS	Surface	100,000 to 1,000,000	$148,000	$157,000	$8,625
Total Annual NTNCWS National Costs				**$18,701,000**	**$18,261,000**	**$-440,000**
Total Annual Private PWS National Costs				**$74,877,000**	**$124,474,000**	**$49,597,000**
Total Annual Public PWS National Costs				**$375,439,000**	**$656,750,000**	**$281,311,000**
Total Annual PWS National Costs				**$450,316,000**	**$781,224,000**	**$330,908,000**

Notes: System Category rows are not included for system categories that contain zero systems. Detail may not add exactly to total due to independent rounding.

5.3.7.3 *Household Costs by CWS Size and Source Water Type*

The SafeWater LCR model calculates the annualized cost per household. The SafeWater LCR model first calculates the cost per gallon of water produced by the model PWS:

$$\text{Cost per gallon}_{cws} = \text{Annualized CWS Cost} / (\text{Average Daily Flow}_{cws} * 365 \times 1{,}000)$$

It then multiplies this cost per gallon by the average annual household consumption (in gallons) to determine the cost per household per year associated with increased costs borne by the model PWS. The SafeWater LCR model then adds to this the total LSLR cost borne by households in the system, divided by the number of households served by the system, to calculate the model PWS's average annual household cost:

$$\text{Average Annual Household Cost} = \text{Annual Household Consumption} * \text{Cost per gallon}_{cws} +$$

$$\text{Total Household Cost of LSLR}_{CWS}/\text{Number of Households}_{CWS}$$

Exhibit 5-139 and Exhibit 5-140 show the distribution of incremental annualized costs for CWS households by primary water source and size category for the low and high scenarios, respectively. Note: the percentiles represent the distribution of average household costs among CWSs in a category not the distribution of costs across all households in a CWS category.

Exhibit 5-139: Annualized Incremental Cost per Household by CWS Category - Low Cost Scenario (2016$)

Funding	Type	Source Water	Size	10th Percentile	25th Percentile	50th Percentile	75th Percentile	90th Percentile
Private	CWS	Ground	Less than 100	$5.36	$7.00	$11.32	$18.48	$26.40
Private	CWS	Ground	100 to 500	$1.45	$2.32	$4.03	$5.85	$9.92
Private	CWS	Ground	500 to 1,000	$0.44	$0.54	$0.68	$0.95	$2.18
Private	CWS	Ground	1,000 to 3,300	$0.16	$0.22	$0.32	$0.42	$0.98
Private	CWS	Ground	3,300 to 10,000	$0.25	$0.31	$0.45	$0.64	$1.96
Private	CWS	Ground	10,000 to 50,000	$0.04	$0.06	$0.09	$0.34	$0.72
Private	CWS	Ground	50,000 to 100,000	$0.05	$0.06	$0.10	$0.31	$0.34
Private	CWS	Ground	100,000 to 1,000,000	$0.03	$0.04	$0.10	$0.26	$0.31
Private	CWS	Surface	Less than 100	$4.96	$7.39	$12.05	$19.57	$34.61
Private	CWS	Surface	100 to 500	$1.43	$2.26	$4.08	$6.92	$13.97
Private	CWS	Surface	500 to 1,000	$0.40	$0.51	$0.78	$1.68	$3.49
Private	CWS	Surface	1,000 to 3,300	$0.16	$0.21	$0.35	$0.77	$1.16
Private	CWS	Surface	3,300 to 10,000	$0.23	$0.31	$0.49	$1.57	$2.45
Private	CWS	Surface	10,000 to 50,000	$0.04	$0.06	$0.36	$0.64	$2.23
Private	CWS	Surface	50,000 to 100,000	$0.03	$0.05	$0.19	$0.30	$1.26
Private	CWS	Surface	100,000 to 1,000,000	$0.02	$0.05	$0.19	$0.27	$0.97
Private	CWS	Surface	Greater than 1,000,000	$0.13	$0.13	$0.14	$0.14	$0.14
Public	CWS	Ground	Less than 100	$3.83	$4.95	$8.27	$14.29	$21.12
Public	CWS	Ground	100 to 500	$1.00	$1.37	$2.36	$3.89	$7.28
Public	CWS	Ground	500 to 1,000	$0.32	$0.39	$0.51	$0.93	$1.95
Public	CWS	Ground	1,000 to 3,300	$0.12	$0.16	$0.24	$0.37	$0.86
Public	CWS	Ground	3,300 to 10,000	$0.20	$0.26	$0.36	$0.52	$1.63

Exhibit 5-139: Annualized Incremental Cost per Household by CWS Category - Low Cost Scenario (2016$)

Funding	Type	Source Water	Size	10th Percentile	25th Percentile	50th Percentile	75th Percentile	90th Percentile
Public	CWS	Ground	10,000 to 50,000	$0.03	$0.05	$0.07	$0.42	$0.57
Public	CWS	Ground	50,000 to 100,000	$0.04	$0.05	$0.21	$0.26	$0.28
Public	CWS	Ground	100,000 to 1,000,000	$0.03	$0.05	$0.09	$0.22	$0.27
Public	CWS	Ground	Greater than 1,000,000	$0.06	$0.06	$0.09	$0.10	$0.10
Public	CWS	Surface	Less than 100	$3.48	$6.44	$12.26	$22.00	$29.05
Public	CWS	Surface	100 to 500	$0.92	$1.45	$2.71	$4.75	$8.36
Public	CWS	Surface	500 to 1,000	$0.31	$0.39	$0.60	$1.28	$2.65
Public	CWS	Surface	1,000 to 3,300	$0.12	$0.16	$0.26	$0.57	$0.97
Public	CWS	Surface	3,300 to 10,000	$0.21	$0.27	$0.40	$1.32	$1.94
Public	CWS	Surface	10,000 to 50,000	$0.04	$0.06	$0.14	$0.57	$2.22
Public	CWS	Surface	50,000 to 100,000	$0.03	$0.06	$0.24	$0.31	$1.10
Public	CWS	Surface	100,000 to 1,000,000	$0.03	$0.06	$0.18	$0.28	$0.40
Public	CWS	Surface	Greater than 1,000,000	$0.04	$0.07	$0.09	$0.10	$0.34

Notes: System Category rows are not included for system categories that contain zero systems. Detail may not add exactly to total due to independent rounding.

Exhibit 5-140: Annualized Incremental Cost per Household by CWS Category - High Cost Scenario (2016$)

Funding	Type	Source Water	Size	10th Percentile	25th Percentile	50th Percentile	75th Percentile	90th Percentile
Private	CWS	Ground	Less than 100	$-10.82	$6.65	$10.86	$18.53	$30.58
Private	CWS	Ground	100 to 500	$1.28	$2.31	$4.31	$6.81	$17.50
Private	CWS	Ground	500 to 1,000	$0.44	$0.56	$0.78	$3.71	$7.09
Private	CWS	Ground	1,000 to 3,300	$0.17	$0.25	$0.36	$1.15	$2.66
Private	CWS	Ground	3,300 to 10,000	$0.24	$0.33	$0.52	$2.44	$5.85
Private	CWS	Ground	10,000 to 50,000	$0.05	$0.07	$0.10	$0.49	$1.45
Private	CWS	Ground	50,000 to 100,000	$0.05	$0.06	$0.08	$0.35	$1.42
Private	CWS	Ground	100,000 to 1,000,000	$0.04	$0.08	$0.36	$0.64	$4.51
Private	CWS	Surface	Less than 100	$3.72	$6.49	$15.93	$30.31	$69.90
Private	CWS	Surface	100 to 500	$1.17	$2.25	$6.70	$13.09	$44.49
Private	CWS	Surface	500 to 1,000	$0.37	$0.61	$3.15	$4.78	$19.00
Private	CWS	Surface	1,000 to 3,300	$0.15	$0.26	$1.01	$2.38	$7.74
Private	CWS	Surface	3,300 to 10,000	$0.17	$0.37	$1.96	$3.35	$9.98
Private	CWS	Surface	10,000 to 50,000	$0.05	$0.08	$0.40	$1.13	$5.70
Private	CWS	Surface	50,000 to 100,000	$0.03	$0.05	$0.13	$0.39	$2.54
Private	CWS	Surface	100,000 to 1,000,000	$0.03	$0.09	$0.36	$0.95	$4.36
Private	CWS	Surface	Greater than 1,000,000	$0.16	$0.16	$0.16	$0.16	$0.17
Public	CWS	Ground	Less than 100	$-5.87	$4.63	$7.76	$15.88	$27.31
Public	CWS	Ground	100 to 500	$0.96	$1.41	$2.65	$6.26	$14.49
Public	CWS	Ground	500 to 1,000	$0.32	$0.41	$0.62	$3.17	$7.14
Public	CWS	Ground	1,000 to 3,300	$0.12	$0.17	$0.29	$1.04	$3.33
Public	CWS	Ground	3,300 to 10,000	$0.20	$0.27	$0.41	$1.88	$4.83

Exhibit 5-140: Annualized Incremental Cost per Household by CWS Category - High Cost Scenario (2016$)

Funding	Type	Source Water	Size	10th Percentile	25th Percentile	50th Percentile	75th Percentile	90th Percentile
Public	CWS	Ground	10,000 to 50,000	$0.04	$0.06	$0.08	$0.40	$1.60
Public	CWS	Ground	50,000 to 100,000	$0.04	$0.05	$0.19	$0.30	$2.24
Public	CWS	Ground	100,000 to 1,000,000	$0.04	$0.06	$0.30	$0.44	$3.97
Public	CWS	Ground	Greater than 1,000,000	$0.08	$0.08	$0.10	$0.10	$0.10
Public	CWS	Surface	Less than 100	$3.30	$5.45	$13.70	$29.79	$62.64
Public	CWS	Surface	100 to 500	$0.90	$1.47	$4.85	$10.08	$34.08
Public	CWS	Surface	500 to 1,000	$0.30	$0.44	$2.61	$3.98	$13.98
Public	CWS	Surface	1,000 to 3,300	$0.12	$0.20	$0.83	$1.63	$5.51
Public	CWS	Surface	3,300 to 10,000	$0.21	$0.33	$1.66	$2.64	$8.76
Public	CWS	Surface	10,000 to 50,000	$0.05	$0.07	$0.38	$1.08	$5.11
Public	CWS	Surface	50,000 to 100,000	$0.04	$0.06	$0.25	$0.37	$2.85
Public	CWS	Surface	100,000 to 1,000,000	$0.04	$0.08	$0.37	$0.97	$4.42
Public	CWS	Surface	Greater than 1,000,000	$0.04	$0.08	$0.09	$0.12	$0.61

Notes: System Category rows are not included for system categories that contain zero systems. Detail may not add exactly to total due to independent rounding.

5.4 Estimating Primacy Agency Costs

For many of the water system activities described in Section 5.3, the 56 Primacy Agencies[117] will incur costs in the form of burden (i.e., hours) to provide oversight and review. The Primacy Agency burden is multiplied by the labor rate ($/hr), as presented in Section 4.3.10.2 to estimate labor unit costs. The remainder of this section mirrors that of Section 5.3 and is organized as follows:

- 5.4.1: Primacy Agency Implementation and Administrative Costs
- 5.4.2: Primacy Agency Sampling Related Costs
- 5.4.3: Primacy Agency CCT Related Costs
- 5.4.4: Primacy Agency Lead Service Line Inventory and Replacement Related Costs
- 5.4.5: Primacy Agency POU Related Costs
- 5.4.6: Primacy Agency Public Education-Related Costs

Section 5.4.7 provides a summary of Primacy Agency costs affected by each major requirement for low and high cost scenarios at a 3 percent and 7 percent discount rate.

Exhibit 5-141 provides an overview of the rule components, subcomponents, and activities for which EPA estimates Primacy Agency costs for the LCRR. The derivation of unit burden is provided in each referenced subsection. At the end of each subsection, EPA provides a summary exhibit showing the SafeWater LCR modeling approach for each Primacy Agency activity, as was done in Section 5.3 for PWSs. The SafeWater LCR model uses the information from these exhibits to calculate total annualized Primacy Agency cost for each activity. See Section 5.2 for detail on the cost modeling methodology.

As noted in Section 5.1, costs for Primacy Agencies presented in this section are LCRR costs if no previous rule were in place. The national costs of the LCRR, or incremental costs, are the difference between the cost of compliance with the LCRR and the cost of compliance with the previous LCR. These costs are presented in Exhibit 5-1 at the 3 percent discount rate and Exhibit 5-2 at the 7 percent discount rate.

Also as discussed throughout Section 5.4, many of the inputs have been modified to include information provided by ASDWA in the February 20, 2020 version of their CoSTS model (ASDWA, 2020a). This model includes estimates of burden and/or cost to implement the new rule requirements based on the proposed LCRR for 49 states excluding Wyoming.

[117] The 56 Primacy Agencies include 49 states (excluding Wyoming), Puerto Rico, Guam, United States Virgin Islands, American Samoa, North Mariana Islands, and Navajo Nation. For cost modeling purposes, EPA also included the District of Columbia (D.C.) as a Primacy Agency when assigning burden and costs of the rule although some of these costs are incurred by the actual Primacy Agency, EPA Region 3.

Exhibit 5-141: Primacy Agency Cost Components, Subcomponents, and Activities Organized by Section[1]

Component	Subcomponents	Activities[2]

5.4.1: PWS Implementation and Administrative Costs	5.4.1.1: Primacy Agency Start-up Implementation and Administrative Activities	a) Adopt rule and develop program b) Modify data management systems c) Provide system training and technical assistance d) Provide staff tra

Component	Subcomponents	Activities[2]
		e) ining Review and approve small system flexibility option
	e): Error! Reference source not found. (***hrs_sm_flex_option_js).*** Primacy Agencies will incur burden to review and approve the compliance option recommended by CWSs serving 10,000 or fewer and all NTNCWSs that exceed the TL. EPA assumed a burden of 5 hours based on the average for Primacy Agencies review of a system's selected compliance option from ASDWA CosTS, worksheet "CCT," row 70 (ASDWA, 2020a). Primacy Agency Annual Implementation and Administrative Activities	f) Coordinate with EPA g) Provide ongoing technical assistance h) Report to

Component	Subcomponents	Activities[2]
		i) SDWIS/Fed Train staff for annual administration
5.4.2: Exhibit 5-12: PWS Administration and Rule Implementation Cost Estimation in SafeWater LCR by Activity	5.4.3.1: PWS Lead Tap Sampling	a) Provide templates for revised sampling instructions and conduct review b) Revie

y	NTNCWS Cost Per Activity	Conditions for Cos Model P	
		Lead 90th - Range	Oth
e rule			
ltiplied	Cost applies as written to NTNCWSs.	All	All mo
esources for rule implementation			
ltiplied e_op)	Cost applies as written to NTNCWSs.	All	All mo
nd technical assistance from Primacy Agency durin			
ltiplied	Cost applies as written to NTNCWSs.	All	All mo
exibility lead compliance option to Primacy Agency			

	Component				Subcomponents		Activities[2]
urs per system multiplied em labor rate. x_option_op*rate_op)	Cost applies as written to NTNCWSs.	Above TL	CWSs serving ≤ 10,000 people and NTNCWSs		One time		w up da te d sa m pli ng pla n for LS L sys te ms c) Re vie w ini tial lea d m on ito rin g da ta an d pr ep ar e sys te ms for sta tus un de r LC RR d) Re vie

Acronyms: CWS = community water system; NTNCWS = non-transient non-community water system; PWS = public water system; TL = trigger level.

Note: The data variables in the exhibit are defined previously in Section 5.3.1.1 with the exception of:

- *rate_op:* PWS hourly labor rate (Section 4.3.10.1).

5.4.1.1 *Estimate of PWS National Implementation and Administrative Costs*

The estimated annualized national PWS implementation and administrative costs for the LCRR are $2,576,000 at a 3 percent discount rate and $4,147,000 at a 7 percent discount rate. Since this cost category represents startup costs associated with the new LCRR regulatory requirements there are no estimated costs for the previous LCR in this category for the period being analyzed; therefore, the PWS implementation and administrative incremental costs are also $2,576,000 at a 3 percent discount rate and $4,147,000 at a 7 percent discount rate (see Exhibit 5-1 and Exhibit 5-2). The number of LSLs, costs to optimize CCT, and effectiveness of CCT do not affect the national PWS implementation and administrative costs.

PWS Sampling Costs

Component	Subcomponents	Activities[2]
		w ch an ge in ta p sa m ple loc ati on s e) Re vie w 9- ye ar m on ito rin g wa ive r re ne wa l f) Re vie w sa m ple inv ali da tio n re qu est s g) Re vie w

Component	Subcomponents	Activities[2]
		customer notification certifications h) Review monitoring results and 90th percentile calculations
	5.4.3.2: PWS Lead Water Quality Parameter	i) Review lead WQP sampling da

Component	Subcomponents	Activities[2]
		and compliance with OWQPs
	5.4.3.3: **Error! Not a valid result for table.**	j) Review copper WQP sampling data and compliance with OWQPs
	5.4.3.4: PWS Source Water Monitoring	k) Review source water m

Component	Subcomponents	Activities[2]
		onitoring results
	5.4.3.5: Primacy Agency School Sampling Costs	l) Review initial list of schools and child cares m) Provide templates on school and child care testing program n) Review

Component	Subcomponents	Activities[2]
		school and child care testing programmaterials o) Review annual reports on school and child care lead in drinking water testing

Component	Subcomponents	Activities[2]
		program

Component	Subcomponents	Activities[2]
5.4.4: **Error! Not a valid result for table.**	5.4.4.1: CCT Installation	a) Review CCT study and determine type of CCT to be installed b) Set OWQPs after CCT installation

Component	Subcomponents	Activities[2]
	5.4.4.2: Re-optimization	c) Review CCT study and determine needed CCT adjustment d) Reset OW QPs after CCT re-optimization
	5.4.4.3: Find-and-Fix Costs	e) Consult with system prior to any find-and-fix CCT adjustments f) Review

Component	Subcomponents	Activities[2]
		report on find-and-fix responses
	5.4.3.4: Primacy Agency Lead CCT Routine Costs	g) Review CCT guidance and applicability to individual PWSs h) Review water quality data with PWSs during sanitary survey i) Consult on require

Component	Subcomponents	Activities[2]
		ed actions in response to source water change j) Consult on required actions in response to treatment change

5.4.5: Primacy Agency Lead Service Line Inventory and Replacement Related Costs	5.4.5.1: LSL Inventory Costs	a) Assist with LSL inventory development and review inventory for PWSs with LSLs b) Review information from PWSs that have no

		LSLs c) Provide templates for general LSL outreach materials d) Review general LSL outreach materials e) Review updates to LSL inventory

Component	Subcomponents	Activities[2]
	5.4.4.2: LSLR Plan	f) Review LSLR plan and negotiate goals
	5.4.5.3: LSL Replacement Costs	g) Provide targeted LSLR program outreach templates and consult with PWS h) Review tar

		ge te d ou tre ac h ma ter ial s i) De ter mi ne ad dit io nal act ivit ies for P W Ss no t m ee tin g th eir go al- ba se d rat e j) Re vie w an nu al LS LR pr og ra m

Component	Subcomponents	Activities[2]
		report
5.4.6: **Error! Not a valid result for table.**	5.4.6.1: One-Time POU Program Costs	a) Review POU plan b) Provide templates for POU outreach materials c) Review POU PE materials
	5.4.6.2: Ongoing POU Program Costs	d) Review sample invalidation re

Component	Subcomponents	Activities[2]
		quest for POU monitoring e) Review customer notification certifications f) Review annual POU program report
5.4.7: PWS Lead Public Education and Outreach Costs	5.4.7.1: Consumer Notice in Response to a Lead Sample > 15 µg/L	a) Review copy of the 3

Component	Subcomponents	Activities[2]
		calendar day notice when sample exceeds 15 µg/L
	5.4.7.2: Consumer Notice in Response to a Lead Sample > 15 µg/L EPA has developed costs for consumer notice in response to a lead sample above 15 µg/L, as shown in Exhibit 5-118. The exhibit provides the unit burden and/or cost for each activity. The assumptions used in the estimation of the unit burden follow the exhibit. The last column provides the corresponding SafeWater LCR model data variable in red/italic font. **Exhibit 5-118: PWS Burden for Consumer Notification When Sample is > 15 µg/L**	b) Provide templates for updated CCR language c) Provide templates for state an

		Unit Burden and/or Cost
y)	Provide notice to customers with lead tap samples > 15 µg/L	0.25 hrs/customer contact
z)	Provide a copy of the 3 calendar day notice to the Primacy Agency	0.08 hrs/customer contact

Component	Subcomponents	Activities[2]
	Source: "Derivation of Public Education Inputs_CWS_Final Rule.xlsx." ***c) Provide notice to customers with lead tap samples > 15 µg/L (hrs_pe_above_al_prep_op).*** Under the LCRR, systems must notify any customer with a sample result above 15 µg/L as soon as practicable but no later than 3 days after learning of the results. Exhibit 5-63 in Section 5.3.3.3 provides the likelihood a system will have a single sample above 15 µg/L for each of the three lead 90th percentile classifications (*pp_above_al_bin_one*, *pp_above_al_bin_two*, and *pp_above_al_bin_three*). Also refer to Chapter 4, Section 4.3.5.2 for a detailed discussion of EPA's approach for developing these percentages. Systems that choose to mail the notification must have the letters postmarked within three days. EPA assumed CWSs would elect to call customers and would incur a burden of 15 minutes or 0.25 hours per call (*hrs_pe_above_al_prep_op*). EPA assumed that NTNCWSs would use the same mechanism they currently use to inform their customers of sample results via posting and electronic notification but would provide this information sooner. To avoid double counting, EPA did not assign any additional burden or costs to NTNCWSs for this quicker notification but included the burden and costs as part of the Lead Tap Sampling Costs using *hrs_NTNCWS_inform_samp_op* and *cost_NTNCWS_inform_lt.*	d) local health department lead outreach e) Review lead outreach materials for state and local health departments f) Participa

Component	Subcomponents	Activities[2]
	d) Provide a copy of the 3 calendar day notice to the Primacy Agency (hrs_above_15_notice_op). Systems must submit a copy of the 3 calendar day notification to their Primacy Agencies. EPA assumed systems would require 5 minutes or 0.083 hours to submit an electronic copy ($0) of this notice to the Primacy Agency (*hrs_above_15_notice_op*). EPA assumed a lower burden to provide this notice than required to notify the customer of their results of 0.25 hours via a phone call (*hrs_pe_above_al_prep_op*) discussed in activity a). Activities Regardless of Lead 90th Percentile Level	ate in joint communication efforts with state and local health departments f) Review PE materials for service line disturba

Component	Subcomponents	Activities[2]
		nces
	5.4.7.3: Public Education Activities in Response to Lead ALE	g) Provide template and review revised lead language h) Consult with CWS on other PE activities in response to lead ALE

Component	Subcomponents	Activities[2]
		i) Review PE certifications

Acronyms: ALE = action level exceedance; CCR = consumer confidence report; CCT = corrosion control treatment; CWS = community water system; LSL = lead service line; LSLR = lead service line replacement; OWQPs = optimal water quality parameters; PE = public education; POU = point-of-use; PWS = public water system; SDWIS/Fed = Safe Drinking Water Act Information System/federal version; WQP = water quality parameter.

Notes:

[1] Primacy Agencies will also incur burden for recordkeeping activities under the LCRR, such as retaining records of decisions, supporting documentation, technical basis for decisions, and documentation submitted by the system. EPA has included burden for recordkeeping with each activity when applicable as opposed to providing separate burden estimates.

[2] EPA assigned a unique letter ID for each activity under a given rule component. Activities are generally organized with upfront, one-time activities first followed by ongoing activities. Note that these activities are different than the activities identified for PWSs in Exhibit 5-10.

5.4.2 Primacy Agency Implementation and Administrative Costs

Primacy Agencies will incur both one-time and annual burden to implement and administer the new requirements. These one-time activities and associated SafeWater LCR model cost inputs are described in Sections 5.4.2.1. Ongoing activities and associated cost inputs are provided in Section 5.4.2.2.

Note that Primacy Agency burden estimates for responding to specific requirements of the LCRR (e.g., review changes in a system's treatment, consult with systems, etc.) are presented in the sections for those particular rule requirements.

5.4.2.1 *Primacy Agency Start-up Implementation and Administrative Activities*

EPA estimated that Primacy Agencies will incur burden from conducting upfront, administrative activities to implement the LCRR. These activities are not directly required by specific provisions of the LCRR; however, they are necessary for Primacy Agencies to ensure that the provisions are properly carried out.

EPA has identified and developed costs for five start-up implementation and administration activities as shown in Exhibit 5-142. The last column provides the data variable used in the SafeWater LCR model. Each of these costs occur during years 1 through 5 of the 35-year period of analysis. Additional assumptions related to each activity follow the exhibit.

Exhibit 5-142: Primacy Agency Administration Activities and Unit Burden Estimates (Occur during Years 1 through 5)

Activity	Unit Burden	*SafeWater LCR Data Variable*
a) **Error! Reference source not found.**	640 hrs/Primacy Agency	*hrs_adopt_rule_js*
b) Modify data management systems[1]	740 hrs/Primacy Agency	*hrs_modify_ds_js*
c) **Error! Reference source not found.**	800 hrs/Primacy Agency	*hrs_initial_ta_js*
d) **Error! Reference source not found.**	196 hrs/Primacy Agency	*hrs_train_imp_js*
e) Review and approve small system flexibility option	5 per CWSs serving ≤10,000 and all NTNCWSs	*hrs_sm_flex_op_js*

Source: "Final CoSTS 2-6-20_Final Rule.xlsx." Costs occur during the first five years of rule implementation (years 1 through 5) (ASDWA, 2020a).

a) Adopt rule and develop program (hrs_adopt_rule_js). EPA assumed Primacy Agencies would incur a burden of 640 hours per year during years 1 through 5 to adopt the rule that includes preparation of a Primacy package and to develop their program for the LCRR. This estimate is based on ASDWA's projection in CoSTS, worksheet "Reg. Start-up" that Primacy Agency would require 3,200 hours over a 5-year period (ASDWA, 2020a).

b) Modify data management system (hrs_modify_ds_js). EPA assumed systems will modify the data management system in-house and incur an annual burden of 740 hours for years 1 through 5. This estimate is based on ASDWA's projection in CoSTS, worksheet "Reg. Start-up" that Primacy Agency would require 3,700 hours over a 5-year period (ASDWA, 2020a).

c) Provide system training and technical assistance (hrs_initial_ta_js). EPA assumed Primacy Agencies would incur an annual burden of 800 hours per year during years 1 through 5 to provide initial system training and technical assistance related to the LCRR. This estimate is based on ASDWA's projection in CoSTS, worksheet "Reg. Start-up" that Primacy Agency would require 4,000 hours over a 5-year period (ASDWA, 2020a).

d) Provide staff training (hrs_train_imp_js). In CoSTS, worksheet "Reg. Start-up," ASDWA provided the estimated burden for states to provide four types of staff training on the LCRR related to: 1) LSL inventories and replacement, 2) CCT, 3) PE, and 4) sampling and simultaneous compliance. ASDWA developed different burden estimates for this training burden for different state sizes, as shown in Exhibit 5-143. EPA used the weighted average divided over a 5-year period of 196 hours as the burden each of the 56 Primacy Agencies included in SafeWater would incur during years 1 through 5.

Exhibit 5-143: Estimated Burden for Primacy Agencies to Provide Staff Training during Years 1 through 5

State Size	# of States	Burden per state
Large	9	2,000
Medium	20	1,000
Small	20	500
Weighted Average		980
5-year weighted average		**196**

Source: "Final CoSTS 2-6-20_Final Rule.xlsx," worksheet Reg. Start-Up.
Note: EPA assumed the four types of training would occur over a 5-year period.

e) *Error! Reference source not found.* ***(hrs_sm_flex_option_js).*** Primacy Agencies will incur burden to review and approve the compliance option recommended by CWSs serving 10,000 or fewer and all NTNCWSs that exceed the TL. EPA assumed a burden of 5 hours based on the average for Primacy Agencies review of a system's selected compliance option from ASDWA CosTS, worksheet "CCT," row 70 (ASDWA, 2020a).

5.4.2.2 *Primacy Agency Annual Implementation and Administrative Activities*

In addition to one-time, upfront activities, Primacy Agencies will incur burden to conduct annual activities to administer the LCRR. EPA has identified and developed costs for four annual administration activities as shown in Exhibit 5-144. The exhibit provides the unit burden estimate for each activity and additional burden for new SDWIS/Fed reporting requirements under the LCRR. The last column provides the corresponding SafeWater LCR model data variable. A more detailed explanation of how EPA derived the inputs are provided in text that follows the exhibit.

Exhibit 5-144: Primacy Agency Annual Administration Activities and Unit Burden Estimates

Activity	Unit Burden (hours/Primacy Agency)	*SafeWater LCR Data Variable*
f) Coordinate with EPA	1,040	*hrs_coord_epa_js*
g) **Error! Reference source not found.**	2,265	*hrs_ta_js*
h) **Error! Reference source not found.**	1,560	*hrs_sdwis_js*
i) **Error! Reference source not found.**	104	*hrs_train_ann_js*
Per Primacy Agency Total	4,969	

Sources:
f), h), and i): "Derivation of Administrative Burden and Costs_Final Rule.xlsx." Unit burdens are based on implementation burden estimated for EPA's 2012, *Economic Analysis for the Final Revised Total Coliform Rule*, Exhibit 7.4, available in the docket.
g): ASDWA CoSTS model (ASDWA, 2020a) and "Derivation of Administrative Burden and Costs_Final Rule.xlsx."

f) ***Coordinate with EPA (hrs_coord_epa_js).*** Primacy Agencies must coordinate with their particular EPA Regional office to be certain that their program is consistent with federal requirements. EPA

estimated an annual burden of 1,040 hours based on the *Economic Analysis for the Final Revised Total Coliform Rule*, Exhibit 7.4 (USEPA, 2012b).

g) Provide ongoing technical assistance (hrs_ta_js). EPA determined the on-going tracking and follow-up per system estimates provided in the ASDWA CoSTS model (ASDWA, 2020a) for LSL inventory and replacement, tap sampling, sample site assessment, PN and education, and lead testing in schools and child cares as follows:

1. Determined the per system burden estimates separately for 12 categories that included small, medium, and large CWSs with and without LSLs and NTNCWSs with and without LSLs because the estimates and rule applicability vary by system size, system type, LSL status.
2. Multiplied the per system estimate by the number of systems in each of the 12 categories based on the system inventory information provided in Chapter 4.
3. Summed the burden for the four system type and LSL status categories to derive a total burden by size category.
4. Divided each burden by the 49 states used in the ASDWA CoSTS model to derive a total burden by size category.
5. Determined the weighted average across the size categories.
6. Divided the burden is step 5 by five because the estimates are provided for a 5-year period.

Note that EPA did not include ASDWA's estimates for reporting or re-evaluation activities in the ongoing technical assistance burden because they are included in other data variables and violations or compliance estimates because EPA assumed full compliance for cost modeling purposes. Also, the ongoing technical assistance burden does not include estimates from the "TL" or "CCT" worksheets because they are one-time activities and EPA has accounted for their burden in other activities.[118]

h) Report to SDWIS/Fed (hrs_sdwis_js). EPA assumed Primacy Agencies will require 1,000 hours to meet the requirements of the previous rule and an additional burden of 560 hours (or 0.25 full time equivalents) to meet the additional requirement for the LCRR for a total annual burden of 1,560 hours. Under the LCRR, Primacy Agencies must report the following to SDWIS/Fed: optimal CCT status of all water systems, including the parameters that define the optimization; all lead 90th percentile values for systems serving 3,300 or fewer in lieu of only those levels above 15 µg/L; and the existing number of LSLs, galvanized requiring replacement, and service lines of unknown material for all water systems. EPA based the burden estimate on the *Economic Analysis for the Final Revised Total Coliform Rule*, Exhibit 7.4 (USEPA, 2012b).

i) *Error! Reference source not found.* ***(hrs_train_ann_js).*** EPA assumed Primacy Agencies will incur annual burden to continue to train staff related to annual administration. EPA estimated an annual

[118] TL refers to the burden needed to review a system's latest rounds of compliance monitoring to determine their requirements under the rule. This burden in captured using input *hrs_initial_tap_rev_js* that is described in Section 5.4.3.1 activity c).

burden of 104 hours based on the *Economic Analysis for the Final Revised Total Coliform Rule*, Exhibit 7.4 (USEPA, 2012b).

Exhibit 5-145 provides details on how costs are calculated for Primacy Agency administrative and rule implementation activities a) through i) including additional cost inputs that are required to calculate these costs.

Exhibit 5-145: Primacy Agency Administration and Rule Implementation Cost Estimation in SafeWater LCR (by Activity)[1]

Primacy Agency Cost Per Activity for CWSs	Primacy Agency Cost Per Activity for NTNCWSs	Conditions for Cost to Apply to a Primacy Agency		Frequency of Activity
		Lead 90th - Range	Other Conditions	
a) Error! Reference source not found.				
The hours per Primacy Agency multiplied by the Primacy Agency labor rate. *(hrs_adopt_rule_js*rate_js)*	Cost applies as written to Primacy Agencies for NTNCWSs.	All	All Primacy Agencies	Annually for first 5 years
b) Error! Reference source not found.				
The hours per Primacy Agency multiplied by the Primacy Agency labor rate. *(hrs_modify_ds_js*rate_js)*	Cost applies as written to Primacy Agencies for NTNCWSs.	All	All Primacy Agencies	Annually for first 5 years
c) Error! Reference source not found.				
The hours per Primacy Agency multiplied by the Primacy Agency labor rate. *(hrs_initial_ta_js*rate_js)*	Cost applies as written to Primacy Agencies for NTNCWSs.	All	All Primacy Agencies	Annually for first 5 years
d) Error! Reference source not found.				
The hours per Primacy Agency multiplied by the Primacy Agency labor rate. *(hrs_train_imp_js*rate_js)*	Cost applies as written to Primacy Agencies for NTNCWSs.	All	All Primacy Agencies	Annually for first 5 years
e) Error! Reference source not found.[2]				
The hours per system multiplied by the Primacy Agency labor rate. *(hrs_sm_flex_option_js*rate_js)*	Cost applies as written to Primacy Agencies for NTNCWSs.	Above TL	CWSs without CCT serving ≤ 10,000 and NTNCWSs[2]	One time
f) Error! Reference source not found.				
The hours per Primacy Agency multiplied by the Primacy Agency labor rate. *(hrs_coord_epa_js*rate_js)*	Cost does not apply as written to Primacy Agencies for NTNCWSs.	All	All Primacy Agencies	Annually
g) Error! Reference source not found.				
The hours per Primacy Agency multiplied by the Primacy Agency labor rate. *(hrs_ta_js*rate_js)*	Cost does not apply as written to Primacy Agencies for NTNCWSs.	All	All Primacy Agencies	Annually

Primacy Agency Cost Per Activity for CWSs	Primacy Agency Cost Per Activity for NTNCWSs	Conditions for Cost to Apply to a Primacy Agency		Frequency of Activity
		Lead 90th - Range	Other Conditions	
h) Error! Reference source not found.				
The hours per Primacy Agency multiplied by the Primacy Agency labor rate. *(hrs_sdwis_js*rate_js)*	Cost does not apply as written to Primacy Agencies for NTNCWSs.	All	All Primacy Agencies	Annually
i) Error! Reference source not found.				
The hours per Primacy Agency multiplied by the Primacy Agency labor rate. *(hrs_train_ann_js*rate_js)*	Cost does not apply as written to Primacy Agencies for NTNCWSs.	All	All Primacy Agencies	Annually

Acronyms: CCT = corrosion control treatment; CWS = community water system; NTNCWS = non-transient non-community water system; TL = trigger level.

Notes:

[1] Costs are applied per Primacy Agency as opposed per system. The data variables in the exhibit are defined previously in Section 5.4.2 with the exception of:

- *rate_js:* Primacy Agency hourly labor rate (Section 4.3.10.2).

[2] Applies to CWSs serving ≤ 10,000 people and all NTNCWSs that exceed the TL.

5.4.3 Primacy Agency Sampling Related Costs

This section provides Primacy Agency unit burden related to lead tap sampling, lead WQP monitoring, copper WQP monitoring, source water monitoring, and school testing in Sections 5.4.3.1 through 5.4.3.5, respectively. As noted in Subsections 5.4.3.1, 5.4.3.2, 5.4.3.4, and 5.4.3.5, as well as Section 5.4.6 that pertains to the POU program and Section 5.3.4.4 that pertain to LSLR, five states incur the cost of bottles, analysis, and providing lead sample results to the system (ASDWA, 2020b). In addition, six states also incur the burden and cost to update lead tap sampling instructions (see Sections 5.3.2.1.2 and 5.4.3.1). Note that there may be additional state laboratories that incur some analytical and reporting burden and costs in lieu of the system that would result in an underestimation of Primacy Agency costs.

5.4.3.1 *Primacy Agency Lead Tap Sampling Costs*

EPA has identified and developed costs for eight Primacy Agency oversight and review activities associated with lead tap sampling conducted by water systems as shown in Exhibit 5-146. The exhibit provides the unit burden for each activity. The assumptions used in the estimation of the unit burden follow the exhibit. The last column provides the corresponding SafeWater LCR model data variable in red/italic font.

Exhibit 5-146: Primacy Agency Lead Tap Sampling Burden Estimates

Activity	Unit Burden	*SafeWater LCR Data Variable*
a) Provide templates for revised sampling instructions and conduct review (one-time)	0.75 to 1 hr/PWS	*hrs_rev_samp_js*[1]

Activity	Unit Burden	*SafeWater LCR Data Variable*
b) **Error! Reference source not found.**	4 to 10 hrs/CWS with LSLs	*hrs_rev_samp_plan_js*
c) Review initial lead monitoring data and prepare systems for status under LCRR	2.1 hours/PWS	*hrs_initial_tap_rev_js*
d) **Error! Reference source not found.**[2]	1 hr/CWS	*hrs_chng_tap_js*
e) **Error! Reference source not found.**	0.5 hrs/PWS for those with 9-year monitoring waiver	*hrs_renew_nine_js*
f) **Error! Reference source not found.**	2 hrs/invalidation request	*hrs_samp_invalid_js*
g) **Error! Reference source not found.**	0.33 to 0.5 hrs/certification	*hrs_cert_cust_lt_js*
h) Review monitoring results and 90th percentile calculations[3]	PWSs without LSLs 0.25 to 1 hr/PWS PWSs with LSLs 0.31 to 1.25 hrs/PWS	*hrs_annual_lt_js*

Acronyms: CWS = community water system; LCRR = Lead and Copper Rule revisions; LSL = lead service line; PWS = public water system.
Source: "Derivation of Lead Analytical Burden and Costs_Final Rule.xlsx."
Notes:
[1] As previously discussed in Section 5.3.2.1.2, in Arkansas, Louisiana, Mississippi, Missouri, North Dakota, and South Carolina the state sends sampling instructions to the water systems and thus are assumed to incur the burden to update the sampling instruction in lieu of the system.
[2] Applies to CWSs only. EPA assumed 0 hours for NTNCWSs because they collect their own samples from sampling locations under their control and thus, are unlikely to change sampling sites and submit documentation to the Primacy Agency for review.
[3] As previously discussed in Section 5.3.2.1.2, in Arkansas, Louisiana, Mississippi, Missouri, and South Carolina the state pays for the cost of bottles, analysis, and providing sample results to the system. Thus, the state will incur the burden and cost for these activities in lieu of the system. In this instance, the system burden to provide monitoring results and 90th percentile calculations is applied to these states and *hrs_annual_lt_js* would be 0. Instead they will incur the system burden of *hrs_annual_lt_op* (see 5.3.2.1.2, activity o)).

a) Provide templates for revised sampling instructions and conduct review (hrs_rev_samp_js). All CWSs and NTNCWSs must update their sampling instructions to be consistent with updated tap sampling procedures. Systems are assumed to use an EPA template provided by the Primacy Agency as the basis for this update**.** EPA estimates Primacy Agencies will incur a one-time burden per system of 0.75 hours to 1 hour to provide each water system with the template and to review the system's updated sampling instructions. This estimate is based on responses provided by North Carolina and Indiana of 0.25 and 0.5 hours, respectively, on the estimated time needed to update sampling instructions based on a template. EPA used this estimate as the hours needed to provide the templates to the water systems. EPA also assumed the Primacy Agencies would not be reviewing extensive changes to the sampling instructions and would require 0.5 hours on average for this review.

b) Review updated sampling plan for LSL systems*Error! Reference source not found.* ***(hrs_rev_samp_plan_js).*** Primacy Agencies will incur a one-time burden to review the revised sampling plans submitted by CWSs with LSLs that demonstrates they will meet their minimum sampling requirements using 100 percent of sites served by LSLs, if available. EPA estimated Primacy

Agencies will require 10 hours, 8 hours, and 4 hours for large, medium, and small CWSs based on ASDWA's CoSTS model, worksheet: Tap Sampling (ASDWA, 2020a), which EPA assumed to be systems serving more than 50,000 people; 3,301 to 50,000 people; and 3,300 or fewer people, respectively. As previously stated in 5.3.2.1.2, activity b), EPA does not anticipate that CWSs without LSLs or NTNCWSs will need to revise their sampling plans under the LCRR.

c) ***Review initial lead monitoring data and prepare systems for status under LCRR (hrs_initial_tap_rev_js).*** EPA estimates Primacy Agencies incur a one-time upfront burden per system to review their latest two rounds of LCRR compliance monitoring data to determine their status under the rule and prepare them for any new requirements. Based on ASDWA's CoSTS model, worksheet "TL," Primacy Agencies will require 2.1 hours to track systems (1 hour), review the information (1 hour), and provide periodic review of (1 hour for 10 percent of systems).

d) ***Review change in tap sample locations (hrs_chng_tap_js).*** EPA estimates Primacy Agencies will spend 1 hour per CWS to review reported changes in tap sample locations between monitoring periods. The burden estimate is based on that provided in the *Disinfectants/Disinfection Byproducts, Chemical, and Radionuclides Rules ICR (Renewal)*, Exhibit 48 in Appendix H (Move Tap Sampling Location) (USEPA, 2015b). EPA assumed this review to be negligible for NTNCWSs because they collect their own samples from sampling locations under their control and thus, are unlikely to change sampling sites and submit documentation to the Primacy Agency for review.

e) ***Review 9-year monitoring waiver renewal (hrs_renew_nine_js).*** EPA estimated Primacy Agencies will require 0.5 hours per system on a 9-year tap monitoring schedule to review its 9-year monitoring waiver renewal request.[119] This estimate is based on *Disinfectants/Disinfection Byproducts, Chemical, and Radionuclides Rules ICR (Renewal)*, Exhibit 48 in Appendix H (Monitoring Waiver Application) (USEPA, 2015b).

f) ***Review sample invalidation requests (hrs_samp_invalid_js).*** EPA estimated that Primacy Agencies will incur 2 hours per sample invalidation request based on Indiana's response of 2 hours to a 2016 ASDWA questionnaire regarding the estimated burden to review this request. As discussed in 5.3.2.1.2, activity e), EPA estimates that 0.6 percent of samples will be invalidated annually (*pp_samp_invalid*).

g) ***Review customer notification certifications (hrs_cert_cust_lt_js).*** EPA estimated Primacy Agencies will require 0.33 hours to 0.5 hours to review each system's certification that monitoring results were reported to the customer based on North Carolina and Indiana's estimates for this review, respectively, in response to a 2016 ASDWA questionnaire. The questionnaire and each state's responses are available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov.

h) ***Review monitoring results and 90th Percentile calculations (hrs_annual_lt_js).*** EPA estimated the burden for Primacy Agencies to review monitoring results and lead 90th percentile calculations. This information is provided in Exhibit 5-147 for Primacy Agencies to review information submitted by systems with and without LSLs with more detailed assumptions provided in the exhibit notes.

[119] Systems serving 3,300 or fewer can apply for 9-year waivers if they can demonstrate their entire system including all buildings they serve are free of lead and copper. However, EPA assumed that only those systems serving 1,000 people or fewer will meet the waiver requirements. For the rationale, see Section 4.3.7.1.

Exhibit 5-147: Burden to Review Lead Tap Sampling Results and 90th Percentile Level

System Size (Population Served)	Review Lead Tap Sampling Results and 90th Percentile Calculation (hrs/system/monitoring period)	
	hrs_annual_lt_js	
	A	B=A*1.25
	No LSL	LSL
≤3,300	0.25	0.31
3,301-10,000	0.5	0.63
10,001-100,000	0.75	0.94
> 100,000	1	1.25

Source: 2015 *Disinfectants/Disinfection Byproducts, Chemical, and Radionuclides Rules ICR (Renewal)*, Exhibit 48 (Tap Sample Calcs) (USEPA, 2015b).
Note: For systems with LSLs, EPA assumed Primacy Agencies would require an additional burden of 25 percent because LSLs systems must also provide documentation under the LCRR if they are unable to collect all of their samples from LSL sites.

Exhibit 5-148 shows the SafeWater LCR model costing approach for these Primacy Agency lead tap sampling activities including additional cost inputs required to calculate these costs.

Exhibit 5-148: Primacy Agency Lead Tap Sampling Unit Cost Estimation in SafeWater LCR by Activity[1]

Primacy Agency Cost Per Activity for CWSs	Primacy Agency Cost Per Activity for NTNCWSs	Conditions for Cost to Apply to a Primacy Agency		Frequency of Activity
		Lead 90th - Range	Other Conditions[2]	
a) Provide templates for revised sampling instructions and conduct review				
The hours per system multiplied by the Primacy Agency labor rate. *(hrs_rev_samp_js*rate_js)*	Cost applies as written to Primacy Agencies for NTNCWSs.	All	All Primacy Agencies	One time
b) Error! Reference source not found.				
The hours per system multiplied by the Primacy Agency labor rate. *(hrs_rev_samp_plan_js*rate_js)*	Cost does not apply to Primacy Agencies for NTNCWSs.	All	All Primacy Agencies with model PWSs with LSLs	One time
c) *Review initial lead monitoring data and prepare systems for status under LCRR*				
The hours per system multiplied by the Primacy Agency labor rate. *(hrs_initial_tap_rev_js*rate_js)*	Cost applies as written to Primacy Agencies for NTNCWSs.	All	All Primacy Agencies	One time
d) Error! Reference source not found.				
The hours per system multiplied by the Primacy Agency labor rate. *(hrs_chng_tap_js*rate_js)*	Cost does not apply to Primacy Agencies for NTNCWSs.	At or below TL	Primacy Agencies with any model PWSs not on reduced tap sampling and not doing POU sampling 1 - *(p_tap_annual + p_tap_triennial + p_tap_nine)*	Twice a year
			Primacy Agencies with any model PWSs on reduced annual tap sampling and not doing POU sampling *p_tap_annual*	Once a year
			Primacy Agencies with any model PWSs on reduced triennial tap sampling and not doing POU sampling *p_tap_triennial*	Every 3 years

Primacy Agency Cost Per Activity for CWSs	Primacy Agency Cost Per Activity for NTNCWSs	Conditions for Cost to Apply to a Primacy Agency		Frequency of Activity
		Lead 90th - Range	Other Conditions[2]	
The hours per system multiplied by the Primacy Agency labor rate. *(hrs_chng_tap_js*rate_js)*	Cost does not apply to Primacy Agencies for NTNCWSs.	At or below TL	Primacy Agencies with any model PWSs on reduced nine year sampling and not doing POU sampling *p_tap_nine*	Every 9 years
		At or below AL and above TL	Primacy Agencies with any model PWSs not doing POU sampling	Once a year
		Above AL	Primacy Agencies with any model PWSs not doing POU sampling	Twice a year
e) Error! Reference source not found.[3]				
The hours per system multiplied by the Primacy Agency labor rate. *(hrs_renew_nine_js*rate_js)*	Cost applies as written to Primacy Agencies for NTNCWSs.	At or below TL[3]	Primacy Agencies with any model PWSs on reduced nine-year sampling and not doing POU sampling *p_tap_nine*	Every 9 years
f) Error! Reference source not found.				
The number of samples determined to be invalid multiplied by the hours per sample per system and the Primacy Agency labor rate. *(numb_samp_customer*pp_samp_invalid)*(hrs_samp_invalid_js*rate_js)*	Cost applies as written to Primacy Agencies for NTNCWSs.	At or below TL	Primacy Agencies with any model PWSs not on reduced tap sampling and not doing POU sampling 1 - *(p_tap_annual + p_tap_triennial + p_tap_nine)*	Twice a year

Primacy Agency Cost Per Activity for CWSs	Primacy Agency Cost Per Activity for NTNCWSs	Conditions for Cost to Apply to a Primacy Agency		Frequency of Activity
		Lead 90th - Range	Other Conditions[2]	
The number of samples determined to be invalid multiplied by the hours per sample per system and the Primacy Agency labor rate. *(numb_reduced_tap*pp_samp_invalid)*(hrs_samp_invalid_js*rate_js)*	Cost applies as written to Primacy Agencies for NTNCWSs.	At or below TL	Primacy Agencies with any model PWSs on reduced annual tap sampling and not doing POU sampling *p_tap_annual*	Once a year
			Primacy Agencies with any model PWSs on reduced triennial tap sampling and not doing POU sampling *p_tap_triennial*	Every 3 years
			Primacy Agencies with any model PWSs on reduced nine year sampling and not doing POU sampling *p_tap_nine*	Every 9 years
The number of samples determined to be invalid multiplied by the hours per sample per system and the Primacy Agency labor rate. *(numb_samp_customer*pp_samp_invalid)*(hrs_samp_invalid_js*rate_js)*	Cost applies as written to Primacy Agencies for NTNCWSs.	At or below AL and above TL	Primacy Agencies with any model PWSs not doing POU sampling	Once a year
		Above AL		Twice a year

Primacy Agency Cost Per Activity for CWSs	Primacy Agency Cost Per Activity for NTNCWSs	Conditions for Cost to Apply to a Primacy Agency		Frequency of Activity
		Lead 90th - Range	Other Conditions[2]	
g) Error! Reference source not found.				
The hours per system multiplied by the Primacy Agency labor rate. *(hrs_cert_cust_lt_js*rate_js)*	Cost applies as written to Primacy Agencies for NTNCWSs.	At or below TL	Primacy Agencies with any model PWSs not on reduced tap sampling and not doing POU sampling 1 - *(p_tap_annual + p_tap_triennial + p_tap_nine)*	Twice a year
			Primacy Agencies with any model PWSs on reduced annual tap sampling and not doing POU sampling *p_tap_annual*	Once a year
			Primacy Agencies with any model PWSs on reduced triennial tap sampling and not doing POU sampling *p_tap_triennial*	Every 3 years
			Primacy Agencies with any model PWSs on reduced nine year sampling and not doing POU sampling *p_tap_nine*	Every 9 years
		At or below AL and above TL	Primacy Agencies with any model PWSs not doing POU sampling	Once a year
		Above AL		Twice a year

Primacy Agency Cost Per Activity for CWSs	Primacy Agency Cost Per Activity for NTNCWSs	Conditions for Cost to Apply to a Primacy Agency		Frequency of Activity
		Lead 90th - Range	Other Conditions[2]	
h) Review monitoring results and 90th percentile calculations Error! Reference source not found.[4]				
The hours per system multiplied by the Primacy Agency labor rate. *(hrs_annual_lt_js*rate_js)*	Cost applies as written to Primacy Agencies for NTNCWSs.	At or below TL	Primacy Agencies with any model PWSs not on reduced tap sampling and not doing POU sampling 1 - *(p_tap_annual + p_tap_triennial + p_tap_nine)*	Twice a year
			Primacy Agencies with any model PWSs on reduced annual tap sampling and not doing POU sampling *p_tap_annual*	Once a year
			Primacy Agencies with any model PWSs on reduced triennial tap sampling and not doing POU sampling *p_tap_triennial*	Every 3 years
			Primacy Agencies with any model PWSs on reduced nine year sampling and not doing POU sampling *p_tap_nine*	Every 9 years
		At or below AL and above TL	Primacy Agencies with any model PWSs not doing POU sampling	Once a year
		Above AL	Primacy Agencies with any model PWSs not doing POU sampling	Twice a year

Acronyms: AL = action level; CWS = community water system; LSL = lead service line; NTNCWS = non-transient non-community water system; POU = point-of-use; PWS = public water system; TL = trigger level.

Notes:

[1] The data variables in the exhibit are defined previously in this section with the exception of the following:

- *numb_reduced_tap*: Number of tap samples for systems on reduced lead tap monitoring that include systems with lead 90th percentile values ≤ 10 µg/L and which are sampling less frequently than semi-annually (Section 5.3.2.1.1).
- *numb_samp_customer*: Number of tap samples for systems on routine lead tap monitoring that include some systems with 90th percentile values ≤ 10 µg/L and all systems > (TL of 10 µg/L (Section 5.3.2.1.1).

- *pp_samp_invalid*: Likelihood that a lead sample will be deemed invalid (Section 5.3.2.1.2, activity e)).
- *p_tap_annual* : Likelihood a system will qualify to collect the reduced number of lead tap samples at an annual frequency (Section 5.3.2.1.1).
- *p_tap_triennial*: Likelihood a system will qualify to collect the reduced number of lead tap samples at a triennial frequency (Section 5.3.2.1.1).
- *p_tap_nine*: Likelihood a system will qualify to collect the reduced number of lead tap samples at a nine-year frequency (Section 5.3.2.1.1).
- *rate_js:* Primacy Agency hourly labor rate (Section 4.3.10.2).

[2] Does not apply to CWSs serving ≤ 3,300 people and all NTNCWSs that have selected POU provision and maintenance as their compliance option if they exceeded the lead AL. See Section 5.3.5 for additional detail.

[3] Only systems with 90th percentile values ≤ the TL of 10 µg/L can quality for a 9-year monitoring waiver.

[4] As previously discussed in Section 5.3.2.1.2, in Arkansas, Louisiana, Mississippi, Missouri, and South Carolina the state pays for the cost of bottles, shipping, analysis, and providing sample results to the system. Thus, the state will incur the burden and cost for these activities in lieu of the system. In this instance, the system burden to provide monitoring results and 90th percentile calculations is applied to these states and *hrs_annual_lt_js* would be 0. Instead they will incur the system burden of *hrs_annual_lt_op* (see Section 5.3.2.1.2, activity o)).

5.4.3.2 *Primacy Agency Lead WQP Sampling Costs*

EPA has developed Primacy Agency costs for the review of lead WQP monitoring data submitted by systems serving 50,000 or fewer people with a lead ALE and all systems serving more than 50,000 people with CCT,[120] as shown in Exhibit 5-149. The exhibit provides the unit burden. The assumptions used in the estimation of the unit burden follow the exhibit. The last column provides the corresponding SafeWater LCR model data variable in red/italic font.

Exhibit 5-149: Primacy Agency Lead WQP Monitoring Burden Estimates

Activity	Unit Burden	*SafeWater LCR Data Variable*
i) Review lead WQP sampling data and compliance with OWQPs	No CCT: 5 hrs/system/6-month monitoring period; With CCT: 8.5 hrs/system/6-month monitoring period	*hrs_wqp_js*

Acronyms: CCT = corrosion control treatment; OWQP = optimal water quality parameter; WQP = water quality parameter.
Source: "Derivation of WQP Analytical Burden and Costs_Final Rule.xlsx."

i) Review lead WQP sampling data and compliance with OWQPs (hrs_wqp_js). Primacy Agencies will review a system's WQP monitoring data collected from entry points and within the distribution system. EPA assumed Primacy Agencies will incur a burden of 5 hours per system during each 6-month period for systems without CCT. This estimate is based on the average of responses provided by North Carolina and Indiana to a 2016 ASDWA survey question regarding the hours to review WQP monitoring data of 6 and 4 hours, respectively. A copy of the questionnaire and each state's responses are available in the docket at EPA-HQ-OW-2017-0300. EPA assumed Primacy Agencies will set OWQPs for all systems with CCT and will incur an additional 3.5 hours per 6-month monitoring period to review compliance with OWQPs for a total of 8.5 hours.

Exhibit 5-150 shows the SafeWater LCR model costing approach for this Primacy Agency lead WQP monitoring activity. As shown in the exhibit, the SafeWater LCR model relies upon additional inputs, such the likelihood a system has a certain type of CCT in place, to estimate total costs. A description of the data variables and section where they are described in more detail are provided in the footnote to the exhibit.

[120] All systems serving more than 50,000 people except those with naturally non-corrosive water (i.e., "b3" systems") are required to have CCT.

Exhibit 5-150: Primacy Agency Lead WQP Monitoring Cost Estimation in SafeWater LCR by Activity[1]

Primacy Agency Cost Per Activity for CWSs	Primacy Agency Cost Per Activity for NTNCWSs	Conditions for Cost to Apply to a Primacy Agency		Frequency of Activity
		Lead 90th - Range	Other Conditions	
i) Review lead WQP sampling data and compliance with OWQPs				
The hours per system multiplied by the Primacy Agency labor rate. *(hrs_wqp_js*rate_js)*	Cost applies as written to Primacy Agencies for NTNCWSs.	Above AL	Primacy Agencies with any PWSs serving ≤50,000 and without CCT	Twice a year
			Primacy Agencies with any PWSs serving ≤50,000 and having pH adjustment in place *pbaseph*	
			Primacy Agencies with any PWSs serving ≤50,000 and having PO_4 or both PO_4 and pH adjustment in place *pbasepo4, pbasephpo4*	
		All	Primacy Agencies with any PWSs serving >50,000 and having pH adjustment in place *pbaseph*	
			Primacy Agencies with any PWSs serving >50,000 and having PO_4 or both PO_4 and pH adjustment in place *pbasepo4, pbasephpo4*	

Acronyms: AL = action level; CCT = corrosion control treatment; CWS = community water system; NTNCWS = non-transient non-community water system; OWQP = optimal water quality parameter; PO_4 = orthophosphate; PWS = public water system; WQP = water quality parameter.

Notes:

The data variables in the exhibit are defined previously in this section with the exception of:

- *pbaseph, pbasepo4, and pbasephpo4:* Likelihood system has pH adjustment, orthophosphate, or pH adjustment and orthophosphate for their CCT (Section 5.3.2.2.1).
- *rate_js:* Primacy Agency hourly labor rate (Section 4.3.10.2).

5.4.3.3 *Primacy Agency Copper WQP Monitoring Costs*

EPA has developed Primacy Agency costs for the review of copper WQP monitoring data per 6-month monitoring period as shown in Exhibit 5-151. The exhibit provides the unit burden. The assumptions used in the estimation of the unit burden follow the exhibit. The last column provides the corresponding SafeWater LCR model data variable in red/italic font. Note that the data variable is the same as for reviewing lead WQP data.

Exhibit 5-151: Primacy Agency Copper WQP Monitoring Burden Estimates

Activity	Unit Burden	*SafeWater LCR Data Variable*
j) Review copper WQP sampling data and compliance with OWQPs	No CCT: 5 hrs/system/6 month monitoring period; With CCT: 8.5 hrs/system/6 month monitoring period	*hrs_wqp_js*

Acronyms: CCT = corrosion control treatment; OWQP = optimal water quality parameter; WQP = water quality parameter.
Source: "Derivation of WQP Analytical Burden and Costs_Final Rule.xlsx."

j) *Error! Reference source not found.* ***(hrs_wqp_js).*** As stated in Section 5.3.2.3, the SafeWater LCR models copper WQP monitoring separately from lead WQP monitoring to avoid double counting the cost of WQP monitoring for systems experiencing a copper ALE and a lead ALE simultaneously. The SafeWater LCR model restricts copper WQP monitoring to systems serving 50,000 or fewer people that do not exceed the lead AL but exceed the copper AL of 1.3 mg/L. See Exhibit 5-42 and Exhibit 5-43 in Section 5.3.2.3.1 for the likelihood a system has a copper only ALE *p_copper_ale*[121] for CWSs and NTNCWSs, respectively. The unit burden for Primacy Agencies to review sampling data and compliance with OWQPs (*hrs_wqp_js*) is identical to that used for Primacy Agency Lead WQP Monitoring of 5 hours and 8.5 hours per system per 6-month monitoring period for systems without CCT and with CCT, respectively (see 5.4.3.2, activity i)).

Exhibit 5-152 shows the SafeWater LCR model costing approach for this Primacy Agency copper WQP monitoring activity. As shown in the exhibit, the SafeWater LCR model relies upon additional inputs that include the likelihood a system has a certain type of CCT in place and, as discussed above, the likelihood a system has a copper ALE. A description of the data variables and section where they are described in more detail are provided in footnote 1 to the exhibit.

Exhibit 5-152: Primacy Agency Copper WQP Monitoring Cost Estimation in SafeWater LCR by Activity[1]

Primacy Agency Cost Per Activity for CWSs	Primacy Agency Cost Per Activity for NTNCWSs	Conditions for Cost to Apply to a Primacy Agency		Frequency of Activity
		Lead 90th - Range	Other Conditions	
j) Error! Reference source not found.				
The hours per system multiplied by the Primacy Agency labor rate. *(hrs_wqp_js*rate_js)*	Cost applies as written to Primacy Agencies for NTNCWSs.	At or below AL	Primacy Agencies with any model PWSs serving ≤50,000, without CCT, and having a copper ALE *p_copper_ale*	Twice a year

[121] As described in Section 5.3.2.3.1, EPA assumed all systems with CCT would have sufficient CCT such that none would have a copper ALE. Because all systems serving 50,000 or more people have CCT (except for 11 "b3" systems), SafeWater LCR does not assign any copper WQP costs to systems serving more than 50,000 people.

Primacy Agency Cost Per Activity for CWSs	Primacy Agency Cost Per Activity for NTNCWSs	Conditions for Cost to Apply to a Primacy Agency		Frequency of Activity
		Lead 90th - Range	Other Conditions	
The hours per system multiplied by the Primacy Agency labor rate. *(hrs_wqp_js*rate_js)*	Cost applies as written to Primacy Agencies for NTNCWSs.	At or below AL	Primacy Agencies with any model PWSs serving >50,000, having pH adjustment in place, and having a copper ALE *p_copper_ale, pbaseph*	Twice a year
			Primacy Agencies with any model PWSs serving >50,000, having PO_4 or both PO_4 and pH adjustment in place, and having a copper ALE *p_copper_ale, pbasepo4, pbasephpo4*	

Acronyms: AL = action level; ALE = action level exceedance; CCT = corrosion control treatment; CWS = community water system; NTNCWS = non-transient non-community water system; OWQP = optimal water quality parameter; PO_4 = orthophosphate; PWS = public water system; WQP = water quality parameter.

Notes:

[1] The data variables in the exhibit are defined previously in this section with the exception of:

- *p_copper_ale:* Likelihood that a system exceeds the copper AL (Section 5.3.2.3.1).
- *rate_js:* Primacy Agency hourly labor rate (Section 4.3.10.2).

5.4.3.4 *Primacy Agency Source Water Monitoring Costs*

EPA has developed Primacy Agency costs to review source water monitoring data as shown in Exhibit 5-153. The exhibit provides the unit burden. The assumptions used in the estimation of the unit burden following the exhibit. The last column provides the corresponding SafeWater LCR model data variable in red/italic font.

Exhibit 5-153: Primacy Agency Source Monitoring Burden Estimates

Activity	Unit Burden	*SafeWater LCR Data Variable*
k) Review source water monitoring results	0.5 hrs/system/monitoring period in which source water samples are collected	*hrs_source_js*

Source: "Derivation of Lead Analytical Burden and Costs_Final Rule.xlsx."

Notes: As previously discussed in Section 5.3.2.4.2 in Arkansas, Louisiana, Mississippi, Missouri, and South Carolina the state pays for the cost of bottles, analysis, and providing sample results to the system. Thus, the state will incur the burden and cost for these activities in lieu of the system. In these states, because the state is reporting the results, the burden to review the results (*hrs_source_js*) is 0. Instead the system burden to report the results (*hrs_report_source_op*) is applied to these states (see Section 5.3.2.4.2, activity bb)).

k) Review source water monitoring results (hrs_source_js). Primacy Agencies will incur burden to review source water monitoring results submitted by water systems. EPA estimates that the Primacy Agency will incur 0.5 hours per system per monitoring period in which the system conducts source water monitoring *(hrs_source_js)*. The burden estimate is based on the state review burden for a

source water monitoring letter in the *Disinfectants/Disinfection Byproducts, Chemical, and Radionuclides Rules ICR (Renewal)*, Exhibit 48 in Appendix H (USEPA, 2015b).

Exhibit 5-154 details how the data variables are used to estimate Primacy Agency source water monitoring unit costs. As shown in the exhibit, the SafeWater LCR model relies upon additional inputs, such the likelihood a system has changed its source. A description of the data variables and section where they are described in more detail in the footnote 1 to the exhibit.

Exhibit 5-154: Primacy Agency Source Water Monitoring Cost Estimation in SafeWater LCR by Activity[1]

Primacy Agency Cost Per Activity for CWSs	Primacy Agency Cost Per Activity for NTNCWSs	Conditions for Cost to Apply to a Primacy Agency		Frequency of Activity
		Lead 90th - Range	Other Conditions	
k) Error! Reference source not found.[2]				
The hours per system multiplied by the Primacy Agency labor rate. *(hrs_source_js*rate_js)*	Cost applies as written to Primacy Agencies for NTNCWSs.	All	Primacy Agencies with any model PWSs with a significant change in source water *p_source_sig * p_source_chng*[3]	Once a year
		At or below AL	Primacy Agencies with any model PWSs with a copper ALE *p_copper_ale*	One time
		Above AL	All Primacy Agencies with PWSs that have not conducted prior source water monitoring	

Acronyms: AL = action level; ALE = action level exceedance; CWS = community water system; NTNCWS = non-transient non-community water system; PWS = public water system.

Notes:

[1] The data variables in the exhibit are defined previously in this section with the exception of:

- *p_source_chng:* Likelihood a system will have a source change (Section 4.3.8.1).
- *p_source_sig:* Likelihood that the system will have a significant change in which it changes its primary source, e.g., for ground water to surface water (Section 4.3.8.1).
- *p_copper_ale:* Likelihood that a system exceeds the copper AL (Section 5.3.2.3.1).
- *rate_js:* Primacy Agency hourly labor rate (Section 4.3.10.2).

[2] As previously discussed in Section 5.3.2.4.2 in Arkansas, Louisiana, Mississippi, Missouri, and South Carolina the state pays for the cost of bottles, shipping, analysis, and providing sample results to the system. Thus, the state will incur the burden and cost for these activities in lieu of the system. In these states, because the state is reporting the results, the burden to review the results (*hrs_source_js*) is 0. Instead the system burden to report the results (*hrs_report_source_op*) is applied to these states (see Section 5.3.2.4.2 activity bb)).

[3] The likelihoods of p_source_chng and p_source_sig are multiplied to determine the joint likelihood that a system that makes a source change will be required to take additional action such as source water monitoring.

5.4.3.5 *Primacy Agency School Sampling Costs*

EPA has developed burden for one-time Primacy Agency activities for oversight of CWSs' lead in drinking water testing programs at schools and child cares as shown in Exhibit 5-155. The exhibit provides the unit burden for each activity. The assumptions used in the estimation of the unit burden follow the exhibit. The last column provides the corresponding SafeWater LCR model data variable in red/italic font. Note that the one-time activities are assumed to occur in year 4 and the on-going activity will occur under the mandatory and on request programs starting in year 4 onward.

Exhibit 5-155: Primacy Agency School Sampling Burden Estimates

Activity	Unit Burden	*SafeWater LCR Data Variable*
l) Review initial list of schools and child cares and confer on initial program (one time)	3 hrs/CWS	*hrs_rev_school_list_js*
m) Provide templates on school and child care testing program (one time)	0.25 to 0.5 hrs/CWS	*hrs_temp_school_js*
n) Error! Reference source not found. (one time)	0.5 hrs/CWS serving ≤ 50,000; 2 hrs/CWS serving > 50,000	*hrs_rev_school_info_js*
o) Error! Reference source not found.	1 hr/CWS/year	*hrs_annual_report_school_js*

Acronyms: CWS = community water system.
Source: "Derivation of School_Child Care Inputs_Final Rule.xlsx."

l) *Error! Reference source not found.* ***(hrs_rev_school_list_js).*** EPA estimated that Primacy Agencies will review the initial list of schools and licensed child cares served by each CWSs. EPA assumed Primacy Agencies will incur a one-time burden of 3 hours per CWS based on ASDWA's CoSTS model, worksheet "Lead Testing in Schools" (ASDWA, 2020a).

m) *Error! Reference source not found.* ***(hrs_temp_school_js).*** CWSs must notify each school and child care they serve about the testing program. EPA assumed Primacy Agencies would provide a template to assist CWSs in developing these materials. EPA assumed Primacy Agencies would incur a similar burden to provide these templates as other outreach materials of 0.25 to 0.5 hours per system. The burden estimates are based on North Carolina and Indiana's response to a 2016 ASDWA survey regarding the burden to provide a sampling instruction template of 0.25 hours and 0.5 hours per template, respectively. The questionnaire and each state's responses are available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov.

n) *Error! Reference source not found.* ***(hrs_rev_school_info_js).*** EPA estimated that Primacy Agencies will incur a one-time burden to review school and child care testing program materials. EPA assumed CWSs serving 50,000 or fewer people will rely mainly on the template, and Primacy Agencies will require 0.5 hours for review. EPA assumed that systems serving more than 50,000 people will adapt the template and the Primacy Agencies will require more time (2 hours) to review these materials. This estimate is consistent with that assumed for the review of other types of consumer outreach and public education materials.

o) *Error! Reference source not found.* ***(hrs_annual_report_school_js).*** EPA estimated Primacy Agencies will require 1 hour per CWS to review the system's annual report (hrs_annual_report_school_js). This burden is based on ASDWA's CoSTS model, worksheet "Lead Testing in Schools" (ASDWA,

2020a). This is likely to overestimate burden in years 14 onward because systems will likely be reporting on their testing program for fewer schools and child cares.

Exhibit 5-156 provides details on how costs are calculated for Primacy Agency school and child care sampling-related costs including additional cost inputs that are required to calculate these costs.

Exhibit 5-156: Primacy Agency School Sampling Cost Estimation in SafeWater LCR by Activity[1,2]

Primacy Agency Cost Per Activity for CWSs	Primacy Agency Cost Per Activity for NTNCWSs	Conditions for Cost to Apply to a Primacy Agency		Frequency of Activity
		Lead 90th – Range	Other Conditions	
l) Error! Reference source not found.				
The hours per system multiplied by the Primacy Agency labor rate. *(hrs_rev_school_list_js*rate_js)*	Cost does not apply to Primacy Agencies for NTNCWSs.	All	All Primacy Agencies	One time
m) Error! Reference source not found.				
The hours per system multiplied by the Primacy Agency labor rate. *(hrs_temp_school_js*rate_js)*	Cost does not apply to Primacy Agencies for NTNCWSs.	All	All Primacy Agencies	One time
n) Error! Reference source not found.				
The hours per system multiplied by the Primacy Agency labor rate. *(hrs_rev_school_info_js*rate_js)*	Cost does not apply to Primacy Agencies for NTNCWSs.	All	All Primacy Agencies	One time
o) Error! Reference source not found.				
The hours per system multiplied by the Primacy Agency labor rate. *(hrs_annual_report_school_js*rate_js)*	Cost does not apply to Primacy Agencies for NTNCWSs.	All	All Primacy Agencies	Once a year

Acronyms: CWS = community water system; NTNCWS = non-transient non-community water system.
Notes:
[1] The data variables in the exhibit are defined previously in this section with the exception of the following:

- *rate_js:* Primacy Agency hourly labor rate (Section 4.3.10.2).

[2] As previously discussed in Section 5.3.2.5 in Arkansas, Louisiana, Mississippi, Missouri, and South Carolina the state pays for the cost of bottles, shipping, and analyses associated with lead testing. Thus, the state will incur the burden and cost for these activities under the mandatory and on request phases of the testing program at schools and child cares.

5.4.4 Primacy Agency CCT Related Costs

Primacy Agency oversight and review activities related to CCT are grouped into four major subcomponents:

- CCT Installation
- Re-optimization
- Find-and-Fix

- Routine

Unit costs and modeling assumptions for each activity related to these three subcomponents are presented in Sections 5.4.4.1 through 5.4.4.4, respectively.

5.4.4.1 *Primacy Agency CCT Installation Costs*

EPA has developed Primacy Agency cost for five one-time activities associated with CCT installation as shown in Exhibit 5-157. The exhibit provides the unit burden for each activity. The assumptions used in the estimation of the unit burden follow the exhibit. The last column provides the corresponding SafeWater LCR model data variables in red/italic font.

Exhibit 5-157: Primacy Agency CCT Installation Related Burden Estimates

Activity	Unit Burden	*SafeWater LCR Data Variable*
a) **Error! Reference source not found.**	• No LSLs: 10 to 24 hrs/system • With LSLs: 12.5 to 30 hrs/system	*hrs_review_cct_study_lead_js*
b) **Error! Reference source not found.**	2 to 12 hrs/system serving ≤ 50,000 people	*hrs_set_owqp_js*

Acronyms: CCT = corrosion control treatment; LSL = lead service line; OWQP = optimal water quality parameter.
Source: a), b): "Derivation of CCT Study and Review Costs_Final Rule.xlsx."

a) Review CCT study and determine type of CCT to be installed (hrs_review_cct_study_lead_js). EPA assumed that Primacy Agencies will incur burden to review a system's CCT study. EPA based its estimates on responses from North Carolina to a 2016 questionnaire provided by ASDWA (available in the docket at EPA-HQ-OW-HQ-2017-0300 at www.regulations.gov). Exhibit 5-158 provides the data variables and input values associated with this activity and detailed assumptions in the exhibit notes.

Exhibit 5-158: Estimated Burden for Primacy Agencies to Review Initial CCT Study

System Size (Population Served)	Review CCT Study Report (hrs/system) *(hrs_review_cct_study_lead_js)*	
	no LSLs	with LSLs
	A	B = A*1.25
≤ 500	10	12.5
501-3,300	12	15
3,301-10,000	16	20
10,001-50,000	24	30
>50,000	N/A	N/A

Source: "Derivation of CCT Study and Review Costs_Final Rule.xlsx."
Notes:
General: With the exception of b3 systems, serving > 50,000 people were already required to conduct a CCT study and install CCT under the previous rule.
A: In response to the ASDWA questionnaire, North Carolina reported spending 16 hours for system serving 3,301 to 10,000 people to 24 hours for system serving 10,001 to 50,000 people to review a CCT study. EPA estimated

burden for smaller system size categories based on North Carolina's estimate. The questionnaire and North Carolina's responses are available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov.
B: EPA assumed 25 percent more hours for systems with LSLs.

b) Set OWQPs after CCT installation (hrs_set_owqp_js). EPA assumed that Primacy Agencies will incur burden to set OWQPs after systems install CCT. EPA based its estimate on responses from North Carolina to a 2016 questionnaire provided by ASDWA. The questionnaire and North Carolina's responses are available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov. Exhibit 5-159 provides the data variable and input values associated with this activity and detailed assumptions in the notes.

Exhibit 5-159: Estimated Burden for Primacy Agency Review to Set OWQPs

System Size (Population Served)	Set OWQPs[1] *(hrs_set_owqp_js)*
≤500	2
501-3,300	5
3,301-50,000	12
>50,000[2]	N/A

Source: "Derivation of CCT Study and Review Costs_Final Rule.xlsx."
Notes:
[1] In response to a 2016 ASDWA questionnaire (docket HQ-OW-HQ-2017-0300 at www.regulations.gov), North Carolina estimated a burden of 2 hours for systems serving ≤ 500 people to 12 hours for systems serving 10,001 to 50,000 people to set OWQPs. EPA assumed a burden within this range of 5 hours for those serving 501 to 3,300 people and 12 hours for those serving 3,301 to 10,000 people.
[2] With the exception of b3 systems, serving > 50,000 people were already required to conduct a CCT study and install CCT under the previous rule and Primacy Agencies would have already set OWQPs.

Exhibit 5-160 provides the SafeWater LCR model costing approach for the two Primacy Agency activities related to CCT Installation including additional cost inputs that are required to calculate total costs.

Exhibit 5-160: Primacy Agency CCT Installation Cost Estimation in SafeWater LCR by Activity[1]

Primacy Agency Cost Per Activity for CWSs	Primacy Agency Cost Per Activity for NTNCWSs	Conditions for Cost to Apply to a Primacy Agency		Frequency of Activity
		Lead 90th - Range	Other Conditions	
a) Review CCT study and determine type of CCT to be installed				
The hours per system multiplied by the Primacy Agency labor rate. *(hrs_review_cct_study_lead_js*rate_js)*	Cost applies as written to Primacy Agencies for NTNCWSs.	Above TL	Primacy Agencies with any model PWSs without CCT conducting a study on the installation of CCT	One time
b) Error! Reference source not found.				

Primacy Agency Cost Per Activity for CWSs	Primacy Agency Cost Per Activity for NTNCWSs	Conditions for Cost to Apply to a Primacy Agency		Frequency of Activity
		Lead 90th - Range	Other Conditions	
The hours per system multiplied by the Primacy Agency labor rate. *(hrs_set_owqp_js*rate_js)*	Cost applies as written to Primacy Agencies for NTNCWSs.	Above AL	Primacy Agencies with any model PWSs installing CCT	One time

Acronyms: AL = action level; CCT = corrosion control treatment; CWS = community water system; NTNCWS = non-transient non-community water system; PWS = public water system; TL = trigger level.
Notes:
[1] The data variables in the exhibit are defined previously in this section with the exception of:

- *rate_js:* Primacy Agency hourly labor rate (Section 4.3.10.2).

5.4.4.2 *Primacy Agency CCT Re-optimization Costs*

EPA has identified and developed Primacy Agency cost for two oversight and review activities associated with a system's re-optimization of existing CCT, as shown in Exhibit 5-161. The exhibit provides the unit burden for each activity. The assumptions used in the estimation of the unit burden follow the exhibit. The last column provides the corresponding SafeWater LCR model data variable in red/italic font.

Exhibit 5-161: Primacy Agency CCT Re-Optimization-Related Burden Estimates

Activity	Unit Burden	*SafeWater LCR Data Variable*
c) **Error! Reference source not found.**	No LSLs: 10 to 40 hrs/system; With LSLs: 12.5 to 50 hrs/system	*hrs_review_cct_study_lead_js*
d) **Error! Reference source not found.**	2 to 20 hrs/system	*hrs_reset_owqp_js*

Acronyms: CCT = corrosion control treatment; LSL = lead service line; OWQP = optimal water quality parameter.
Source: "Derivation of CCT Study and Review Costs_Final Rule.xlsx."

c) Review CCT study and determine needed CCT adjustment (hrs_review_cct_study_lead_js). Primacy Agencies will incur burden to review the revised CCT study for PWSs with existing CCT when they exceed the TL. EPA assumed the Primacy Agency would incur the same burden to review a revised study as a new study for systems serving 50,000 or fewer as provided in Exhibit 5-157 in Section 5.4.4.1, activity a) and a burden of 40 and 50 hours to review a revised study for systems serving more than 50,000 people without LSLs and with LSLs, respectively. The estimated burden to review a revised study is also provided in Exhibit 5-162.

Exhibit 5-162: Estimated Burden for Primacy Agencies to Review a Revised CCT Study and Determine Needed CCT Adjustment

System Size (Population Served)	Review Revised CCT Study Report (hrs/system) *(hrs_review_cct_study_lead_js)*	
	no LSLs	with LSLs
	A	B = A*1.25
≤ 500	10	12.5
501-3,300	12	15
3,301-10,000	16	20
10,001-50,000	24	30
>50,000	40	50

Source: "Derivation of CCT Study and Review Costs_Final Rule.xlsx."

d) *Error! Reference source not found.* ***(hrs_reset_owqp_js).*** Primacy Agencies will need to reset OWQPs after the system re-optimizes its CCT. For systems serving 50,000 or fewer people, EPA assumed this burden is the same as the burden to set OWQPs for the first time (2 to 12 hours, data variable *hrs_set_owqp_js* as presented in Exhibit 5-159). For systems serving more than 50,000 people, EPA assumed a burden of 20 hours for Primacy Agencies to reset OWQPs due to the larger size and relative complexities of these systems.

Exhibit 5-163 details how the data variables are used to estimate Primacy Agency activities related to CCT re-optimization including additional cost inputs that are required to calculate the total costs.

Exhibit 5-163: Primacy Agency CCT Re-optimization Cost Estimation in SafeWater LCR by Activity[1]

Primacy Agency Cost Per Activity for CWSs	Primacy Agency Cost Per Activity for NTNCWSs	Conditions for Cost to Apply to a Primacy Agency		Frequency of Activity
		Lead 90th - Range	Other Conditions	
c) Error! Reference source not found.				
The hours per system multiplied by the Primacy Agency labor rate. *(hrs_review_cct_study_lead_js*rate_js)*	Cost applies as written to Primacy Agencies for NTNCWSs.	Above TL	Primacy Agencies with model PWS conducting a study prior to re-optimizing CCT	One time
d) Error! Reference source not found.				
The hours per system multiplied by the Primacy Agency labor rate. *(hrs_reset_owqp_js*rate_js)*	Cost applies as written to Primacy Agencies for NTNCWSs.	Above TL	Primacy Agencies with model PWS re-optimizing CCT	One time

Acronyms: CCT = corrosion control treatment; CWS = community water system; NTNCWS = non-transient non-community water system; OWQP = optimal water quality parameters PWS = public water system; TL = trigger level.

Notes:

[1] The data variables in the exhibit are defined previously in this section with the exception of:

- *rate_js:* Primacy Agency hourly labor rate (Section 4.3.10.2).

5.4.4.3 *Primacy Agency Find-and-Fix Costs*

EPA developed Primacy Agency costs to related to find-and-fix activities as shown in Exhibit 5-164. The exhibit provides the unit burden for each activity. The assumptions used in the estimation of the unit burden follow the exhibit. The last column provides the corresponding SafeWater LCR model data variable in red/italic font.

Exhibit 5-164: Primacy Agency Find-and-Fix Burden Estimates

Activity	Unit Burden	*SafeWater LCR Data Variable*
e) Consult with system prior to any find-and-fix CCT adjustments	2 hrs per PWS	*hrs_consult_find_fix_js*
f) Review report on find-and-fix responses	1 hr/PWS serving ≤ 50,000 people; 2 hrs/PWS serving > 50,000 people	*hrs_comp_report_rev_find_fix_js*

Source: "Derivation of Probability_Sample_Above_15_Final Rule.xlsx."

e) Consult with system prior to any find-and-fix CCT adjustment (hrs_consult_find_fix_js). Systems with CCT that have at least one sample > 15 µg/L must consult with their Primacy Agency prior to making any CCT changes. EPA assumed Primacy Agencies will incur a 2 hour burden per system that is consistent with other types of consultations, e.g., Primacy Agency consultation prior to a change in source or treatment.

f) *Error! Reference source not found.* ***(hrs_comp_report_rev_find_fix_js).*** Primacy Agencies will incur burden to review the system's report that provides the results of tap and WQP monitoring, a distribution system assessment, and recommended corrective actions (i.e., find-and-fix responses) if a system has one or more samples above 15 µg/L in a given year. EPA assumed the Primacy Agency will require 1 hour and 2 hours to review the report submitted by systems serving 50,000 or fewer and those serving more than 50,000 people, respectively.

Exhibit 5-165 provides details on how total costs for the LCRR are calculated for this activity including additional cost inputs that are required to calculate the total costs.

Exhibit 5-165: Primacy Agency CCT Find-and-Fix Cost Estimation in SafeWater LCR by Activity[1,2]

Primacy Agency Cost Per Activity for CWSs	Primacy Agency Cost Per Activity for NTNCWSs	Conditions for Cost to Apply to a Primacy Agency		Frequency of Activity
		Lead 90th - Range	Other Conditions	
e) Consult with system prior to any find-and-fix CCT adjustments				

Primacy Agency Cost Per Activity for CWSs	Primacy Agency Cost Per Activity for NTNCWSs	Conditions for Cost to Apply to a Primacy Agency		Frequency of Activity
		Lead 90th - Range	Other Conditions	
The hours per system multiplied by the Primacy Agency labor rate. *(hrs_consult_find_fix_js*rate_js)*	Cost applies as written to Primacy Agencies for NTNCWSs.	All	All Primacy Agencies with model PWS with at least one sample > 15 µg/L *pp_above_al_bin_three*, *pp_above_al_bin_two*, *pp_above_al_bin_one*	Once a year
f) Review report regarding all find-and-fix activities				
The hours per system multiplied by the Primacy Agency labor rate. *(hrs_comp_report_rev_find_fix_js*rate_js)*	Cost applies as written to Primacy Agencies for NTNCWSs.	All	All Primacy Agencies with model PWS with at least one sample > 15 µg/L *pp_above_al_bin_three*, *pp_above_al_bin_two*, *pp_above_al_bin_one*	Once a year

Acronyms: CWS = community water system; NTNCWS = non-transient non-community water system; PWS = public water system.

Notes:

[1] The data variables in the exhibit are defined previously in this section with the exception of the following (see Section **Error! Reference source not found.**):

- *pp_above_al_bin_one*: Likelihood a sample will be > 15 µg/L when the system's lead 90th percentile level is > 15 µg/L.
- *pp_above_al_bin_two*: Likelihood a sample will be > 15 µg/L when the system's lead 90th percentile level is above 10 µg/L but at or below 15 µg/L.
- *pp_above_al_bin_three*: Likelihood a sample will be > 15 µg/L when the system's lead 90th percentile level is ≤ 10 µg/L.
- *rate_js:* Primacy Agency hourly labor rate (Section 4.3.10.2).

[2] As previously discussed in Section 5.3.3.2.2 in Arkansas, Louisiana, Mississippi, Missouri, and South Carolina the state pays for the cost of bottles, shipping, and analyses. Thus, the state will incur the burden and cost for these activities.

5.4.4.4 *Primacy Agency Lead CCT Routine Costs*

EPA developed Primacy Agency costs to review and consult on system's activities related to review of CCT guidance, submitted water quality data during the sanitary survey, and the notification of a source or treatment change as shown in Exhibit 5-166. The exhibit provides the unit burden for each activity. The assumptions used in the estimation of the unit burden follow the exhibit. The last column provides the corresponding SafeWater LCR model data variable in red/italic font.

Exhibit 5-166: Primacy Agency CCT Installation Related Burden Estimates

Activity	Unit Burden	*SafeWater LCR Data Variable*
g) Review CCT guidance and applicability to individual PWSs	• 16 hrs/Primacy Agency/update	*hrs_cct_review_js*
h) **Error! Reference source not found.**	• 2 to 5 hrs/system/sanitary survey	*hrs_sanit_surv_js*

Activity	Unit Burden	*SafeWater LCR Data Variable*
i) **Error! Reference source not found.**	• 6 to 12 hrs/system on reduced tap monitoring • 4 to 7 hrs/system on routine tap monitoring	*hrs_coop_source_chng_red_js* *hrs_coop_source_chng_rout_js*
j) **Error! Reference source not found.**	• 4 to 82 hrs/system on reduced tap monitoring • 3 to 42 hrs/system on routine tap monitoring	*hrs_coop_treat_chng_red_js* *hrs_coop_treat_chng_rout_js*

Acronyms: *CCT = corrosion control treatment; PWS = public water system.*
Sources:
g), h): "Derivation of CCT Study and Review Costs_Final Rule.xlsx."
i): "Derivation of Probability_SourceChange_Final Rule.xlsx."
j): "Derivation of Probability_TreatmentChange_Final Rule.xlsx."

g) Review CCT guidance and to which PWSs it applies (hrs_cct_review_js). Primacy Agencies will incur burden to review updated EPA guidance, identify changes that could affect their systems, prepare a memo to communicate changes to state surveyors, and be available to answer questions (*hrs_cct_review_js*) at an estimated burden of 16 hours total. The estimate is based on Indiana's response to an ASDWA questionnaire. Specifically, Indiana estimated that they spent 30 hours reviewing EPA's *Optimal Corrosion Control Treatment Evaluation Technical Recommendations for Primacy Agencies and Public Water Systems* (originally released in 2016 and updated in 2019) excluding reviewing templates and travel time for training (USEPA, 2019a). The questionnaire and Indiana's responses are available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov. EPA anticipates that future updates to the guidance will be less extensive than the 2016 document (the 2016 document was the first complete update since 1992) and each Primacy Agency will take approximately half the time (rounded to two days or 16 hours) to review. EPA assumed this guidance will be updated every 5 years.

h) *Error! Reference source not found.* ***(hrs_sanit_surv_js).*** Primacy Agencies will also incur burden to review water quality data with water systems that have CCT during sanitary surveys. Exhibit 5-167 provides the data variables and input values associated with this review.

Exhibit 5-167: Estimated Primacy Agency Burden to Review CCT-Related Data during Sanitary Survey

System Size (Population Served)	Primacy Agency Burden (hrs / system) *(hrs_sanit_surv_js)*
≤1,000	2
1,001-10,000	3
10,001-100,000	4
>100,000	5

Note:
EPA assumed that Primacy Agency burden for reviewing CCT-related non-compliance data would be twice that of the system burden to gather the data (see data variable: *hrs_sanit_surv_op* in Section 5.3.3.4, activity n) plus 1 hour to discuss the sanitary survey.

The minimum sanitary survey frequency is every 3 years for surface water CWSs and every 5 years for NTNCWSs. The minimum frequency for ground water CWSs is also every 3 years except for the subset that can meet certain treatment or performance criteria. For these systems, the minimum frequency can be extended to every 5 years. Refer to Section 5.3.3.4, activity n) for the likelihood a ground water system will meet these treatment or performance criteria (*p_spec_req)*.

i) ***Consult on required actions in response to source water change (hrs_coop_source_chng_red_js, hrs_coop_source_chng_rout_js).*** Systems are required to seek prior approval before making any source water changes and to consult with the Primacy Agency on needed responses. Exhibit 5-168 provides the estimated Primacy Agency burden estimate of 6 to 12 hours (6 hours most likely) per system per monitoring period for systems on reduced monitoring and an estimate of 4 to 7 hours (4 hours most likely) per system per monitoring period for system on routine monitoring for this review and consultation, which is based on input received from North Carolina and Indiana in response to a 2016 ASDWA questionnaire regarding potential LCRR requirements. North Carolina estimated 2 hours to review a change in source from ground water to another ground water source and 3 hours for surface water source changes or surface water/ground water mixing. Indiana estimated 6 hours to review a change to a similar source and 20 hours to review a change to a dissimilar source. *The questionnaire and each state's responses are available in the docket at EPA-HQ-OW-2017-0300 at* www.regulations.gov.

The estimated burden for Primacy Agencies to consult with systems in response to source change depends on the system's lead tap monitoring and reporting frequency as follows:

- For systems monitoring less frequently than every 6 months (*hrs_coop_source_chng_red_js*), EPA used the average of the two estimates of 2 and 6 hours (4 hours) for the minimum and most likely value. EPA set the most likely equal to the minimum because less than 1 percent of systems made more significant sources changes during 2013 - 2016. For the maximum, EPA assumed the 20 hours were more reflective of the system burden to prepare needed documentation and instead set the state burden to equal 50 percent of that estimated for the system (50 percent of 20 hours). Additionally, EPA assumed Primacy Agencies would incur an additional 2 hour burden to consult with the system on needed actions in response to the source change for a total burden of 6 hours for the minimum and most likely and 12 hours for the maximum.
- For systems monitoring every 6 months, EPA assumed 50 percent of the burden estimated for *hrs_coop_source_chng_rout_js* for the review portion because the Primacy Agency is already reviewing data semi-annually as opposed to annually and an additional 2 hours for the consultation. For the minimum and most likely the burden equals 2 hours for the review plus 2 hours for the consultation for a total of 4 hours. For the maximum, the burden equals 5 hours for the review plus 2 hours for the consultation for a total of 7 hours.

Exhibit 5-168: Estimated Hours per System for Primacy Agency to Consult on Source Water Change

Hrs per system per monitoring period					
hrs_coop_source_chng_red_js			*hrs_coop_source_chng_rout_js*		
Minimum	**Maximum**	**Most Likely**	**Minimum**	**Maximum**	**Most Likely**
6	12	6	4	7	4

Source: "Derivation of Probability_SourceChange_Final Rule.xlsx."

As discussed in Section 4.3.8.1, EPA used historical data from SDWIS/Fed to estimate the likelihood that 5 percent of systems would have a source change in any given year *(p_source_change)*.

j) Consult on required actions in response to treatment change (hrs_coop_treat_chng_red_js; hrs_coop_treat_chng_rout_js). Systems are also required to seek prior approval before making any long-term treatment changes and to consult with the Primacy Agency on needed responses. Exhibit 5-169 below provides the estimated Primacy Agency burden for this review and consultation, which is based on burden estimates provided by North Carolina's response to a 2016 ASDWA questionnaire regarding possible LCRR requirements. North Carolina estimated that time needed to review a proposed change in treatment would be 1-2 hours for small systems and 80 hours for systems serving more than 50,000 people. Indiana also responded to the questionnaire and provided an estimated burden of 6 to 10 hours but did not provide detail on system size. *The questionnaire and each state's responses are available in the docket at EPA-HQ-OW-2017-0300 at* www.regulations.gov.

Similar to activity i) above, the estimated burden for Primacy Agencies to consult with systems in response to treatment change depends on the system's lead tap monitoring and reporting frequency as follows:

- For systems monitoring less frequently than every six months (*hrs_coop_treat_chng_red_js)*, EPA assumed the same burden for systems and Primacy Agencies. EPA assumed an incremental increase in burden from 2 hours at the smallest system size up to 80 hours for those serving more than 50,000 people. EPA assumed an additional 2 hours for Primacy Agency consultation with the water system.
- For systems monitoring every six months (*hrs_coop_treat_chng_rout_js*), EPA assumed 50 percent of the burden estimated for the review portion of *hrs_coop_treat_chng_red_js* because systems on routine monitoring are submitting data on a more frequent basis than those on reduced monitoring and an additional 2 hours for consultation.

Exhibit 5-169: Estimated Hours per System for Primacy Agency to Consult on Treatment Change

System Size (Population Served)	Hrs per system per monitoring period	
	hrs_coop_treat_chng_red_js	*hrs_coop_treat_chng_rout_js*
≤100	4	3
101-500	8	5
501-1,000	12	7

System Size (Population Served)	Hrs per system per monitoring period	
	hrs_coop_treat_chng_red_js	*hrs_coop_treat_chng_rout_js*
1,001-3,300	22	12
3,301-10,000	42	22
10,001-50,000	42	22
>50,000	82	42

Source: "Derivation of Probability_TreatmentChange_Final Rule.xlsx."

EPA used historical data from SDWIS/Fed to estimate the likelihood that systems would have a treatment change in any given year (2 percent for all systems, data variable *p_treat_change*, see Section 4.3.8.3 for details).

Exhibit 5-170 details how the data variables are used to estimate Primacy Agency activities related to CCT re-optimization including additional cost inputs that are required to calculate the total costs.

Exhibit 5-170: Primacy Agency CCT Re-optimization Cost Estimation in SafeWater LCR by Activity[1]

Primacy Agency Cost Per Activity for CWSs	Primacy Agency Cost Per Activity for NTNCWSs	Conditions for Cost to Apply to a Primacy Agency		Frequency of Activity
		Lead 90th - Range	Other Conditions	
g) Error! Reference source not found.				
The total hours multiplied by the Primacy Agency labor rate. *(hrs_cct_review_js*rate_js)*	Cost applies as written to Primacy Agencies for NTNCWSs.	All	Primacy Agencies with any model PWSs with CCT	Every 5 years
h) Error! Reference source not found.				
The hours per system multiplied by the Primacy Agency labor rate. *(hrs_sanit_surv_js*rate_js)*	Cost applies as written to Primacy Agencies for NTNCWSs.	All	Primacy Agencies with any model PWSs that do not meet the special requirements to conduct the Sanitary Survey at a reduced interval 1 - *p_spec_req*	Every 3 years
			Primacy Agencies with any model PWSs that do meet the special requirements to conduct the Sanitary Survey at a reduced interval *p_spec_req*	Every 5 years
i) Error! Reference source not found.				

Primacy Agency Cost Per Activity for CWSs	Primacy Agency Cost Per Activity for NTNCWSs	Conditions for Cost to Apply to a Primacy Agency		Frequency of Activity
		Lead 90th - Range	Other Conditions	
The hours per system multiplied by the Primacy Agency labor rate. *(hrs_coop_source_chng_rout_js*rate_js)*	Cost applies as written to Primacy Agencies for NTNCWSs.	At or below TL	Primacy Agencies with any model PWSs not on reduced tap sampling that have a change in source water 1 - *(p_tap_annual + p_tap_triennial + p_tap_nine); p_source_chng*	Once per event
		Above TL	Primacy Agencies with any model PWSs with a change in source water *p_source_chng*	
The hours per system multiplied by the Primacy Agency labor rate. *(hrs_coop_source_chng_red_js*rate_js)*		At or below TL	Primacy Agencies with any model PWSs on reduced tap sampling that have a change in source water *p_tap_annual, p_tap_triennial, p_tap_nine, p_source_chng*	

Primacy Agency Cost Per Activity for CWSs	Primacy Agency Cost Per Activity for NTNCWSs	Conditions for Cost to Apply to a Primacy Agency		Frequency of Activity
		Lead 90th - Range	Other Conditions	
j) Error! Reference source not found.				
The hours per system multiplied by the Primacy Agency labor rate. *(hrs_coop_treat_chng_rout_js*rate_js)*	Cost applies as written to Primacy Agencies for NTNCWSs.	At or below TL	Primacy Agencies with any model PWSs not on reduced tap sampling that have a change in treatment 1 - *(p_tap_annual + p_tap_triennial + p_tap_nine); p_treat_chng*	Once per event
		Above TL	Primacy Agencies with any model PWSs with a change in treatment *p_treat_change*	
The hours per system multiplied by the Primacy Agency labor rate. *(hrs_coop_treat_chng_red_js*rate_js)*		At or below TL	Primacy Agencies with any model PWSs on reduced tap sampling that have a change in treatment *p_tap_annual, p_tap_triennial, p_tap_nine, p_treat_change*	

Acronyms: CCT = corrosion control treatment; CWS = community water system; NTNCWS = non-transient non-community water system; PWS = public water system; TL = trigger level.

Note:

[1] The data variables in the exhibit are defined previously in this section with the exception of:

- *p_tap_annual*, *p_tap_triennial*, and *p_tap_nine*: Likelihood a system will qualify to collect the reduced number of lead tap samples at an annual, triennial, and nine-year frequency, respectively (Section 4.3.7.1).
- *p_source_chng*: Likelihood that a system will change sources in a given year (Section 4.3.8.1).
- *p_spec_req*: Likelihood a ground water CWS will meet special conditions to conduct a sanitary survey every 3 years vs. every 5 years (5.3.3.4, activity n)).
- *p_treat_chng:* Likelihood that a system will change treatment in a given year (Section 4.3.8.3).
- *rate_op:* PWS hourly labor rate (Section 4.3.10.1).

5.4.5 Primacy Agency Lead Service Line Inventory and Replacement Related Costs

Primacy Agencies will incur burden to conduct oversight activities related to systems' LSL inventory and replacement programs. Section 5.4.5.1 describes oversight activities associated with the LSL inventory. Section 5.4.5.2 includes activities to review the LSLR plan and Section 5.4.5.3 includes those related to systems' LSLR programs.

5.4.5.1 *LSL Inventory Costs*

EPA has identified and developed Primacy Agency costs for one-time activities associated with LSL inventory development as shown in Exhibit 5-171. The exhibit provides the unit burden for each activity. The assumptions used in the estimation of the unit burden follow the exhibit. The last column provides the corresponding SafeWater LCR model data variable in red/italic font.

Exhibit 5-171: Primacy Agency LSL Inventory Burden Estimates

Activity	Unit Burden	*SafeWater LCR Data Variable*
a) Assist with LSL inventory development and review inventory for PWSs with LSLs	4 hrs/CWS serving ≤ 3,300 people & all NTNCWSs with LSLs; 8 hrs/PWS serving > 3,300 with LSLs	*hrs_inventory_js*
b) Review information from PWSs that have no LSLs	2 hrs/PWS	*hrs_rev_nolsl_js*
c) Provide templates for general outreach materials	0.25 to 0.5 hrs/system with LSLs	*hrs_pe_LSL_gen_temp_js*
d) Review general LSL outreach materials	0.5 hrs/PWS serving ≤ 50,000 people; 2 hrs/PWS serving > 50,000 people	*hrs_pe_LSL_rev_js*
e) Review updates to LSL inventory	0.5 hrs/PWS with LSLs	*hrs_inv_update_rev_js*

Acronyms: CWS = community water system; LSL = lead service lines; NTNCWS = non-transient non-community water system; PWS = public water system.
Sources:
a), b), e): "Derivation of LSLR Ancillary Costs_Final Rule.xlsx."
c) & d): "Derivation of Public Education Inputs_CWS_Final Rule.xlsx."
Note: As previously discussed in Section 5.3.4.4, Arkansas, Louisiana, Mississippi, Missouri, and South Carolina incur the burden and cost to provide sample bottles and conduct lead sample analyses.

a) *Error! Reference source not found.* ***(hrs_inventory_js).*** Under the LCRR, all systems must complete an inventory that identifies system and customer portions of the service lines that are lead, galvanized requiring replacement, lead status unknown, and non-LSL within the first three years after final rule promulgation. Some will have completed their inventory in advance of the rule. See Section 5.3.4.1, activity a) for the estimated percentage of systems with LSLs (*p_inventory*). EPA assumed Primacy Agencies would incur a burden to review the inventory developed by systems with LSLs (*hrs_inventory_js*). This burden is based on ASDWA's CoSTS model, as provided in Exhibit 5-172. It is only attributable to the portion of systems that did not complete their inventory in advance of the rule, or 1 minus *p_inventory*.

Exhibit 5-172: One-Time Burden to Review System LSL Inventory (hrs/system)

System size (Population Served)	CWSs	NTNCWSs
	hrs_inventory_js	
≤3,300	4	4
3,301-50,000	8	4
> 50,000	8	4

Source: ASDWA's "Final CoSTS 2-6-20," worksheet "LSL Inv. and Repl" (Row 22) (ASDWA, 2020a).

b) Review information from PWSs that have no LSLs (hrs_rev_nolsl_js). Some systems are expected to complete their inventory in advance of the rule by submitting documentation to the Primacy Agency that none of their service lines are lead. See Section 5.3.4.1, activity b) for the estimated percentage of systems without LSLs (*p_inventory*). Primacy Agencies will incur burden to review this documentation for CWSs and NTNCWSs with LSLs. For CWSs, the documentation may also include a request to omit the revised mandatory LSL-specific information in their CCR. EPA estimates this review will be 2 hours for all systems based on information provided in ASDWA's CoSTS model, worksheet LSL Inv. and Repl., row 43 (ASDWA, 2020a).

c) *Error! Reference source not found.* ***(hrs_pe_LSL_gen_temp_js).*** CWSs and NTNCWSs with LSLs must provide notification to customers with LSLs or that are served by lines of unknown material regarding information on the health effects and sources of lead in drinking water (including LSLs), how to have water tested for lead, actions customers can take to reduce exposure to lead, and information about the opportunities for LSLR. EPA estimates that Primacy Agencies will incur a one-time burden to provide a template for LSLR outreach of 0.25 to 0.5 hours. EPA assumed that the burden to provide the outreach template would be the same as the burden to provide a template for updated sampling instructions *(hrs_rev_samp_js)*. The burden estimates are based on North Carolina and Indiana's response to a 2016 ASDWA survey. The questionnaire and each state's responses are available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov.

d) *Error! Reference source not found.* ***(hrs_pe_LSL_rev_js).*** Primacy Agencies will incur one-time burden to review the general LSL outreach materials before they are made publicly available. EPA assumed CWSs serving 50,000 or fewer people will use the templates with minor modification and thus, Primacy Agencies will require minimal time to review the outreach materials of 0.5 hours per system. EPA assumed that systems serving more than 50,000 people will adapt template and Primacy Agencies will require more time to review these materials of 2 hours per system.

e) Review updates to LSL inventory (hrs_inv_update_rev_js). Primacy Agencies will incur additional burden to review updates to systems LSL inventory. Systems must provide this update annually for systems on semi-annual or annual monitoring or every 3 years for systems on triennial monitoring. EPA assumes no systems on 9-year monitoring have LSLs and thus would not submit an updated LSL inventory. EPA estimates the Primacy Agency will require 0.5 hours to review each update.

Exhibit 5-177 in Section 5.4.5.3 provides the SafeWater LCR model approach including additional cost inputs that are required to calculate the total costs.

5.4.5.2 *LSLR Plan Costs*

EPA has developed Primacy Agency costs for the one time cost associated with the LSLR Plan as shown in Exhibit 5-173. The exhibit provides the unit burden for the activity. The assumptions used in the estimation of the unit burden follow the exhibit. The last column provides the corresponding SafeWater LCR model data variable in red/italic font.

Exhibit 5-173: Primacy Agency LSL Inventory Burden Estimates

Activity	Unit Burden	*SafeWater LCR Data Variable*
f) Review LSLR plan and negotiate goals	6 to 26 hrs/CWS; 6 hrs/NTNCWS	*hrs_lslr_plan_js*

Acronyms: CWS = community water system; LSLR = lead service line replacement; NTNCWS = non-transient non-community water system.

f) Review LSLR plan and negotiate goals (hrs_lslr_plan_js). Primacy Agencies will incur burden to review the LSLR plan that are required of all systems with LSLR at the start of rule implementation (year 4). This estimate also includes burden for the Primacy Agency to negotiate a replacement goal with CWSs serving more than 10,000 people, should the systems be triggered into the goal-based replacement program due to a TLE. This burden is based on ASDWA's CoSTS model, as provided in Exhibit 5-174 (ASDWA, 2020a).

Exhibit 5-174: One-Time Burden to Review LSLR Plan and Negotiate Replacement Goal (hrs/system)

System size (Population Served)	CWSs	NTNCWSs
	hrs_lslr_plan_js	
≤3,300	6	6
3,301-10,000	10	6
10,001-50,000	18	6
> 50,000	26	6

Source: ASDWA's "Final CoSTS 2-6-20," worksheet "LSL Inv. and Repl." includes the burden to review the LSLR plan in row 71 of 6, 10, 18 hours for NTNCWS/small CWS, medium CWS, and large CWS, respectively. EPA assumed large, medium, and small systems corresponded to those size categories defined in the previous rule as systems serving more than 50,000 people, 3,301 to 50,000 people, and 3,300 or fewer people, respectively. For CWSs serving more than 10,000 people, the burden also includes hours to negotiate a goal of 8 hours from row 73 (ASDWA, 2020a).

5.4.5.3 *LSL Replacement Costs*

EPA has developed Primacy Agency oversight costs for ongoing activities associated with LSL testing and replacement as shown in Exhibit 5-175. The exhibit provides the unit burden for each activity. The assumptions used in the estimation of the unit burden follow the exhibit. The last column provides the corresponding SafeWater LCR model data variable in red/italic font.

Exhibit 5-175: Primacy Agency Ongoing LSL Testing and Replacement-Related Costs Burden Estimates

Activity	Unit Burden	*SafeWater LCR Data Variable*
g) Provide targeted LSLR program outreach templates and consults with PWS	2.25 to 2.5 hrs/CWSs serving > 10,000 people with LSLs and TLE	*hrs_temp_lslr_out_js*

Activity	Unit Burden	*SafeWater LCR Data Variable*
h) Review targeted outreach materials	0.5 hours/CWS serving 10,001 - 50,000 people with LSLs and TLE; 2 hours/CWS serving > 50,000 people with LSLs and TLE	*hrs_review_targeted_pe_js*
i) Determine additional activities for PWSs not meeting their goal-based rate	2 hours/CWS serving > 10,000 with TLE that fails to meet LSLR goal	*hrs_consult_fail_js*
j) Review annual LSLR program report	0.5 to 4 hrs/CWS with LSLs and TLE or ALE; 0.5 hrs/NTNCWS with LSLs and TLE or ALE	*hrs_report_lcr_js*

Acronyms: ALE = action level exceedance; CWS = community water system; LSL = lead service lines; LSLR = lead service line replacement; NTNCWS = non-transient non-community water system; PWS = public water system; TLE = trigger level exceedance.
Sources:
g), h): "Derivation of Public Education Input_CWS_Final Rule.xlsx."
i), - j): "Derivation of LSLR Ancillary Costs_Final Rule.xlsx."

g) *Error! Reference source not found.* ***(hrs_temp_lslr_out_js).*** CWSs serving more than 10,000 people with LSLs and a TLE must provide additional outreach to customers with LSLs regarding the system's LSLR program. EPA assumed that the Primacy Agency will incur a one-time burden to provide a template for these outreach materials and consult with the system of 2.25 to 2.5 hours. The estimates are based on responses from Indiana and North Carolina to an ASDWA survey regarding the burden to provide a template for revised sampling instructions. EPA assumed that the burden to provide the outreach template would be the same as the burden to provide the sampling template *(hrs_rev_samp_js)*, which is based on the North Carolina estimate of 0.25 hours per sampling instructions template and the Indiana estimate of 0.5 hours per template. It includes an additional 2 hours for consultation with the CWS. The questionnaire and each state's responses are available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov.

h) *Error! Reference source not found.* ***(hrs_review_targeted_pe_js).*** EPA assumed that Primacy Agencies will incur a one-time burden to review the LSL program outreach materials described in activity g) above. EPA assumed that CWSs serving 10,001 to 50,000 people will use a template and Primacy Agencies will require 0.5 hours to review the outreach materials. EPA assumed that systems serving more than 50,000 people will adapt the template and the Primacy Agencies will require more time to review these materials of 2 hours. This estimate is consistent with that assumed for the review of other types of consumer outreach and public education materials.

i) *Error! Reference source not found.* ***(hrs_consult_fail_js).*** Primacy Agencies will also incur burden to determine needed activities for CWSs serving more than 10,000 people with a TLE that fail to meet their goal-based replacement requirements. EPA assumed Primacy Agencies will incur a burden of 2 hours per system *(hrs_consult_fail_js).* EPA assumed this consultation burden is similar to that used for other activities and is based on the estimated burden for systems to consult with their Primacy Agency on public education activities from pg. 60 of the *Economic and Supporting Analyses: Short-Term Regulatory Changes to the Lead and Copper Rule* (USEPA, 2007).

To estimate total costs for this activity, EPA multiplied the burden by the estimated number of systems that fail to meet their LSLR goal. For modeling purposes, EPA assumed that Primacy

Agencies would set an average replacement rate goal of 2 percent per year (*pp_lsl_replaced_vol_goal*). To recognize that this is a goal and not a requirement, EPA modeled a range of actual replacement rates of 1 to 5 percent with a most likely value of 2.5 percent (*pp_lsl_replaced_vol_pct*). For each system in the goal-based program, the SafeWater LCR model randomly selects a replacement rate from this distribution and when the rate is less than 2 percent, the Primacy Agency will incur burden to determine additional activities for PWSs.

j) ***Review annual LSLR program report (hrs_report_lcr_js).*** Primacy Agencies will incur annual burden to review systems' reports on their LSL mandatory and goal-based program, their replacement schedule, location of LSLs replaced, customer outreach, and post-LSLR sampling. Exhibit 5-176 provides the estimated burden associated with this review. Note that EPA estimated a larger burden for CWSs than NTNCWSs because NTNCWSs have fewer LSLs. Refer to Sections 4.3.4.1 and 4.3.4.2 for an estimate of the number of LSLs for CWSs and NTNCWSs, respectively, by system size.

Exhibit 5-176: Primacy Agency Burden to Review System's Annual LSLR Report (hrs per system)

System Size (Population Served)	CWSs	NTNCWSs
	SafeWater cost input ID: *hrs_report_lcr_js*	
	A	B
≤3,300	0.5	0.5
3,301-10,000	1	0.5
10,001-100,000	2	0.5
>100,000	4	0.5

Acronyms: CWS = community water system; NTNCWS = non-transient non-community water system.
Source: "Derivation of LSLR Ancillary Costs_Final Rule.xlsx."

Exhibit 5-177 provides the SafeWater LCR model costing approach including additional cost inputs that are required to calculate the total costs.

Exhibit 5-177: Primacy Agency Lead Service Line Replacement Cost Estimation in SafeWater LCR by Activity[1,2]

Primacy Agency Cost Per Activity for CWSs	Primacy Agency Cost Per Activity for NTNCWSs	Conditions for Cost to Apply to a Primacy Agency		Frequency of Activity
		Lead 90th - Range	Other Conditions	
a) Assist with LSL inventory development and review inventory for PWSs with LSLs				
The hours per system multiplied by the Primacy Agency labor rate. *(hrs_inventory_js*rate_js)*	Cost applies as written to Primacy Agencies for NTNCWSs.	All	Primacy Agencies with any model PWSs without LSLs that has not previously submitted documentation *p_lsl;* 1 - *p_inventory*	One Time
b) Review information from PWSs that have no LSLs				
The hours per system multiplied by the Primacy Agency labor rate. *(hrs_rev_nolsl_js*rate_js)*	Cost applies as written to Primacy Agencies for NTNCWSs.	All	Primacy Agencies with any model PWSs with LSLs without an existing inventory *p_lsl;* 1 - *p_inventory*	One Time

Primacy Agency Cost Per Activity for CWSs	Primacy Agency Cost Per Activity for NTNCWSs	Conditions for Cost to Apply to a Primacy Agency		Frequency of Activity
		Lead 90th - Range	Other Conditions	
c) Error! Reference source not found.				
The hours per system multiplied by the Primacy Agency labor rate. *(hrs_pe_lsl_gen_temp_js*rate_js)*	Cost applies as written to Primacy Agencies for NTNCWSs.	All	Primacy Agencies with any model PWSs with LSLs *p_lsl*	One Time
d) Error! Reference source not found.				
The hours per system multiplied by the Primacy Agency labor rate. *(hrs_pe_lsl_rev_js*rate_js)*	Cost applies as written to Primacy Agencies for NTNCWSs.	All	Primacy Agencies with any model PWSs with LSLs *p_lsl*	One Time
e) Review updates to LSL inventory				
The hours per system multiplied by the Primacy Agency labor rate. *(hrs_inv_update_rev_js*rate_js)*	Cost applies as written to Primacy Agencies for NTNCWSs.	All	Primacy Agencies with any model PWSs with LSLs *p_lsl*	Once a year
f) Review LSLR plan and negotiate goals				
The hours per system multiplied by the Primacy Agency labor rate. *(hrs_lslr_plan_js*rate_js)*	Cost applies as written to Primacy Agencies for NTNCWSs.	All	Primacy Agencies with any model PWSs with LSLs *p_lsl*	One Time
g) Error! Reference source not found.				
The hours per system multiplied by the Primacy Agency labor rate. *(hrs_temp_lslr_out_js*rate_js)*	Cost does not apply to Primacy Agencies for NTNCWSs.	At or below AL and above TL	Primacy Agencies with any model PWSs participating in the goal-based LSLR programs *p_lsl*	One Time
h) Error! Reference source not found.				
The hours per system multiplied by the Primacy Agency labor rate. *(hrs_review_targeted_pe_js*rate_js)*	Cost does not apply to Primacy Agencies for NTNCWSs.	At or below AL and above TL	Primacy Agencies with any model PWSs participating in the goal-based LSLR programs *p_lsl*	One Time
i) Error! Reference source not found.				
The hours per system multiplied by the Primacy Agency labor rate. *(hrs_consult_fail_js*rate_js)*	Cost does not apply to Primacy Agencies for NTNCWSs.	At or below AL and above TL	Primacy Agencies with any model PWSs that do not meet their goal-based replacement rate *p_lsl; (num_lsl_replace / num_lsl_base) < pp_lsl_replaced_vol_goal*	Once a year
j) Error! Reference source not found.				
The hours per system multiplied by the Primacy Agency labor rate. *(hrs_report_lcr_js*rate_js)*	Cost applies as written to Primacy Agencies for NTNCWSs.	Above TL	Primacy Agencies with any model PWSs participating in the goal-	Once a year

Primacy Agency Cost Per Activity for CWSs	Primacy Agency Cost Per Activity for NTNCWSs	Conditions for Cost to Apply to a Primacy Agency		Frequency of Activity
		Lead 90th - Range	Other Conditions	
			based or mandatory LSLR programs *p_lsl*	

Acronyms: AL = action level; CWS = community water system; LSL = lead service line; LSLR = lead service line replacement; NTNCWS = non-transient non-community water system; PWS = public water system; TL = trigger level.

Notes:

[1] The data variables in the exhibit are defined previously in this section with the exception of the following:

- *num_lsl_replace:* total number of LSLs replaced each year (see 5.3.4.3, activity g)).
- *num_lsl_base:* baseline number of LSLs (see Section 4.3.4).
- *p_inventory*: Likelihood a system has complete its service line inventory in advance of the rule (Section 5.3.4.1, activity a)).
- *p_lsl*: Likelihood a system has LSLs (Section 4.3.4).
- *rate_js:* Primacy Agency hourly labor rate (Section 4.3.10.2).

[2] As previously discussed in Section 5.3.4.4, in Arkansas, Louisiana, Mississippi, Missouri, and South Carolina the state pays for the cost of bottles and shipping and conducting the analysis for samples following LSLR. Thus, the state will incur the burden and cost for these activities.

5.4.6 Primacy Agency POU Related Costs

Primacy Agencies will incur both one-time and ongoing burden to conduct oversight activities related to systems' POU programs. As previously discussed in Section 3.2.2, CWSs serving 10,000 or fewer people above the TL and NTNCWSs with a lead 90th percentile above the TL must evaluate and recommend to their Primacy Agency which compliance alternative they would implement if they have a future lead ALE that can include POU device installation and maintenance. Primacy Agency activities and associated SafeWater LCR model cost inputs for one-time and ongoing activities are described in Sections 5.4.6.1 and 5.4.6.2, respectively.

5.4.6.1 *One-Time POU Program Costs*

EPA has developed costs for three one-time Primacy Agency activities related to POU program oversight as shown in Exhibit 5-178. The exhibit provides the unit burden for each activity. The assumptions used in the estimation of the unit burdens follow the exhibit. The last column provides the corresponding SafeWater LCR model data variable in red/italic font.

Exhibit 5-178: Primacy Agency One-Time POU-Related Burden Estimates

Activity	Unit Burden	*SafeWater LCR Data Variable*
a) Review POU plan	89 to 164 hrs/CWS serving ≤ 10,000; 74 to 194 hrs/NTNCWSs	*hrs_pou_plan_rev_js*
b) Provide templates for POU outreach materials	0.25 to 0.5 hrs/PWS serving ≤ 10,000	*hrs_temp_pou_js*
c) Review POU PE materials	0.5 hrs/CWS serving ≤ 10,000; 0.5 to 2 hrs/NTNCWSs	*hrs_review_pe_pou_js*

Acronyms: CWS = community water system; NTNCWS = non-transient non-community water system; PE = public education; POU = point-of-use; PWS = public water system.
Source:
a): "Derivation of POU Inputs_Final Rule.xlsx."
b) & c): "Derivation of Public Education Inputs_CWS_Final Rule.xlsx"; "Derivation of Public Education Inputs_NTNCWS_Final Rule.xlsx."
Notes:
a) - c): Primacy Agencies will only conduct these activities for the subset of CWS serving ≤3,300 people and NTNCWSs that have a TLE or lead ALE without a prior TLE and for which POU provision and maintenance is their approved lead compliance option.

a) Review POU plan (hrs_pou_plan_rev_js). As previously stated in Section 5.3.5.2, the rule does not explicitly require systems to prepare a POU plan. However, EPA assumed systems would prepare a plan and Primacy Agencies would incur burden to review water systems' POU plans. These assumptions are made given the desire in the EA to capture all reasonable costs incurred by the impacted entities and the high likelihood that Primacy Agencies will want to have oversight on the human health protective actions being taken by a system in response to high lead samples at households. The SafeWater LCR model assumes that these plans are developed by CWSs serving 10,000 or fewer people and NTNCWSs that meet the following criteria: 1) have no CCT, 2) have a lead ALE, and 3) POU provision and maintenance is their approved compliance option. EPA assumed that Primacy Agency burden to review the plan is 50 percent of the PWS burden to prepare the plan (hrs_pou_plan_dev_op). The Primacy Agency burden is provided in Exhibit 5-179. See Section 5.3.5.2, activity b) for assumptions used to estimate the PWS burden. EPA estimates NTNCWSs on average will have more taps that will require POU devices than CWSs and thus they will require additional burden to develop the plan and for the Primacy Agency to review the plan.

Exhibit 5-179: Estimated Hours for Primacy Agency Review of POU Plan (hrs/system)

System size (Population Served)	CWSs	NTNCWSs
	SafeWater LCR Data Variable: hrs_pou_plan_rev_js	
	A	B
≤500	89	74
501-3,300	164	114
3,301 to 10,000	164	114
10,001-50,000	N/A	194
50,001-1,000,000	N/A	114
>1,000,000	N/A	

Acronyms: CWS = community water system; NTNCWS = non-transient non-community water system; POU = point-of-use.
Source: "Derivation of POU Inputs_Final Rule.xlsx."
Notes:
A: EPA assumed Primacy Agencies will incur 50 percent of the burden as to review the plan as for water systems to prepare the plan (see data variable *hrs_pou_plan_dev_op* in Section 5.3.5.2, activity b)).
B: No NTNCWSs serves more than 1 million people; thus, the burden for this size category is 0. EPA estimates that NTNCWSs serving 10,001 - 50,000 people have the highest estimated number of taps, will have a higher burden to prepare the POU plan, and Primacy Agencies will require additional burden to review the plan. See "Derivation of POU Inputs_Final Rule.xlsx" for the approach for estimating the required number of POU devices.

b) ***Provide templates for POU outreach materials (hrs_temp_pou_js).*** EPA assumed that Primacy Agencies will provide templates to CWSs serving 10,000 or fewer people and NTNCWSs to develop POU outreach materials that describe the POU program and proper use of the POU devices. EPA assumed Primacy Agencies will incur a one-time burden of 0.25 to 0.5 hours to provide these templates based on responses to an ASDWA survey regarding the burden to provide revised sampling instruction templates from North Carolina and Indiana of 0.25 and 0.5 hours, respectively. The questionnaire and each state's responses are available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov.

c) ***Review POU PE materials (hrs_review_pe_pou_js).*** CWSs serving 10,000 or fewer people with a lead ALE that selected the POU option must provide PE on the use of POU device to all households they serve. NTNCWSs must provide this outreach to the consumers they serve. EPA estimated that Primacy Agencies will incur a one-time burden to review these PE materials of 0.5 hours for CWSs serving 10,000 or fewer people and NTNCWSs serving 50,000 or fewer. EPA assumed Primacy Agencies would require 2 hours to review these materials for NTNCWSs serving more than 50,000 people.

Exhibit 5-181 in Section 5.4.6.2 provides the SafeWater LCR model approach including additional cost inputs that are required to calculate the total costs.

5.4.6.2 *Ongoing POU Program Costs*

EPA has developed costs for three ongoing Primacy Agency activities related to POU program oversight as shown in Exhibit 5-180. The exhibit provides the unit burden for each activity. The assumptions used in the estimation of the unit burdens follow the exhibit. The last column provides the corresponding SafeWater LCR model data variable in red/italic font.

Exhibit 5-180: Primacy Agency Ongoing POU-Related Burden Estimates

Activity	Unit Burden	*SafeWater LCR Data Variable*
d) Review sample invalidation request for POU monitoring	2 hrs/request	*hrs_samp_invalid_js*
e) Review customer notification certifications	0.33 to 0.5/certification	*hrs_cert_cust_lt_js*
f) Review annual POU program report	0.5 hrs/CWS serving ≤ 10,000 people; 0.5 to 4 hr/NTNCWS	*hrs_pou_report_ann_rev_js*

Acronyms: CWS = community water system; NTNCWS = non-transient non-community water system; POU = point-of-use.
Sources:
d) & e): "Derivation of Lead Analytical Burden and Costs_Final Rule.xlsx."
f): "Derivation of POU Inputs_Final Rule.xlsx."

d) ***Review sample invalidation request for POU monitoring (hrs_samp_invalid_js).*** Systems must sample one-third of locations with POU devices annually. For CWSs, all households must have POU devices, so sampling must occur at one third of households. The number of households per system

is estimated as the retail population (pws_pop) divided by the total number of households per system (numb_hh). For NTNCWSs, the number of POUs is equivalent to the number of taps used for drinking water consumption. See Section 5.3.5.1 for additional details and values for these inputs. EPA assumed that 0.6 percent of samples will be invalidated, consistent with the assumption for other compliance tap sampling (pp_samp_invalid). See Section 5.3.2.1.2, activity e) for additional information. EPA assumed Primacy Agencies will require 2 hours per sample invalidation request based on a 2016 ASDWA questionnaire. The questionnaire and each state's responses are available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov.

e) ***Review customer notification certifications (hrs_cert_cust_lt_js).*** As discussed in Section 5.4.3.1 the burden for Primacy Agencies to review each system's certification that monitoring results were reported to customers is 0.33 hours to 0.5 hours and is based on North Carolina and Indiana's estimates for this review, respectively, in response to a 2016 ASDWA questionnaire. EPA assumed this review has the same burden regardless of whether the lead tap sample is collected at a site with or without a POU device and thus used the same data variable and input. The questionnaire and each state's responses are available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov.

f) ***Review annual POU program report (hrs_pou_report_ann_rev_js).*** Primacy Agencies will incur burden to review a system's annual report on its POU program that includes monitoring results and may include corrective actions and routine maintenance activities. EPA estimated that Primacy Agencies will incur 50 percent of the burden to review the plan as assumed for the system to prepare the plan (*hrs_pou_report_ann_prep_op). See* Exhibit 5-181 *for the estimated burden to review POU reports for CWSs and NTNCWSs.*

Exhibit 5-181: Primacy Burden to Review Annual POU Program Report (hours/system

System size (Population Served)	CWSs	NTNCWSs
	SafeWater Cost Model Input: *hrs_pou_report_ann_rev_js*	
	A	B
≤3,300	0.5	0.5
3,301-10,000	1	1
10,001-50,000	N/A	2
50,001-100,000	N/A	2
100,001-1,000,000	N/A	4
>1,000,000	N/A	

Acronyms: CWS = community water system; NTNCWS = non-transient non-community water system.
Source: "Derivation of POU Inputs_Final Rule.xlsx."
Notes:
A & B: Estimated as 50 percent of system burden to prepare the report (*hrs_pou_report_ann_prep_op*). *See Section 5.3.5.2, activity m)* for details. No NTNCWSs serves more than 1 million people. Thus, the burden for this size category is 0.

Exhibit 5-182 provides the SafeWater LCR model costing approach for POU-related activities a) through f) including additional cost inputs that are required to calculate the total costs.

Exhibit 5-182: Primacy Agency POU Cost Estimation in SafeWater LCR (by Activity)[1,2]

Primacy Agency Cost Per Activity for CWSs	Primacy Agency Cost Per Activity for NTNCWSs	Conditions for Cost to Apply to a Primacy Agency		Frequency of Activity
		Lead 90th – Range	Other Conditions	
a) Review POU plan				
The hours per system multiplied by the Primacy Agency labor rate. *(hrs_pou_plan_rev_js*rate_js)*	Cost applies as written to Primacy Agencies for NTNCWSs.	Above TL	Primacy Agencies with model PWSs installing POU devices or conducting a POU plan	One time
b) Provide templates for POU outreach materials				
The hours per system multiplied by the Primacy Agency labor rate. *(hrs_temp_pou_js*rate_js)*	Cost applies as written to Primacy Agencies for NTNCWSs.	Above TL	Primacy Agencies with model PWSs installing POU devices or conducting a POU devices	One time
c) Review POU PE materials				
The hours per system multiplied by the Primacy Agency labor rate. *(hrs_review_pe_pou_js*rate_js)*	Cost applies as written to Primacy Agencies for NTNCWSs.	Above AL	Primacy Agencies with any model PWSs installing POU devices	One time
d) Review sample invalidation request for POU monitoring				
One third of households per system where the sample is determined to be invalid (assume one sample per household) multiplied by the hours per sample per system and the Primacy Agency labor rate. *(((1/3)*(pws_pop/numb_hh)*pp_samp_invalid)*(hrs_samp_invalid_js*rate_js)*	One third the number of POU devices per system where the sample is determined to be invalid (assume one sample per POU device) multiplied by the hours per sample per system and the Primacy Agency labor rate. *(((1/3)*numb_pou)*pp_samp_invalid)*(hrs_samp_invalid_js*rate_js)*	All	Primacy Agencies with any model PWSs installing POU devices	Once a year
e) Review customer notification certifications				
The hours per system multiplied by the Primacy Agency labor rate. *(hrs_cert_cust_lt_js*rate_js)*	Cost applies as written to Primacy Agencies for NTNCWSs	All	Primacy Agencies with any model PWSs installing POU devices	Once a year
f) Review annual POU program report				
The hours per system multiplied by the Primacy Agency labor rate. *(hrs_pou_report_ann_rev_js*rate_js)*	Cost applies as written to Primacy Agencies for NTNCWSs	All	Primacy Agencies with any model PWSs installing POU devices	Once a year

Acronyms: AL = action level; CWS = community water system; NTNCWS = non-transient non-community water system; POU = point-of-use; PWS = public water system; TL = trigger level.

Notes:
[1] The data variables in the exhibit are defined previously in this section with the exception of:

- *numb_pou*: Number of POU devices per PWSs that elects POU option (Section 5.3.5.1).
- *pp_samp_invalid*: Likelihood that a lead sample will be deemed invalid (Section 5.3.2.1.2, activity e)).
- *rate_js:* Primacy Agency hourly labor rate (Section 4.3.10.2).

[2] As previously discussed in Section 5.3.5.2, in Arkansas, Louisiana, Mississippi, Missouri, and South Carolina the state pays for the cost of bottles and shipping and conducting the analysis for samples following LSLR. Thus, the state will incur the burden and cost for these activities.

5.4.7 Primacy Agency Public Education-Related Costs

Primacy Agencies will incur burden to conduct oversight and review activities related to the public education requirements of the LCRR. These activities are broadly grouped into those: related to a consumer notice in response to a single lead sample above 15 µg/L that are independent of a system's lead 90th percentile level and conducted in response to a lead ALE. These activities and associated costs are detailed in Sections 5.4.7.1 through 5.4.7.3, respectively.

Note that Primacy Agency public education activities associated with general LSL outreach and targeted outreach were previously discussed in Section 5.4.5.3. Primacy Agency public education activities associated with the POU program were previously discussion in Section 5.4.6.

5.4.7.1 *Consumer Notice in Response to a Lead Sample > 15 µg/L*

EPA has developed Primacy Agency costs related to a system's 3 day calendar consumer notice in response to a lead sample above 15 µg/L, as shown in Exhibit 5-183. The exhibit provides the unit burden. The assumptions used in the estimation of the unit burden follow the exhibit. The last column provides the corresponding SafeWater LCR model data variable in red/italic font.

Exhibit 5-183: PWS Burden for Consumer Notification When Sample is > 15 µg/L

Activity	Unit Burden	*SafeWater LCR Data Variable*
a) Review copy of the 3 calendar day notice when sample exceeds 15 µg/L	0.08 hrs/customer contact	*hrs_above_15_notice_js*

Source: "Derivation of Public Education Inputs_CWS_Final Rule.xlsx."

a) Review a copy of the 3 calendar day notice when sample exceeds 15 µg/L (hrs_above_15_notice_js). EPA assumed Primacy Agencies will incur a burden of 5 minutes or 0.08 hours to review a copy of the 3 calendar day notice that systems must provide to consumers if their sample exceeds 15 µg/L.

5.4.7.2 *Activities Regardless of the Lead 90th Percentile Level*

EPA has developed system costs for activities associated with new public education requirements under the LCRR that are independent of a system's lead 90th percentile status, as provided in Exhibit 5-184. The exhibit provides the unit burden. The assumptions for the unit burden follow the exhibit. The last column provides the corresponding SafeWater LCR model data variable in red/italic font.

Exhibit 5-184: Primacy Agency Burden for Public Education Activities that Are Independent of Lead 90th Percentile Levels

Activity	Unit Burden	*SafeWater LCR Data Variable*
b) Provide templates for updated CCR language (one-time)	0.25 to 0.5 hrs/CWS	*hrs_temp_ccr_js*
c) Provide templates for state and local health departments lead outreach	0.25 to 0.5 hrs/CWS	*hrs_pub_temp_hc_js*
d) Review lead outreach materials for state and local health departments	0.5 to 2 hrs/CWS	*hrs_pub_rev_hc_js*
e) Participate in joint communication efforts with state and local health departments	1 hr/CWS	*hrs_hc_js*
f) Review PE materials for service line disturbances	0.5 to 2 hrs/CWS with LSLs	*hrs_review_wtr_pe_js*

Acronyms: CCR = consumer confidence report; CWS = community water system; LSL = lead service lines; PE = public education.
Sources:
b) - f): "Derivation of Public Education Inputs_CWS_Final Rule.xlsx."

b) Provide templates for updated CCR language (hrs_temp_ccr_js). EPA assumed that Primacy Agencies will provide templates to CWSs to update their CCR language to include the revised mandatory health effects language and for those with LSLs to further update their materials to include information about the system's LSLR program and opportunities to replace LSLs. EPA assumed Primacy Agencies will incur a one-time burden of 0.25 to 0.5 hours to provide these templates. These estimates are based on responses to an ASDWA survey regarding the burden to provide revised sampling instruction templates from North Carolina and Indiana of 0.25 and 0.5 hours, respectively. This estimate is the same as the estimated burden to provide the sampling template *(hrs_rev_samp_js)* as discussed in Section 5.4.3.1, activity a). The questionnaire and each state's responses are available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov.

c) Provide templates for state and local health departments lead outreach (hrs_pub_temp_hc_js). EPA assumed Primacy Agencies will incur a one-time burden to provide templates to CWSs to develop outreach materials that will be sent to state and local health departments. EPA assumed Primacy Agencies will incur a one-time burden of 0.25 to 0.5 hours to provide these templates. These estimates are based on responses to an ASDWA survey regarding the burden to provide revised sampling instruction templates from North Carolina and Indiana of 0.25 and 0.5 hours, respectively. This estimate is the same as the estimated burden to provide the sampling template *(hrs_rev_samp_js)* as discussed in Section 5.4.3.1, activity a). The questionnaire and each state's responses are available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov.

d) Review lead outreach materials for state and local health departments (hrs_pub_rev_hc_js). EPA estimated that Primacy Agencies will incur a one-time burden to review PE material developed by CWSs that is described in activity c). EPA assumed systems serving 50,000 or fewer people will use the template with minor changes. Thus, Primacy Agencies will require minimal time to review the PE

materials of 0.5 hours per system. Systems serving more than 50,000 people will adapt the template and Primacy Agencies will require more time to review these materials of 2 hours per system.

e) ***Participate in joint communication efforts with state and local health departments (hrs_hc_js).*** Primacy Agencies will incur annual burden to participate in joint communication efforts with CWSs to provide lead PE to health departments annually. EPA assumed that water systems would have the major role in this activity, but Primacy Agencies would provide support to develop joint letters to be sent to state and local health departments of 1 hour per system.

f) ***Review PE materials for service line disturbances (hrs_review_wtr_pe_js).*** EPA estimated that Primacy Agencies will incur a one-time burden to review PE material developed by CWSs with LSLs for delivery during scheduled water-related work. EPA assumed systems serving 50,000 or fewer people will use the template with minor changes. Thus, Primacy Agencies will require minimal time to review the PE materials of 0.5 hours per system. Systems serving more than 50,000 people will adapt the template and Primacy Agencies will require more time to review these materials of 2 hours per system.

Exhibit 5-186 in Section 5.4.7.3 provides details on how costs are calculated for PWS public education activities a) through i) including additional cost inputs that are required to calculate these costs.

5.4.7.3 *Public Education Activities in Response to Lead ALE*

EPA has developed Primacy Agency costs for activities associated with public education requirements in response to a lead ALE as provided in Exhibit 5-185. The exhibit provides the unit burden. The assumptions for the unit burden follow the exhibit. The last column provides the corresponding SafeWater LCR model data variable in red/italic font.

Exhibit 5-185: Primacy Agency PE Burden in Response to Lead ALE

Activity	Unit Burden	*SafeWater LCR Data Variable*
g) Provide template and review revised lead language (one-time)	0.5 to 2 hrs/CWS or NTNCWS	*hrs_ale_lang_js*
h) Consult with CWS on other PE activities in response to a lead ALE	2 hrs/CWS	*hrs_ale_consult_js*
i) Review PE certifications	CWSs 1 to 1.5 hrs/CWS NTNCWSs 0.33 to 0.5 hr/NTNCWS	CWSs *hrs_pe_certify_quarterly_js* NTNCWSs *hrs_cert_outreach_annual_js*

Acronyms: ALE = action level exceedance; CWS = community water system; NTNCWS = non-transient non-community water system; PE = public education.
Sources:
g): "Derivation of Public Education Inputs_CWS_Final Rule.xlsx"; "Derivation of Public Education Inputs_NTNCWS_Final Rule.xlsx."
h) & i): "Derivation of Public Education Inputs_CWS_Final Rule.xlsx."

g) ***Provide template and review revised lead language (hrs_ale_lang_js).*** The LCRR requires systems with a lead ALE to update the mandatory health effects language and those with LSLs to further

update their materials to include information about their LSLR program and opportunities for customers to replace LSLs. Primacy Agencies will incur one-time burden to provide templates and review each system's revised public education mandatory language in materials that are delivered when a system has a lead ALE. EPA assumed the same burden to provide a template and review PE language that is used for other types of PE. Specifically, systems serving 50,000 or fewer people will use the template with only very minor changes and Primacy Agencies will require 0.5 hrs/system for their review. Systems serving more than 50,000 people will adapt template and Primacy Agencies will require more time to review these materials of 2 hours per system.

h) ***Consult with CWS on other PE activities in response to a lead ALE (hrs_ale_consult_js).*** Primacy Agencies will consult with CWSs on other required PE activities conducted in response to a lead ALE and will incur a burden of 2 hours per CWS. This assumption is based on the estimate for systems to consult with their Primacy Agency on public education activities used in the *Economic and Supporting Analyses: Short-Term Regulatory Changes to the Lead and Copper Rule* (USEPA, 2007).

i) ***Review PE certifications (hrs_pe_certify_quarterly_js, hrs_cert_outreach_annual_js).*** Primacy Agencies will review each system's certification that they have met their public education and outreach requirements including any done in response to a lead ALE. CWSs have quarterly, semi-annual, and annual public education requirements in response to a lead ALE (see Section 3.8.1 for detailed requirements). Thus, CWSs must report the certification on a quarterly basis. EPA estimated an average 0.33 and 0.5 hours to review public education certifications under the previous rule based on data from North Carolina and Indiana, respectively, in response to an ASDWA survey about LCR implementation. These estimates were multiplied by 0.75 to account for quarters where there is less information to report on the self-certification. Then the numbers were multiplied by four to account for the quarterly frequency of the self-certification letter. EPA assumed that the review of each certification for systems serving 50,000 or fewer people would require 0.33 hours or 1 hour annually (based on the lower burden reported from North Carolina) and 0.5 hours/certification or 1.5 hours annually for CWSs serving more than 50,000 people (based on the higher burden reported from Indiana). As previously discussed in Section 5.3.6.3, NTNCWSs do not have quarterly public education requirements in response to a lead ALE and submit an annual certification only *hrs_cert_outreach_annual_js*. The questionnaire and each state's responses are available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov.

Note as previously discussed in Section 5.3.6.3, EPA assumed that a system's certification would not only include any outreach conducted in response to a lead ALE but also include lead consumer notice that is conducted in response to a sample exceeding 15 µg/L and other outreach activities that are independent of a system's lead 90th percentile level.

Exhibit 5-186 provides details on how total costs for the LCRR are calculated these activities including additional cost inputs that are required to calculate the total costs.

Exhibit 5-186: Primacy Agency Lead Public Education Cost Estimation in SafeWater LCR (by Activity)[1, 2]

Primacy Agency Cost Per Activity for CWSs	Primacy Agency Cost Per Activity for NTNCWSs	Conditions for Cost to Apply to a Primacy Agency		Frequency of Activity
		Lead 90th - Range	Other Conditions	
a) Review copy of the 3 calendar day notice when sample exceeds 15 µg/L				
The hours per system multiplied by the Primacy Agency labor rate. *(hrs_above_15_notice_js*rate_js)*	Cost applies as written to Primacy Agencies for NTNCWSs.	All	All Primacy Agencies	Once per event
b) Provide templates for updated CCR language				
The hours per system multiplied by the Primacy Agency labor rate. *(hrs_temp_ccr_js*rate_js)*	Cost does not apply to Primacy Agencies for NTNCWSs.	All	All Primacy Agencies	One time
c) Provide templates for state and local health departments lead outreach				
The hours per system multiplied by the Primacy Agency labor rate. *(hrs_pub_temp_hc_js*rate_js)*	Cost does not apply to Primacy Agencies for NTNCWSs.	All	All Primacy Agencies	One time
d) Review lead outreach materials for state and local health departments				
The hours per system multiplied by the Primacy Agency labor rate. *(hrs_pub_rev_hc_js*rate_js)*	Cost does not apply to Primacy Agencies for NTNCWSs.	All	All Primacy Agencies	One time
e) Participate in joint communication efforts with local health departments				
The hours per system multiplied by the Primacy Agency labor rate. *(hrs_hc_js*rate_js)*	Cost does not apply to Primacy Agencies for NTNCWSs.	All	All Primacy Agencies	Once per year
f) Review PE materials for service line disturbances				
The hours per system multiplied by the Primacy Agency labor rate. *(hrs_review_wtr_pe_js*rate_js)*	Cost does not apply Primacy Agencies for NTNCWSs.	All	Primacy Agencies with any model PWSs with LSLs *p_lsl*	One time
g) Provide template and review revised lead language				
The hours per system multiplied by the Primacy Agency labor rate. *(hrs_ale_lang_js*rate_js)*	Cost applies as written to Primacy Agencies for NTNCWSs.	Above AL	All Primacy Agencies	One time
h) Consult with CWS on other PE activities in response to lead ALE[3]				
The hours per system multiplied by the Primacy Agency labor rate. *(hrs_ale_consult_js*rate_js)*	Cost does not apply to Primacy Agencies for NTNCWSs.	Above AL	All Primacy Agencies	Once a year
i) Review PE certifications				
The hours per system multiplied by the Primacy Agency labor rate.	The hours per system multiplied by the Primacy Agency labor rate.	Above AL	All Primacy Agencies	Once per year[4]

Primacy Agency Cost Per Activity for CWSs	Primacy Agency Cost Per Activity for NTNCWSs	Conditions for Cost to Apply to a Primacy Agency		Frequency of Activity
		Lead 90th - Range	Other Conditions	
*(hrs_pe_certify_quarterly_js*rate_js)*	*(hrs_cert_outreach_annual_js*rate_js)*			

Acronyms: AL = action level; ALE = action level exceedance; CCR = consumer confidence report; CWS = community water system; LSL = lead service line; NTNCWS = non-transient non-community water system; PE = public education; PWS = public water system.

Notes:

[1] Primacy Agency oversight burden and costs for systems with LSLs with the exception of those associated with service line disturbances and implementing the POU program are included in Sections 5.4.5 and 5.4.6.1, respectively.

[2] The data variables in the exhibit are defined previously in this section with the exception of:

- *p_lsl*: Likelihood a system has LSLs (Section 4.3.4).
- *rate_js:* Primacy Agency hourly labor rate (Section 4.3.10.2).

[3] Primacy Agencies can discontinue these activities when the system no longer has a lead ALE for one monitoring period.

[4] Primacy Agencies will review certifications quarterly for CWSs that are providing PE in response to a lead ALE. For modeling purposes, the Primacy Agency burden is estimated on an annual basis.

5.4.8 Summary of Primacy Agency Costs

The estimated national annualized Primacy Agency costs for the final rule, under the low cost scenario, are $25,852,000 at a 3 percent discount rate and $26,949,000 at a 7 percent discount rate. The Primacy Agency costs of the final rule for the high cost scenario are $27,893,000 discounted at 3 percent and $29,645,000 discounted at 7 percent. The incremental costs range from $19,707,000 to $20,756,000 at a 3 percent discount rate and from $20,876,000 to $22,216,000 at a 7 percent discount rate, under the low and high cost scenarios respectively (see Exhibit 5-1 and Exhibit 5-2).

5.5 Costs and Ecological Impacts Associated with Additional Phosphate Usage

Adding phosphate to LSLs creates a protective inner coating on pipes that can inhibit lead leaching. However, once phosphate is added to the PWS, some of this incremental loading remains in the water stream as it flows into WWTPs downstream. This generates treatment costs for certain WWTPs. In addition, at those locations where treatment does not occur, water with elevated phosphorus concentrations may discharge to water bodies and induce certain ecological impacts.

5.5.1 Estimating the Costs of Increased Phosphorus Loadings

5.5.1.1 *Incremental phosphorus loading to wastewater treatment plants*

When PWSs add orthophosphate to their finished water for corrosion control purposes, some portion of the orthophosphate added will reach downstream WWTPs. To estimate the potential fate of the orthophosphate added at PWSs, EPA developed a conceptual mass balance model, shown in Exhibit 5-187. EPA applied this conceptual model to estimate the increase in loading at WWTPs (G in Exhibit 5-187), given an initial loading from corrosion control at water treatment plants (A in Exhibit 5-187). In applying the model, EPA used the assumptions shown in Exhibit 5-188 regarding the other sources and losses of phosphorus (B through F in Exhibit 5-187).

Exhibit 5-187: Phosphorus Mass Balance Conceptual Model

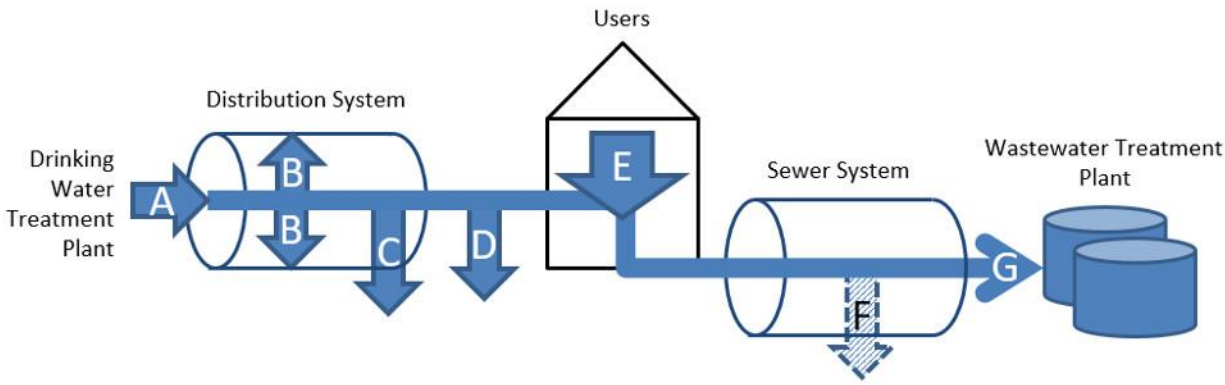


Exhibit 5-188: Summary of Assumptions Used in Estimating Phosphorus Loading Increase

Phosphorus Source or Loss	Assumptions Used
Loss Due to Incorporation in Distribution System Scale (B)	Assumed 0 percent based on data that P accounted for very little of the total mass of the scale formed during pipe loop testing (Benjamin et al., 1990); this assumption results in a conservative estimate of the incremental loading (i.e., erring on the side of greater loading).
Loss to Distribution System Leaks and Breaks (C)	Average = 57.42 gpd/connection; Warm Climate = 53.64 gpd/connection; Cold Climate = 78.52 gpd/connection (Chastain-Howley et al., 2013).[1]
Loss to Outdoor or Other Uses (D)	Average = 30 percent (USEPA, 2008b); Warm Climate = 67%; Cold Climate = 22% (Mayer et al., 1999).[2]
Baseline Residential Loading (E)	Not used; relevant only to calculating total loading, not incremental loading.
Loss to Sewer System Leaks and Overflows (F)	Assumed 0 percent based on an estimate that that losses due to sewer overflows and misconnections are relatively small (Comber et al., 2013); this assumption results in a conservative estimate of the incremental loading (i.e., erring on the side of greater loading).

Acronyms: P = phosphorus; gpd = gallons per day.
Notes:
[1] With respect to temperature, systems were classified as one of two categories depending on whether their location had an average annual temperature above or below 50°F (10°C).
[2] Warm climate value reflects the upper bound of outdoor use reported for cities in hot climates; cold climate value reflects the lower bound of outdoor use reported for cities in a cooler, wetter climates.

Specifically, EPA adapted the conceptual mass balance model and the assumptions, shown in Exhibit 5-187 and Exhibit 5-188, respectively into Equation 1, and applied this equation in SafeWater LCR model to estimate the incremental WWTP loading resulting from adding upstream orthophosphate at each affected drinking water treatment plant.

Equation 1:

$$P_{incremental} = 0.775 \times Average\ Flow \times PO_4\ Dose - 0.061 \times Connections\ \times\ PO_4\ Dose$$

Where:

$P_{incremental}$ = incremental WWTP loading in pounds per year measured as phosphorus
Average Flow = drinking water system average flow in thousand gallons per year
PO_4 Dose = incremental orthophosphate dosage in milligrams per liter (mg/L) as PO_4
Connections = drinking water system number of connections

The equation above incorporates the colder climate assumptions from Chastain-Howley et al. (2013) and Mayer et al. (1999). Colder climates have greater losses to leaks and break, but a lower percentage of losses of outdoor use. Warmer climates show the opposite pattern. The equation uses the colder climate assumptions because, in combination, these assumptions result in an overall larger estimated loading increases than the warm climate or average climate assumptions.[122]

5.5.1.2 *Incremental phosphorus removal costs at wastewater treatment plants*

WWTPs could incur costs because of upstream orthophosphate addition if they have permit discharge limits for phosphorus parameters. Exhibit 5-189 shows data from EPA's national pollutant discharge elimination system (NPDES) on the status of WWTPs with respect to permit limits for phosphorus.

Exhibit 5-189: WWTP Status with Respect to Phosphorus Discharge Permit Limits

Year	Total Number of WWTPs	Number of WWTPs with Phosphorus Permit Limits	Percentage of WWTPs with Phosphorus Permit Limits
2007	14,593	1,436	9.8%
2016	15,387	2,027	13.2%

Source: Based on data from EPA's Discharge Monitoring Report (DMR) "EZ Search" using search criteria limiting results to the phosphorus parameter group and WWTPs only. Includes 50 states, the District of Columbia, and 5 territories.

As shown in Exhibit 5-189, the percentage of WWTPs with phosphorus limits has increased over time. From 2007 to 2016, in annual percentage rate terms, the growth rate in the percentage of WWTPs with phosphorus limits is 3.3 percent, calculated as follows:

$$\left(\frac{13.2\%}{9.8\%}\right)^{(1/9)} - 1$$

EPA assumed this increase would continue as states transition from narrative to numerical nutrient criteria and set numeric permits limits, especially for impaired waters. EPA applied the growth rate observed from 2007 to 2016 to estimate the anticipated percentage of WWTPs with phosphorus limits in future years. EPA estimated the percentage anticipated for a given year using Equation 2. EPA

[122] The derivation file "WWTP P Loading Equations.xlsx" shows the detailed derivation of Equation 1 from the assumptions identified in Exhibit 5-188, including conversion factors.

calculated the estimated percentage for each year of the analysis and applied these percentages in the SafeWater LCR model as discussed below.

Equation 2:

$$\%_Y = \%_{2016} \times (1 + Rate)^{(Y-2016)}$$

Where:

Y = specific year being estimated
$\%_Y$ = percentage of WWTPs anticipated to have phosphorus discharge limits in year Y
$\%_{2016}$ = percentage of WWTPs with phosphorus discharge limits in 2016, or 13.2%
Rate = historical annual percent growth rate observed from 2007 to 2016, or 3.3%

Note that Equation 2 results in an estimated 41 percent of WWTPs with phosphorus discharge limits after 35 years. Applied as the percentage of WWTPs that need to take treatment actions, this estimate is likely conservative particularly given the potential availability of alternative compliance mechanisms, such as, individual facility variance and nutrient trading programs.

The specific actions a WWTP might need to take to maintain compliance with its NPDES phosphorus limit will depend on the type of treatment present at the WWTP and the corresponding phosphorus removal provided (if any). Assuming a phosphorus permit limit of 1 mg/L (as Total P) – the most common limit observed in the source data for Exhibit 5-189 – it is likely that most of the WWTPs that already have phosphorus limits have some type of treatment to achieve the limit. Technologies for phosphorus removal from wastewater include the following (Jiang et al., 2004; USEPA, 2013; Rodgers, 2014):

- enhanced biological processes (e.g., those that rely on phosphate accumulating organisms);
- chemical precipitation;
- adsorptive media;
- membrane processes;
- various emerging or innovative technologies; and
- treatment trains that combine one or more of the above.

Some treatment processes can accommodate incremental increases in influent loading and still maintain their removal efficiency. Examples include enhanced biological processes (assuming they are not limited by influent biological oxygen demand) and membrane processes. Such processes might not require significant adjustment to maintain their existing phosphorus removal efficiency, given an incremental increase.

Other treatment processes can require modification to their design or operation to maintain their removal efficiency in the face of an influent loading increase. A specific example is chemical precipitation, in which the dosage of chemical(s) added (e.g., ferric chloride, alum) is directly proportional to the influent phosphorus concentration. If influent loading increases, treatment trains

relying on chemical precipitation would need to add more chemicals to maintain their efficiency of phosphorus removal.

Data are not available to identify the specific WWTPs that might be affected by increased orthophosphate loading or the burden associated with the phosphorus removal technologies in place at these WWTPs. Therefore, EPA estimated costs by assuming that, on average, these costs would be similar to costs for a WWTP that uses ferric chloride for chemical precipitation to maintain 90 to 98 percent removal, and that has sufficient existing capacity to accommodate the increase in phosphorus loading.

Specifically, EPA used the assumptions shown in Exhibit 5-190 to derive a unit cost of $4.59 per pound of phosphorus for removing incremental phosphorus. This unit cost includes the cost of additional chemical consumption and the operating cost of additional sludge processing and disposal.[123] This unit cost will overestimate costs for WWTPs that do not require significant operational adjustment to maintain their existing phosphorus removal efficiency. That would include, for example, WWTPs using enhanced biological processes that are not limited by biological oxygen demand. The unit cost, however, assumes that existing chemical feed, solids separation, and sludge management equipment has sufficient capacity. Therefore, it will underestimate costs for WWTPs that need to expand their treatment process capacity or install additional treatment to handle the increased loading.

Exhibit 5-190: Summary of Assumptions Used in Estimating Phosphorus Removal Unit Cost

Assumption	Value Used	Sources
Unit cost for ferric chloride	$0.11 per pound of bulk solution	Average of vendor bids in Fredrick County (2014) and Bi-state Commission (2014), escalated to 2016 dollars using Bureau of Labor Statistics Producer Price Index for industrial chemicals
Ferric chloride solution concentration	40%	Consistent with vendor bids in Frederick County (2014) and Bi-state Commission (2014)
Ferric chloride solution bulk density	11.85 pounds per gallon	Consistent with 40% ferric chloride solution concentration; used to convert vendor bids in Bi-state Commission (2014)
Molar ratio required for phosphorus removal	2 moles iron per mole of phosphorus	A molar ratio of 1.5 to 2:1 (iron-to-phosphorus) can achieve an 80 to 98% reduction in soluble phosphorus per USEPA (2010)
Unit cost for sludge processing and disposal	$336 per dry ton	Average of actual sludge management costs reported in Stamford Water Pollution Control Authority (WPCA) (2013), City of Seabrook (2016), Sloan et al. (2008), Center for Rural Pennsylvania (2007), escalated to 2016 dollars using the consumer price index
Sludge production factor	10 grams per gram of phosphorus removed	USEPA (2010)

[123] The derivation file "WWTP P Unit Costs.xlsx" shows the detailed derivation of this unit costs from the assumptions identified in Exhibit 5-190, including conversion factors.

Finally, the costs a WWTP could incur depend on the magnitude of the loading increase relative to the specific WWTP's effluent permit limit. WWTPs whose current discharge concentrations are closer to their limit are more likely to have to take action. However, WWTPs whose current concentrations are well below their limit could incur costs if, for example:

1. They are currently achieving their limit using a P removal technology.
2. The P removal provided by that technology is significant.
3. The P removal achieved by technology is sensitive to incremental P loading increases (e.g., chemical phosphorus removal).

Furthermore, future phosphorus limits could be more stringent than existing limits.

Therefore, EPA assumed that any WWTP with a discharge limit for phosphorus parameters could incur costs. Accordingly, in calculating costs in the SafeWater LCR model, EPA used the anticipated percentage of WWTPs with phosphorus discharge limits, calculated as shown in Equation 2, as the likelihood that incremental orthophosphate loading from a drinking water system would reach a WWTP with a limit. EPA combined this likelihood and the unit cost estimated above with incremental phosphorus loading to calculate incremental costs to WWTPs for each year of the analysis period. This calculation is equivalent to that shown in Equation 3.

Equation 3:

$$\boldsymbol{Incremental\ Cost_Y} = \%_Y \times \boldsymbol{Unit\ Cost} \times \sum \boldsymbol{P_{incremental}}$$

Where:

Incremental $Cost_Y$ = incremental cost to WWTPs in year Y
$\%_Y$ = percentage of WWTPs anticipated to have phosphorus discharge limits in year Y, calculated as shown in Equation 2
Unit Cost = incremental cost of treatment per pound of phosphorus, or $4.59 per pound
$\sum P_{incremental}$ = incremental WWTP loading in pounds per year measured as total phosphorous from all affected drinking water treatment plants

As shown in Exhibit 5-1 and Exhibit 5-2, the incremental annualized cost that WWTPs will incur to remove additional phosphorous associated with the final LCRR ranges from $1.2M to $1.8M at a 3 percent discount rate, and $1.5M to $2.6M at a 7 percent discount rate.

5.5.2 Ecological Impacts of Phosphorus Loadings

The ecological impacts of increased phosphorous loadings are highly localized: total phosphorus loadings will depend on the amount and timing of the releases, characteristics of the receiving water body, effluent discharge rate, existing total phosphorus levels, and weather and climate conditions. Unfortunately, detailed spatially explicit information on effluents and on receiving water bodies does not exist in a form suitable for this analysis. Rather, to evaluate the potential ecological impacts of the rule, EPA developed approximate, national-level total phosphorous loading estimates, and evaluated the significance of the loadings compared to other phosphorous sources in the terrestrial ecosystem.

5.5.2.1 *Incremental total phosphorus loadings in water bodies*

The SafeWater LCR model, using Equation 1 described above, estimated the total incremental phosphorus loadings to reach WWTPs under the final LCRR. Exhibit 5-191 provides the estimated total and increase in phosphorus loadings nationally for selected years after the final LCRR goes into effect under the low cost scenario. Exhibit 5-192 provides the same information for the high cost scenario.

Exhibit 5-191: Nationwide Annual Phosphorus Reaching WWTPs after Implementation of the Final LCRR under Low Cost Scenario

	Thousands of Pounds of Phosphorous				
	Year 0	**Year 5**	**Year 15**	**Year 25**	**Year 35**
Previous LCR	14,010	14,010	14,327	14,399	14,474
Final LCRR		14,010	14,716	15,016	15,330
Increase Under Previous LCR		-	317	389	464
Increase under Final LCRR		-	706	1,006	1,320
Incremental Increase over Previous LCR		-	389	617	855

Exhibit 5-192: Nationwide Annual Phosphorus Reaching WWTPs after Implementation of the Final LCRR under High Cost Scenario

	Thousands of Pounds of Phosphorous				
	Year 0	**Year 5**	**Year 15**	**Year 25**	**Year 35**
Previous LCR	14,040	14,040	15,179	15,240	15,310
Final LCRR		14,040	16,499	16,792	17,049
Increase Under Previous LCR		-	1,139	1,200	1,270
Increase under Final LCRR		-	2,459	2,752	3,009
Incremental Increase over Previous LCR		-	1,321	1,552	1,739

EPA then adjusted these values for the expected treatment of influent at WWTPs. Based on the Clean Watersheds Needs Survey, about 50 percent of facilities (36 percent of flow) have secondary water treatment and 34 percent of facilities (57 percent of flow) have greater than secondary treatment (USEPA, 2012b) that will reduce the amount of phosphorus reaching waterbodies. Estimates suggest that secondary treatment may remove 20 to 75 percent of total phosphorus and greater than secondary treatment may remove 90 to 95 percent (Metcalf and Eddy, 2003; Grady, 2011; USEPA, 2015c) of the phosphorus reaching waterbodies. Thus, EPA conservatively estimates that 36 percent of flow will experience a 20 percent reduction in total phosphorus and 57 percent of the flow will experience a 90 percent reduction of total phosphorus, generating a flow-weighted average reduction in total phosphorus levels of about 58.5 percent. Using these assumptions, EPA estimated the amount of total phosphorus that is expected to enter receiving waterways nationally as a result of the previous and final rules under the low cost assumptions (Exhibit 5-193) and high cost assumptions (Exhibit 5-194).

Exhibit 5-193: Nationwide Annual Phosphorus Reaching Waterbodies after Implementation of the Final LCRR under Low Cost Scenario

	Thousands of Pounds of Phosphorous				
	Year 0	Year 5	Year 15	Year 25	Year 35
Previous LCR	5,812	5,812	5,944	5,973	6,004
Final LCRR		5,812	6,105	6,229	6,359
Increase Under Previous LCR		-	132	161	193
Increase under Final LCRR		-	293	417	547
Incremental Increase over Previous LCR		-	161	256	355

Exhibit 5-194: Nationwide Annual Phosphorus Reaching Waterbodies after Implementation of the Final LCRR under High Cost Scenario

	Thousands of Pounds of Phosphorous				
	Year 0	Year 5	Year 15	Year 25	Year 35
Previous LCR	5,824	5,824	6,297	6,322	6,351
Final LCRR		5,824	6,845	6,966	7,073
Increase Under Previous LCR		-	472	498	527
Increase under Final LCRR		-	1,020	1,142	1,248
Incremental Increase over Previous LCR		-	548	644	722

To put these phosphorus loadings in context, estimates from the United States Geological Survey (USGS) SPAtially Referenced Regression On Watershed attributes (SPARROW) model suggest that anthropogenic sources deposit roughly 750 million pounds of total phosphorus per year (USEPA, 2019b). Under the high cost scenario, this additional phosphorous loading is small, less than 0.1 percent (722,000/ 750,000,000) of the total phosphorous load deposited annually from all other anthropogenic sources.

Of course, national average load impacts may obscure significant localized ecological impacts. The existing data do not allow an assessment as to whether this incremental load will induce ecological impacts in particular areas; however, localized impacts may occur in water bodies without restrictions on phosphate deposits, or in locations with existing elevated phosphate levels. The next section describes potential ecological impacts that could occur in receiving water bodies.

5.5.2.2 *Ecological impacts of potential increases in phosphate loadings*

Aquatic organisms rely on some amount of essential nutrients, including nitrogen and phosphorous, for growth and survival. In many aquatic ecosystems, phosphorous is the limiting nutrient, therefore controlling the growth rate (USEPA, 2016b). Discharging excess phosphorous into waterbodies can therefore stimulate excess plant and algae growth and, under certain circumstances, impose create undesirable ecological impacts. Phosphorous in the environment can persist longer periods of time relative to nitrogen. Sediment-bound phosphorous can persist unchanged and, when re-suspended back to the water column, can pose renewed threats. Localized conditions will enhance or dissipate phosphorous problems.

In particular, nutrient pollution causes eutrophication—that is, excessive plant and algae growth—in lakes, reservoirs, streams, and estuaries throughout the United States. According to EPA's 2012 National Lakes Assessment, 40 percent of lakes in the United States have excess phosphorus (USEPA, 2016b). EPA's 2008-2009 National Rivers and Streams Assessment found that 40 percent of river and stream miles have nutrient pollution (USEPA, 2016c). Eutrophication, by inducing primary production, leads to seasonal decomposition of additional biomass, consuming oxygen and creating a state of hypoxia, or low oxygen, within the water body. In extreme cases, the low to no oxygen states can create dead zones, or areas in the water where aquatic life cannot survive. Studies indicate that eutrophication can decrease aquatic diversity for this reason (e.g., Dodds et al., 2009).

Eutrophication may also stimulate the growth of harmful algal blooms (HABs), or over-abundant algae populations. Algal blooms can seriously harm the aquatic ecosystem by blocking sunlight and creating diurnal swings in oxygen levels as a result of overnight respiration. Such conditions can starve and deplete aquatic species. In addition, rapid photosynthesis may consume dissolved inorganic carbon and elevate pH (Chislock et al., 2013). Certain types of phosphorous-fueled algal blooms, such as cyanobacteria, also produce toxins to both humans and aquatic life. These toxins include microcystins (liver toxins) and neurotoxins. This issue is particularly prevalent in lakes or other slow-flowing water bodies. HAB events have directly or indirectly contributed to fish kill events by causing the absorption or ingestion of toxins, or by creating conditions of limited sunlight and oxygen (Glibert et al., 2005).

Finally, an increase in phosphorus loadings can lead to significant economic impacts and undesirable aesthetic impacts. Research estimates significant economic costs of eutrophication, including recreation and angling costs and property value costs (Dodds et al., 2009). Aesthetic impacts such as reduced water clarity and an increase in foul-smelling odors may also arise, making water unsuitable for recreational activities such as swimming, boating, and fishing (Dodds et al., 2009). Phosphorus additions can also reduce the non-use (e.g., option, existence or bequest value) value of the water resource.

5.6 References

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6 Benefits Resulting from the Lead and Copper Rule Revisions

6.1 Introduction

Lead is a highly toxic pollutant that can damage neurological, cardiovascular, immunological, developmental, and other major body systems (USEPA, 2013). Children are at higher risk from the effects of lead than adults, due to differences in physiology and behavior (USEPA, 2013).

Similarly, although copper is essential to normal physiology, its excess intake is also associated with several adverse health outcomes (NRC, 2000). Most commonly, excess exposure to copper leads to gastrointestinal symptoms such as nausea, vomiting, and diarrhea (NRC, 2000). In children with genetic disorders or predispositions to accumulate copper, chronic exposure to non-physiological levels of this element can result in liver damage.

Due to these serious adverse effects, the Lead and Copper Rule revisions (LCRR) are expected to lead to reduced exposures and thus significant health benefits, which are described in this chapter and associated appendices. Some of these benefits are expressed in monetary terms. Section 6.2 presents data on the reduction of lead levels in water as a result of two interventions: 1) the removal of lead service lines (LSLs) and 2) the introduction of corrosion control treatment (CCT). Section 6.3 discusses the assignment of drinking water concentrations to public water system (PWS) populations. Sections 6.4 and 6.5 focus on the benefits of line removal and corrosion control interventions.

Appendices D–K contain additional information on the effects of lead and copper exposure, and the potential benefits of interventions in the LCRR. While only the estimated benefits of avoided intelligence quotient (IQ) loss in children are quantified in this chapter, numerous other adverse health effects are associated with exposures to lead, many at low doses. Appendix D provides more detailed information on the six categories of health effects that the United States Environmental Protection Agency (EPA or the Agency) and the National Toxicology Program (NTP) have deemed to be associated with lead exposures: cardiovascular effects, renal effects, reproductive and developmental effects, immunological effects, neurological effects, and cancer. Also, the adverse health effects associated with copper are summarized in Appendix E. At sufficient exposures, copper has been associated with gastrointestinal effects in the general population and with liver toxicity in susceptible individuals. EPA anticipates that these adverse health effects will also be reduced due to the rule, but they are not explicitly quantified in this analysis. Appendix F presents additional information on the water lead modeling; and Appendix G provides information on children's blood lead modeling, IQ estimates, and valuation for children up to age 7. Appendix H presents a sensitivity analysis on the blood lead estimates provided in this chapter for adults, looking at alternative models. Appendix I provides blood lead estimates and discusses additional endpoints that might potentially be quantified for children once peer reviewed. Appendix J provides more detail on studies used to develop concentration response functions between blood lead level (BLL) and IQ loss, and studies EPA may consider using to relate blood lead to other adverse endpoints after the methodologies are peer reviewed. Appendix K provides further detail on the literature and methodologies behind the value of an IQ point, which is described in Section 6.4.4.

6.2 Baseline and Post-Rule Drinking Water Lead Exposures

This section discusses methods for estimating baseline (i.e., current) and post-rule exposures to lead through drinking water. EPA used the lead concentration of water drawn from the kitchen tap to estimate exposure through drinking water under each of the potential CCT and LSL scenarios. No national level dataset exists that incorporates sufficient detail regarding these scenarios, so EPA obtained datasets from multiple sources. This combined dataset has limitations, such as varying sampling methods and locations. EPA managed these limitations, first through data cleaning, coding, model fitting, and selection. EPA subsequently used this model to produce a simulated dataset of lead concentrations under the different scenarios used to control for variation in the combined dataset to the extent possible.

To estimate drinking water lead concentrations at the tap, EPA obtained and assessed tap water lead concentration data from utilities, EPA's regional offices and Office of Research and Development, and authors of published journal articles. These data include information about sampling methods, locations, dates, and LSL status. EPA further divided the lead tap concentration records into CCT categories based on the locations and dates of samples, and known treatment and finished water quality histories. EPA combined these sources to produce a dataset (described in Section 6.2.1) for further analysis (Section 6.2.2). EPA then fit a model to these data and subsequently used the fitted model to simulate representative lead concentrations in PWSs. The resulting simulated dataset of the tap sample lead concentrations was used to estimate BLL (Section 6.2.3; Stanek et al., 2020).

Ideally, to determine the potential lead tap concentrations under the various CCT and LSL scenarios, a researcher would analyze the variation of lead concentrations in tap samples nationwide across the defined scenarios. However, due to the nature of the available data, EPA's lead concentration data were collected from different locations, with different methods, over multiple decades, and for different purposes. Therefore, the interpretation of what is driving the tap sample lead concentration variation within and across CCT and LSL scenarios becomes complicated. A good deal of the variation in the lead concentration data may be due to the use of different sample collection methodologies and unequal numbers of repeated samples in the same time and place. Therefore, rather than using summary statistics from the original data directly, EPA undertook a detailed analysis to understand the effects of the LSL and CCT scenarios while statistically controlling for data collection artifacts that may have contributed to variation in measurements of lead concentration at the tap (Sections 6.2.1 and 6.2.2).

EPA implemented the following analyses of the aggregate dataset and made adjustments to the data to enhance the quality. After compiling the water lead concentration dataset, EPA statistically modeled the relationship of LSLs and CCT with lead concentrations at the tap (Section 6.2.2). This model also related lead concentration to the amount of water that had flowed from the tap after stagnation. Additionally, EPA incorporated methods to estimate the effects of different water systems, residences, and sampling events at the same residence. EPA incorporated terms into the model for the amount of water, city water system, and residence to control for data collection artifacts from different studies, as most cities were linked to a single study per city water system (Exhibit 6-1). EPA similarly controlled for differences among sampling events in the same homes and within studies.

The fitted model demonstrates that LSL status and CCT both affect lead concentration at the tap. The presence of an LSL is associated with higher lead concentrations. In homes with any LSL (full or partial), improved CCT is associated with lower lead concentrations. CCT has less of an effect in homes with no

LSL present. Assessment showed that seven combinations (i.e., scenarios) of LSL status and CCT had predicted concentrations that were sufficiently distinct to warrant separate predictive modeling. These seven scenarios were used to produce estimates of drinking water concentration. EPA also used information from the statistical model to simulate estimates of lead concentration for the fifth cumulative one-liter volume drawn from a household tap after stagnation (Section 6.2.3). This represents the average cumulative sample volume after stagnation for samples in the original dataset, and is therefore analogous to the central tendency of the original dataset, statistically controlling across interventions for profile liter, city, site, and sampling event to produce comparable estimates. The fifth liter, on average, is representative of a liter drawn near the lead concentration peak in water from an LSL and where lead concentrations differed the most among the different scenarios. This volume would be drawn from the tap roughly 30–45 seconds after starting the tap at a flow rate of 2 gal/min.

Throughout this document, EPA uses a standard terminology to describe LSL status and CCT implementation. "LSL" indicates lead service lines are present, "partial" indicates some presence of lead in service lines (i.e., partial replacement), and "no LSL" indicates no LSLs. For CCT, "none" indicates no CCT, "partial" represents systems that have some CCT in place but are not optimized, and "representative" indicates a water chemistry that exemplifies the best CCT currently in use (which can include some combination of higher phosphate values or optimized pH levels). Water lead concentration prediction intervals overlapped completely for all CCT scenarios in homes with no LSL (described in Section 6.2.3), so "combined" indicates pooled CCT estimates representing all three states of CCT in non-LSL households. Further details are provided in Section 6.3.

6.2.1 Drinking Water Lead Concentration Profile Data

EPA combined data from multiple sources for use in estimating lead concentration at the tap based on LSL status and CCT implementation. These data represented 18,039 samples collected from 1,638 homes in 15 cities representing 14[124] city water systems across the United States and Canada (Exhibit 6-1). Data included lead concentrations and information regarding LSL status, location, and date of sample collection from seven municipal water systems in the United States and eight in Canada between 1998 and 2016. EPA chose to include data from Canada because data from the United States were limited or nonexistent for certain types of sites, such as sites without corrosion control after LSL removal or homes with LSLs but no CCT. Overall, geometric mean concentrations were similar in the two countries (described in Section 6.2.1.2), although there were not enough overlapping data to compare the geometric means for all combinations of LSL and CCT status.

[124] The proposed rule discussed 15 cities. This number included two cities, Providence and Cranston in Rhode Island, which have been re-categorized as a single city water system to reflect their shared water source. Cranston is a consecutive system and receives its water from Providence. No data were removed from the analysis after public comment.

Exhibit 6-1: Tap Water Lead Concentration Sample Data: Source Citations, City Water System, LSL and CCT Status Represented in the Data Source, and Number of Individual Sample Bottles per Source*

Citation of Data Source[a]	City Water System Represented by Data Source[b]	LSL Status of Samples by Data Source	CCT Status by Data Source	Total Number of Samples by Data Source[c]
Camara et al., 2013	Halifax, NS	LSL, No LSL, Partial	Partial[d]	16
The Cadmus Group, Inc., 2007	Washington, D.C.	LSL, Partial	Partial	969
Campbell, 2016	Ottawa, ON	LSL, Partial	Representative	5,149
Commons, 2011	Providence, RI [d]	LSL, Partial	Partial	169
Commons, 2014	Providence, RI [d]	Partial	Partial	40
Craik, 2016	Edmonton, AB	LSL, No LSL, Partial	None	967
Del Toral et al., 2013	Chicago, IL	LSL	Representative	695
Del Toral, 2016	Flint, IL	LSL, No LSL	Partial, Representative	3,678
Deshommes et al., 2016	Montreal, QC	LSL, No LSL, Partial	None	630
Desmarais et al., 2015	London, ON	LSL, Partial	None	1,430
EPCOR Water Services, 2008	Edmonton, AB	LSL	None	107
Hayes et al., 2014	Calgary, AB	LSL, No LSL	None	144
Muylwyk, 2016	Guelph, ON	LSL, No LSL, Partial	None	1,039
O'Brien & Gere, 2015	Providence, RI [d]	LSL, Partial	Partial	158
DC Water, 2016	Washington, D.C.	LSL, No LSL, Partial	Representative	1,391
Schock, 2016	Sebring, OH	LSL	Partial, None	825
Estes-Smargiassi et al., 2006	Boston, MA	LSL, Partial	Representative	50
Swertfeger et al., 2006 Desmarais et al., 2015 Triantafyllidou et al., 2015	Cincinnati, OH	LSL, No LSL, Partial	Partial, Representative	582

* The full analytical dataset is provided in Docket # EPA HQ-OW-2017-0300 "Combined Lead Profile Data.xlsx."
[a] Some of these citations contain data from multiple studies, including previously published and unpublished data.
[b] Some of these cities represent places where corrosion control levels changed in the same location over time, or where LSLs were replaced.
[c] The number of samples is the number of individually measured water samples (i.e., bottles). The number of profile sampling events is shown in Section 6.2.1.2.
[d] Cincinnati before 2006; Halifax and Providence/Cranston water systems were revised from "Representative" CCT to "Partial" CCT based on public comment as well as peer review of Stanek et al., 2020. These changes were applied to all of the following figures and tables.

6.2.1.1 *Lead Concentration Profiles*

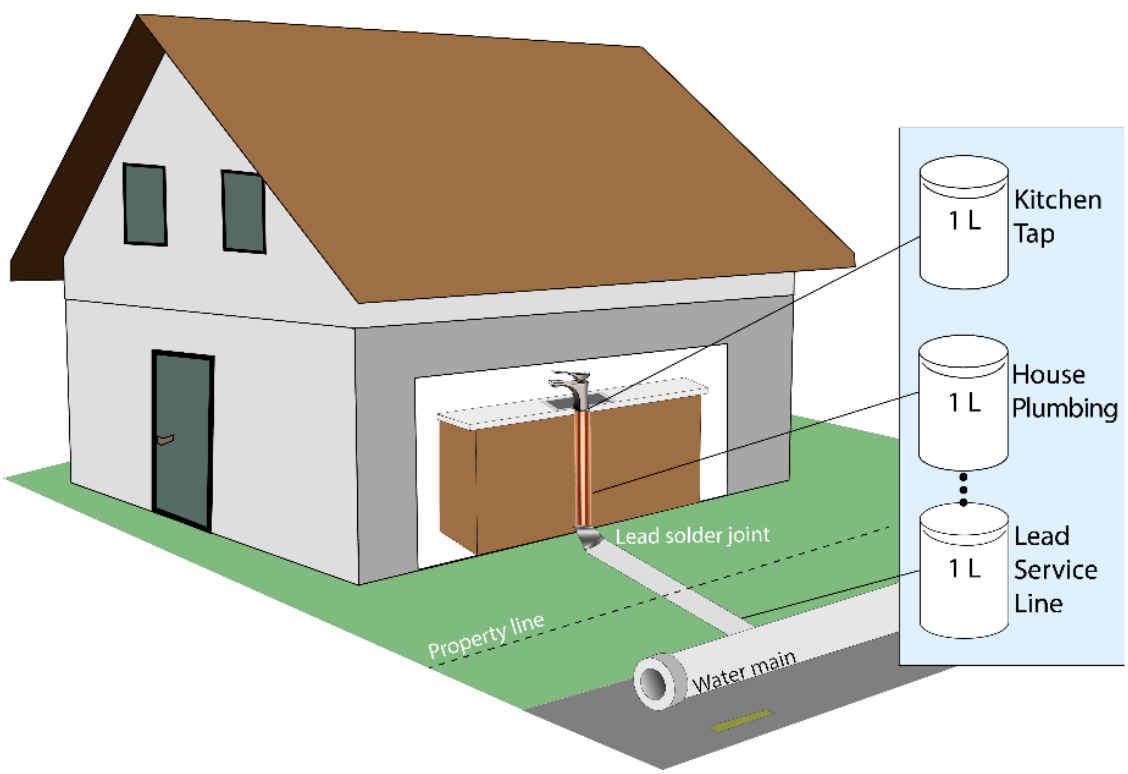
Most data sources contained series, or "profiles," of water samples that were drawn from the same kitchen tap after a whole-house stagnation period. Exhibit 6-2 shows the general sampling process as it relates to portions of home plumbing, service line, and the connection to the city water main. In general, the water in water mains does not contain lead. Water can become contaminated during stagnation by lead leaching from LSL and home plumbing containing lead. When the tap is turned on and water is drawn after stagnation, lead concentrations may show peaks based on the amount and location of lead-bearing plumbing materials in contact with the water between the tap and the water main. In other words, there may be considerable variation in lead concentration measured in water samples drawn from a tap after a stagnation period; this variation decreases as non-stagnant water from

the main reaches the tap. Taps have different flow rates, and the volume of water rather than the length of time was used to account for the position in tap sampling series.

A "complete" profile includes consecutive measurements taken from the tap, through any peaks in lead concentration, to a point where the lead concentration in water shows little to no further decrease. Exhibit 6-3 displays an example of a complete profile of lead in tap water. Most of the primary data sources, representing the 14 city water systems, contain profiles of varying levels of completeness (Exhibit 6-4 and Exhibit 6-5). However, the sources also incorporate data regarding sample volume and position in the profile series for each individual sample. EPA used this information to calculate the "profile liter" variable (Section 6.2.2) to control for variability in differences in profile position and volume among samples within the fitted model and the following simulation.

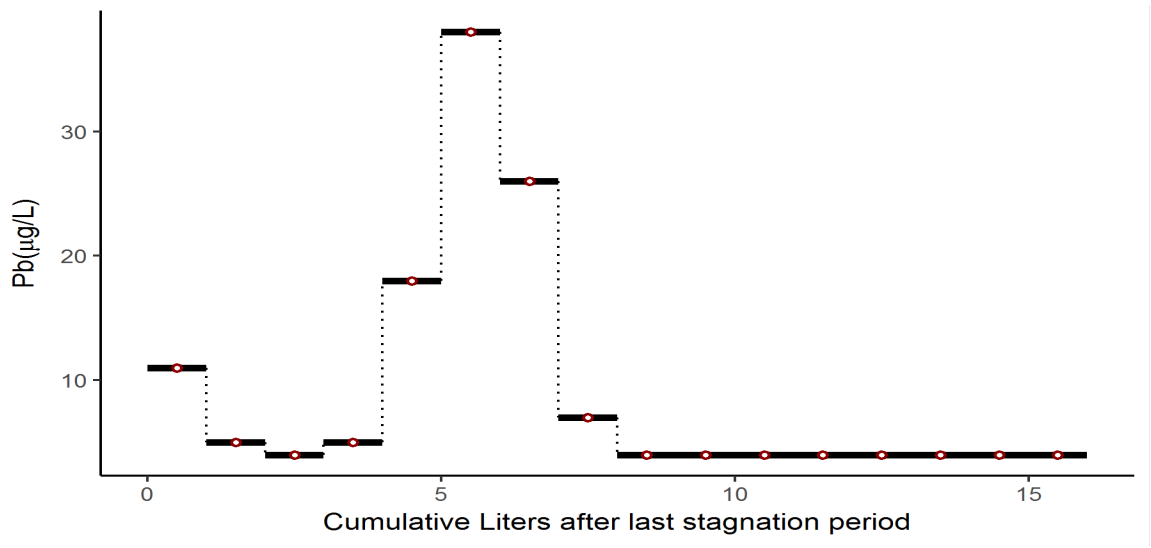
Although these data represent a large portion of available data, they may not be nationally representative with respect to the following factors: water chemistry and corrosion control practices; service line length, materials, and scales; size, type, and location of internal piping and lead sources; the type and number of residences with LSLs; and the relative contribution of particulate lead. These data also do not incorporate water usage patterns within a home that could affect exposure, such as dishwasher use, laundry, and showering. Some usage patterns may flush water lines and reduce exposure to stagnant water through drinking and cooking. The following sections describe how EPA cleaned the data; coded and fit models to control for some of the variation in the existing dataset due to water system, site, and sampling methods; and produced simulated values for use in BLL estimation.

Exhibit 6-2: Diagram Showing Plumbing Where Water Can Become Contaminated with Lead



Shows a profile of multiple, one-liter samples. Although mixing occurs, the earliest samples drawn after stagnation are representative of water in fixtures and home plumbing, while those that follow represent water from service lines, and finally, the water main.

Exhibit 6-3: Example of a Complete Consecutive Liter Profile of Lead Concentrations in Tap Water from a Location with a Lead Service Line



Note: Lead concentration is elevated in the first liter, lower in the second through third liters, highest from the fourth to sixth liters, and zero after the seventh liter. Red dots represent lead (Pb) concentration plotted at the midpoint of the cumulative volume of each sample ("profile liter"). The widths of the horizontal bars indicate the total volume of each sample. These samples were from a residence with an LSL and representative CCT in Providence, RI.

6.2.1.2 *Data Cleaning*

EPA cleaned and combined the datasets listed in Exhibit 6-1 by removing duplicate records, records without water lead concentration values, and records that did not meet the criteria for inclusion in the profile dataset. Only samples of known volume after stagnation periods of at least 30 minutes were included in the profile data. Samples that were collected immediately after flushing events were generally excluded, unless the flushing volume had also been recorded. Samples from known locations other than kitchen taps, such as exterior spigots, were also excluded from the data. Concentration records for homes that underwent partial or full lead service line replacements (LSLRs) occasionally included a number of post-replacement sampling profile series collected over several months to years after service line replacement. In these cases, lead concentrations typically declined over subsequent sampling periods, as residual lead in household plumbing was flushed. As there were too few cases of this post-replacement sampling in the dataset to incorporate this effect in models, only the last profile after LSLR was included in the analysis dataset. If elapsed time after an LSLR could not be determined for the post-replacement samples, all samples after LSLR were included, which may increase the observed variability in estimates of concentration after LSLR. An outlier for a site in Washington, D.C., was removed after confirming with the data provider (personal communication, DC Water, Maureen Schmelling, May 2017) that the sample was unlikely to be representative of concentrations in most homes. Other cases with concentrations higher or lower than expected for particular CCT and LSL categories did not have clear reasons to exclude them, such as suspect sample collection conditions or obvious particulate lead. These values were included for the integrity of the dataset.

Before producing summary statistics or fitting models using the profile dataset, EPA set all known lead non-detects to 0.1 µg/L,[125] and then log-transformed the lead concentrations. The summary tables in Exhibit 6-4 and Exhibit 6-5 reflect the data cleaning steps, and a more detailed description can be found in Appendix F, Section F.1.

Exhibit 6-4 and Exhibit 6-5 show the geometric mean, standard deviation (SD), and maximum lead concentration for each combination of CCT and LSL status in the cleaned data after log-transformation of lead concentrations for all 18,039 samples included in the model. Notes regarding data cleaning and categorization for specific datasets are contained in Appendix F, Section F-1. Exhibit 6-5 provides summary statistics by LSL and CCT status from the existing data, ignoring differences in city water system, site, sampling event, and study sampling volume methodology.

[125] As the log of zero is not a real number, setting all known non-detects to a small, non-zero value allows log-transformation of all results in a dataset. It was not possible to determine detection limits or all non-detects for all included datasets, and known non-detects were identified from zeroes or missing values.

Exhibit 6-4: Summary Statistics for Tap Water Lead Concentrations by LSL and CCT Status Combinations, Country, and Citation

LSL	CCT	Country	Citation[a]	Geometric Mean Lead (µg/L)	Geometric SD Lead	Arithmetic Mean Profile Liter[b]	Arithmetic SD Profile Liter	Number of Samples	Number of Profiles	Number of Sites
LSL	None	USA	Schock, 2016	26.84	1.13	5.87	4.29	15	1	1
		CND	Craik, 2016	15.35	2.50	4.95	3.52	194	26	20
			Deshommes et al., 2016	26.87	2.14	3.99	2.80	309	69	27
			Desmarais et al., 2015	16.43	2.21	4.00	2.29	1,062	133	11
			EPCOR Water Services, 2008	21.45	1.93	3.87	3.26	107	26	11
			Hayes et al., 2014	14.55	1.71	6.00	3.47	120	5	5
			Muylwyk, 2016	16.63	2.56	1.00	0.50	248	124	123
LSL	Partial	USA	The Cadmus Group Inc., 2007	9.81	3.30	11.95	7.82	895	41	36
			Commons, 2011	14.60	2.70	7.81	4.78	121	8	8
			Del Toral, 2016	2.71	4.41	5.60	4.23	2,068	137	91
			O'Brien & Gere, 2015	14.77	2.99	1.77	2.14	133	46	7
			DC Water, 2016	6.17	3.16	8.48	5.55	205	13	6
			Schock, 2016	6.89	2.49	5.93	4.28	810	53	14
			Swertfeger et al., 2006; Desmarais et al., 2015; Triantafyllidou et al., 2015	10.47	1.96	0.38	0.00	91	91	21
		CND	Camara et al., 2013	16.30	1.93	2.00	1.20	8	2	2
LSL	Representative	USA	Del Toral et al., 2013	8.00	2.03	6.19	3.70	695	57	32
			Del Toral, 2016	2.81	3.07	6.50	4.73	1,270	80	47
			DC Water, 2016	3.05	3.34	6.74	4.12	839	64	52
			Estes-Smargiassi et al., 2006	5.23	2.28	3.03	2.78	25	2	2
			Swertfeger et al., 2006; Desmarais et al., 2015; Triantafyllidou et al., 2015	1.38	4.01	3.55	2.70	303	46	12
		CND	Campbell, 2016	1.89	3.57	2.15	1.35	4,997	1,205	639

LSL	CCT	Country	Citation[a]	Geometric Mean Lead (µg/L)	Geometric SD Lead	Arithmetic Mean Profile Liter[b]	Arithmetic SD Profile Liter	Number of Samples	Number of Profiles	Number of Sites
Partial	None	USA	None	---	---	---	---	---	---	---
		CND	Craik, 2016	6.81	5.71	1.96	1.13	451	122	116
			Deshommes et al., 2016	12.71	2.04	4.76	3.26	248	40	40
			Desmarais et al., 2015	10.00	2.06	4.00	2.29	368	46	4
			Muylwyk, 2016	7.53	4.86	1.00	0.50	341	171	169
Partial	Partial	USA	The Cadmus Group, Inc., 2007	3.70	3.02	10.64	7.21	74	4	2
			Commons, 2011	9.12	2.88	3.56	2.19	48	7	7
			Commons, 2014	10.19	2.19	6.88	4.20	40	3	3
			O'Brien & Gere, 2015	8.84	2.57	1.70	2.11	25	9	1
			DC Water, 2016	8.80	1.93	7.50	4.47	15	1	1
			Swertfeger et al., 2006; Desmarais et al., 2015; Triantafyllidou et al., 2015	2.78	2.53	0.38	0.00	11	11	11
		CND	Camara et al., 2013	18.44	1.27	2.00	1.29	4	1	1
Partial	Representative	USA	DC Water, 2016	1.95	2.45	7.30	4.60	266	19	19
			Estes-Smargiassi et al., 2006	0.24	4.53	3.03	2.78	25	2	2
			Swertfeger et al., 2006; Desmarais et al., 2015; Triantafyllidou et al., 2015	1.54	2.07	3.35	2.68	116	10	2
		CND	Campbell, 2016	1.71	3.37	4.00	2.30	152	19	11
No LSL	None	USA	None	---	---	---	---	---	---	---
		CND	Craik, 2016	0.82	9.18	1.97	1.13	322	85	85
			Deshommes et al., 2016	3.31	3.72	5.31	4.04	73	12	10
			Hayes et al., 2014	1.01	1.80	6.00	3.53	24	1	1
			Muylwyk, 2016	1.24	3.15	1.00	0.50	450	225	224
No LSL	Partial	USA	Del Toral, 2016	1.74	3.71	8.33	6.85	222	11	7
			DC Water, 2016	1.92	2.02	7.50	4.47	15	1	1
			Swertfeger et al., 2006; Desmarais et al., 2015; Triantafyllidou et al., 2015	2.41	3.59	0.38	0.00	61	61	5
		CND	Camara et al., 2013	1.42	2.98	2.00	1.29	4	1	1
No LSL	Representative	USA	Del Toral, 2016	0.66	1.81	6.87	4.87	118	7	4
			DC Water, 2016	0.66	2.39	6.44	3.83	51	4	4
		CND	None	---	---	---	---	---	---	---

[a] Each citation contains data from a single city water system (Exhibit 6-1). Some citations have entries in multiple categories.

[b] Arithmetic mean and SD of the "profile liter" term and number of individual sample bottles, profiles, and sites provide information regarding some of the differences in sampling methods observed among studies. Studies with fewer samples, or with smaller sample volumes, have smaller values of profile liter. Some studies always collected the same sample volume and others sampled to a particular point (e.g., until the water had run cold from the tap). CND = Canada, USA = United States of America, and SD = standard deviation.

Exhibit 6-5: Summary Statistics, Including Geometric Mean, Standard Deviation (SD), Maximum Value, and Sample Size for Tap Water Lead Concentration Sample Data by LSL and CCT Status Used in Statistical Modeling*

LSL Status	CCT Status	Number of Individual Samples	Geometric Mean Lead Concentration (µg/L)	Geometric SD Lead Concentration	Maximum Lead Concentration (µg/L)
LSL	None	2,055	17.79	2.27	170
Partial	None	1,408	8.61	3.9	180
No LSL	None	869	1.15	5.32	119.3
LSL	Partial	4,331	4.99	4.13	2,970
Partial	Partial	217	6.49	2.97	81.13
No LSL	Partial	302	1.86	3.6	36
LSL	Representative	8,129	2.37	3.60	714
Partial	Representative	559	1.63	2.95	38.03
No LSL	Representative	169	0.66	1.98	12.3

Note: The table shows values based on the full dataset used for the analysis shown in Section 6.2.2, not just those at a particular position in a sampling series. These values were not directly used in blood lead modeling, as they do not adequately control for repeated sampling within sites and city water systems, or for differences in profile liter.
* CCT designations changed from "Representative" to "Partial" for three city water systems based on public comment. These changes are reflected in this table and the following analysis.

6.2.1.3 *Coding*

After cleaning the data as described above, EPA added a centered "profile liter" term and contrast-coded variables describing LSL and CCT for use in fitting models. The profile liter term controls for differences in cumulative sample volume and sampling profile series position, as described in Section 6.2.1.1. Centering the intercept at the mean value of a profile liter for all samples allowed for improved interpretation of interaction terms. Contrast codes likewise improve interpretability and ease of projection from the fitted model, particularly when interactions are included.

To produce the centered profile liter term, EPA calculated the midpoint of the cumulative sample volume, as described in Section 6.2.1.1. Then, the mean of the original profile liter term was subtracted from the profile liter term for all samples. This sets the intercept for the model to a profile liter of approximately 4.5,[126] this point is analogous to the fifth liter drawn from the tap after stagnation.

EPA used the sample data's descriptive information on LSL status to generate two contrast variables that allow for the statistical comparison of water lead concentrations between the three LSL scenarios represented in the data ("LSL," "Partial," and "No LSL"). The "LSL (yes/no)" variable indicates lead concentration samples that come from sites with a full LSL compared to samples from locations with no LSL. "LSL (no/partial)" designates samples that come from sites with a partial LSL in place compared to site samples that come from locations with no LSL. Used together in the statistical model, these two variables allow EPA to compare water lead concentrations in homes with no LSLs to concentrations

[126] The mean of the original, un-centered profile liter term is 4.495. This has been rounded to 4.5, or the "fifth liter" for readability throughout this document.

in homes with full LSLs and homes with partial LSLs. Exhibit 6-6 shows the numeric codes used to describe LSL status in the analysis.

EPA determined corrosion control levels for each lead concentration sample reported through records of CCT practices and implementation dates, as well as water quality samples. CCT was coded as a single contrast variable, "CCT (yes/no)," marking those tap samples taken in the presence of corrosion control against those sample taken at sights without CCT. This variable is used to quantify the difference between water lead concentrations at sites with representative CCT, partial CCT, and no CCT. Exhibit 6-7 shows the codes used to represent CCT in the analysis.

Exhibit 6-6: Numeric Values Assigned to Two Discrete Contrast Variables Representing LSL Status in the Estimated Drinking Water Lead Concentration Regression Model

LSL Status	LSL (yes/no)	LSL (no/partial)
LSL	-0.5	0
Partial	0	-0.5
No LSL	0.5	0.5

Exhibit 6-7: Numeric Values Assigned to a Discrete Contrast Variable Representing CCT Status Use in the Estimated Drinking Water Lead Concentration Regression Model

CCT Status	CCT (yes/no)
None	-0.5
Partial	0
Representative	0.5

6.2.2 Drinking Water Lead Concentration Model Fitting and Selection

Next, EPA developed a model to estimate typical lead concentrations for each intervention category. The intervention category is confounded with differences in profile liter of individual samples, as well as with numbers of sites and profiles from each city water system (Exhibit 6-4: Summary Statistics for Tap Water Lead Concentrations by LSL and CCT Status Combinations, Country, and CitationExhibit 6-4, Exhibit 6-5). Therefore, geometric means cannot be directly compared across intervention categories. Rather than selecting only samples from some common profile liter (e.g., the "first liter"), and aggregating within sites and city water systems to produce a homogeneous subset of the dataset, EPA fit linear mixed-effects models with explicit terms to statistically control for the differences in profile liter, city water system, site, and sampling event. This single-step meta-analysis allowed for the greatest inclusion of available data, while limiting the effects of different methods.

EPA fit multiple, nested, linear mixed-effects models (Equation 1–Equation 5), Exhibit 6-8) of tap water lead concentration as predicted by LSL presence ("LSL" or "No LSL"), LSL extent ("None" or "Partial"), CCT status, and profile liter. To simplify model fitting, these models assumed equal variance in lead concentration among combinations of LSL and CCT status, profile liter, and sampling events. This assumption means the model may slightly over- or under-estimate the variation in lead water concentrations in some scenarios. For instance, increased variability may occur as lead flushes from

residential pipes after LSLR; or in cases of "partial" CCT, where poorly optimized and changing corrosion control may interact unpredictably with pipe chemistry to produce more variable concentrations than would be expected with fully optimized corrosion control. To understand how this assumption of equal variance might affect model results, EPA performed additional sensitivity analyses using multiple means and variances for lead water concentrations (Appendix F).

EPA compared several models, from simple to more complex, to find the best function for use in predicting lead concentrations at the tap (Equation 1–(Equation 5). For all models, EPA allowed the intercept of the fitted equation (mean lead concentration at the fifth liter[127] assuming no LSL or CCT; see Section 6.2.1.2) to vary by sampling event and location, with each sampling event nested within a site and each site nested within a city water system[128]. EPA also considered models that accounted for random variation in parameters, such as differences in length of a service line among sites, or specific features that could change the effectiveness of CCT, related to event, site, and city water system, but found that the collected dataset does not contain sufficient information to fit such models.

To describe the non-linear effects of the profile liter, the models include a natural cubic spline. The spline models the effect of the profile liter as a curve, and allows the fitted lead concentration to increase and decrease as water is drawn through the household and service line (Exhibit 6-2 and Exhibit 6-3). This spline included three interior knots and two boundary knots. Knots define points where different pieces of the curve meet and allow the model to be fit with different "sub" curves for each piece between the knots. The three interior knots correspond to the first 0.5, 4, and 8 liters after beginning sampling and have curves at either end. Boundary knots correspond to 0.06 liters and 13 liters after beginning sampling.[129] These knots produce linear sections at either end of the curve where there were few samples. Models were fitted with the *lme4* package in R (Bates, 2010; Bates et al., 2015; Pinheiro et al., 2017; R Core Team, 2016) with full-information maximum likelihood (FIML) for model comparisons and restricted maximum likelihood (REML) to produce final parameters after model selection (Bolker et al., 2009).[130]

In the equations below, "*i*" identifies a particular water sample, and "*j*" identifies a sampling event, nested within a site and a city water system. β refers to the coefficient for each parameter. Thus, β_{0j} is the intercept for a particular sampling event *j*. β_s terms refer to matrices of spline coefficients (not shown) for each model term that includes a spline. Thus, β_{s1} is the matrix of spline coefficients for the effect of the profile liter term alone.

[127] EPA centered the term for profile liter at its mean. As a result, the "fifth liter" occurs at the intercept, which is close to the fifth liter of a 5- liter sampling series, or roughly 30 seconds of flushing the tap.

[128] A 'nested' variable structure represents data where a particular factor level can occur only within a particular level of another factor. This structure reflects the structure of sample concentration data. A single sampling event could only occur within a particular site, and that site can only occur within a particular city.

[129] Interior knot positions were chosen to represent potentially important transition points in the profile. The fitted splines were compared against models that used standard quantile selection for interior knot position and were found to produce similar estimates (Appendix F, Section F-2). Therefore, the knot positions chosen by transition point (i.e., faucet, beginning, and end of largest service line-related lead increases) were retained for the final model.

[130] Using REML reduces bias in the SD of random effects parameters but does not produce meaningful values of log-likelihood, Akaike Information Criterion (AIC), or Bayesian Information Criterion (BIC) when comparing models with different fixed effects. Therefore, EPA used FIML for model comparisons and REML to fit the final model.

Full spline model:

$$\begin{aligned} log_e\left(Pb\ \frac{\mu g}{L}\right)_{ij} = {} & \beta_{0j} + Spline(Profile\ Liter_i) * \beta_{s1} + \beta_1 LSL\ (yes/no)_{i_i} \\ & + \beta_2 LSL\ (no/partial)_i + \beta_3 CCT_i + \beta_4 LSL\ (yes/no)_{i_i} * CCT_i \\ & + \beta_5 LSL\ (no/partial)_i * CCT_i \\ & + Spline(Profile\ Liter_i) * \beta_{s2} LSL\ (yes/no)_{i_i} \\ & + Spline(Profile\ Liter_i) * \beta_{s5}\ LSL\ (no/partial)_i \\ & + Spline(Profile\ Liter_i) * \beta_{s4}\ CCT_i \\ & + Spline(Profile\ Liter_i) * \beta_{s5} LSL\ (yes/no)_{i_i} * CCT_i \\ & + Spline(Profile\ Liter_i) * \beta_{s6} LSL\ (no/partial)_i * CCT_i + \varepsilon_i \end{aligned} \qquad \text{(Equation 1)}$$

Reduced spline model with CCT interactions:

$$\begin{aligned} log_e\left(Pb\ \frac{\mu g}{L}\right)_{ij} = {} & \beta_{0j} + Spline(Profile\ Liter_i) * \beta_{s1} + \beta_1 LSL\ (yes/no)_i \\ & + \beta_2 LSL\ (no/partial)_i + \beta_3 CCT(level)_i \\ & + \beta_4 LSL\ (yes/no)_{\ i} * CCT_i + \beta_5 LSL\ (no/partial)_i * CCT_i \\ & + Spline(Profile\ Liter_i) * \beta_{s2} LSL\ (yes/no)_i \\ & + Spline(Profile\ Liter_i) * \beta_{s5}\ LSL\ (no/partial)_i + \varepsilon_i \end{aligned} \qquad \text{(Equation 2)}$$

Reduced spline model without CCT interactions:

$$\begin{aligned} log_e\left(Pb\ \frac{\mu g}{L}\right)_{ij} = {} & \beta_{0j} + Spline(Profile\ Liter_i) * \beta_{s1} \\ & + \beta_1 LSL(yes/no)_i + \beta_2 LSL\ (no/partial)_i + \beta_3 CCT_i \\ & + Spline(Profile\ Liter_i) * \beta_{s2} LSL\ (yes/no)_i \\ & + Spline(Profile\ Liter_i) * \beta_{s5}\ LSL\ (no/partial)_i \\ & + \varepsilon_i \end{aligned} \qquad \text{(Equation 3)}$$

Spline model with no interactions:

$$\begin{aligned} log_e\left(Pb\ \frac{\mu g}{L}\right)_{ij} = {} & \beta_{0j} + Spline(Profile\ Liter_i) * \beta_{s1} \\ & + \beta_1 LSL(yes/no)_i + \beta_2 LSL\ (no/partial)_i + \beta_3 CCT_i \\ & + \varepsilon_i \end{aligned} \qquad \text{(Equation 4)}$$

Linear model with no interactions:

$$\begin{aligned} log_e\left(Pb\ \frac{\mu g}{L}\right)_{ij} = {} & \beta_{0j} + \beta_1(Profile\ Liter_i) \\ & + \beta_2 LSL\ (yes/no)_i + \beta_3 LSL\ (no/partial)_i + \beta_4 CCT_i \\ & + \varepsilon_i \end{aligned} \qquad \text{(Equation 5)}$$

EPA selected the "Reduced spline model with CCT interactions" (Equation Equation 2) to produce simulated lead concentrations for use in the benefits analysis. Although the most complex "full spline" model showed the best fit overall (Equation 1, Exhibit 6-8), the improvement in fit was small relative to the increase in complexity, and a close examination of the fitted model suggested that the full spline model over-fit specific study parameters and produced predictions that were likely unrealistic. The full model projected a gradual rise in lead concentration after the service line peak for some intervention combinations, which is unlikely to be realistic given that the water represented in this tail of the profile represents non-stagnated water from the system main. In addition, for homes with no LSLs, the full model produced predictions of relatively high lead concentrations in homes with representative CCT, and relatively low concentrations in homes with no CCT. Again, this is unlikely to represent the true effects of CCT; therefore, the simpler model was selected for simulation.

Exhibit 6-8: Comparison of Tap Sample Lead Concentration Model Results Based on Maximum Likelihood Estimators for Goodness of Fit

Model	DF[a]	Log-Likelihood	AIC	BIC
Full spline (Equation 1)	34	-19,922	39,912	40,177
Reduced spline with CCT interaction (Equation 2)	22	-20,016	40,077	40,248
Reduced spline without CCT interaction (Equation 3)	20	-20,036	40,112	40,268
Spline model with no interactions (Equation 4)	12	-20,139	40,302	40,395
Linear with no interactions (Equation 5)	9	-20,675	41,367	41,437

a Degrees of freedom (DF) are the number of parameters estimated for the model, including the variance for each random effects level (sampling event is nested within the site nested within the city water system), fixed coefficients, and the residual error. The other columns provide model fit statistics for comparing the fixed terms of the model. AIC is Akaike's Information Criterion & BIC is Bayesian Information Criterion. For AIC and BIC, the smaller numbers imply more preferred models; and for log-likelihood, the larger numbers imply a better fit to the underlying data.

The reduced spline model with CCT interactions suggests that besides water system, residence, and sampling event, the largest effects on lead concentration come from LSLs and the number of liters drawn since the last stagnation period (Exhibit 6-9).

Exhibit 6-9: Results from the Reduced Cubic Spline Interaction Model with CCT Interactions: Fixed Effects and Random Effects for Sampling Event, Site, and City Water System

Fixed Effects	β[a]	SE[b]	F (Type III SS)[c]
Intercept	1.41	0.165	80
Cumulative volume (spline)	---	---	165
LSL (yes/no)	-1.06	0.094	128
LSL (no/partial)	-0.89	0.173	27
CCT (no/representative)	-0.74	0.164	21
LSL (yes/no)* CCT (no/representative)	0.95	0.182	27
LSL (no/partial)* CCT (no/representative)	1.78	0.321	31
LSL (yes/no)* Cumulative volume (spline)	---	---	38
LSL (no/partial)* Cumulative volume (spline)	---	---	25
Random Effects[d]	**N**		**SD**
Sampling event in site in city water system	3,102		0.53
Site in city water system	1,638		1.07
City water system	14		0.59
Individual samples (Total N)[e]	18,039		

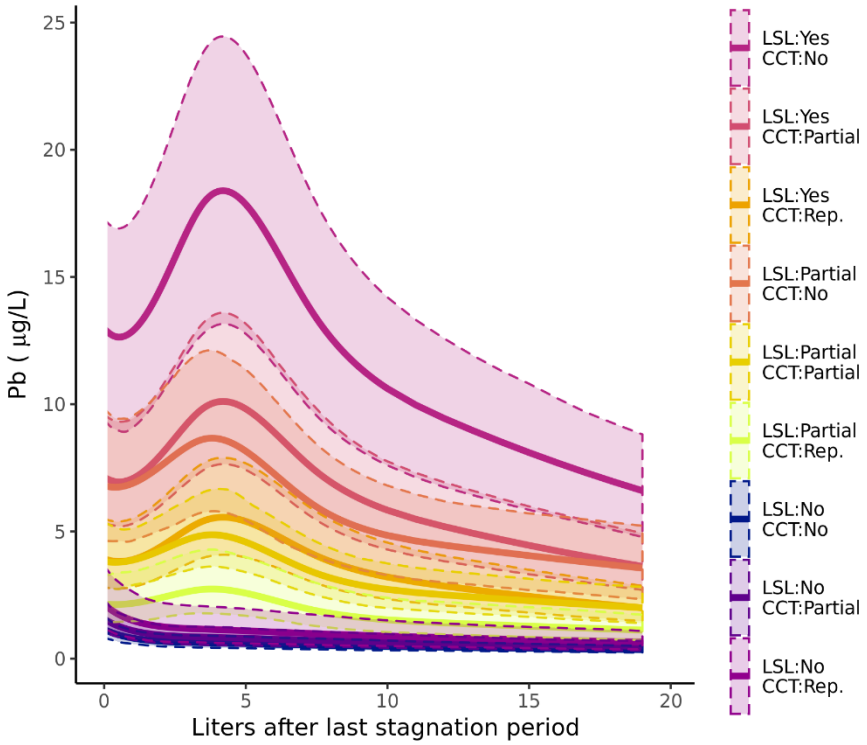
[a] β, the unstandardized regression coefficient, provides the size and direction of the relationship between each model term and log-transformed lead concentration. β for spline effects are too complex to show in this exhibit.
[b] SE shows the standard error estimated for each coefficient.
[c] F provides the F statistic for each coefficient after controlling for all other coefficients for type III sums of squares (SS). Unbalanced sample sizes for random effects complicate accurate degrees of freedom (DF) calculations, and no p-values are provided. However, larger F values indicate stronger effects.
[d] For random effects, N shows the number of groups at each level, and SD provides the attributable to that level of random effect.
[e] Total N is the number of individual sample bottles.
N = number of observations, and SD = standard deviation.

The fitted model for the reduced cubic spline interaction (Equation 2) was used to produce simulated concentrations of lead at the kitchen tap that statistically control for variation in the sample dataset due to differences in profile liter among studies, the city water system, the site, and the sampling event. Additionally, the simulated concentrations incorporate variation in lead levels found among sampling events, sites, and city water systems.

6.2.3 Simulated Drinking Water Lead Concentrations Based on Selected Model Fit

For use in blood lead modeling, EPA produced 500,000 simulated lead concentrations based on the final model (reduced spline with CCT interactions; Equation Equation 2; Exhibit 6-9). These concentrations were simulated using the arithmetic mean profile liter value of the original dataset (4.45) taken after stagnation (Exhibit 6-10), which, on average, was the peak lead concentration for residences with "LSL" or "Partial LSL" regardless of CCT level. The dataset simulates concentrations for new cities, sites, and sampling events not included in the original dataset using estimates of variability and uncertainty from the fitted model, and given information on LSL and CCT status. While the simulated dataset includes variability similar to the original data, individual simulated estimates are best thought of as central tendencies of possible concentration values given fitted model parameters and estimated variance. The simulated results also incorporate the model assumptions of equal variance in lead concentration among different scenarios, and equal variance over the range of profile liters, as previously discussed in Section 6.2.2.

Exhibit 6-10: Estimates for the Simulated Data Showing the Relationship between Tap Lead Concentration and Profile Liter for Each Combination of CCT and LSL Status



Note: Central estimates are solid lines, and 95 percent confidence intervals (CIs) (bootstrapped) are indicated by shaded areas bounded by dotted lines. The highest concentrations occur, on average, roughly 5 liters after the last stagnation period in homes with LSLs in place. Note that CIs can overlap somewhat even where there is a significant effect of scenario (i.e., CCT and LSL presence). However, for scenarios with no LSLs, CIs for CCT scenarios overlap almost completely.

Though CCT produced significant reductions in lead water concentrations, the simulated predictions for sites with full LSL removals primarily overlapped for all CCT conditions in the final model (Exhibit 6-8). Therefore, EPA used the pooled estimate for all CCT conditions in residences with no LSL in place (this is referred to as "combined CCT"). Because of this overlap in the simulated data, EPA was unable to quantify the impacts of improvements in CCT status on non-LSL households using these data.

Exhibit 6-11: LSL and CCT Scenarios and Simulated Geometric Mean Tap Water Lead Concentrations and Standard Deviations at the Fifth Liter Drawn after Stagnation for Each Combination of LSL and CCT Status

LSL Status	CCT Status	Simulated Mean of Log Lead (µg/L)	Simulated SD[a] of Log Lead	Simulated Geometric Mean of Lead (µg/L)	Simulated Geometric SD[a] of Lead
LSL	None	2.89	1.33	18.08	3.78
Partial	None	2.13	1.33	8.43	3.77
No LSL	None	**-0.19[b]**	**1.35[b]**	**0.82[b]**	**3.86[b]**
LSL	Partial	2.29	1.33	9.92	3.78
Partial	Partial	1.55	1.32	4.72	3.75
No LSL	Partial	**-0.19[b]**	**1.35[b]**	**0.82[b]**	**3.86[b]**
LSL	Representative	1.70	1.33	5.48	3.77
Partial	Representative	0.97	1.32	2.64	3.76
No LSL	Representative	**-0.19[b]**	**1.35[b]**	**0.82[b]**	**3.86[b]**

[a] SD reflects "among-sampling event" variability.
[b] Bolded values show how simulated results were pooled to produce a common estimate for homes with no LSL across CCT conditions.
LSL = lead service line, CCT = corrosion control treatment, and SD = standard deviation.

Although the existing data did not provide enough information to estimate the effect of CCT where no LSL were present (Exhibit 6-10 and Exhibit 6-11), the CCT status of the PWS is tracked in the analysis regardless of LSL status. This is described in Section 6.3. Note in Exhibit 6-11 that the statistics describing the distribution of tap water lead concentrations are the same for all three rows for "no LSLs," regardless of whether there is representative, partial, or no CCT. Effectively, in the primary analysis EPA did not quantify the incremental benefits of CCT when LSLs are absent. On the other hand, because CCT is done on a system-wide basis, there are no incremental costs associated with providing CCT to homes without LSLs when it is being provided for the entire system. The impact of CCT for these no LSL homes likely varies by location depending on whether there are legacy system and/or household lead solder or higher lead content brass parts.

Two approaches for alternative water modeling in the absence of LSLs are discussed in the appendices. Appendix F outlines an approach for considering the potential increase in benefits that may accrue to non-LSL households experiencing changes in CCT as a result of the rule if indeed the effect of CCT for these households is larger than assumed in the main analysis. This first supplemental analysis incorporates data from homes in Michigan where CCT presence/absence and LSL status were known, and first liter samples were available for homes without LSL.[131] The second analysis, described in Appendix G, also approximates the lead concentration of water in non-LSL homes where CCT changes occur as a result of the rule using the mean value lead tap concentration values from the original cleaned profile dataset, rather than the simulated data output. The existing cleaned profile liter data

[131] This dataset is made up of first liter regulatory compliance samples and does not include additional consecutive profile samples for homes without LSLs. While CCT presence/absence could be inferred from the data, quality and nature of CCT was not determined for this dataset. This dataset was therefore not incorporated into the primary benefits analysis. The data are available in [2020_MI_LCR_sample_database.xlsx].

used to fit the curves for simulation did not contain enough profiles before and after the implementation of representative CCT from homes without LSL to fit parameter estimates. Therefore, these estimates were based on close examination of the existing data for homes without LSLs under varying CCT conditions, as well as expert knowledge regarding the potential effects of improving CCT. Neither of these methods, however, account for inter- and intra-system water quality variability in the need for LSLR or the distribution of household ages. Again, EPA did not look at the potential for the impact of added CCT to be less than estimated in the primary analysis presented in this chapter. To maintain a consistent data-driven underpinning for the primary benefits analysis, these estimates were not used for the primary benefits calculation, but are presented in Appendix F as part of a sensitivity analysis.

6.2.4 Determination of Point-of-Use Water Concentrations

In addition to modeled drinking water concentrations, the following water filtration devices are also considered:

- *A point-of-use (POU) device* is a water filtration device physically installed or connected to a single fixture, outlet, or tap to reduce or remove contaminants in drinking water. For the purposes of subpart I, it is certified by an American National Standards Institute (ANSI)-accredited certifier to reduce lead in drinking water.
- *A pitcher filter* means a non-plumbed water filtration device that consists of a gravity feed water filtration cartridge and a filtered drinking water reservoir, and is certified by an ANSI-accredited certifier to reduce lead in drinking water.

To estimate benefits, only the first bullet is included under "POU" device. Pitcher filters are useful in some cases, such as mitigating potential short-term increases in lead exposure after the replacement of an LSL. However, only the physical installation of a POU device is included in the rule option. POU devices that are potentially used under the LCRR as part of the treatment technique requirements must be certified by an ANSI-accredited certifier to reduce lead in drinking water. To be certified, POU devices need to demonstrate an ability to remove at least 93 percent of lead. One third-party certification organization, NSF International, conducts demonstration tests well beyond manufacturers' recommended filter replacement schedules (NSF International, 2019). Due to the high efficiency of these filters, EPA chose to assign the lowest-modeled water concentration (0.82 µg/L) to those households using POU devices, regardless of LSL and CCT status. In doing so, EPA assumes that POU devices are properly used and maintained. EPA did not perform sampling to confirm this assumption.

6.2.5 Limitations of Baseline and Post-Rule Water Concentration Estimates

Although EPA tried to account for and model variability in lead concentrations at the tap using all available historical datasets that met inclusion criteria, the underlying data and chosen modeling strategy have limitations. First, the datasets came from 14 water systems in the United States and Canada (Exhibit 6-1, Exhibit 6-4, and Exhibit 6-5). Within the United States, datasets include only samples from the Northeast and from a few water systems in the upper Midwest. Therefore, the source data do not fully represent water quality conditions, chemistry differences in pipe scale, and treatment practices across all United States regions. There was not enough information to include housing age,

which may be related to additional sources of lead. Additionally, the original studies (Exhibit 6-1, Exhibit 6-4, and Exhibit 6-5) were conducted for different reasons by different entities, and sometimes varied in their sampling methods. Both of these issues may limit generalizability of the data.

The simulated concentrations statistically control for differences in methodology among studies by standardizing the "profile liter" term and including random effects to control for repeated samples within sampling event, site, and city water system. This approach is not equivalent to conducting a large new study to collect consistent samples over a broader variety of water systems. As previously discussed, using simulated concentrations also incorporates some assumptions, such as equal variance in lead concentrations among different combinations of CCT and LSL status.

6.3 Assignment of Drinking Water Lead Tap Concentrations to PWS Populations

This section first describes how the simulated drinking water concentrations described in Section 6.2 are assigned to each type of PWS, and next describes how the number of people in each PWS are estimated and tracked through the analysis period. Each tap water lead concentration displayed in Exhibit 6-11 is assigned to the various LSL, POU, and CCT scenarios under the rule. Due to data limitations, some scenarios have been assigned the same lead tap water concentration. As illustrated in Exhibit 6-10, in the case where there is no LSL, CIs on modeled drinking water concentrations, regardless of CCT status, all overlap. Therefore, as described in Section 6.2.1, these were combined in the analysis. It is possible that given more data, one might expect to see lower drinking water lead levels when CCT is optimized. For this reason, EPA kept these scenarios separate in the benefits modeling, including tracking the number of people in PWSs with this LSL/CCT status.[132]

Mapping Exhibit 6-11 drinking water concentrations to modeled benefit scenarios is illustrated in Exhibit 6-12.

Exhibit 6-12: Mapping Simulated Drinking Water Lead Tap Concentrations to Benefit Scenarios

LSL Status	CCT Status	Geometric Mean Tap Water Lead Concentration[a] (µg/L)	Geometric SD
LSL	None	18.08	3.78
Partial	None	8.43	3.77
No LSL	None	**0.82[b]**	**3.86[b]**
LSL	Partial	9.92	3.78
Partial	Partial	4.72	3.75
No LSL	Partial	**0.82[b]**	**3.86[b]**
LSL	Representative	5.48	3.77
Partial	Representative	2.64	3.76
No LSL	Representative	**0.82[b]**	**3.86[b]**
POU		**0.82[b]**	**3.86[b]**

[132] Note that these are also tracked in the cost side of the model (see Chapter 5).

[a] Simulated geometric mean water concentrations are based on available data for various LSL and CCT scenarios, as described in Section 6.2.3.

[b] Bolded values show how simulated results were pooled to produce a common estimate for homes with no LSLs across CCT conditions. Also, these "No LSL" values were used for POU lead tap concentrations.

EPA estimated benefits under both the low- and high-cost scenarios used in the LCRR that characterize uncertainty in the cost estimates. The low- and high-cost scenario differ in their assumptions about 1) the existing number of LSLs in PWSs, 2) the number of PWS above the action level (AL) or trigger level (TL) under the previous and final rule monitoring requirements, 3) the cost of installing and optimizing CCT, 4) the effectiveness of CCT in mitigating lead concentrations, and 5) the cost of LSLR.

The monetary benefits of the rule are modeled in the SafeWater Lead and Copper Rule (LCR) model. For each model PWS, a population cohort is created in the SafeWater LCR model. Each simulated population cohort for each PWS has an age distribution equal to that of the general population, and is followed in the benefits analysis for 35 years. A new cohort of infants is added in each subsequent year of the 35-year analysis based on birth rates from the 2000 United States Census. Thus, 35 cohorts of children are modeled to age 7 and can possibly accrue benefits due to implementation of the rule – one cohort for each year of the analysis. EPA does not quantify avoided IQ loss for children who have not reached age 7 by the end of the analysis period. This assumption would underestimate benefits for the LCRR given that children ages 1–6 in the final (35th) year of the analysis are not predicted to experience quantified avoided IQ loss in this approach but are expected to experience a reduction in lead exposure.

In the analysis, EPA assumes that characteristics of households with LSLs have the same characteristics as the general population. Each statistical person within a model PWS in the SafeWater LCR model is initially assigned to one of the simulated drinking water lead concentrations in Exhibit 6-11, depending on the CCT status and number of LSLs assigned to that modeled system in the baseline. Depending on the rule requirements, implementation schedule, and each year's tracked system level 90th percentile tap sample lead concentration, a modeled PWS may experience changes in CCT, LSL, and POU status if the system has a TL or AL exceedance. Based on these modeled changes in CCT, POU, and LSL status, specific proportions of the modeled population within the system will be assigned to a new lead tap water concentration category representing the new technology in place at the system in each year of the 35-year period of performance.

For a further discussion of how this is implemented in the SafeWater LCR model, see the flow charts in Appendix B; and for the following discussions, see Section B.3, *Estimating the Cost of Compliance with the LCRR*:

- Small community water systems (CWSs) serving 3,300 or fewer people and all non-transient non-community water systems (NTNCWSs) can choose POU, CCT, or LSLR; and are assumed to choose whichever compliance option has the lowest cost,
- How the SafeWater LCR model determines if a PWS installs/optimizes CCT or installs a POU device, and
- How the SafeWater LCR model determines if a PWS replaces LSLs.

Due to different assumptions, different numbers of people will experience benefits under the low- and high-cost scenarios.

Error! Reference source not found. and Exhibit 6-14 summarize the number of people who move from one treatment combination (i.e., beginning condition) to another (i.e., ending condition) over the 35-year analysis period across all model PWS strata in the SafeWater LCR model for the low- and high-cost scenarios, respectively. These exhibits include people who move more than once over the 35-year period. These exhibits do not display the total number of people in the Nation with this type of treatment; rather, it displays those who are estimated to experience a change in water lead concentration as a result of the final rule. The exhibits present the number of people experiencing a change from a baseline water lead concentration, represented in the "Beginning Concentration" column of the exhibits; to a new water lead concentration, labeled "Ending Concentration" over the 35-year period of analysis as a result of implementing the LCRR requirements with the SafeWater LCR model. In the case of a CCT installation or re-optimization, the entire population of a model PWS will move to the new CCT status at the same time. EPA also assumes that the entire PWS moves to the drinking water lead concentration (from Exhibit 6-12), assigned to a POU device when this option is implemented by the PWS, which implies that everyone is properly using the POU device. Thus, a corresponding change in the concentration of lead in drinking water will occur for the entire PWS population in the year the change is implemented. Chapter 5 provides more detail on these assumptions.

For LSLR, the portion of the population corresponding to the number of households undergoing LSLR each year will change to the lower drinking water lead concentrations and BLLs in the year the LSL is replaced. For each year of analysis, IQ benefits are captured once a child reaches 7 years of age, which is described in more detail in Section 6.4. To simplify the analysis, EPA assumes no change in other sources of lead exposure besides drinking water over the 35-year timeline used in the analysis. This includes exposure to lead in drinking water not consumed in the home.

EPA did not quantify the benefits of reduced lead exposure to individuals who reside and work in buildings that do not have LSLs. These buildings, while not having an LSL in place, may still contain leaded plumbing materials, including leaded brass fixtures and leaded solder. EPA expects that the LCRR requirements will result in reduced lead exposure to the occupants of these buildings as a result of improved monitoring and additional actions to optimize CCT. In the analysis of the final rule, approximately 20 million people (8 million households) for the low-cost scenario and 44 million people (17 million households) for the high-cost scenario could potentially be affected by reductions in lead drinking water concentrations that result from water systems' increasing their corrosion control during the 35-year analysis period. A sensitivity analysis of this assumption using alternative water concentrations is presented in Appendix G.

In the main LCRR analysis, EPA assumes there is no difference in the geometric mean water lead concentration in households with no LSL, regardless of CCT status. In other words, for each of the three scenarios of no LSL (i.e., no LSL – no CCT, no LSL – partial CCT, and no LSL – representative CCT), the geometric mean water lead concentration is equivalent to 0.82 µg/L, which is likely to lead to an underestimate of benefits. EPA assessed potential benefits to children in these homes by also estimating alternative water concentrations for these scenarios. This approach assumes that there is still a benefit to CCT in the absence of an LSL due to the potential leaching of lead from internal fixtures such as lead solder on brass water faucets. The Agency has determined that the data are too limited and the uncertainties too significant to include this assessment in the primary quantified and monetized benefit estimates of this regulation. This analysis is presented in Appendix G.

Exhibit 6-13: Summary of Geometric Mean Water Lead Concentration Changes Resulting from Rule Implementation, and Associated Number of People for Each Treatment Combination Change over 35-Year Analysis Period (Low-Cost Scenario)

Beginning Condition			Ending Condition				Number of People (over 35 years)		
LSL	CCT	Concentration (µg/L)	LSL	CCT	POU	Concentration (µg/L)	Baseline	Option	Incremental
LSL	None	18.08	No LSL	None	None	0.82	93	1,322	1,229
LSL	None	18.08	LSL	Representative	None	5.48	322	0	-322
LSL	None	18.08	No LSL	Representative	None	0.82	0	0	0
LSL	None	18.08	LSL	None	Yes	0.82	0	6	6
Partial	None	8.43	No LSL	Partial	None	0.82	0	333	333
Partial	None	8.43	Partial	Representative	None	2.64	0	0	0
Partial	None	8.43	No LSL	Representative	None	0.82	0	0	0
Partial	None	8.43	Partial	Partial	Yes	0.82	0	2	2
No LSL	None	0.82	No LSL	Representative	None	0.82	1,855,625	1,645,916	-209,710
No LSL	None	0.82	No LSL	None	Yes	0.82	0	206,907	206,907
LSL	Partial	9.92	No LSL	Partial	No	0.82	10,470	630,532	620,062
LSL	Partial	9.92	LSL	Representative	None	5.48	44,487	2,357,596	2,313,109
LSL	Partial	9.92	No LSL	Representative	None	0.82	0	90,505	90,505
LSL	Partial	9.92	LSL	Partial	Yes	0.82	0	1,857	1,857
Partial	Partial	4.72	No LSL	Partial	No	0.82	15,371	152,245	136,874
Partial	Partial	4.72	Partial	Representative	None	2.64	64,514	584,661	520,147

Exhibit 6-13: Summary of Geometric Mean Water Lead Concentration Changes Resulting from Rule Implementation, and Associated Number of People for Each Treatment Combination Change over 35-Year Analysis Period (Low-Cost Scenario)

Beginning Condition			Ending Condition				Number of People (over 35 years)		
LSL	CCT	Concentration (µg/L)	LSL	CCT	POU	Concentration (µg/L)	Baseline	Option	Incremental
Partial	Partial	4.72	No LSL	Representative	None	0.82	0	22,621	22,621
Partial	Partial	4.72	Partial	Partial	Yes	0.82	0	52	52
No LSL	Partial	0.82	No LSL	Representative	None	0.82	4,170,466	23,895,595	19,725,129
No LSL	Partial	0.82	No LSL	Partial	Yes	0.82	0	29,455	29,455
LSL	Representative	5.48	No LSL	Representative	None	0.82	0	133,346	133,346
LSL	Representative	5.48	LSL	Representative	Yes	0.82	0	0	0
Partial	Representative	2.64	Partial	Representative	Yes	0.82	0	0	0
No LSL	Representative	0.82	No LSL	Representative	Yes	0.82	0	0	0

Note: This exhibit summarizes the number of people who move from one treatment combination (i.e., beginning condition) to another (i.e., ending condition) over the 35-year analysis period across all modeled PWSs in the SafeWater LCR model.

Exhibit 6-14: Summary of Geometric Mean Water Lead Concentration Changes Resulting from Rule Implementation, and Associated Number of People for Each Treatment Combination Change over 35-Year Analysis Period (High-Cost Scenario)

Beginning Condition			Ending Condition				Number of People (over 35 years)		
LSL	CCT	Concentration (µg/L)	LSL	CCT	POU	Concentration (µg/L)	Baseline	Option	Incremental
LSL	None	18.08	No LSL	None	None	0.82	8,450	6,895	-1,555
LSL	None	18.08	LSL	Representative	None	5.48	31,482	34,379	2,897
LSL	None	18.08	No LSL	Representative	None	0.82	0	1	1
LSL	None	18.08	LSL	None	Yes	0.82	0	14,941	14,941
Partial	None	8.43	No LSL	Partial	None	0.82	0	1,874	1,874
Partial	None	8.43	Partial	Representative	None	2.64	0	8,595	8,595
Partial	None	8.43	No LSL	Representative	None	0.82	0	0	0
Partial	None	8.43	Partial	Partial	Yes	0.82	0	3,735	3,735
No LSL	None	0.82	No LSL	Representative	None	0.82	4,250,688	3,675,454	-575,234
No LSL	None	0.82	No LSL	None	Yes	0.82	0	496,093	496,093
LSL	Partial	9.92	No LSL	Partial	No	0.82	132,648	934,467	801,820
LSL	Partial	9.92	LSL	Representative	None	5.48	610,584	6,716,410	6,105,826
LSL	Partial	9.92	No LSL	Representative	None	0.82	0	181,779	181,779
LSL	Partial	9.92	LSL	Partial	Yes	0.82	0	135,027	135,027
Partial	Partial	4.72	No LSL	Partial	No	0.82	219,833	226,360	6,527
Partial	Partial	4.72	Partial	Representative	None	2.64	980,129	1,670,537	690,408
Partial	Partial	4.72	No LSL	Representative	None	0.82	0	45,438	45,438

Exhibit 6-14: Summary of Geometric Mean Water Lead Concentration Changes Resulting from Rule Implementation, and Associated Number of People for Each Treatment Combination Change over 35-Year Analysis Period (High-Cost Scenario)

Beginning Condition			Ending Condition				Number of People (over 35 years)		
LSL	CCT	Concentration (µg/L)	LSL	CCT	POU	Concentration (µg/L)	Baseline	Option	Incremental
Partial	Partial	4.72	Partial	Partial	Yes	0.82	0	31,656	31,656
No LSL	Partial	0.82	No LSL	Representative	None	0.82	16,034,874	61,039,398	45,004,523
No LSL	Partial	0.82	No LSL	Partial	Yes	0.82	0	89,077	89,077
LSL	Representative	5.48	No LSL	Representative	None	0.82	0	281,271	281,271
LSL	Representative	5.48	LSL	Representative	Yes	0.82	0	0	0
Partial	Representative	2.64	Partial	Representative	Yes	0.82	0	0	0
No LSL	Representative	0.82	No LSL	Representative	Yes	0.82	0	0	0

Note: This exhibit summarizes the number of people who move from one treatment combination (i.e., beginning condition) to another (i.e., ending condition) over the 35-year analysis period across all modeled PWSs in the SafeWater LCR model.

6.4 Quantification and Monetization of Children's Benefits from Reductions in Lead Drinking Water Concentrations

EPA assessed benefits of the final LCRR in terms of avoided losses in IQ in children that result from additional actions required under the final rule. Section 6.4.1 describes methods used to estimate BLLs in children, which are presented in Section 6.4.2. Concentration-response functions used to estimate changes in IQ are described in Section 6.4.3 and Section 6.4.4 outlines methods used for valuation of these effects on children's IQ. Lastly, estimates of the benefits of the LCRR in children are presented in Section 6.4.6. Appendix G presents sensitivity analyses of the IQ benefits in children. These sensitivity analyses explore alternative blood modeling assumptions, concentration-response functions, and the estimates for the value of an IQ point. Appendix I presents potential methods for quantifying 1) decreases in cases of attention deficit hyperactivity disorder (ADHD) based on reduced BLLs in children ages 8 to 15, and 2) avoided reductions in birth weight based on reduced maternal BLLs. These methods have not undergone extensive peer review and have therefore not been quantified or monetized as part of the primary benefits assessment of the final rule.

6.4.1 Methods for Estimating Blood Lead Levels in Children

Estimating benefits of the final LCRR in children requires estimates of BLLs from ages 0 to 7. Specifically, to estimate the effects of lead exposures on IQ, estimates of BLLs in each year of life and lifetime BLLs for each year of life from ages 0 to 7 are needed.

The Agency compiled available environmental lead concentration data across various media (i.e., soil, air, food, and water). The lead concentration estimates for soil, air, and food in this analysis are held constant in the blood lead modeling in order to represent background lead levels, with the only varying concentration being drinking water. In order to estimate the potential changes in BLLs that result from the LCRR requirements, EPA used several modeled/estimated drinking water lead concentration values associated with drinking water system scenarios that represent possible combinations of CCT and LSL status, as described in Section 6.3 above and Exhibit 6-12. The Stochastic Human Exposure and Dose Simulation (SHEDS)-Multimedia model, using environmental lead concentration data available across various media and modeled/estimated drinking water lead concentrations from the drinking water system scenarios, generated estimates of daily lead intakes (in µg/day), or exposures, from various environmental media for each year of life. Next, EPA used the estimated lead intakes/exposures from each environmental medium multiplied by applicable absorption factors (e.g., ingestion and inhalation) and summed them to estimate the total daily available lead uptake. Lastly, EPA derived regression equations from the Integrated Exposure Uptake Biokinetic (IEUBK) model and used them to relate total lead absorbed into the body to a set of BLLs representing the different CCT and LSL scenarios.

This section begins with an overview of the two models, followed by a detailed description of the methods for coupling the models.

6.4.1.1 *SHEDS-Multimedia Modeling*

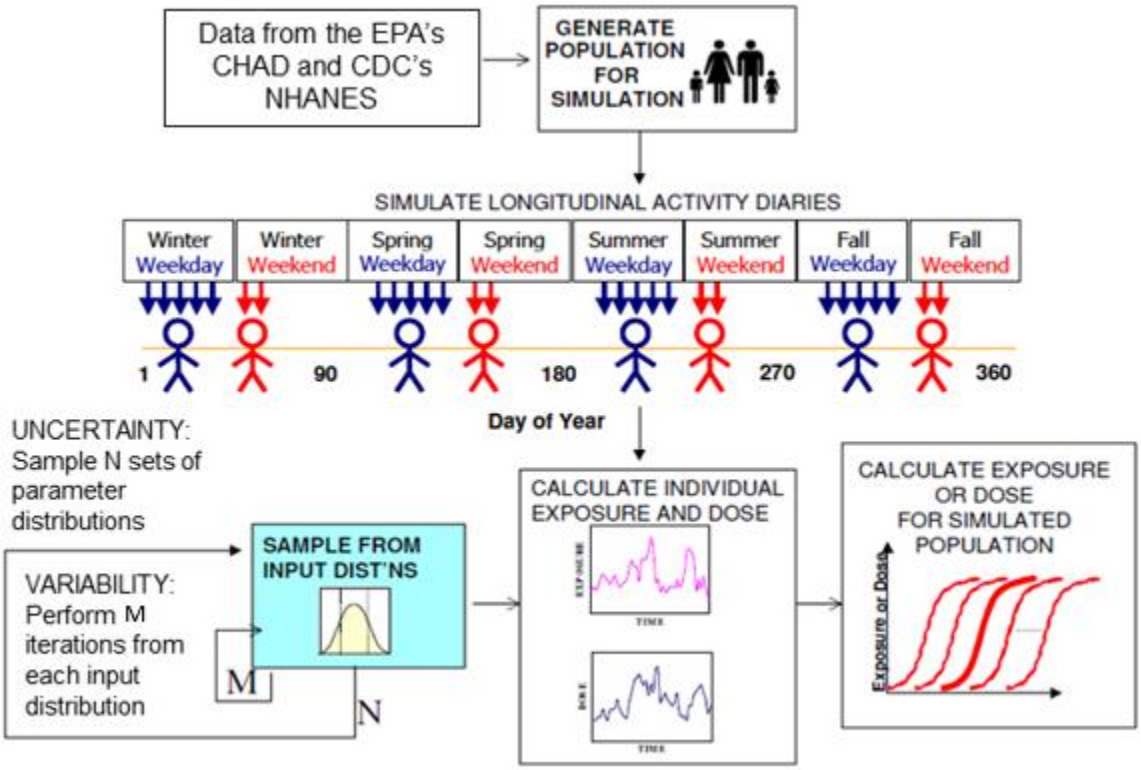
SHEDS-Multimedia is a probabilistic model that simulates aggregate (i.e., multimedia) and cumulative population exposures to chemicals over space and time based on realistic activity patterns,

concentration distributions, and exposure factors (Zartarian et al., 2006, 2012; Xue et al., 2010, 2012a, 2012b, 2014a, 2014b; Glen et al., 2012; USEPA, 2016).

The SHEDS-Multimedia model has undergone numerous peer reviews and has been well-validated for use in assessing exposures to diverse chemicals (USEPA, 2016). SHEDS-Multimedia provides exposure estimates as a result of both dietary and residential exposures, and it can be used to estimate these exposures by sex and age. SHEDS-Multimedia has the capability to assess exposures via ingestion, inhalation, and dermal pathways. However, dermal exposures are not considered in the current analysis because lead exposures through this pathway are assumed to be negligible.

Inputs to the model are the concentrations of the chemical(s) of interest in various media and human behavior data from EPA's Consolidated Human Activity Database (CHAD) and the Centers for Disease Control and Prevention's (CDC's) National Health and Nutrition Examination Survey (NHANES) (CDC, 2014). SHEDS-Multimedia first uses individual time-activity diaries from CDC's NHANES and EPA's CHAD for the specified population of interest to simulate longitudinal activity diaries. Information from these diaries is then combined with relevant input distributions (e.g., outdoor air lead concentrations, inhalation rates) to estimate exposure. For example, drinking water consumption values (see Section 6.4.1.3) were obtained from 2005 to 2012 NHANES. These values represent direct and indirect (e.g., tea, infant formula) consumption of public water system water but do not include bottled water. Within the SHEDS-Multimedia program, for any modeled individual on a given day, one person with drinking water information was randomly selected from the NHANES data pool based on similar socioeconomic characteristics (i.e., age, sex) and drinking water exposure was simulated. For detailed information on other default values in SHEDS-Multimedia, please refer to the technical guidance document for the model (Zartarian et al., 2008). Outputs of the model are distributions of exposures in the specified population(s) of interest. Exhibit 6-15 provides an overview of the SHEDS-Multimedia methodology.

Exhibit 6-15: Overview of SHEDS-Multimedia Methodology

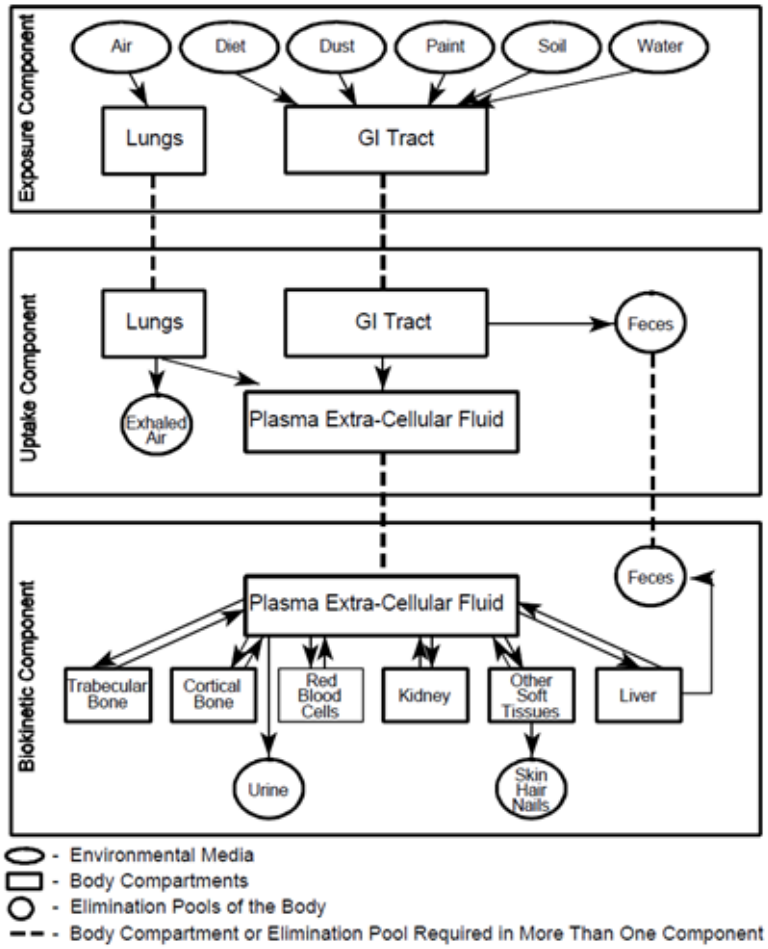


SHEDS-Multimedia has several strengths that make it a powerful tool to assess chemical exposures, such as the ability to consider correlated inputs (e.g., correlations between concentrations of contaminants in dust and soil); and the use of two-stage Monte Carlo sampling, which allows variability in population exposure and dose estimates, and uncertainty associated with different percentiles to be quantified.

6.4.1.2 *IEUBK Model*

The IEUBK model was developed as a simulation tool to predict BLLs in children from birth up to age 7 and thereby assist in the risk assessment of contaminated sites (USEPA, 1994). The model is intended to "enable rapid calculations and recalculations of an extremely complex set of equations that includes scores of exposure, uptake, and biokinetic parameters" (USEPA, 1994, p. 1-1). It provides an estimate of the BLL for a population of similarly exposed children associated with specified concentrations of lead in media (e.g., water, soil) in the child's environment (USEPA, 2007). In addition, the IEUBK model estimates the probability that a population of similarly exposed children with a given exposure scenario will have a BLL greater than a specified level. Users can modify inputs and assumptions within the model (e.g., concentrations of lead in environmental media, intake rates for environmental media) to explore the effects on children's BLLs. An overview of the model is presented in Exhibit 6-16.

Exhibit 6-16: Structure of the IEUBK Model for Lead in Children



GI = gastrointestinal.

Source: USEPA, 1994.

The IEUBK model uses four main components to mathematically and statistically link environmental lead exposure to children's BLLs: exposure, uptake, biokinetics, and variability (White et al., 1998). Exposures are quantified by combining information on the concentration of lead in environmental media, the amount of contact with the media (e.g., amount of drinking water ingested per day), and the duration of the contact (e.g., number of days) (White et al., 1998). The environmental media included in the IEUBK model are drinking water, soil, household dust, air, and food; exposure to leaded paint is assessed via its contribution to household dust and soil concentrations (White et al., 1998). The uptake component models the transfer of lead to the bloodstream (i.e., the absorption) after intake into the child's body via inhalation or ingestion routes. In the present analysis, EPA used information from the IEUBK model on uptake and biokinetics only, as further described below in the SHEDS-IEUBK coupling section.

6.4.1.3 *Background Lead Exposure Inputs into SHEDS*

Exhibit 6-17 to Exhibit 6-20 provide a summary of the main inputs for the SHEDS-IEUBK analyses, which were previously published in the supplemental material of Zartarian et al. (2017). The estimates for daily water consumption are used in conjunction with the set of drinking water system scenario modeled lead concentrations in Exhibit 6-12. The other levels, such as daily lead from food, dust, and soil are used as background and do not change across drinking water system scenarios. While the distributions are summarized in these tables, the full distribution of data (all the data points) are imputed into the SHEDS-Multimedia model, allowing for the full range of available data to be included in the modeling. BLLs are estimated for each drinking water system scenario modeled.

Exhibit 6-17: Summary of Daily Water Consumption Inputs for Drinking Water Consumption in SHEDS-IEUBK Coupling (Zartarian et al., 2017)

Daily Water Consumption (mL/day) NHANES[a] 2005–2012										
Age (years)	**Age (months)[b]**	**N**	**Mean**	**SD**	**50th Percentile**	**Geometric Mean**	**Geometric SD**	**75th Percentile**	**95th Percentile**	**99th Percentile**
06 months	0–6[c]	1,246	662	320	630	526	2.5	854	1,216	1,481
0	0–11[c]	2,618	581	349	532	410	3.0	806	1,172	1,489
1	12–23	1,792	247	247	219	151	3.3	306	690	1,148
2	24–35	1,948	300	312	251	176	3.4	360	909	1,424
3	36–47	1,272	316	313	257	193	3.1	398	917	1,640
4	48–59	1,358	320	333	261	197	3.2	404	874	1,434
5	60–71	1,196	364	366	303	213	3.5	447	1,037	1,802
6	72–83	1,306	377	353	332	228	3.5	480	1,067	1,601

Note: This exhibit summarizes drinking water consumption values that were used as inputs for the SHEDS-IEUBK analysis. These values were previously published in the supplemental material of Zartarian et al. (2017).
N = number of observations, and SD = standard deviation.
[a] The National Health and Nutrition Examination Survey (NHANES) is a program of studies designed to assess the health and nutritional status of adults and children in the United States. It provides nationally representative data on the United States population, including estimates of drinking water consumption.
[b] Age in months was added to clarify the age ranges listed in years.
[c] Water consumption for 0–11 months was used in the modeling for 6–11 month-old infants.

Exhibit 6-18: Summary of Daily Inputs for Dietary Lead Intake (µg/day) in SHEDS-IEUBK (Xue et al., 2010)

Age (years)	Age (months)[a]	N	Mean	SD	Median	Geometric Mean	Geometric SD	75th Percentile	95th Percentile	99th Percentile
06 months	0–6	1,072	0.7	0.98	0.3	0.27	4.75	0.91	2.71	3.47
1	12–23	2,226	2.58	1.84	2.17	2	2.16	3.41	5.83	7.63
2	24–35	1,788	3.44	2.03	3.06	2.85	1.94	4.49	7.23	8.46
3	36–47	1,160	3.54	2.06	3.18	2.98	1.89	4.63	7.26	8.43
4	48–59	1,240	3.57	2.16	3.18	3	1.87	4.55	7.25	8.63
5	60–71	1,066	3.85	2.18	3.43	3.31	1.77	4.83	7.86	9.52
6	72–83	1,086	3.8	2.02	3.51	3.29	1.76	4.84	7.55	8.3

Notes: This exhibit summarizes dietary lead intake values that were used as inputs for the SHEDS-IEUBK analysis. These values were previously published in the supplemental material of Zartarian et al. (2017).
N = number of observations, and SD = standard deviation.
Data sources: United States Food and Drug Administration's (FDA's) Total Diet Study (TDS) 2007–2013 and recipe mapping data from the Center for Food Safety and Applied Nutrition (CFSAN).
Method source: Xue et al., 2010. N=Number of Observations
[a] Age in months was added to clarify the age ranges listed in years. Data for 6–11 month-old infants not available.

Exhibit 6-19: Summary of Daily Inputs for Soil and Dust Lead Concentration (ppm) in SHEDS-IEUBK Coupling (Zartarian et al., 2017)

Media	House Age	N	Mean	SD	Median	Geometric Mean	Geometric SD	Fitted Log Mean	Fitted Log Mean SD	75th Percentile	95th Percentile	99th Percentile
Dust	Before 1950	223	207.7	238.2	113.3	133.9	2.47	4.89	0.88	238.6	706.6	1,108.9
Dust	After 1950	908	79	77.2	64.5	61.3	2	4.12	0.63	87.1	195.3	353.1
Soil	Before 1950	193	532.2	912.6	203.2	221.1	3.89	5.38	1.3	774.5	1,841.3	5,793.7
Soil	After 1950	749	63.7	202	19.2	23	3.37	3.18	1.05	39.9	207.7	933.3

Notes: This exhibit summarizes soil and dust lead concentration values that were used as inputs for the SHEDS-IEUBK analysis. These values were previously published in the supplemental material of Zartarian et al. (2017). Empirical distribution from the United States Department of Housing and Urban Development (HUD, 2011) American Healthy Homes Survey (AHHS) 2005–2006 data, http://portal.hud.gov/hudportal/documents/huddoc?id=AHHS_Report.pdf.
N = number of observations, and SD = standard deviation.

Exhibit 6-20: Summary of Daily Inputs for Soil/Dust Ingestion (mg/day) in SHEDS-IEUBK Coupling (Ozkaynak et al., 2011)

Age (years)	Age (months)[a]	Soil/Dust	Mean	SD	50th Percentile	Geometric Mean	Geometric SD	95th Percentile	97.5th Percentile	99th Percentile
1	12–23	mg total	43.9	54.8	27.8	26.6	2.8	135	188	262
2	24–35	mg total	45.2	58.8	25.8	25.9	3.0	146	201	276
3	36–47	mg total	51.7	64.2	31.1	28.9	3.2	168	220	304
4	48–59	mg total	57.8	75.5	34	31.6	3.2	197	268	364
5	60–71	mg total	62.6	79.8	37.9	34.4	3.2	204	270	380
6	72–83	mg total	54.3	76.1	30.4	29.2	3.2	183	252	357

Notes: This exhibit summarizes soil/dust ingestion values, which were used as inputs for the SHEDS-IEUBK analysis. These values were previously published in the supplemental material of Zartarian et al. (2017) and were originally developed in Ozkaynak et al. (2011).
Data for ages 0–11 months were unavailable.
[a] Age in months was added to clarify the age ranges listed in years. Data for 0–11 month-old infants not available. Inputs for 12–23 month-old infants were used for 0–11 month-old toddlers.
SD = standard deviation.

6.4.1.4 *Coupling of SHEDS-IEUBK*

To estimate changes in children's BLLs as a result of the rule, EPA first used SHEDS-Multimedia to generate probabilistic estimates of lead intakes from all routes of exposure for children aged 0 to 7. In the coupling methodology, SHEDS-Multimedia takes the place of the exposure and variability components of the IEUBK model by generating a probability distribution of lead intakes (µg/day).

The distributions of inputs from SHEDS are then converted to lead uptakes by multiplying by the route-specific (e.g., inhalation, ingestion) absorption fractions, thereby accounting for the uptake component of IEUBK. The absorption fractions are summarized in Exhibit 6-21 and are the default values in IEUBK.

Exhibit 6-21: Default Lead Absorption Fractions across Media Used in SHEDS-IEUBK Model Runs

Media	Absorption Fraction (%)
Soil	30
Dust	30
Water	50
Diet	50
Air	32

Note: This exhibit summarizes absorption fractions across media, which are the default IEUBK values.
Source: White et al. (1998).

Applying these absorption fractions results in distributions of lead uptake by exposure/media route, which can be summed across routes to give total lead uptake per day (µg/day). Next, EPA used age-based relationships derived from IEUBK to relate these lead uptakes (µg/day) to BLLs (µg/dL). Specifically, EPA developed regression equations between lead uptake and blood lead by running IEUBK with increasing amounts of lead intake. Since the relationship between lead uptake and blood lead in IEUBK is not perfectly linear, EPA used a polynomial regression to address the slight departures from linearity, which represent the non-linear binding of lead to red blood cells. Exhibit 6-22 shows age-specific regressions used to describe an age-dependent relationship relating lead uptake to blood lead. The coefficients pertain to a third-order polynomial regression of the form:

$$\text{Blood lead } (\mu g/dL) = \beta_0 + \beta_1 \text{ Uptake} + \beta_2 \text{ Uptake}^2 + \beta_3 \text{ Uptake}^3 + e \qquad \text{(Equation 6)}$$

Coefficients for the month that represents the midpoint of the age range of interest were used in the analyses.

Exhibit 6-22: Age-Specific Polynomial Regressions Equations for Approximating IEUBK (Zartarian et al., 2017)

IEUBK Age Interval (year)	Age (months)[a]	β_0	β_1	β_2	β_3
0.5–1	6–11	7.86E-03	5.47E-01	-1.31E-03	6.01E-6
1–2	12–23	-3.11E-04	4.47E-01	-6.37E-04	1.53E-6
2–3	24–35	1.23E-03	3.79E-01	-4.29E-04	8.45E-7
3–4	36–47	6.58E-04	3.55E-01	-3.71E-04	6.24E-7
4–5	48–59	6.36E-04	3.36E-01	-3.38E-04	5.44E-7
5–6	60–71	1.65E-03	3.13E-01	-2.78E-04	3.57E-7
6–7	72–83	1.32E-04	2.88E-01	-2.30E-04	3.08E-7

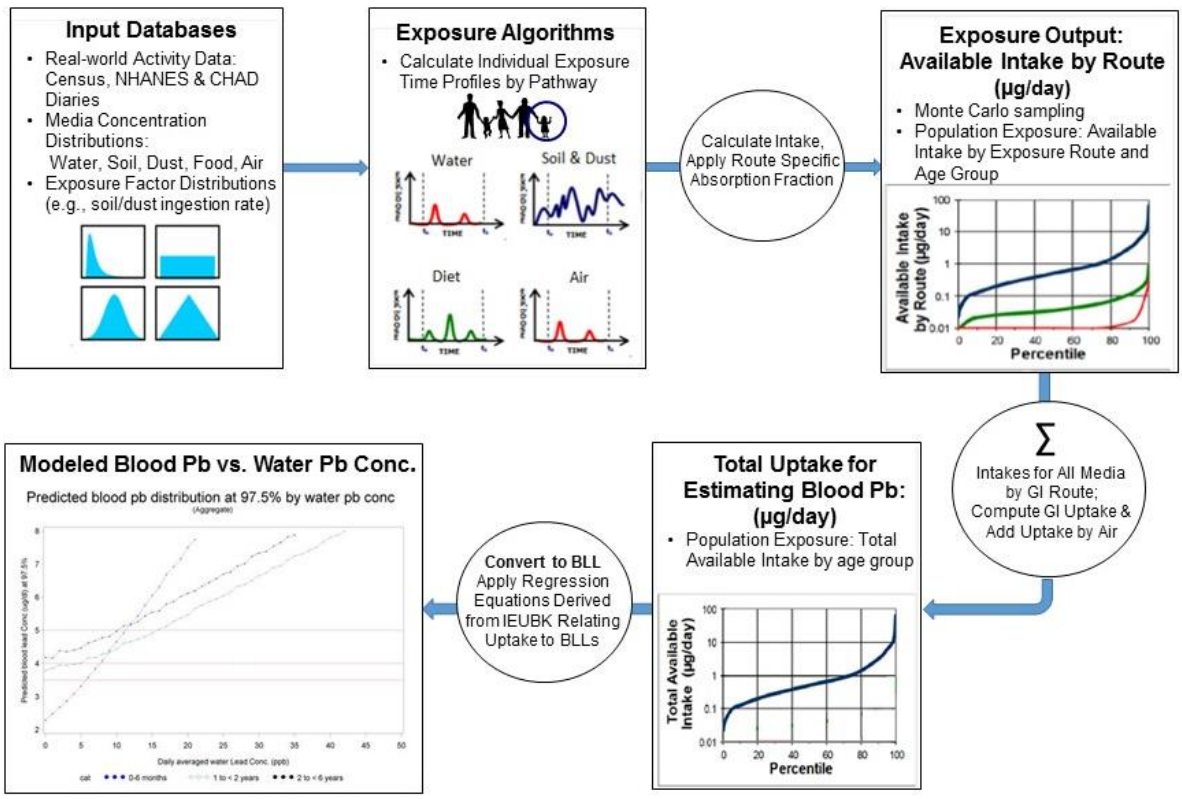
Notes: $R^2 > 0.995$. This exhibit summarizes the coefficients used for age-specific IEUBK modeling to predict BLLs.

[a] Age in months was added for consistency across input tables.

In its basic coupled form, SHEDS-IEUBK only represents exposure variability and does not consider biological variability associated with inter-individual differences in the relationship between lead exposure and blood lead. Uncoupled IEUBK applies a geometric SD of 1.6 to outputs to account for biological variability and measurement error, but because the IEUBK component of SHEDS-IEUBK has been reduced to deterministic regression equations, we are unable to apply this geometric SD to account for biological variability in our outputs. To account for this biological variability, EPA applied a biological variance correction factor of 0.185 for 1- to < 2-year-olds and 0.176 for 2- to < 7-year-olds to the predicted blood lead variance estimated by the SHEDS-IEUBK model. Additional details about the calculation of these biological variance correction factors can be found in Zartarian et al. (2017).

Exhibit 6-23 summarizes the SHEDS-IEUBK coupling method, which EPA used to develop distributions of BLLs for each scenario of exposure to lead in drinking water under the LCRR.

Exhibit 6-23: Summary of SHEDS-IEUBK Coupling



Estimates generated using the SHEDS-IEUBK coupling method were compared to BLL estimates reported from NHANES (2013–2014) and from the National Human Exposure Assessment Survey (NHEXAS) in Zartarian et al. (2017); and were shown to closely estimate these BLLs. For further information on SHEDS-IEUBK model development and evaluation, refer to Zartarian et al.'s (2017) paper, "Children's Lead Exposure: A Multimedia Modeling Analysis to Guide Public Health Decision-Making."

6.4.2 Estimates of Pre- and Post-Rule Blood Lead Levels in Children

Exhibit 6-24 presents modeled SHEDS-IEUBK geometric mean BLLs in children by year of life. The BLLs in this exhibit represent what children's BLLs would be if they lived under the corresponding drinking water system scenario for their entire lives from birth to age 7. These BLLs are used as inputs for the representative children in each corresponding PWS for the benefits modeling, and do not represent weighted population estimates. In the SafeWater LCR model analyses of benefits, EPA estimated lifetime BLLs from these values by taking the average of the BLLs for each year of the child's life, up to age 7, based on their drinking water system scenario status during each year. The age at implementation of the rule was taken into account when calculating lifetime average BLLs. If, for example, the child is age 3 at implementation of the rule, EPA would calculate lifetime average BLLs by averaging 3 years of pre-rule BLLs and 4 years of post-rule BLLs. Or, if the child is age 5 at implementation of the rule, EPA would calculate lifetime average BLLs by averaging 5 years of pre-rule BLLs and 2 years of post-rule BLLs. The column labeled "Average" contains calculated average lifetime BLLs, assuming a child lived in the corresponding LSL/CCT scenario for their entire life.

Exhibit 6-24: Modeled SHEDS-IEUBK Geometric Mean Blood Lead Levels in Children for Each Possible Drinking Water Lead Exposure Scenario for Each Year of Life

LSL Status	CCT Status	Geometric Mean Blood Lead Level (µg/dL)[a] for Specified Year of Life							
		0–1[b]	1–2	2–3	3–4	4–5	5–6	6–7	Average[c]
LSL	None	3.61	2.47	2.65	2.47	2.48	2.66	2.34	2.67
Partial	None	2.35	1.83	1.88	1.81	1.81	1.88	1.65	1.89
No LSL	None	0.97	1.14	1.18	1.15	1.14	1.19	0.98	1.11
LSL	Partial	2.57	1.93	2.05	1.95	1.94	2.03	1.76	2.03
Partial	Partial	1.72	1.52	1.57	1.54	1.51	1.58	1.37	1.54
No LSL	Partial	0.97	1.14	1.18	1.15	1.14	1.19	0.98	1.11
LSL	Representative	1.85	1.57	1.64	1.60	1.57	1.63	1.43	1.62
Partial	Representative	1.36	1.33	1.36	1.34	1.32	1.37	1.19	1.32
No LSL	Representative	0.97	1.14	1.18	1.15	1.14	1.19	0.98	1.11
POU		0.97	1.14	1.18	1.15	1.14	1.19	0.98	1.11

Notes: This table presents modeled SHEDS-IEUBK BLLs in children by year of life and lifetime average.
[a] The geometric mean BLLs are used to represent the BLL for a child living with the LSL/CCT status in the first two columns of the exhibit. The BLL for each year of age corresponding to a representative child is summed and divided by seven in the model to estimate the lifetime average BLL.
[b] Due to lack of available data, BLLs for the first year of life are based on regression from IEUBK for 0.5- to 1-year-olds only.
[c] This column contains calculated average lifetime BLLs, assuming a representative child lived in the corresponding LSL/CCT scenario for their entire life.

6.4.3 Concentration-Response Functions for Lead and Changes in IQ

To estimate avoided IQ loss in children, EPA selected a concentration-response function from a study by Crump et al. (2013). This study used data from a 2005 paper by Lanphear et al. (2005) that has formed the basis of concentration-response functions used in several regulations. EPA explored the choice of two additional IQ functions in the sensitivity analysis presented in Appendix G, both using the corrected

Lanphear et al. (2005) function,[133] as reported in Kirrane and Patel (2014): one with a low-dose linearization and the other without a low-dose linearization.

This section provides an overview of these two key studies, as well as the rationale for selection of the concentration-response function from Crump et al. (2013). Additional details of Crump et al. (2013) and Lanphear et al. erratum (2019) can be found in Appendix J, which provides more in-depth summaries of the key studies used in the concentration-response functions for the benefits analysis, as well as the Kirrane and Patel (2014) correction to the Lanphear et al. (2005) results.

Lanphear et al. erratum (2019) conducted a pooled analysis of seven international cohort studies that investigated the relationship between BLLs and full-scale IQ (the composite of verbal and performance IQ scores) in children 5–10 years old. The pooled study sample comprised 1,333 children, with a lifetime average BLL of 12.4 µg/dL. All the children underwent IQ testing with the Wechsler Intelligence Scale for Children. The mean IQ in the study sample was approximately 93 points. Associations between IQ and four different measures of BLLs in children were examined: concurrent (measurement obtained closest to the IQ test), maximum (peak value at any time before the IQ test), early (mean BLL from 6 to 24 months of age), and lifetime (mean BLL from 6 months of age to concurrent). For each of these measures, Lanphear et al. erratum (2019) estimated the relationship between BLLs and IQ by constructing an adjusted log-linear model.

Results of the Lanphear et al. erratum (2019) study showed that all blood lead measures were significantly associated with IQ loss, and were highly correlated with one another. Based on the R^2 values for each regression model (data not presented in the paper), Lanphear et al. erratum (2019) determined that concurrent BLLs were the strongest predictors of IQ, followed by lifetime average BLLs. Changes in IQ associated with changes in BLLs were estimated using Equation 7 below.

$$IQ\ Loss = \beta \times \ln\left(\frac{PbB_1}{PbB_2}\right) \qquad \text{(Equation 7)}$$

Where:

β	=	Beta estimate from Lanphear et al. (2005)
PbB_1	=	Pre-rule BLL
PbB_2	=	Post-rule BLL

Exhibit 6-25 shows the beta estimates for the log-linear associations between each of the blood lead measures examined in Lanphear et al. erratum (2019). The estimated decreases in IQ associated with increases in concurrent BLLs from 2.4 to 10 µg/dL, 10 to 20 µg/dL, and 20 to 30 µg/dL were 3.8, 1.8, and 1.1 points, respectively. Consistent with the log-linear model, IQ deficits were greater at lower levels of lead exposures.

In their 2013 paper, Crump et al. had two aims: 1) to perform a reanalysis of the methods in Lanphear et al. (2005), and 2) to conduct an independent analysis of the data from Lanphear et al. (2005). In the reanalysis, Crump et al. (2013) identified a few minor errors in the original Lanphear et al. (2005) paper. The correction of these minor errors resulted in slight changes to the regression coefficients but did not

[133] Lanphear et al. (2005) was a widely cited paper on the relationship between BLLs and IQ in children. Crump et al. (2013) and Kirrane and Patel (2014) noted minor errors in the analysis, which Lanphear et al. corrected and published in their erratum, which we cite in the remainder of this chapter as Lanphear et al. erratum (2019).

affect the main conclusions of the paper. These errors were confirmed by EPA in a reanalysis by Kirrane and Patel (2014), which also reaffirmed that the main conclusions of Lanphear et al. (2005) remained unchanged, and Lanphear et al. erratum (2019) confirmed this in an *Erratum* of the original study. Kirrane and Patel (2014) additionally found that the early childhood blood lead measure had the highest R^2 value, though all R^2 values were similar.

In their independent analysis, Crump et al. (2013) made changes to the dataset used for final analysis (e.g., in selecting IQ measurements and defining blood lead measurements). Additionally, the authors opted to add 1 to BLLs before log-transformation so that IQ loss was equal to 0 when BLL was 0, as shown in Equation 8.

$$IQ\ Loss = \beta \times \ln\left(\frac{PbB_1 + 1}{PbB_2 + 1}\right) \qquad \text{(Equation 4)}$$

Where:

β	=	Beta estimate from Crump et al. (2013) independent analysis
PbB_1	=	Pre-rule BLL
PbB_2	=	Post-rule BLL

Exhibit 6-25 displays the regression coefficients and R^2 values for the Lanphear et al. erratum (2019), the Crump et al. (2013) and Kirrane and Patel (2014) reanalysis of Lanphear et al. (2005), and the Crump et al. (2013) independent analysis.

Exhibit 6-25: Comparison of Adjusted Coefficients from Lanphear et al. Erratum (2019) with Those Obtained in the Kirrane and Patel (2014) Reanalysis and Independent Analysis of Lanphear et al. (2005) by Crump et al. (2013)

BLL Variable	Kirrane and Patel (2014)		Lanphear et al. Erratum (2019)		Crump et al. (2013) Reanalysis ln(BLL)		Crump et al. (2013) Independent Analysis ln(BLL + 1)	
	β (95% CI)	R^2	β (95% CI)	R^{2a}	β (95% CI)	R^2	β (95% CI)	R^2
Early	-2.21 (-3.38, -1.04)	0.643	-2.21 (-3.38, -1.04)	n/a	-2.21 (-3.38, -1.03)	0.643	-2.46 (-3.82, -1.10)	0.659
Peak	-2.86 (-4.10, -1.61)	0.640	-2.86 (-4.10, -1.61)	n/a	-2.86 (-4.10, -1.61)	0.640	-2.48 (-3.83, -1.14)	0.656
Lifetime	-3.14 (-4.39, -1.88)	0.641	-3.25 (-4.51, -1.99)	n/a	-3.19 (-4.45, -1.94)	0.641	-3.25 (-4.66, -1.83)	0.659
Concurrent	-2.65 (-3.69, -1.61)	0.641	-2.65 (-3.69, -1.61)	n/a	-2.65 (-3.69, -1.61)	0.641	-3.32 (-4.55, -2.08)	0.658

Notes: This table displays regression coefficients and R^2 values for the Lanphear et al. erratum (2019) analysis, the Crump et al. (2013) and Kirrane and Patel (2014) reanalysis of Lanphear et al. (2005), and the Crump et al. (2013) independent analysis of Lanphear et al. (2005). This table summarizes the relationship between BLL and IQ loss across various blood lead metrics.
Sources: Crump et al. (2013, Table 2 and Table 5), Kirrane and Patel (2014, Table 1), Lanphear et al. erratum (2019, Table 4).
[a] R^2 not reported in Lanphear et al. erratum (2019); however, the paper reported that the concurrent BLL was the largest R^2.

As can be seen in Exhibit 6-25, the R^2 values are all similar: the strength of the relationship between BLLs and IQ loss appears to be similar regardless of the blood lead metric used. Because lifetime average BLLs are more reflective of the long-term changes in lead exposure anticipated under the LCRR, EPA chose to

model the benefits based on lifetime BLLs rather than concurrent BLLs. Lifetime BLLs also reflect varied BLLs over the representative child's life in the benefits analysis.

To estimate the benefits of the LCRR, EPA used the concentration-response function based on lifetime BLLs from the independent analysis by Crump et al. (2013) in the main analysis. EPA selected this function over the Lanphear et al. (2005) reanalysis reported in Kirrane and Patel (2014) and confirmed in the Lanphear et al. erratum (2019). This function was selected to minimize issues with overestimating predicted IQ loss at the lowest levels of lead exposure (less than 1 µg/dL), which is a result of the use of the log-linear function (the log of zero is undefined). The Crump et al. (2013) function avoids this issue by adding 1 to the estimated BLLs before log-transformation. Since the LCRR is expected to reduce chronic exposures to lead, EPA selected lifetime BLLs as the most appropriate measure with which to evaluate benefits. No threshold has been identified for the neurological effects of lead (Schwartz and Otto, 1991; Budtz-Jørgensen et al., 2013; Crump et al., 2013; USEPA, 2013). Therefore, EPA assumes that there is no threshold for this endpoint and quantified avoided IQ loss associated with all BLLs (Schwartz and Otto, 1991; Budtz-Jørgensen et al., 2013; Crump et al., 2013; USEPA, 2013). Budtz-Jørgensen et al. (2013), as well as the smaller cohort study of Min et al. (2009), used more recent BLLs than those used in the Crump and Lanphear analyses, and confirmed the results in Crump et al. (2013) and Lanphear et al. erratum (2019). Additionally, in Min et al. (2009), the steeper slopes at lower BLLs without log-transformation show increased deficits, which provides additional evidence that reducing lead levels in the lower range of average BLLs has a significant impact on preventing IQ loss.

EPA explored the choice of two additional IQ functions in the sensitivity analyses, which were based on Lanphear et al. erratum (2019), and similar to those from the quantitative risk assessment in support of the 2008 review of the United States National Ambient Air Quality Standards (NAAQS) for lead (USEPA, 2007). These functions and alternative benefits calculations are presented in Appendix G.

Exhibit 6-26 displays the avoided IQ loss per representative child associated with BLLs at the geometric mean, the 25th percentile, and the 75th percentile. This calculation assumes the representative child spends their lifetime from birth to age 7 either in the pre-rule water conditions or the post-rule water conditions in the same row. Observe that when "No LSL" is the beginning or post-rule state, 0.82 µg/L is the assumed concentration across all levels of CCT status (i.e., none, partial, representative). The extent to which changes in CCT status make a meaningful difference in lead concentrations for those without LSL cannot be determined from this exhibit.

Exhibit 6-26: Avoided IQ Loss per Child Associated with the Concentration-Response Function from Crump et al. (2013) and Additional Blood Lead Estimates

Pre-Rule Drinking Water			Post-Rule Drinking Water			Avoided IQ Loss per Child Associated with Specified BLL Change		
Lead Conc. (µg/L)	LSL Status	CCT Status	Lead Conc. (µg/L)	LSL Status	CCT Status	Geometric Mean	25th Percentile	75th Percentile
18.08	LSL	None	0.82	No LSL	None	1.80	1.36	2.40
18.08	LSL	None	5.48	LSL	Representative	1.10	0.83	1.45
18.08	LSL	None	0.82	No LSL	Representative	1.80	1.36	2.40
18.08	LSL	None	0.82	POU		1.80	1.36	2.40
8.43	Partial	None	0.82	No LSL	None	1.02	0.77	1.37

Pre-Rule Drinking Water			Post-Rule Drinking Water			Avoided IQ Loss per Child Associated with Specified BLL Change		
8.43	Partial	None	2.64	Partial	Representative	0.70	0.51	0.97
8.43	Partial	None	0.82	No LSL	Representative	1.02	0.77	1.37
8.43	Partial	None	0.82	POU		1.02	0.77	1.37
0.82	No LSL	None	0.82	No LSL	Representative	0.00	0.00	0.00
0.82	No LSL	None	0.82	POU		0.00	0.00	0.00
9.92	LSL	Partial	0.82	No LSL	Partial	1.18	0.88	1.61
9.92	LSL	Partial	5.48	LSL	Representative	0.48	0.35	0.66
9.92	LSL	Partial	0.82	No LSL	Representative	1.18	0.88	1.61
9.92	LSL	Partial	0.82	POU		1.18	0.88	1.61
4.72	Partial	Partial	0.82	No LSL	Partial	0.61	0.46	0.81
4.72	Partial	Partial	2.64	Partial	Representative	0.29	0.20	0.41
4.72	Partial	Partial	0.82	No LSL	Representative	0.61	0.46	0.81
4.72	Partial	Partial	0.82	POU		0.61	0.46	0.81
0.82	No LSL	Partial	0.82	No LSL	Representative	0.00	0.00	0.00
0.82	No LSL	Partial	0.82	POU		0.00	0.00	0.00
5.48	LSL	Representative	0.82	No LSL	Representative	0.70	0.54	0.95
5.48	LSL	Representative	0.82	POU		0.70	0.54	0.95
2.64	Partial	Representative	0.82	No LSL	Representative	0.32	0.26	0.40
2.64	Partial	Representative	0.82	POU		0.32	0.26	0.40
0.82	No LSL	Representative	0.82	POU		0.00	0.00	0.00

Note: This exhibit displays the avoided IQ loss per representative child associated with BLLs at the geometric mean, the 25th percentile, and the 75th percentile. It assumes the representative child spends their entire life in either the pre-rule or the post-rule drinking water concentration in the row. These calculations use the BLLs summarized in Exhibit 6-24.

6.4.4 Valuation of Avoided IQ Loss

The value of an IQ point is derived from EPA's reanalysis of Salkever (1995), which estimates that a one-point change in IQ results in a mean 1.9 percent change in lifetime earnings for males and a mean 3.4 percent change in lifetime earnings for females. Lifetime earnings are estimated using the average of 10 American Community Survey (ACS) single-year samples (2008 to 2017) and projected cohort life tables from the Social Security Administration. Projected increases in lifetime earnings are then adjusted for direct costs of additional years of education and forgone earnings while in school. The reanalysis of Salkever (1995) estimates a mean change of 0.08 years of schooling per change in IQ point resulting from a reduction in lead exposure for males and a mean change of 0.09 years of schooling for females.

To estimate the uncertainty underlying the model parameters of the Salkever (1995) reanalysis, EPA used a bootstrap approach to estimate a distribution of model parameters over 10,000 replicates (using random sampling with replacement). For each replicate, the net monetized value of a one-point change in IQ is subsequently estimated as the gross value of an IQ point, less the value of additional education costs and lost earnings while in school.

Based on the mean value of the 10,000 sampling iterations, EPA estimated that the change in one IQ point to be discounted to age 7 is $5,708 using a 7 percent discount rate and $22,503 using a 3 percent discount rate.[134] These are presented in 2016$ to be consistent with the cost estimates. As described in Section 6.4.5, benefits are further discounted back to year one of the analysis and annualized within the SafeWater LCR model. An additional discussion of the literature on the value of an IQ point, as well as details of the methods used in the EPA reanalysis of the value of the IQ point, are included in Appendix K. EPA will continue to review the economics literature and evaluate new data and methods that could result in improved estimates and a better understanding of the uncertainties surrounding the estimated effect of changes in IQ on lifetime earnings.

6.4.5 Implementation of Children's Benefit Calculations in the SafeWater LCR model

IQ benefits are estimated based on LSLRs, installation of POU devices, and installation and re-optimization of CCT that occur over the 35-year analysis period. As benefits are captured in the analysis when children turn 7 years of age, it is necessary to estimate the number of 7-year-olds who are served by each PWS receiving a benefit from a change in the lead concentration of their drinking water. In order to estimate the number of 7-year-olds receiving a benefit in a given year, the SafeWater LCR model takes the total population experiencing each water lead change, and multiplies that figure by the proportion of the United States population that is 7 years of age.

Because the SafeWater LCR model follows the population for a period of 35 years, all children who lived in areas experiencing the water lead concentration change who are younger than 7 years of age would also accrue benefits in future years of the 35-year period, as well as children born after the change in lead concentration as long as they reach the age of 7 during the course of the 35-year period. However, the proportion of the total PWS population experiencing a change in lead concentration that receives an IQ benefit in a given year remains the same: approximately 1.34 percent (the percentage of 7-year-olds in the total United States population according to the 2010 United States Census). This is because both the age distribution and the population served by each PWS are assumed to remain constant over the analysis period. Children who turn 7 a year after a LSL change is made will receive a comparatively smaller benefit than children who are born after the change was made, due to living a larger proportion of their life without the higher contribution of lead in their drinking water, and the resulting difference in BLLs between the with- and without-rule scenarios (without considering discounting). EPA refers to these comparatively smaller benefits as "partial benefits."

EPA does not assume that all homes with replaced LSLs have children living in the home. Rather, EPA assumes that the proportion of 7-year-olds living in homes that are undergoing a LSLR is equal to the proportion of the United States population that is 7 years old. This assumption takes care of the need to

[134] It should be noted that these values are slightly different than those used in other recent rulemakings (e.g., the Lead Dust Standard and the Proposed National Primary Drinking Water Regulations (NPDWR) for Perchlorate). This is simply due to the differences in the age of the child when the benefits are assumed to accrue in the analysis, as well as the year of constant dollars to which the value of an IQ point is inflated. Benefits for the LCRR are assumed to accrue at age 7, and therefore the value of an IQ point is discounted back to age 7 in the LCRR analysis. This results in a slightly higher estimate than the values used for the Lead Dust Standard, which are discounted to age 3. It should also be noted, and is described in Section 6.4.5, that the benefits in the LCRR are further discounted back to year one of the analysis and annualized within the SafeWater LCR model. Therefore, age of the child when IQ benefits are accrued in the analysis has no effect on the total benefits estimate from the LCRR.

model the movement of children in and out of homes in the community, as the proportion of the population in these age groups is assumed to remain constant. In other words, if there are 1,000 households being served by a PWS that underwent a change in lead concentration, approximately 1.34 percent of the population in those households would accrue benefit annually, regardless of which specific home being served by the PWS they lived in. The accrued benefit for those children who are served by a PWS that has undergone a change is then a function of changes in the average lifetime BLL of the children due to the change in lead concentration, and the subsequent avoided IQ loss.

The modeling assumption that 1.34 percent of an affected water system's population is made up of 7-year-olds in each year of the analysis and that these children are evenly distributed across LSL and non-LSL households is necessary to estimate the national level impacts of the LCRR rule requirements. At the national level, total benefits calculated using these assumptions can be accurate, however, please note that the potential geographic variability in the impacted population of children will not be represented in this national scale model. For example, some geographic areas of the country may have higher percentages of young children, receiving greater benefits from implementing lead concentration reducing actions like CCT and LSLR. This national scale model does not capture the potential local variation in the estimated unit benefits for a given unit of cost at the local level.

Generally speaking, benefits in a given analysis year are calculated by the SafeWater LCR model using the inputs described earlier in this chapter in the following manner:

1. LSLR, POU device installations, and CCT upgrades are recorded based on the rule option for the current analysis year.
2. All people who are served by each PWS are assigned a water lead level based on the current state of their PWS.
3. A without-rule lifetime average BLL is calculated for a representative 7-year-old child in each PWS water lead scenario modeled in a given analysis year. This without-rule lifetime average BLL assumes a BLL resulting from the water lead levels in the PWS if the rule had not been implemented. This lifetime average is calculated as the sum of the child's annual concurrent BLLs divided by the 7 years of life. Since this without-rule lifetime average BLL assumes this analysis year's rule implementation changes have not occurred, the without-rule blood lead average is equal to the BLL associated with the current state of water lead in the PWS.
4. A with-rule lifetime average BLL is calculated for a representative 7-year-old child in each PWS water lead scenario that is modeled in the current analysis year. The with-rule lifetime average considers the water lead levels of the past 7 years of life with the rule. Again, this lifetime average is calculated as the sum of annual concurrent BLLs from Exhibit 6-24 divided by the 7 years of life, but is based on the new water lead levels that occurred due to the rule. Note that the years during the 7-year timeframe that were prior to any water lead changes resulting from the rule's implementation will have equivalent BLLs to the without-rule scenario. So, for this current analysis year, only the 7th year of the 7 years of BLLs incorporated into the lifetime blood lead average calculation will reflect the new water lead concentration.
5. These estimated average BLLs from steps 3 and 4 are used with Equation 8 in Section 6.4.3 to estimate the avoided IQ loss due to the rule for a representative 7-year-old child in each particular implementation scenario.

6. The number of current 7-year-olds who experience avoided IQ loss based on each of the changes made in the analysis year is then calculated by multiplying the total number of people from each PWS by both the proportion of the United States population that is 7 years of age and the proportion of people in each PWS experiencing each particular change.
7. Each population of children 7 years of age for each PWS change is then multiplied by the avoided IQ loss calculated by Equation 8 to determine the total number of lost IQ points avoided in this current analysis year based on this year's changes.
8. The total number of lost IQ points avoided in this current analysis year for all 7-year-olds based on this year's changes is then multiplied by the appropriately discounted value of an IQ point. This yields the total monetary benefit for the current analysis year for all changes that occurred in that analysis year. These estimated current year benefits are only considered partial benefits, as the current analysis year's 7-year-olds have only received a reduction in blood lead for this one year of their life. However, benefits are *only* realized in the year when a child is 7 years of age.
9. EPA then calculates all future avoided IQ loss benefits through the end of the 35-year period that are associated with each PWS water lead change from this current analysis year using discounted values of an IQ point. The number of children 7 years of age affected by the current analysis year water lead changes in each PWS is assumed to remain constant for each future year of benefits. Partial benefits are calculated for children who were born before the year the water lead change occurred but were younger than age 7, and full benefits are calculated for all children age 0 in the current year of the analysis and all future children who are to be born and reach age 7 during the course of the period of analysis, as they will have lived their full lives with reduced BLLs due to the rule.
10. All current and future avoided IQ loss benefits are summed to obtain the total benefits realized for the current analysis year's water lead changes due to the rule.
11. This is repeated for each of the remaining analysis years.

Total benefits over the 35-year period are calculated by summing all the total benefits realized for all water lead changes that occur over the entire period of analysis.

The value of an IQ point presented in Section 6.4.4 is discounted to age 7 at both a 3 percent and 7 percent rate. Benefits are further discounted back to year one of the analysis and annualized within the SafeWater LCR model. This means that benefits that are accrued for 7-year-olds in year 25 of the analysis (e.g., the relevant discount rate is applied for each of the 24 years that have passed since year one of the analysis). EPA summed benefits for all years and all PWSs, and then annualized benefits for both the baseline and final rule scenarios.

Appendix G presents alternative blood lead estimates for children, alternative concentration-response functions for the relationship between lead and IQ, and an analysis with an alternative value of an IQ point.

6.4.6 Monetized National Annual Children's Benefits

The national annual children's benefits for a 3 percent and 7 percent discount rate are presented in Exhibit 6-27 and Exhibit 6-28, respectively. As described in Section 6.3, EPA estimated benefits under both the low- and high-cost scenarios used in the LCRR analysis to characterize uncertainty in the cost estimates.

Exhibit 6-27: National Annual Children's Benefits, All PWS, 3 Percent Discount Rate (2016$)

	Low-Cost Estimate			High-Cost Estimate		
	Previous LCR	**Final LCRR**	**Incremental**	**Previous LCR**	**Final LCRR**	**Incremental**
Number of Children Impacted (over 35 years)	29,000	928,000	900,000	704,000	3,210,000	2,506,000
Annual IQ Point Decrement Avoided (CCT due to ALE)	190	3,225	3,035	5,228	18,000	12,000
Annual Value of IQ Impacts Avoided (CCT due to ALE)	$3,344,000	$56,083,000	$52,739,000	$96,449,000	$318,322,000	$221,873,000
Annual IQ Point Decrement Avoided (CCT due to TLE)	0	3,680	3,680	0	10,000	10,000
Annual Value of IQ Impacts Avoided (CCT due to TLE)	$0	$64,736,000	$64,736,000	$0	$190,822,000	$190,822,000
Annual IQ Point Decrement Avoided (LSLR – mandatory)	128	2,620	2,492	3,106	8,204	5,097
Annual Value of IQ Impacts Avoided (LSLR – mandatory)	$2,375,000	$47,525,000	$45,150,000	$61,497,000	$156,772,000	$95,275,000
Annual IQ Point Decrement Avoided (LSLR – goal-based)	0	1,807	1,807	0	3,337	3,337
Annual Value of IQ Impacts Avoided (LSLR – goal-based)	$0	$32,855,000	$32,855,000	$0	$63,610,000	$63,610,000
Annual IQ Point Decrement Avoided (LSLR – customer initiated)	0	1,572	1,572	0	1,677	1,677

	Low-Cost Estimate			High-Cost Estimate		
	Previous LCR	**Final LCRR**	**Incremental**	**Previous LCR**	**Final LCRR**	**Incremental**
Annual Value of IQ Impacts Avoided (LSLR – customer initiated)	$0	$27,540,000	$27,540,000	$0	$29,198,000	$29,198,000
Annual IQ Point Decrement Avoided (POU)	0	17	17	0	2,214	2,214
Annual Value of IQ Impacts Avoided (POU)	$0	$324,000	$324,000	$0	$44,498,000	$44,498,000
Total Annual Benefits	**$5,719,000**	**$229,062,000**	**$223,344,000**	**$157,946,000**	**$803,222,000**	**$645,276,000**

Acronyms: ALE = action level exceedance, TLE = trigger level exceedance.
Note: This exhibit summarizes the national annual children's benefit for a 3 percent discount rate under the low- and high-cost scenarios. This table uses a 3 percent discount rate over the 35-year analysis period. Representative children are modeled throughout their lifetime, and their drinking water concentration and BLL can change in each year of the analysis as CCT, POU, or LSL changes happen in their modeled PWS. Detail may not add exactly to total due to independent rounding.

Exhibit 6-28: National Annual Children's Benefits, All PWS, 7 Percent Discount Rate (2016$)

	Low-Cost Estimate			High-Cost Estimate		
	Previous LCR	**Final LCRR**	**Incremental**	**Previous LCR**	**Final LCRR**	**Incremental**
Number of Children Impacted (over 35 years)	29,000	928,000	900,000	704,000	3,210,000	2,506,000
Annual IQ Point Decrement Avoided (CCT Due to ALE)	190	3,225	3,035	5,228	18,000	12,000
Annual Value of IQ Impacts Avoided (CCT Due to ALE)	$581,000	$9,551,000	$8,971,000	$17,790,000	$57,148,000	$39,358,000
Annual IQ Point Decrement Avoided (CCT Due to TLE)	0	3,680	3,680	0	10,000	10,000
Annual Value of IQ Impacts Avoided (CCT Due to TLE)	$0	$11,232,000	$11,232,000	$0	$34,750,000	$34,750,000
Annual IQ Point Decrement Avoided (LSLR – Mandatory)	128	2,620	2,492	3,106	8,204	5,097

	Low-Cost Estimate			High-Cost Estimate		
	Previous LCR	**Final LCRR**	**Incremental**	**Previous LCR**	**Final LCRR**	**Incremental**
Annual Value of IQ Impacts Avoided (LSLR-Mandatory)	$451,000	$8,703,000	$8,252,000	$12,707,000	$30,776,000	$18,069,000
Annual IQ Point Decrement Avoided (LSLR – Goal Based)	0	1,807	1,807	0	3,337	3,337
Annual Value of IQ Impacts Avoided (LSLR-Goal Based)	$0	$6,039,000	$6,039,000	$0	$12,469,000	$12,469,000
Annual IQ Point Decrement Avoided (LSLR – customer initiated)	0	1,572	1,572	0	1,677	1,677
Annual Value of IQ Impacts Avoided (LSLR-customer initiated)	$0	$4,797,000	$4,797,000	$0	$5,038,000	$5,038,000
Annual IQ Point Decrement Avoided (POU)	0	17	17	0	2,214	2,214
Annual Value of IQ Impacts Avoided (POU)	$0	$62,000	$62,000	$0	$9,417,000	$9,417,000
Total Annual Benefits	**$1,032,000**	**$40,385,000**	**$39,353,000**	**$30,497,000**	**$149,599,000**	**$119,102,000**

Note: This exhibit summarizes the national annual children's benefit for a 7 percent discount rate under the low- and high-cost scenarios. It uses a 7 percent discount rate over the 35-year analysis period. Representative children are modeled throughout their lifetime, and their drinking water concentration and BLL can change in each year of the analysis as CCT, POU, or LSL changes happen in their modeled PWS. Detail may not add exactly to total due to independent rounding.

It should be noted that the results displayed here are national averages. EPA expects that there will be individuals that are exposed to higher (or lower) water concentrations than represented by the mean estimates in the exhibits. These individuals will have greater (or lower) reductions in risk of adverse health effects, and thus higher (or lower) benefits due to the rule for those endpoints quantified here and presented as population averages.

Appendix G contains a discussion of two alternative concentration-response functions and an alternative value of an IQ point used in conjunction with the BLLs and methods described in the main analysis. Appendix G also includes sensitivity analyses regarding alternative assumptions for drinking water inputs when no LSL is present. The first-liter alternative regulatory option benefits are also presented.

As can be seen in Appendix G, using the alternative concentration-response functions increases the benefits by 50 percent and 54 percent with and without the low-dose linearization assumptions, assuming a 3 percent discount rate, and 50 percent and 54 percent with and without the low-dose

linearization assuming a 7 percent discount rate, compared to the Crump et al. (2013)-based estimates in this chapter. Additionally, use of the alternative IQ value based on Lin et al. (2018) decreases the valuation of the IQ benefits by 46 percent assuming a 3 percent discount rate, and 48 percent assuming a 7 percent discount rate. Alternative assumptions about the variation in water concentration due to changes in CCT when there is no LSL increases benefits by 133 percent and 130 percent when CCT with no LSL is assumed to have a water lead concentration of 1.15 µg/L at a 3 and 7 percent discount rate, respectively, and increases benefits by 220 percent and 215 percent when CCT with no LSL is assumed to have a water lead concentration of 1.86 µg/L at a 3 and 7 percent discount rate, respectively.

The alternative regulatory option requiring first-liter compliance sampling at LSLs and non-LSL locations reduced benefits by 48 percent in the low-cost option and 16 percent in the high-cost option assuming a 3 percent discount rate, and 49 percent in the low-cost option and 15 percent in the high-cost option assuming a 7 percent discount rate.

Additional concentration-response functions identified in the literature include Min et al. (2009), Jusko et al. (2008), and Budtz-Jørgensen et al. (2013),[135] all of which confirm a stronger association between blood lead and IQ at lower BLLs. The use of any of these three concentration-response functions in place of the Crump et al. (2013) concentration-response function in this economic analysis would also lead to an increase in estimated benefits, as they each estimated a steeper relationship between blood lead and IQ than the Crump et al. (2013) study. Further discussion of these three studies can be found in Appendices D and J.

If EPA used a discount rate lower than 3 percent, it would generally result in an increase in benefits above those estimated using a 3 percent discount rate. This increase in benefits would result from both a higher baseline value of an IQ point due to the decreased discounting of future earnings and a higher value of an IQ point in future analysis years, as this base value would be subject to less discounting from year-to-year. Results using discount rates of 3 percent and 7 percent are presented in this economic analysis to remain consistent with the regulatory analysis guidance outlined in the Office of Management and Budget (OMB) Circular A-4.

6.5 Quantification of Adult Blood Lead Levels

In this section, EPA presents estimates of the changes in BLLs in adults associated with the LCRR. Adverse health endpoints in adults, which are also anticipated to be reduced by the rule, are discussed qualitatively in Appendix D. Likewise, the adverse health effects associated with copper are discussed in Appendix E. Methods used to estimate BLLs in adults are described in Section 6.5.1, and BLLs anticipated under the rule scenarios are presented in Section 6.5.2. Appendix H presents a sensitivity analysis of BLLs in adults when alternate background inputs are used as well as alternate blood lead models.

6.5.1 Methods for Estimating Blood Lead Levels in Adults

EPA estimated the BLLs associated with exposure from drinking water throughout adulthood. EPA estimated BLLs in adults for each year of life, beginning at age 20 and ending at age 80. EPA assessed

[135] This cohort was also included in Lanphear et al. (2005).

men and women separately because NHANES data indicate that men have higher average BLLs than women.

6.5.1.1 *Adult Lead Methodology*

The Adult Lead Methodology (ALM) "uses a simplified representation of lead biokinetics to predict quasi-steady state blood lead concentrations among adults who have relatively steady patterns of site exposures" (USEPA, 2003, p. 1). The model assumes a linear slope between lead uptake and BLLs, which is termed the "biokinetic slope factor" and has units of µg/dL per µg/day. EPA developed the ALM primarily as a tool to estimate fetal blood lead concentrations in pregnant women exposed to lead-contaminated soils. Thus, the original version of the model estimates BLLs by adding site-specific exposures from soil lead to the geometric mean BLL for United States women aged 17 to 45. Equation Equation 5 displays the original version of the ALM.

$$PbB = \left(\frac{Pb_S \times IR_S \times AF_S \times EF_S \times BKSF}{AT_S}\right) + PbB_0 \qquad \text{(Equation 5)}$$

Where:

PbB	=	BLL
Pb_S	=	Soil lead concentration (µg/g)
IR_S	=	Soil ingestion rate (g/day)
AF_S	=	GI tract absorption fraction for soil (unitless)
EF_S	=	Exposure frequency in soil (days/year)
BKSF	=	Biokinetic slope factor (µg/dL per µg/day)
AT_S	=	Averaging time for soil exposure (days/year)
PbB_0	=	Background blood lead (µg/dL).

The ALM can be tailored for use in estimating blood lead concentrations in any adult exposed population and is able to consider additional sources of lead exposure, such as contaminated drinking water. Additionally, the biokinetic slope factor of 0.4 µg/dL per µg/day is in part derived from studies that measure both adult BLLs and concentrations of lead in drinking water (Sherlock et al., 1982; Pocock et al., 1983). Thus, EPA determined that the model is suitable for estimating steady-state changes in BLLs under the LCRR.

6.5.1.2 *Modified Adult Lead Methodology*

To estimate changes in BLLs in adults associated with the LCRR, EPA used a modified version of the ALM. As shown in Equation Equation 6, EPA used the same basic form of the ALM equation, with the inputs for soil lead replaced by those for drinking water lead.

$$PbB = \left(\frac{Pb_W \times IR_W \times AF_W \times EF_W \times BKSF}{AT_W}\right) + PbB_0 \qquad \text{(Equation 6)}$$

Where:

PbB	=	BLL
Pb_W	=	Water lead concentration (µg/L)
IR_W	=	Water intake rate (L/day)
AF_W	=	GI tract absorption fraction (unitless)
EF_W	=	Exposure frequency to water (days/year)
BKSF	=	Biokinetic slope factor (µg/dL per µg/day)
AT_W	=	Averaging time for exposure to water (days/year)
PbB_0	=	Background blood lead (µg/dL).

For the background BLLs, EPA used geometric mean BLLs for males and females for each year of life between ages 20 and 80 from NHANES 2011–2016 (CDC, 2016). These results are summarized in 10-year age categories in Exhibit 6-29.

Exhibit 6-29: Geometric Mean Blood Lead Levels from NHANES 2011–2016 (CDC, 2016)

Age Group	Sex	Geometric Mean Blood Lead Level (µg/dL)
20–29	Male	0.82
	Female	0.52
30–39	Male	0.94
	Female	0.61
40–49	Male	1.14
	Female	0.81
50–59	Male	1.34
	Female	1.14
60–69	Male	1.50
	Female	1.22
70–80	Male	1.70
	Female	1.33

Note: This exhibit summarizes geometric mean BLLs for males and females for each year of life between ages 20 and 80 from NHANES 2011–2016. EPA used the background BLLs to estimate changes in BLLs in adults associated with the LCRR.

Exhibit 6-30 displays the constant variables used with Equation Equation 6 above. Drinking water lead concentrations varied by LCR scenario and are presented in Exhibit 6-12.

Exhibit 6-30: Constant Variables Entered into the ALM

Water-Related Parameter	Proposed Value	Data Source
Water intake rate (mL/day)	724 mL (age 20) 997 mL (ages 21–65) 1,094 mL (ages 65+)	NHANES 2005–2012 data
GI tract absorption fraction	0.15	Absorption fraction for adults suggested by Leggett (1993)
Exposure frequency (days/year)	365	Consistent with assumption of daily exposure
Averaging time (days/year)	365	Consistent with assumption of daily exposure
Biokinetic slope factor	0.4	Default value in ALM

Note: This exhibit summarizes the constant variables used in the Adult Lead Methodology (ALM).

A limitation to this approach is that there is "double-counting" of exposures to lead in drinking water, since NHANES is a nationally representative sample of individuals throughout the United States who may also be exposed to various concentrations of lead in their drinking water. By using the NHANES BLLs to set the background in the ALM, national average drinking water exposure would already be factored into the background levels. However, since the results of a quantitative benefits analysis typically depend on changes in BLLs rather than absolute values, the potential ramifications of this double-counting are minimal. Appendix H contains alternate approaches to the blood lead modeling using exposure estimates from SHEDS in place of NHANES for background inputs to the ALM, and also presents results using the beta version of EPA's All Ages Lead Model (AALM), which is currently under peer review. Neither of these approaches suffer from the potential issue of double-counting and include only modeled lead in drinking water estimates. EPA is not estimating benefits of avoided cardiovascular mortality that may result from the LCRR. EPA acknowledges that the scientific understanding of the relationship between lead exposure and cardiovascular mortality is evolving and scientific questions remain. In particular, there remains uncertainty about the best quantitative relationship to describe the impacts of changes in current adult blood lead levels on the risk of CVD mortality. The studies currently available to the Agency which quantitatively describe the risk relationship attempt to control for a variety of potential confounders that may affect CVD risk as well as exposure to lead. EPA needs additional scientific guidance on which studies sufficiently control for potential confounding factors that might introduce bias into the estimated lead CVD risk relationship. The Agency also needs to develop additional information on appropriate methods for modeling the lead cessation lag in the adult population (i.e. the time between the lead exposure reduction and the reduction in CVD risk). EPA is considering ways to take these considerations into account as it explores approaches to quantifying such benefits.

6.5.2 Estimates of Pre- and Post-Rule Blood Lead Levels in Adults

Exhibit 6-31 displays BLL estimates for adults by each LSL, POU, or CCT combination summarized by age groups. Note that when "No LSL" is the beginning or post-rule state, 0.82 µg/L is the assumed concentration across all levels of CCT status (i.e., none, partial, representative). The extent to which changes in CCT status make meaningful differences in lead concentrations for those without LSL cannot be determined from the results presented in Exhibit 6-31.

Exhibit 6-31: Estimates of Blood Lead Levels in Adults Associated with Drinking Water Lead Exposures from LSL/CCT or POU Combinations

LSL Status	CCT Status	Sex	Geometric Mean Blood Lead Level (µg/dL) for Specified Age Group in Years from the ALM					
			20–29	30–39	40–49	50–59	60–69	70–80
LSL	None	Male	1.87	2.02	2.22	2.42	2.63	2.89
		Female	1.57	1.69	1.89	2.22	2.35	2.52
Partial	None	Male	1.31	1.44	1.64	1.84	2.03	2.25
		Female	1.01	1.11	1.31	1.64	1.75	1.88
No LSL	None	Male	0.87	0.99	1.19	1.39	1.55	1.75
		Female	0.57	0.66	0.86	1.19	1.27	1.38
LSL	Partial	Male	1.40	1.53	1.73	1.93	2.12	2.35
		Female	1.10	1.20	1.40	1.73	1.84	1.98
Partial	Partial	Male	1.09	1.22	1.42	1.62	1.80	2.01
		Female	0.79	0.89	1.09	1.42	1.52	1.64
No LSL	Partial	Male	0.87	0.99	1.19	1.39	1.55	1.75
		Female	0.57	0.66	0.86	1.19	1.27	1.38
LSL	Representative	Male	1.14	1.27	1.47	1.67	1.84	2.06
		Female	0.84	0.94	1.14	1.47	1.56	1.69
Partial	Representative	Male	0.97	1.10	1.30	1.50	1.67	1.87
		Female	0.67	0.77	0.97	1.30	1.39	1.50
No LSL	Representative	Male	0.87	0.99	1.19	1.39	1.55	1.75
		Female	0.57	0.66	0.86	1.19	1.27	1.38
POU		Male	0.87	0.99	1.19	1.39	1.55	1.75
		Female	0.57	0.66	0.86	1.19	1.27	1.38

Note: This exhibit displays BLL estimates for adults by each LSL, POU, or CCT combination summarized by age groups. Note that BLLs by each year (not age group average) are used in the analysis.

Similar to the presented childhood BLLs (Section 6.4.2), the estimated BLLs in Exhibit 6-31 are average adult BLLs given the corresponding estimated lead tap water concentrations resulting from LSL, CCT, and POU status at steady-state, holding other exposures constant. In the LCRR cost-benefit simulation model, water systems are tracked as they move from one LSL, CCT, or POU status to another as a result of rule implementation. The number of males and females in each age group served by those water systems are proportional to the age/sex makeup of the United States population as a whole.

Exhibit 6-32 shows the estimated change in average lifetime BLLs for adults who experience a change in water lead concentration as a result of LSL removal and/or installation of CCT or POU, rather than the set of initial LSL, CCT, and POU status combinations.

Exhibit 6-32: Estimated Lifetime Average Blood Lead Level Change for Adults Experiencing Alternate LSL, CCT, and POU Status Combinations

Pre-Rule Drinking Water				Post-Rule Drinking Water			Estimated Change in the Geometric Mean of Blood Lead Change Ages 20–80 (µg/dL)
Lead Concentration (µg/L)	LSL Status		CCT Status	Lead Concentration (µg/L)	LSL Status	CCT Status	
18.08	LSL	None	0.82	No LSL	None		1.03
18.08	LSL	None	5.48	LSL	Representative		0.75
18.08	LSL	None	0.82	No LSL	Representative		1.03
18.08	LSL	None	0.82	POU			1.03
8.43	Partial	None	0.82	No LSL	None		0.46
8.43	Partial	None	2.64	Partial	Representative		0.35
8.43	Partial	None	0.82	No LSL	Representative		0.46
8.43	Partial	None	0.82	POU			0.46
0.82	No LSL	None	0.82	No LSL	Representative		0.00
0.82	No LSL	None	0.82	POU			0.00
9.92	LSL	Partial	0.82	No LSL	Partial		0.54
9.92	LSL	Partial	5.48	LSL	Representative		0.27
9.92	LSL	Partial	0.82	No LSL	Representative		0.54
9.92	LSL	Partial	0.82	POU			0.54
4.72	Partial	Partial	0.82	No LSL	Partial		0.23
4.72	Partial	Partial	2.64	Partial	Representative		0.12
4.72	Partial	Partial	0.82	No LSL	Representative		0.23
4.72	Partial	Partial	0.82	POU			0.23
0.82	No LSL	Partial	0.82	No LSL	Representative		0.00
0.82	No LSL	Partial	0.82	POU			0.00
5.48	LSL	Representative	0.82	No LSL	Representative		0.28
5.48	LSL	Representative	0.82	POU			0.28
2.64	Partial	Representative	0.82	No LSL	Representative		0.11
2.64	Partial	Representative	0.82	POU			0.11
0.82	No LSL	Representative	0.82	POU			0.00

Note: This exhibit summarizes the estimated change in average lifetime BLLs for adults that experience the new status as a result of LSL removal and/or installation of CCT or POU, rather than the set of initial LSL, CCT, and POU status combinations.

6.6 Summary of Non-Quantified and Non-Monetized Benefits

In addition to the benefits monetized in the final rule analysis for reductions in lead exposure, several other benefits are not quantified. Multiple adverse health effects due to lead are expected to decrease

as a result of the final LCRR. These adverse effects are summarized in Appendix D and are expected to affect both children and adults. EPA focused its non-quantified impacts assessment on the endpoints identified using two comprehensive United States Government documents summarizing the recent literature on lead exposure health impacts. These documents are EPA's Integrated Science Assessment for Lead (ISA) (USEPA, 2013), and the United States Department of Health and Human Services' NTP Monograph on Health Effects of Low-Level Lead (NTP, 2012). Both of these sources present comprehensive reviews of the literature on the risk of adverse health effects associated with lead exposure. EPA summarized those endpoints to which either the EPA ISA or the NTP Monograph assigned one of the top two tiers of confidence in the relationship between lead exposure and the risk of adverse health effects. These endpoints include cardiovascular effects, renal effects, reproductive and developmental effects, immunological effects, neurological effects, and cancer.

EPA was unable to quantify a number of final rule requirements that reduce lead exposure to both children and adults. The final rule will require additional lead public education requirements that target consumers, schools and child cares, health agencies, and specifically people living in homes with LSLs. Increased education will lead to additional averting behavior on the part of the exposed public, resulting in reductions in the negative impacts of lead. For example, residents at LSL locations may purchase and use POU devices to filter their drinking and cooking water, thereby reducing exposure. The final rule also will require the development of LSL inventories and making the location of LSLs publicly accessible. This will give exposed consumers more information and will provide potential homebuyers this information as well, possibly resulting in additional LSL removals initiated by homeowners before, during, or following home sale transactions. The benefits of these additional removals are not quantified in the analysis of the LCRR. Also, because of the lack of granularity in the lead tap water concentration data available to EPA for the regulatory analysis, the benefits of small improvements in CCT to individuals residing in homes with LSLs, like those modeled under the "find-and-fix," are not quantified.

EPA also did not quantify the benefits of reduced lead exposure to individuals who reside in homes that do not have LSLs. EPA has determined that the revised LCR requirements may result in reduced lead exposure to the occupants of these buildings as a result of improved monitoring and additional actions taken to optimize CCT. In the analysis of the LCRR, the number of non-LSL homes potentially affected by water systems increasing their corrosion control during the 35-year period of analysis is 8 million in the low-cost scenario and 17 million in the high-cost scenario. These households, while not having an LSL in place, may still contain leaded plumbing materials, including leaded brass fixtures and lead solder. These households could potentially see reductions in tap water lead concentrations. EPA has assessed the potential benefits to children of reducing lead water concentrations in these homes (see Appendix G), but has determined that the data are too limited and the uncertainties regarding the magnitude of decreases in lead levels are too significant to include in the quantified and monetized benefit estimates of this regulation. However, because of the significant number of homes without LSLs but with other leaded plumbing materials, these unquantified benefits could be significant.

Additionally, the risk of adverse health effects associated with copper that are expected to be reduced by the LCRR are summarized in Appendix E. These risks include acute GI symptoms, which are the most common adverse effect observed among adults and children. In sensitive groups, there may be reductions in chronic hepatic effects, particularly for those with rare conditions such as Wilson's disease and children predisposed to genetic cirrhosis syndromes. These diseases disrupt copper homeostasis, leading to excessive accumulation that can be worsened by excessive copper ingestion (NRC, 2000).

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7 Comparison of Costs to Benefits

This chapter compares the incremental costs and benefits of the final Lead and Copper Rule revisions (LCRR). As a reminder, the incremental cost is the difference between costs that will be incurred under the final LCRR and the costs that would have been incurred if the previous Lead and Copper Rule (LCR) had remained in place with no changes. The same concept holds for the incremental benefits. The estimated benefits that would have accrued under the previous LCR are subtracted from those that will accrue under the final LCRR. That is, the previous LCR is the baseline for this analysis. Section 7.1 summarizes the incremental costs that were discussed in detail in Chapter 5. In Section 7.2, the United States Environmental Protection Agency (EPA) summarizes the incremental benefits that were presented in Chapter 6. Finally, Section 7.3 compares the incremental costs and benefits.

7.1 Summary of the Incremental Costs of the Final LCRR

7.1.1 Monetized Incremental Costs

Exhibit 7-1 provides the incremental costs of the final LCRR, for both the low and high cost scenarios, at a 3 percent discount rate in 2016 dollars. The same information is provided in Exhibit 7-2 at a 7 percent discount rate in 2016 dollars. Because many of the additional costs associated with the final LCRR are spread out fairly evenly over the 35-year period of analysis, the annual incremental cost is quite similar at the two discount rates.

Exhibit 7-1: National Annualized Incremental Costs of the Final LCRR at 3 Percent Discount Rate ($2016)

PWS Annual Costs	Low Cost Scenario	High Cost Scenario
Sampling	$25,782,000	$33,641,000
PWS Lead Service Line Replacement	$43,744,000	$112,965,000
Corrosion Control Technology	$19,412,000	$85,407,000
Point-of Use Installation and Maintenance	$3,418,000	$20,238,000
Public Education and Outreach	$36,861,000	$43,994,000
Rule Implementation and Administration	$2,576,000	$2,576,000
Total Annual PWS Costs	**$131,792,000**	**$298,820,000**
State Rule Implementation and Administration	$19,707,000	$20,756,000
Household Lead Service Line Replacement	$7,918,000	$14,076,000
Wastewater Treatment Plant Costs	$1,152,000	$1,828,000
Total Annual Rule Costs	**$160,571,000**	**$335,481,000**

Notes:

1. Sub-totals values may not add exactly to total values due to independent rounding.

Exhibit 7-2: National Annualized Incremental Costs of the Final LCRR at 7 Percent Discount Rate (2016$)

PWS Annual Costs	Low Cost Scenario	High Cost Scenario
Sampling	$29,307,000	$39,243,000
PWS Lead Service Line Replacement	$46,136,000	$131,235,000
Corrosion Control Technology	$17,623,000	$92,745,000
Point-of Use Installation and Maintenance	$3,308,000	$19,928,000
Public Education and Outreach	$36,084,000	$43,612,000
Rule Implementation and Administration	$4,147,000	$4,147,000
Total Annual PWS Costs	**$136,605,000**	**$330,908,000**
State Rule Implementation and Administration	$20,876,000	$22,216,000
Household Lead Service Line Replacement	$8,393,000	$16,728,000
Wastewater Treatment Plant Costs	$1,458,000	$2,607,000
Total Annual Rule Costs	**$167,333,000**	**$372,460,000**

Notes:

1. Sub-totals values may not add exactly to total values due to independent rounding.

7.1.2 Non-monetized Costs

As discussed in Section 5.5 of Chapter 5, the final LCRR is expected to result in additional phosphate being added to drinking water in order to reduce the amount of lead leaching into the water in the distribution system. The SafeWater LCR model estimated that, nationwide, the final LCRR will result in an increase of between 161,000 and 548,000 pounds of phosphorous being deposited into the nation's water bodies within 15 years of the rule's promulgation. This will grow to between 355,000 and 722,000 pounds per year within the 35-year period of analysis. At the national level, these additional quantities of phosphorous loadings are small, only 0.1 percent of the total phosphorous load deposited annually from all other sources. However, national average load impacts may obscure significant localized ecological impacts. These localized impacts, such as eutrophication, may occur in water bodies without restrictions on phosphate deposits, or in locations with existing elevated phosphate levels.

Also, note that the lead service line replacement (LSLR) unit cost estimates used in the SafeWater LCR model do not include certain indirect and non-market costs such as traffic congestion costs, inconvenience to homeowners and neighbors at LSLR sites, potential short term impact to the aesthetic appeal of the property, and additional impacts to landscaping and cost of replacement beyond lawn repair, which is covered in the cost estimates above. Because of these omissions the estimated cost of LSLR may be underestimated.

7.2 Summary of the Incremental Benefits of the final LCRR

7.2.1 Monetized Incremental Benefits

Acronyms: ALE = action level exceedance; CCT = corrosion control treatment; IQ = intelligence quotient; LSLR = lead service line replacement; POU = point-of-use; TLE = trigger level exceedance.

shows the incremental monetized benefits of the final LCRR at a 3 percent discount rate under the low and high cost scenarios. The information is provided in **Error! Reference source not found.** at a 7 percent discount rate. The benefit values are also broken out by the treatment technique action required by the final LCRR (e.g., corrosion control treatment [CCT], LSLR, point-of-use [POU] filtration). The benefits of annual intelligence quotient (IQ) point decrements avoided differ significantly by discount rate. This is because the value of an IQ point decrement is estimated as the present value of the lifetime lost earnings associated with lower IQ, and the longer a stream of income is discounted – in this case, up to 58 years – the more impact the discount rate has on the income stream's present value.[136]

Exhibit 7-3: National Annualized Incremental Benefits of the Final LCRR at 3 Percent Discount Rate (2016$)

	Low Cost Scenario	High Cost Scenario
Number of Children Impacted (over 35 years)	900,000	2,506,000
Annual IQ Point Decrement Avoided (CCT due to ALE)	3,035	12,000
Annual Value of IQ Impacts Avoided (CCT due to ALE)	$52,739,000	$221,873,000
Annual IQ Point Decrement Avoided (CCT due to TLE)	3,680	10,000
Annual Value of IQ Impacts Avoided (CCT due to TLE)	$64,736,000	$190,822,000
Annual IQ Point Decrement Avoided (LSLR – mandatory)	2,492	5,097
Annual Value of IQ Impacts Avoided (LSLR – mandatory)	$45,150,000	$95,275,000
Annual IQ Point Decrement Avoided (LSLR – goal based)	1,807	3,337
Annual Value of IQ Impacts Avoided (LSLR – goal based)	$32,855,000	$63,610,000
Annual IQ Point Decrement Avoided (LSLR – customer initiated)	1,572	1,677
Annual Value of IQ Impacts Avoided (LSLR – customer initiated)	$27,540,000	$29,198,000
Annual IQ Point Decrement Avoided (POU)	17	2,214
Annual Value of IQ Impacts Avoided (POU)	$324,000	$44,498,000
Total Annual Benefits	**$223,344,000**	**$645,276,000**

Acronyms: ALE = action level exceedance; CCT = corrosion control treatment; IQ = intelligence quotient; LSLR = lead service line replacement; POU = point-of-use; TLE = trigger level exceedance.
Note: Sub-totals values may not add exactly to total values due to independent rounding.

[136] The value of an IQ point decrement is the present value of the loss of income over a lifetime where people are assumed to work to age 65. Therefore, the value of future earnings is discounted back to the year in which the IQ decrement is valued in the SafeWater LCR model, which is age seven. So, the value of lost income at age 65 is discounted over 58 years to age seven, and the value of lost income at age 64 is discounted over 57 years to age seven, and so on.

Exhibit 7-4: National Annualized Incremental Benefits of the Final LCRR at 7 Percent Discount Rate (2016$)

	Low Cost Scenario	High Cost Scenario
Number of Children Impacted (over 35 years)	900,000	2,506,000
Annual IQ Point Decrement Avoided (CCT due to ALE)	3,035	12,000
Annual Value of IQ Impacts Avoided (CCT due to ALE)	$8,971,000	$39,358,000
Annual IQ Point Decrement Avoided (CCT due to TLE)	3,680	10,000
Annual Value of IQ Impacts Avoided (CCT due to TLE)	$11,232,000	$34,750,000
Annual IQ Point Decrement Avoided (LSLR – mandatory)	2,492	5,097
Annual Value of IQ Impacts Avoided (LSLR – mandatory)	$8,252,000	$18,069,000
Annual IQ Point Decrement Avoided (LSLR – goal based)	1,807	3,337
Annual Value of IQ Impacts Avoided (LSLR – goal based)	$6,039,000	$12,469,000
Annual IQ Point Decrement Avoided (LSLR – customer initiated)	1,572	1,677
Annual Value of IQ Impacts Avoided (LSLR – customer initiated)	$4,797,000	$5,038,000
Annual IQ Point Decrement Avoided (POU)	17	2,214
Annual Value of IQ Impacts Avoided (POU)	$62,000	$9,417,000
Total Annual Benefits	**$39,353,000**	**$119,102,000**

Acronyms: ALE = action level exceedance; CCT = corrosion control treatment; IQ = intelligence quotient; LSLR = lead service line replacement; POU = point-of-use; TLE = trigger level exceedance.
Note: Sub-totals values may not add exactly to total values due to independent rounding.

7.2.2 Non-monetized Benefits

In addition to the benefits monetized in the final rule analysis for reductions in lead exposure due to the final LCRR summarized above, there are several other benefits that were not quantified. EPA did not quantify or monetize benefits for lifestages beyond children ages 0-7. However, there are multiple adverse health effects due to lead exposure that are expected to decrease as a result of the final LCRR. These adverse health effects are summarized in Appendix D and are expected for both children and adults. Additionally, the adverse health effects associated with copper that are expected to be reduced by the final LCRR are summarized in Appendix E.

In Appendix D, six categories of adverse health effects associated with lead exposures are summarized. These include: cardiovascular effects (both morbidity and mortality effects; Section D.1), renal effects (Section D.2), reproductive and developmental effects (Section D.3), immunological effects (Section D.4), neurological effects (Section D.7), and cancer (Section D.8). While other adverse health effects are associated with exposure to lead, EPA focused on these endpoints in Appendix D because they were identified using two comprehensive U.S. Government documents summarizing the literature on lead exposure health impacts. These documents are EPA's Integrated Science Assessment for Lead (USEPA, 2013), hereafter referred to as the EPA ISA; and the U.S. Department of Health and Human Services' National Toxicology Program Monograph on Health Effects of Low-Level Lead (National Toxicology Program, 2012), and hereafter referred to as the NTP Monograph. Both of these sources present

comprehensive reviews of the literature on adverse health effects associated with lead exposure. EPA summarized those endpoints to which either the EPA ISA[137] or the NTP Monograph[138] assigned one of the top two tiers of confidence in the relationship between lead exposure and the adverse health effects. Appendix I presents potential methods for quantifying 1) decreases in cases of attention-deficit/hyperactivity disorder (ADHD) based on reduced blood lead in children aged 8 to 15 years old and 2) avoided reductions in birth weight based on reduced maternal blood lead. These methods have not undergone extensive peer review and have therefore not been quantified or monetized as part of the primary benefits assessment of the final rule.

There are a number of final LCRR requirements that reduce lead exposure to both children and adults that EPA could not quantify. The final rule would require additional lead public education requirements that target consumers directly, schools and child cares, health agencies, and specifically people living in homes with lead service lines (LSLs). Increased education will likely induce members of the public to take additional averting behavior that incurs costs but also results in benefits from reductions in the negative impacts of lead. For example, residents may purchase and use POU devices to filter their drinking and cooking water, thereby reducing exposure. The final rule also would require the development of LSL inventories and making the location of LSLs publicly accessible. This information would give exposed consumers more information, and it would provide potential home buyers this information as well, potentially driving additional LSL removals initiated by homeowners. The benefits and costs of these additional removals are not quantified in the analysis of the final LCR. Because individuals are likely to only undertake voluntary actions in response to new information when the private benefits outweigh the costs, the net benefits of these voluntary actions are expected to be positive. Because of the lack of granularity in the lead concentration profile data, with regard to CCT status when samples were collected (see Section 6.2), the benefits of small improvements in CCT to individuals residing in homes with LSLs, like those modeled under the find-and-fix provisions, are not quantified.

EPA also did not quantify the benefits of reduced lead exposure to individuals who reside in homes that do not have LSLs. EPA has determined that the revised LCR requirements will result in reduced lead exposure to the occupants of these buildings as a result of improved monitoring and additional actions to optimize CCT. In the analysis of the final LCRR, the number of non-LSL homes potentially affected by water systems increasing their corrosion control during the 35-year period of analysis is 8 million in the

[137] EPA (2013) ISA uses a five-level hierarchy to classify the weight of evidence for causation. Appendix D primarily discusses health endpoints assigned causal determinations in the top two levels of the hierarchy. These top two categories are:

- **Causal relationship:** Pollutant (Contaminant) has been shown to result in health effects in studies in which chance, bias, and confounding variables could be ruled out with reasonable confidence.
- **Likely to be a causal relationship:** Pollutant (Contaminant) has been shown to result in health effects in studies in which chance and bias can be ruled out with reasonable confidence but potential issues remain.

[138] Similarly, the NTP Monograph conducted a review of the epidemiological literature for the association between low-level lead exposure (defined by blood lead levels <10 µg/dL) and select health endpoints, and categorized their conclusions using a four-level hierarchy. Appendix D primarily discusses health endpoints assigned conclusions in the top two levels of the NTP Monograph hierarchy. These top two categories are:

- **Sufficient evidence of association:** Chance, bias, and confounding variables could be ruled out with reasonable confidence.
- **Limited evidence of association:** Chance, bias, and confounding variables could not be ruled out with reasonable confidence.

low cost scenario and 17 million in the high cost scenario.[139] These households, while not having an LSL in place, may still contain leaded plumbing materials, including leaded brass fixtures, and lead solder. These households could potentially see reductions in lead tap water concentrations. EPA has assessed some of the potential benefits to children of reducing lead water concentrations in these homes in Appendix G but has determined that the data are too limited and the uncertainties regarding the magnitude of decreases in lead levels are too significant to include in the quantified and monetized benefit estimates of this regulation. However, because of the significant number of homes without LSLs but with other leaded plumbing materials these unquantified benefits could be significant.

While the anticipated health benefits due to the final LCRR are expected to be primarily associated with reductions in lead exposures, some benefits due to copper reductions are also anticipated. These include decreased rates of acute gastrointestinal symptoms, which are the most common adverse effect observed among adults and children. In sensitive groups, there may be reductions in chronic hepatic effects, particularly for those with Wilson's disease and children pre-disposed to genetic cirrhosis syndromes. These diseases disrupt copper homeostasis, leading to excessive accumulation that can be worsened by excessive copper ingestion (National Research Council, 2000). These are discussed further in Appendix E.

7.3 Comparison of Incremental Costs to Incremental Benefits

Exhibit 7-5 compares the monetized annual incremental costs and the annual incremental benefits of the final LCRR at a 3 percent discount rate; the monetized net annual incremental benefits range from $63 to $310 million. Exhibit 7-6 provides the same information assuming a 7 percent discount rate; the monetized net annual incremental benefits range from negative $253 to negative $128 million. EPA considered both monetized and non-monetized costs and benefits for the final rule; see Sections VI.F.1 and VI.F.2 of the final rule Federal Register Notice.

Exhibit 7-5: Comparison of Estimated Monetized National Annualized Incremental Costs to Benefits of the Final LCRR at 3 Percent Discount Rate

PWS Annual Costs	Low Cost Scenario	High Cost Scenario
Annualized Incremental Costs	$160,571,000	$335,481,000
Annualized Incremental Benefits	$223,344,000	$645,276,000
Annual Net Benefits	**$62,773,000**	**$309,795,000**

[139] EPA estimated the number of individuals at LSL and non-LSL sites impacted by CCT changes over the 35-year period of analysis (See Exhibits 6-13 and 6-14 in Chapter 6). Therefore, in order to calculate the estimated number of non-LSL homes potentially affected by improvements in CCT EPA divided the model output number of impacted individuals in non-LSL sites by an average of 2.59 persons per household based on 2010 United States Census data (United States Census Bureau, 2010).

Exhibit 7-6: Comparison of Estimated Monetized National Annualized Incremental Costs to Benefits of the Final LCRR at 7 Percent Discount Rate

PWS Annual Costs	Low Cost Scenario	High Cost Scenario
Annualized Incremental Costs	$167,333,000	$372,460,000
Annualized Incremental Benefits	$39,353,000	$119,102,000
Annual Net Benefits	**-$127,980,000**	**-$253,358,000**

7.4 References

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8 Statutory and Administrative Requirements

8.1 Introduction

As part of the rulemaking process, the United States Environmental Protection Agency (EPA) is required to address the direct and indirect burden that the final Lead and Copper Rule revisions (LCRR) may place on certain types of governments, businesses, and populations. This chapter presents analyses performed by EPA in accordance with the following 13 federal mandates and statutory requirements:

1. Executive Order 12866: Regulatory Planning and Review and Executive Order 13563: Improving Regulation and Regulatory Review.
2. Paperwork Reduction Act (PRA).
3. The Regulatory Flexibility Act (RFA) of 1980, as amended by the Small Business Regulatory Enforcement Fairness Act (SBREFA) of 1996.
4. Unfunded Mandates Reform Act (UMRA) of 1995.
5. Executive Order 13132: Federalism.
6. Executive Order 13175: Consultation and Coordination with Indian Tribal Governments.
7. Executive Order 13045: Protection of Children from Environmental Health and Safety Risks.
8. Executive Order 13211: Actions That Significantly Affect Energy Supply, Distribution, or Use.
9. National Technology Transfer and Advancement Act of 1995 (NTTAA).
10. Executive Order 12898: Federal Action to Address Environmental Justice in Minority Populations and Low-Income Populations.
11. Consultations with the Science Advisory Board (SAB), National Drinking Water Advisory Council (NDWAC), and the Secretary of Health and Human Services.

Many of the statutory requirements and executive orders listed above call for an explanation of why the final LCRR requirements are necessary, the statutory authority for the final requirements, and the primary objectives that the final requirements are intended to achieve (see Chapter 2 for additional information regarding the goals of the final LCRR). Others are designed to assess the financial and health effects of the final regulatory requirements on sensitive, low-income, and tribal populations as well as on small systems and governments.

8.2 Executive Order 12866: Regulatory Planning and Review and Executive Order 13563: Improving Regulation and Regulatory Review

Executive Order 12866, *Regulatory Planning and Review* (58 FR 51735, October 4, 1993), gives the Office of Management and Budget (OMB) the authority to review regulatory actions that are categorized as

"significant" under Section 3(f) of Executive Order 12866. The Order defines "significant regulatory action" as one that is likely to result in a rule that may:

1. Have an annual effect on the economy of $100 million or more or adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or state, local, or tribal governments or communities.

2. Create a serious inconsistency or otherwise interfere with an action taken or planned by another agency.

3. Materially alter the budgetary impact of entitlements, grants, user fees, or loan programs or the rights and obligations of recipients thereof.

4. Raise novel legal or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in the Executive Order.

This action is an economically significant regulatory action that was submitted to the OMB for review. Any changes made in response to OMB recommendations have been documented in the docket. Exhibit 7-5 compares the annual estimated incremental costs and the annual incremental benefits of the final LCRR at a 3 percent discount rate, the net annual incremental benefits range from $63 to $310 million. Exhibit 7-6 provides the same information assuming a 7 percent discount rate, the net annual incremental benefits range from a negative $128 to a negative $253 million. The range in reported values represent cost-benefit estimation under the low and high cost scenarios developed by the Agency to characterize uncertainty in the computed cost estimates.

In addition to the monetized costs and benefits of the final regulation a number of non-monetized impacts exist. The localized eutrophication impacts to surface waters of increased phosphorous loading that might result from increased use of corrosion control treatment (CCT) under the final rule have not been assessed. Also, the positive impacts from reductions in drinking water lead exposure on cardiovascular effects (both morbidity and mortality effects), renal effects, reproductive and developmental effects, immunological effects, neurological effects, and cancer have not been quantified.

EPA did not quantify the impacts for reductions in lead exposure resulting from: the additional lead public education (PE) requirements that target consumers directly, schools and child cares, health agencies, and people living in homes with lead service lines (LSLs); nor the development of LSL inventories and making the inventories publicly accessible. These requirements to increase consumer information could drive averting behavior by private citizens and increase the number of LSLs replaced. Also, the benefits of small improvements in CCT to individuals residing in homes with LSLs, like those modeled under find-and-fix, are not quantified.

EPA did not quantify the benefits of reduced lead exposure to individuals who reside in homes that do not have LSLs. These households, while not having an LSL in place, may still contain leaded plumbing materials, including leaded brass fixtures, and lead solder. See Appendix F, Section F.4. These households could potentially see reductions in lead tap water concentrations under the final LCRR.

Additionally, the adverse health effects associated with copper that are expected to be reduced by the final LCRR are summarized in Appendix E. These include acute gastrointestinal symptoms, which are the most common adverse effect observed among adults and children. In sensitive groups, there may be reductions in chronic hepatic effects, particularly for those with Wilson's disease and children pre-disposed to genetic cirrhosis syndromes. These diseases disrupt copper homeostasis, leading to excessive accumulation that can be worsened by excessive copper ingestion (National Research Council, 2000). See Chapter 7 of this economic analysis (EA) document for greater detail on the non-monetized impacts of the final regulation.

8.3 Paperwork Reduction Act

The information collection requirements for the final LCRR has been submitted for approval to OMB under the PRA, 44 U.S.C. 3501 *et seq*. The Information Collection Request (ICR) document prepared by EPA has been assigned the EPA ICR number 2040-0204 and is available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov.

The PRA requires EPA to estimate the burden, as defined in 5 CFR 1320.3(b), on systems and Primacy Agencies of complying with the rule. The information collected as a result of the final LCRR should allow Primacy Agencies and EPA to determine appropriate requirements for specific systems and evaluate compliance with the final LCRR. Burden is defined at 5 CFR 1320.3(b) and means the total time, effort, and financial resources required to generate, maintain, retain, disclose, or provide information to or for a federal agency. The burden includes the time needed to conduct Primacy Agency and system activities during the first three years after promulgation, as described in Sections 8.3.1 and 8.3.2, respectively.

8.3.1 Primacy Agency Activities

EPA anticipates Primacy Agencies will be involved in the following activities for the first three years after publication of the final LCRR:

Implementation

- Read and understand the final rule.
- Adopt the rule and develops implementation program.
- Modify data management systems.
- Provide Primacy Agency staff training.
- Provide water system staff with training and technical assistance for implementation.
- Assist water system staff on the development of the water system's LSL inventory.
- Review water system lead service line replacement (LSLR) plan.
- Review water system LSL inventory.
- Review water system demonstrations of no LSLs.

8.3.2 System Activities

EPA anticipates systems will be involved in the following activities for the first three years after publication of the final LCRR:

Implementation

- Read and understand the final rule.
- Assign personnel and resources for rule implementation.
- Attends training and receive technical assistance from the Primacy Agency.
- Develop and submit to the Primacy Agency a LSLR plan.
- Develop and submit to the Primacy Agency a LSL inventory.
- Submit, if applicable, a demonstration to the Primacy Agency that they do not have LSLs.

For the first three years after publication of the rule in the *Federal Register*, the major information requirements apply to 67,712 respondents annually, including 67,656 public water systems (PWSs) and 56 Primacy Agencies. The net change in burden associated with moving from the information requirements of the previous rule to those in the final LCRR over the three years covered by the ICR is 3.17 to 3.39 million hours, for an average of 1.06 to 1.13 million hours per year. The range reflects the upper- and lower-bound estimates of the number of systems with LSLs. The total net change in costs over the three-year compliance period covered by the ICR are $115.2 to 123.3 million, for an average of $38.4 to $41.1 million per year (simple average over three years). The average burden per response (i.e., the amount of time needed for each activity that requires a collection of information) is 9.16 to 9.63 hours; the average cost per response is $333 to $351. The collection requirements are mandatory under the Safe Drinking Water Act (SDWA) (42 U.S.C. 300j-4 Subsections (a)(1)(A) and (a)(1)(B)). Details on the calculation of the final LCRR information collection burden and costs can be found in the ICR for final LCRR and Chapter 5 of this EA. A summary of the average annual burden and costs of the collection is presented in Exhibit 8-1. **Error! Reference source not found.**The burdens and costs reflect labor; there are no operation and maintenance (O&M) or capital costs associated with the activities in the first three years following rule promulgation.

Exhibit 8-1: Change in Average Annual Net Burden and Costs for the Final LCRR ICR

Item	Burden (labor)	Cost	Responses
Systems	838,014 to 896,641	$25,848,865 to $27,795,257	91,485 to 92,423
Primacy Agencies	219,011 to 232,699	$12,536,209 to $13,319,672	23,903 to 24,842
Total	1,057,025 to 1,129,340	$38,385,074 to $41,114,928	115,388 to 117,265
Average per response	9.16 to 9.63	$333 to $351	not applicable

Source: ICR Supporting Statement, available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov.
Note: Calculated in 2016 dollars. Detail may not add to totals because of independent rounding. Ranges shown for number of responses reflect upper- and lower-bound estimates of the number of systems with LSLs.

The low cost and high cost scenario total responses, burden, and cost for system and Primacy Agency startup activities, LSL inventory, and LSLR plan is provided in Exhibit 8-2: Total Net Responses, Burden, and Costs for the Final LCRR ICR for Each Required Activity

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Exhibit 8-2: Total Net Responses, Burden, and Costs for the Final LCRR ICR for Each Required Activity

Requirement	Low Cost Scenario			High Cost Scenario		
	Responses	Burden (Hours)	Cost	Responses	Burden (Hours)	Cost
System startup activities	202,968	1,353,120	$40,028,655	202,968	1,353,120	$40,028,655
Systems develop lead service line inventory	10,269	467,081	$15,970,421	12,624	613,141	$20,816,484
Systems submit a demonstration to the Primacy Agency that they do not have lead service lines	49,435	477,185	$13,171,203	47,104	443,055	$12,121,265
Systems conduct initial planning of LSLR Program	11,782	216,656	$7,065,992	14,574	280,608	$9,166,998
System Subtotal	274,454	2,514,042	$77,546,595	277,270	2,689,924	$83,385,770
Primacy Agency startup activities	224	399,168	$22,848,376	224	399,168	$22,848,376
Primacy Agency works with systems to develop lead service line inventory	10,269	50,668	$2,900,236	12,624	64,416	$3,687,172
Primacy Agency reviews demonstration of no lead service lines from systems	49,435	98,870	$5,659,319	47,104	94,208	$5,392,466
Primacy Agencies confer with PWS on initial planning for LSLR as part of initial LSLR Program activities	11,782	108,328	$6,200,695	14,574	140,304	$8,031,001
Primacy Agency Subtotal	71,710	657,034	$37,608,626	74,526	698,096	$39,959,015
Combined Systems and Primacy Agency	346,164	3,171,076	$115,155,221	351,796	3,388,020	$123,344,785

Source: ICR Supporting Statement, available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov.ith lead service lines.
Note: Calculated in 2016 dollars. Detail may not add to totals because of independent rounding. Ranges shown for number of responses reflect upper- and lower-bound estimates of the number of systems with lead service lines.

An agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number. The OMB control numbers for EPA's regulations in 40 CFR are listed in 40 CFR part 9.

8.4 The Final Regulatory Flexibility Analysis (FRFA)

The RFA of 1980, amended by the SBREFA of 1996, requires regulators to assess the effects of regulations on small entities including businesses, nonprofit organizations, and governments. RFA/SBREFA generally requires an agency to prepare a regulatory flexibility analysis of any rule subject to notice and comment rulemaking requirements under the Administrative Procedure Act or any other statute unless the agency certifies that the rule will not have a significant economic impact on a substantial number of small entities (SISNOSE). Small entities include small businesses, small organizations, and small governmental jurisdictions.

The RFA provides default definitions for each type of small entity. Small entities are defined as: 1) a small business as defined by the Small Business Administration's (SBA) regulations at 13 CFR 121.201; 2) a small governmental jurisdiction that is a government of a city, county, town, school district, or special district with a population of less than 50,000; and 3) a small organization that is any "not-for-profit enterprise which is independently owned and operated and is not dominant in its field." However, the RFA also authorizes an agency to use alternative definitions for each category of small entity, "which are appropriate to the activities of the agency" after proposing the alternative definition(s) in the *Federal Register* and taking comment (5 USC 601(3)-(5)). In addition, to establish an alternative small business definition, agencies must consult with SBA's Chief Counsel for Advocacy.

For purposes of assessing the impacts of the final LCRR on small entities, EPA considered small entities to be systems serving 10,000 people or fewer. This is the cut-off level specified by Congress in the 1996 Amendments to the SDWA for small system flexibility provisions. As required by the RFA, EPA proposed using this alternative definition in the *Federal Register* (FR) (63 FR 7620, February 13, 1998; USEPA, 1998a), requested public comment, consulted with the SBA, and finalized the alternative definition in the Agency's Consumer Confidence Reports regulation (63 FR 44524, August 19, 1998; USEPA, 1998b). As stated in that Final Rule, the alternative definition would be applied for all future drinking water regulations.

8.4.1 Need for and Objectives of the Rule

The need for the rule, the objectives of the rulemaking, the stakeholder outreach conducted, and the statutory authority EPA is utilizing to finalize the rule are described in detail in Chapter 2. See Section 2.1 for detailed information on the need for the rule and the Lead and Copper Rule's (LCR) regulatory history, Section 2.2 for information on stakeholder outreach during the rulemaking process, and Section 2.3 for additional detail on the statutory authority for the promulgation of the final LCRR.

8.4.2 Summary of SBAR Comments and Recommendations

Because the Agency has determined that the LCRR has a SISNOSE, EPA sought input from small entity stakeholders. On August 14, 2012, the EPA's Small Business Advocacy Chairperson convened an SBAR Panel under Section 609(b) of the RFA, as amended by the SBREFA. In addition to its chairperson, the

SBAR Panel consisted of the Director of the Standards and Risk Management Division within the EPA's Office of Ground Water and Drinking Water, the Administrator of the Office of Information and Regulatory Affairs within the OMB, and the Chief Counsel for Advocacy of the SBA. Detailed information on the overall panel process can be found in the panel report titled, *The Small Business Advocacy Review Panel on EPA's Planned Proposed Rule to Public Water System Requirements (SBREFA Panel Report)* and can be found in the LCRR docket (EPA-HQ-OW-2017-0300). Prior to convening the SBAR Panel, EPA conducted outreach with small entities that will potentially be affected by the proposed LCRR. In July 2012, the EPA invited SBA, OMB, and nine potentially affected Small Entity Representatives (SERs) to a conference call and solicited comments on the previous materials sent to them. EPA shared the small entities' written comments with the SBAR Panel as part of the convening document.

8.4.3 Summary of the Proposed Rule and Public Comments on the Impacts to Small Entities

EPA proposed revisions that provide small community water systems (CWSs), serving 10,000 or fewer persons, and all non-transient, non-community water systems (NTNCWSs) greater flexibility to comply with the requirements of the LCRR. In 1998, EPA designated CCT as an affordable compliance technology for all categories of small systems in accordance with SDWA Section 1412(b)(4)(E)(iii) (USEPA, 1998). EPA has determined that CCT is still an affordable technology for small systems, however, EPA recognized that small systems tend to have more limited technical, financial, and managerial capacity to implement complex treatment techniques.

EPA proposed three compliance alternatives for a lead action level exceedance (ALE) to allow increased flexibility for small CWSs that serve 10,000 or fewer people and four compliance alternatives for NTNCWSs of any size. The proposed rule would allow water systems to select the most financially and technologically viable strategy that is effective in reducing lead in drinking water. EPA proposed the following compliance alternatives for small CWSs: 1) full LSLR, 2) installation and maintenance of OCCT, or 3) installation and maintenance of POU treatment devices. EPA proposed the above three compliance alternatives for NTNCWSs and an additional compliance alternative of replacement of all lead-bearing plumbing materials. As proposed, the NTNCWS must have control of all plumbing materials and must have no LSLs to select this last option.

All other regulatory requirements of the proposed rule were consistent between small (serving 10,000 or fewer people) and medium (PWSs serving 10,001 to 50,000 people) sized PWSs. For an outline of other proposed rule requirements, see **Error! Reference source not found.** below, the final rule FRN (USEPA, 2020), and the proposed rule documents including the proposed rule FRN (USEPA, 2019a) and Chapter 3 of the proposed rule EA (USEPA, 2019b).

EPA received no comments from the public on the analytical methods employed in the assessment of the impacts to small systems from the proposed rule requirements. EPA did receive comment on the proposed revisions that provide small CWSs, serving 10,000 or fewer persons, and all NTNCWSs greater flexibility to comply with the requirements of the LCRR. The detailed public comment summaries including EPA's detailed responses are provided in Section III.E.B of the preamble to the final rule (USEPA, 2020).

8.4.4 Number and Description of Small Entities Affected

EPA used Safe Drinking Water Information System (SDWIS)/Federal data from the third quarter of 2016 to identify 63,324 small PWSs that may be impacted by the final LCRR. A small PWS serves 10,000 or fewer people. These water systems include 45,758 CWSs that serve year-round residents and 17,566 NTNCWSs that serve the same persons over six months per year (*e.g.*, a PWS that is an office park or church). Additional information on the characteristics of these small drinking water systems along with a discussion of uncertainty in the dataset used to derive the estimated number of small systems impacted by the LCRR can be found in Chapter 4, Section 4.3.1.

8.4.5 Description of the Compliance Requirements of the Rule

For a detailed description of the general regulatory requirements under the final LCRR see Chapter 3.

Of particular importance to small entities is the flexibility for CWSs serving 10,000 or fewer people (referred to as small systems) and all NTNCWSs provided in the final LCRR to select the compliance options that best protects public health, recognizing the unique nature of these systems. This flexibility applies to CWSs serving 10,000 or fewer people and all NTNCWSs that exceed the new lead trigger level (TL) of 10 µg/L or lead AL of 15 µg/L. Compliance options for these systems after a TLE or ALE include CCT; provision, monitoring, and maintenance of POU devices; LSLR; and replacement of lead-bearing materials. A CWS serving 10,000 or fewer people or any NTNCWS that exceeds the TL must select a compliance option and submit a recommendation to the Primacy Agency for approval within six months from the end of the tap sampling monitoring period in which it exceeded the TL. The Primacy Agency has six months to approve the recommendation or designate an alternative approach. If the system has a subsequent ALE, it must implement the compliance option selected and approved by the Primacy Agency. See Exhibit 3-3 in Chapter 3 which summarizes these system flexibility requirements and provides the sub-sections where each option is discussed in more detail in Chapter 3.

Reporting and recordkeeping requirements associated with the final LCRR are discussed under the Paperwork Reduction Act (PRA) in Section 8.3, which requires that all reporting and recordkeeping requirements have practical utility and appropriately balance the needs of the government with the burden on the public. The Agency has assessed the need for revisions to reporting and recordkeeping requirements and has considered them in the estimation of the burden and benefits of the rule changes.

The LCRR includes requirements for conducting an LSL inventory that is updated annually; installing or re-optimizing CCT when water quality declines; enhancing WQP monitoring; establishing a “find-and-fix” provision to evaluate and remediate elevated lead at a site where the tap sample exceeds the lead AL; and improving customer outreach. These final rule requirements include reporting and recordkeeping requirements. Primacy Agencies are required to implement operator certification (and recertification) programs per SDWA Section 1419 to ensure operators of CWSs and NTNCWSs, including small water system operators, have the appropriate level of certification to complete the required task, including the record keeping requirements, of the LCR.

8.4.6 Analysis of Alternative Small System Rule Requirements

EPA considered two options that would mitigate the economic impact of the LCRR on small entities. The options differed by the size threshold at which CWSs could take advantage of the compliance

flexibilities. The selected option, codified in the final LCRR, includes significant flexibility for CWSs that serve 10,000 or fewer people, and all NTNCWSs. If these water systems have a lead 90th percentile above the AL, they can choose from the following four options to reduce the concentration of lead in their water:

1. Fully replace all LSLs within 15 years.[140]
2. Optimize existing CCT or install new CCT.
3. Install and maintain POU devices at all locations being served.
4. Replace lead-bearing plumbing materials for systems that have control over their entire plumbing system and no unknown, galvanized, or LSLs.[141]

In order to estimate the economic impact on small entities EPA's cost model applies the least cost compliance option to all model PWSs that exceed the AL. To determine the least cost compliance option the cost of each alternative is computed across each representative model PWS in the cost model based on its assigned characteristics including: the number of LSLs, cost of LSLR, the presence of CCT, the cost and effectiveness of CCT, the starting water quality parameters (WQPs), monitoring requirements, the number of entry points, the unit cost of POU, and the number of households served. For an expanded discussion on the assignment of system characteristics, see Chapter 5, Section 5.2. These characteristics are the primary drivers in determining the costs once a water system has been triggered into CCT installation or re-optimization, LSLR, or POU requirements. The model estimates the net present value for implementing each compliance option and selects the least cost alternative to retain in the summarized final rule costs. EPA lacks the system characteristic data that would allow the Agency to determine a small system's cost for replacement of lead-bearing plumbing materials because of the significant variability among systems and the plumbing materials in the buildings they serve. EPA assumes a system would only select the replacement of lead-bearing plumbing materials compliance option if it cost less than the three other alternative compliance options. By selecting the least cost of the three other options EPA has accounted for the costs that small water systems would incur but may be overestimating the costs for those systems that find the cost of lead bearing plumbing replacement to be less than the other three options.

EPA estimated low and high cost scenarios to characterize uncertainty in the cost model results. These scenarios are functions of assigning different, low and high, input values to a number of variables that affect the relative cost of the small system compliance options (see Chapter 5, Section 5.2 for additional information on uncertain variable value assignment). Therefore, as the model output shows, the selection of a compliance option is different across the low and high cost scenarios. The total and incremental costs of the final LCRR, under both the low and high cost scenarios, can be found in Chapter

[140] Primacy Agencies may, under the final LCRR, require small CWSs serving 10,000 or fewer people and NTNCWSs to remove more than 7 percent of LSLs per year, i.e., replace all LSLs in fewer than 15 years. However, for modeling purposes EPA assumed 7 percent per year.

[141] Under the proposed LCRR, replacement of lead-bearing materials was limited to NTNCWSs. EPA revised this allowance to include CWSs in response to public comment that indicated in certain circumstances replacement of all lead-bearing plumbing material might be an effective option for the small CWSs to reduce drinking water lead exposure, when they have no LSLs, galvanized, or lead status unknown service lines, and have control over all of the plumbing materials in the system.

5, in Exhibit 5-1 and Exhibit 5-2 discounted at 3 and 7 percent respectively. The total annualized cost of the final LCRR ranges from $554 to $808 million at a 3 percent discount rate, and from $539 to $839 million at a 7 percent discount rate in 2016 dollars. The incremental annualized cost of the final LCRR ranges from $161 to $335 million at a 3 percent discount rate, and from $167 to $372 million at a 7 percent discount rate in 2016 dollars. The total and incremental rule costs as well as the total and incremental cost for the sub cost components which make up total rule sampling, LSLR, and CCT costs, under both the low and high cost scenarios, can be found in the exhibits in Appendix C broken out by: the analyzed small system size categories (systems serving less than 100, 101-500, 501-1,000, 1,001-3,300, and 3,301-10,000); the type of system (CWS and NTNCWS); public and private ownership; and ground or surface water source.[142]

To assess the impact of the small system compliance option selected for the final LCRR, Exhibit 8-3 and Exhibit 8-4 show the total number of CWSs serving 10,000 or fewer people and NTNCWSs, the total number of systems by type and population size that would select one of the small system compliance options, the number of NTNCWSs selecting each compliance alternative in the model, and the number of CWSs by population size selecting each compliance alternative in the model, under both the low and high cost scenarios. In general, the exhibits show across both the low and high scenarios that the majority of CWSs serving more than 500 people would select re-optimizing CCT under the small system compliance options. If a system has CCT in place, the incremental costs of re-optimization are low compared to all other alternatives. The POU device implementation seems to be the least cost alternative when the number of households in the system is small as demonstrated by the decrease in the selection of the POU option as CWS population size increases in the model. The pattern seen in the selection of LSLR between the low and high cost scenarios demonstrates that the choice of compliance by small systems is driven by relative costs. Under the low cost scenario far greater numbers of systems select LSLR given the assumed lower numbers of LSLs per system and lower cost of replacement under this scenario. While CCT installation cost is also lower under the low cost scenario, the difference in cost between the high and low scenarios is relatively small compared to the reduction in cost for LSLR between the scenarios. POU cost remains unchanged between the low cost and high cost scenarios. The installation of CCT becomes more cost effective as system population size increases.

Exhibit 8-3: NTNCWS and Small CWS Counts Impacted Under Flexibility Option - Low Cost Scenario (Over 35 Year Period of Analysis)

	NTNCWS	**CWS**				
	All Systems	***≤100***	***101-500***	***501-1,000***	***1,001-3,300***	***3,301-10,000***
Total PWS Count in System Size Category	17,589	12,046	15,307	5,396	8,035	4,974

[142] In the proposed rule analysis, the small CWS and NTNCWS compliance flexibility cost minimization computer code within EPA's cost model framework did not properly account for costs to systems with existing CCT when they exceeded the action level. This error resulted in the under reporting of potential estimated costs and benefits associated with 800 (low cost scenario) to 4,000 (high cost scenario) small CWSs and NTNCWSs over the 35-year period of analysis, which had a minor impact on the total estimated costs and benefits of the proposed rule. This computer code error has been corrected for the final LCRR analysis.

Exhibit 8-3: NTNCWS and Small CWS Counts Impacted Under Flexibility Option - Low Cost Scenario (Over 35 Year Period of Analysis)

	NTNCWS	CWS				
	All Systems	*≤100*	*101-500*	*501-1,000*	*1,001-3,300*	*3,301-10,000*
Total PWS Count of Systems with LSLR, POU, or CCT activity	714	641	910	314	418	257
Number of PWSs with LSL Removals	48	274	330	74	29	2
Number of PWSs that Install CCT	4	4	232	134	155	82
Number of PWSs that Re-optimize CCT	25	2	144	101	234	173
Number of PWSs that Install POU	637	361	205	4	1	-

Acronyms: CCT = corrosion control treatment; CWS = community water system; LSL = lead service line; LSLR = lead service line replacement; NTNCWS = non-transient non-community water system; POU = point-of-use; PWS = public water system.
Notes: Detail may not add to totals because of independent rounding

Exhibit 8-4: NTNCWS and Small CWS Counts Impacted Under Flexibility Option - High Cost Scenario (Over 35 Year Period of Analysis)

	NTNCWS	CWS				
	All Systems	*≤100*	*101-500*	*501-1,000*	*1,001-3,300*	*3,301-10,000*
Total PWS Count in System Size Category	17,589	12,046	15,307	5,396	8,035	4,974
Total PWS Count of Systems with LSLR, POU, or CCT activity	1,407	1,362	2,029	877	1,475	894
Number of PWSs with LSL Removals	56	59	40	8	50	10
Number of PWSs that Install CCT	7	1	346	284	349	178
Number of PWSs that Re-optimize CCT	21	20	381	542	1,072	704
Number of PWSs that Install POU	1,322	1,283	1,261	42	4	2

Acronyms: CCT = corrosion control treatment; CWS = community water system; LSL = lead service line; LSLR = lead service line replacement; NTNCWS = non-transient non-community water system; POU = point-of-use; PWS = public water system.
Notes: Detail may not add to totals because of independent rounding

Because EPA also considered an alternative small system compliance option which lowered the CWS compliance flexibility threshold to 3,300 or fewer people, where CWSs serving 3,301-10,000 people would not be eligible for the small system flexibility allowances, Exhibit 8-5 and Exhibit 8-6 show the total and incremental annualized final rule cost to all CWSs serving populations from 3,301 to 10,000 people, under both the low and high cost scenarios and discounted at 3 and 7 percent, respectively. These exhibits allow for easy comparison of the deferential impacts to the CWS size category (3,301-

10,000 people served) across the two small system compliance flexibility threshold options assessed by EPA. Exhibit 8-5 and Exhibit 8-6 also show total and incremental annualized rule costs accruing to Primacy Agencies, households, and wastewater treatment plants from implementing the final rule requirements on systems serving 3,301 to 10,000 people. As indicated in Exhibit 8-5, at the 3 percent discount rate, systems serving between 3,301 and 10,000 people have estimated incremental annual costs that range from $12 to $34 million, and total estimated annual incremental national rule costs for this category of system ranges from $15 to $37 million. Exhibit 8-6 shows the total PWS and total national estimated annual incremental costs of the final LCRR, for the system size category serving 3,301 to 10,000 people, range from $13 to $36 million and $16 to $39 million, respectively, at the 7 percent discount rate.

Exhibit 8-5: National Annualized Rule Costs - CWSs Serving 3,301 to 10,000 People with Small System Compliance Flexibility (Final Rule) at 3% Discount Rate (2016$)

	Low Cost Estimate			High Cost Estimate		
PWS Annual Costs	**Previous LCR**	**Final LCRR**	**Incremental**	**Previous LCR**	**Final LCRR**	**Incremental**
Sampling	$6,533,000	$9,670,000	$3,137,000	$7,169,000	$13,240,000	$6,071,000
PWS Lead Service Line Replacement	$62,546	$1,523,000	$1,461,000	$4,417,000	$4,891,000	$474,000
Corrosion Control Technology	$36,791,000	$40,619,000	$3,830,000	$41,686,000	$62,782,000	$21,096,000
Point-of Use Installation and Maintenance	$0	$0	$0	$0	$367,000	$367,000
Public Education and Outreach	$103,220	$3,781,000	$3,677,000	$331,000	$6,590,000	$6,260,000
Rule Implementation and Administration	$0	$156,118	$156,118	$0	$156,118	$156,118
Total Annual PWS Costs	$43,489,000	$55,749,000	$12,261,000	$53,604,000	$88,026,000	$34,422,000
State Rule Implementation and Administration	$912,000	$3,740,000	$2,829,000	$1,001,000	$4,147,000	$3,146,000
Household Lead Service Line Replacement	$17,982	$0	$-17,982	$891,000	$0	$-891,000
Wastewater Treatment Plant Costs	$7,826	$48,485	$40,306	$36,701	$174,179	$136,478
Total Annual Rule Costs	$44,425,000	$59,538,000	$15,113,000	$55,535,000	$92,347,000	$36,812,000

Exhibit 8-6: National Annualized Rule Costs - CWSs Serving 3,301 to 10,000 People with Small System Compliance Flexibility (Final Rule) at 7% Discount Rate (2016$)

	Low Cost Estimate			High Cost Estimate		
PWS Annual Costs	**Previous LCR**	**Final LCRR**	**Incremental**	**Previous LCR**	**Final LCRR**	**Incremental**
Sampling	$6,450,000	$10,044,000	$3,593,000	$7,313,000	$14,583,000	$7,270,000
PWS Lead Service Line Replacement	$72,373	$1,611,000	$1,538,000	$6,220,000	$4,934,000	$-1,285,000
Corrosion Control Technology	$35,071,000	$38,750,000	$3,679,000	$40,100,000	$63,374,000	$23,275,000

Point-of Use Installation and Maintenance	$0	$0	$0	$0	$358,000	$358,000
Public Education and Outreach	$140,040	$3,771,000	$3,631,000	$452,000	$6,725,000	$6,273,000
Rule Implementation and Administration	$0	$258,494	$258,494	$0	$258,494	$258,494
Total Annual PWS Costs	$41,733,000	$54,434,000	$12,703,000	$54,086,000	$90,234,000	$36,149,000
State Rule Implementation and Administration	$885,000	$3,885,000	$2,999,000	$1,010,000	$4,396,000	$3,386,000
Household Lead Service Line Replacement	$21,416	$0	$-21,416	$1,255,000	$0	$-1,255,000
Wastewater Treatment Plant Costs	$12,986	$79,784	$66,486	$61,822	$287,913	$226,091
Total Annual Rule Costs	$42,652,000	$58,399,000	$15,747,000	$56,412,000	$94,919,000	$38,506,000

For detailed output from the cost-benefit model on the number of systems in the 3,301 to 10,000 size category selecting the CCT, LSLR, and POU compliance alternatives by system type, size, and source water see Appendix C. Also see Appendix C for additional cost breakdowns, including the sub cost components of sampling, LSLR, and CCT, based on system type, size, and source water for the 3,301 to 10,000 size category.

EPA also assessed the degree to which the final LCRR small system flexibilities would mitigate compliance costs. The Agency estimated the cost of the LCRR if no compliance alternatives were available to small systems. As shown in Exhibit 8-7 the annual incremental cost of the LCRR without the small system compliance alternatives ranges from $174 to $419 million at a 3 percent discount rate, and from $180 to $474 million at a 7 percent discount rate in 2016 dollars. This analysis demonstrates a cost savings, from allowing CWSs that serve 10,000 or fewer people, and all NTNCWSs compliance flexibilities, of between $13 million and $101 million across discount rates and low/high cost scenarios.

Exhibit 8-7: Comparison of Final LCRR Incremental Cost with Small System Flexibility to LCRR Incremental Cost without the Small System Flexibility (2016$)

Option	Annual Incremental Cost (2016$)	
	Low Cost Scenario	High Cost Scenario
3% Discount Rate		
Final LCRR: Small System Flexibility for CWSs serving ≤ 10,000 people and all NTNCWSs	$160,571,000	$335,481,000
LCRR with No Small System Flexibility	$173,634,000	$419,012,000
Cost Savings with Small System Flexibility	$13,063,000	$83,531,000
7% Discount Rate		
Final LCRR: Small System Flexibility for CWSs serving ≤ 10,000 people and all NTNCWSs	$167,333,000	$372,460,000
LCRR with No Small System Flexibility	$180,299,000	$473,946,000
Cost Savings with Small System Flexibility	$12,966,000	$101,486,000

In the case of the regulatory flexibility analysis, EPA limited the assessment to small CWSs since small NTNCWSs operate in numerous industries and EPA does not have information on NTNCWSs revenue. EPA's decision to limit its regulatory flexibility analysis to CWSs is supported by EPA's *Assessment of the Vulnerability of Noncommunity Water Systems to SDWA Cost Increases* (2008). In this study, EPA examined the burden of the SDWA rule costs in comparison to the average revenues of various categories of NTNCWSs. All of the NTNCWS categories reviewed were found to be less vulnerable to the SDWA-related increases than a typical CWS. The report notes that in some categories of businesses, costs are more easily passed on to the customer base than in others. However, in each NTNCWS category, expenditures on water were found to be a relatively small percentage of total revenues. Water expenditures (including expenditures for sewer service and miscellaneous other utilities) totaled less than 1 percent of total revenues in nearly all cases and were not more than 1.3 percent of total revenues for any category. Several caveats were put forth in this report, including one that considered the potential for underestimating the impact to golf courses, which were grouped in with other recreational entities whose use of water was less significant to the core business than the golf courses. Despite the significant caveats listed, the report strongly suggests that NTNCWSs should not be considered particularly vulnerable to operating cost increases resulting from the SDWA rulemakings.

EPA calculated the annual revenue per CWS by using each PWS's average daily flow and the average revenue per thousand gallons delivered from the Community Water System Survey (CWSS) (USEPA, 2009b, Table 61). These revenue estimates were then inflated to 2016 dollars using the consumer price index (CPI) for utilities.

Exhibit 8-8 and Exhibit 8-9 provide the estimated total number of small CWSs, by size and source water type, which have incremental annual costs that exceed the 1 percent and 3 percent of annual revenue threshold values under the low and high cost scenarios. Under the final LCRR, the number of small CWSs that will experience incremental annual costs of more than 1 percent of revenues ranges from 21,524 to 25,483 (47 percent to 56 percent of all small CWSs) and the number of small CWSs that will have annual incremental costs exceeding 3 percent of revenues ranges from 11,560 to 14,611 (25 percent to 32 percent of small CWSs).

Exhibit 8-8: Incremental Costs vs. Revenue for Small CWSs – Low Cost Scenario

Funding	Source Water	Size Category	Number of CWSs	Number of CWSs with Cost Revenue Ratio > 1%	Number of CWSs with Cost Revenue Ratio > 3%	Percent of CWSs with Cost Revenue Ratio > 1%	Percent of CWSs with Cost Revenue Ratio > 3%
Private	Ground	Less than 100	9,652	8,841	7,427	91.6%	76.9%
Private	Ground	101 to 500	8,391	5,372	1,729	64.0%	20.6%
Private	Ground	501 to 1,000	1,301	206	54	15.8%	4.2%
Private	Ground	1,001 to 3,300	999	64	12	6.4%	1.2%
Private	Ground	3,301 to 10,000	333	24	8	7.1%	2.4%
Private	Surface	Less than 100	456	432	344	94.7%	75.3%
Private	Surface	101 to 500	760	452	124	59.5%	16.3%
Private	Surface	501 to 1,000	222	29	7	13.2%	3.0%
Private	Surface	1,001 to 3,300	285	10	2	3.4%	0.8%
Private	Surface	3,301 to 10,000	163	7	1	4.3%	0.4%
Public	Ground	Less than 100	1,428	1,115	408	78.1%	28.6%
Public	Ground	1010 to 500	4,844	2,291	677	47.3%	14.0%
Public	Ground	5010 to 1,000	2,949	580	184	19.7%	6.2%
Public	Ground	1,0010 to 3,300	4,538	455	122	10.0%	2.7%
Public	Ground	3,3010 to 10,000	2,438	250	56	10.3%	2.3%
Public	Surface	Less than 100	510	419	183	82.2%	35.9%
Public	Surface	101 to 500	1,312	571	146	43.5%	11.2%
Public	Surface	501 to 1,000	924	159	39	17.2%	4.2%
Public	Surface	1,001 to 3,300	2,213	129	26	5.8%	1.2%
Public	Surface	3,301 to 10,000	2,040	117	11	5.7%	0.6%
Total			45,758	21,524	11,560	47%	25.3%

Exhibit 8-9: Incremental Costs vs. Revenue for Small CWSs – High Cost Scenario

Funding	Source Water	Size Category	Number of CWSs	Number of CWSs with Cost Revenue Ratio > 1%	Number of CWSs with Cost Revenue Ratio > 3%	Percent of CWSs with Cost Revenue Ratio > 1%	Percent of CWSs with Cost Revenue Ratio > 3%
Private	Ground	Less than 100	9,652	8,432	7,045	87.4%	73.0%
Private	Ground	101 to 500	8,391	5,501	2,284	65.6%	27.2%
Private	Ground	501 to 1,000	1,301	506	226	38.9%	17.4%
Private	Ground	1,001 to 3,300	999	186	72	18.6%	7.2%
Private	Ground	3,301 to 10,000	333	68	28	20.6%	8.4%
Private	Surface	Less than 100	456	414	326	90.8%	71.4%
Private	Surface	101 to 500	760	502	269	66.1%	35.4%
Private	Surface	501 to 1,000	222	127	39	57.3%	17.7%
Private	Surface	1,001 to 3,300	285	73	31	25.5%	10.8%
Private	Surface	3,301 to 10,000	163	33	7	20.4%	4.1%
Public	Ground	Less than 100	1,428	1,071	456	75.0%	31.9%
Public	Ground	101 to 500	4,844	2,593	1,160	53.5%	23.9%
Public	Ground	501 to 1,000	2,949	1,319	664	44.7%	22.5%
Public	Ground	1,001 to 3,300	4,538	1,213	547	26.7%	12.1%
Public	Ground	3,301 to 10,000	2,438	582	232	23.9%	9.5%
Public	Surface	Less than 100	510	406	226	79.6%	44.2%
Public	Surface	101 to 500	1,312	755	396	57.5%	30.2%
Public	Surface	501 to 1,000	924	560	211	60.6%	22.8%
Public	Surface	1,001 to 3,300	2,213	647	270	29.2%	12.2%
Public	Surface	3,301 to 10,000	2,040	495	123	24.3%	6.0%
Total			45,758	25,483	14,611	55.7%	31.9%

Exhibit 8-10 shows the distribution of the ratio of the incremental annual cost of the final LCRR to total annual revenue by CWS size and source water type category under the low cost scenario, while Exhibit 8-11 provides this information for the high cost scenario.

Exhibit 8-10: Distribution of Incremental Costs vs. Revenue for Small CWSs – Low Cost Scenario

			Incremental Cost Revenue Ratio				
Funding	**Source Water**	**Size Category**	**10th Percentile**	**25th Percentile**	**50th Percentile**	**75th Percentile**	**90th Percentile**
Private	Ground	Less than 100	1.9%	3.1%	5.2%	8.9%	15.9%
Private	Ground	101 to 500	0.4%	0.7%	1.4%	2.5%	5.0%
Private	Ground	501 to 1,000	0.2%	0.2%	0.3%	0.7%	1.6%
Private	Ground	1,001 to 3,300	0.1%	0.1%	0.2%	0.3%	0.7%
Private	Ground	3,301 to 10,000	0.0%	0.1%	0.1%	0.3%	0.7%
Private	Surface	Less than 100	2.0%	2.9%	5.1%	8.3%	14.9%
Private	Surface	101 to 500	0.4%	0.7%	1.2%	2.2%	4.1%
Private	Surface	501 to 1,000	0.1%	0.2%	0.3%	0.6%	1.4%
Private	Surface	1,001 to 3,300	0.1%	0.1%	0.1%	0.3%	0.6%
Private	Surface	3,301 to 10,000	0.0%	0.1%	0.1%	0.3%	0.5%
Public	Ground	Less than 100	0.7%	1.1%	1.9%	3.2%	5.7%
Public	Ground	101 to 500	0.3%	0.5%	1.0%	1.8%	3.7%
Public	Ground	501 to 1,000	0.2%	0.2%	0.5%	0.8%	1.9%
Public	Ground	1,001 to 3,300	0.1%	0.1%	0.2%	0.4%	1.0%
Public	Ground	3,301 to 10,000	0.1%	0.1%	0.2%	0.4%	0.9%
Public	Surface	Less than 100	0.7%	1.3%	2.4%	4.3%	5.8%
Public	Surface	101 to 500	0.3%	0.5%	0.9%	1.6%	3.4%
Public	Surface	501 to 1,000	0.2%	0.2%	0.4%	0.8%	1.7%
Public	Surface	1,001 to 3,300	0.1%	0.1%	0.2%	0.4%	0.7%
Public	Surface	3,301 to 10,000	0.0%	0.1%	0.1%	0.3%	0.7%

Exhibit 8-11: Distribution of Incremental Costs vs. Revenue for Small CWSs – High Cost Scenario

			Incremental Cost Revenue Ratio				
Funding	Source Water	Size Category	10th Percentile	25th Percentile	50th Percentile	75th Percentile	90th Percentile
Private	Ground	Less than 100	-2.7%	2.9%	5.0%	9.2%	17.4%
Private	Ground	101 to 500	0.4%	0.8%	1.5%	3.3%	7.4%
Private	Ground	501 to 1,000	0.2%	0.2%	0.5%	1.7%	4.8%
Private	Ground	1,001 to 3,300	0.1%	0.1%	0.3%	0.7%	2.1%
Private	Ground	3,301 to 10,000	0.0%	0.1%	0.2%	0.8%	2.1%
Private	Surface	Less than 100	1.5%	2.7%	6.6%	13.7%	28.5%
Private	Surface	101 to 500	0.4%	0.7%	2.0%	4.3%	16.1%
Private	Surface	501 to 1,000	0.1%	0.2%	1.1%	1.9%	7.2%
Private	Surface	1,001 to 3,300	0.1%	0.1%	0.4%	1.0%	3.3%
Private	Surface	3,301 to 10,000	0.0%	0.1%	0.3%	0.8%	1.8%
Public	Ground	Less than 100	-0.9%	1.0%	1.8%	3.5%	7.3%
Public	Ground	101 to 500	0.3%	0.5%	1.1%	2.9%	7.1%
Public	Ground	501 to 1,000	0.2%	0.3%	0.8%	2.7%	6.6%
Public	Ground	1,001 to 3,300	0.1%	0.1%	0.3%	1.1%	3.8%
Public	Ground	3,301 to 10,000	0.1%	0.1%	0.3%	0.9%	2.6%
Public	Surface	Less than 100	0.6%	1.2%	2.7%	5.8%	12.5%
Public	Surface	101 to 500	0.3%	0.5%	1.6%	3.8%	12.4%
Public	Surface	501 to 1,000	0.2%	0.3%	1.4%	2.8%	8.2%
Public	Surface	1,001 to 3,300	0.1%	0.1%	0.5%	1.2%	3.5%
Public	Surface	3,301 to 10,000	0.1%	0.1%	0.4%	1.0%	2.1%

Note: This exhibit provides a comparison of incremental costs to revenues, negative values indicate that the estimated costs of the final LCRR are less than the costs systems are projected to incur under the previous rule requirements over the 35-year period of analysis.

8.4.6.1 *Alternative Small System Flexibility Option*

The second option that EPA assessed as a means to mitigate the economic impact of the LCRR on small entities provided the same regulatory flexibility when a system exceeds the 90th percentile lead AL allowing the PWSs to choose among: fully replacing all LSLs within 15 years; optimizing existing CCT or installing new CCT; installing and maintaining POU devices at all locations being served; or replacing lead-bearing plumbing materials. This second option only differs from the final LCRR requirements by lowering the CWS size threshold for system that can choose between the regulatory compliance alternatives from CWSs serving 10,000 or fewer people to CWSs serving 3,300 or fewer people.

EPA estimated the annual incremental cost to PWSs and the annual incremental total cost of the LCRR with the small system flexibilities threshold set so that CWSs serving 3,300 or fewer people would be able to choose from the set of alternative compliance options CCT, LSLR, or POU. As shown in Exhibit 8-12, the annual incremental cost of the LCRR with the alternative threshold of 3,300 ranges from $163 to $364 million at a 3 percent discount rate, and from $170 to $409 million at a 7 percent discount rate in 2016 dollars. These estimated total costs are higher than those estimated for the final LCRR, by a range from $2.9 million to $36 million. See Exhibit 9-9 and Exhibit 9-10, in Chapter 9, showing the annual incremental costs for PWSs, the total rule annual incremental costs, and the total rule incremental benefits for both the final LCRR and the rule with the alternative 3,300 or fewer people served CWS small system size threshold.

Exhibit 8-12: National Annualized Incremental Rule Costs with Compliance Flexibility for CWSs Serving 3,300 or Fewer People and All NTNCWSs (2016$)

Benefit/Cost Category	3% Discount Rate		7% Discount Rate	
	Low Cost Scenario	High Cost Scenario	Low Cost Scenario	High Cost Scenario
Total Annual PWS Costs	$134,013,000	$322,711,000	$138,993,000	$361,732,000
Total Annual Rule Costs	$163,460,000	$363,607,000	$170,418,000	$408,500,000

Unlike the Final LCRR, CWSs serving 3,301 to 10,000 do not have compliance flexibility when they exceeds the AL, under this alternative option, and must conduct CCT installation, CCT re-optimization, and LSLR in accordance with the LCRR requirements for medium sized systems (See Chapter 3 for the regulatory requirements and Chapter 5 for the cost assessment methodology). Under the high cost assumption scenario, 1,594 out of 4,974 CWSs serving 3,301 to 10,000 as a group perform LSLRs (700 systems), CCT installation (180 systems), or CCT re-optimization (714 systems). Under the low cost assumption scenario, 386 out of 4,974 CWSs serving 3,301 to 10,000 as a group perform LSLRs (129 systems), CCT installation (82 systems), or CCT re-optimization (175 systems).

Error! Reference source not found. and Exhibit 8-13 show the total and incremental annualized rule cost to all CWSs serving populations from 3,301 to 10,000 people, under the alternative CWS size threshold which does not allowing systems serving 3,301 or more people compliance flexibility, for both the low and high cost scenarios and discounted at 3 and 7 percent, respectively. These exhibits also show total and incremental annualized rule costs accrue to Primacy Agencies, households, and wastewater treatment plants from implementing the rule requirements on systems serving 3,301 to 10,000 people. As indicated in Exhibit 8-13, at the 3 percent discount rate, CWSs serving between 3,301 and 10,000 people have estimated incremental annual costs that range from $14 to $58 million, and total estimated annual incremental national rule costs for this category of system ranges from $18 to $65 million. Exhibit 8-14 shows the total PWS and total national estimated annual incremental costs of the final LCRR, for the system size category serving 3,301 to 10,000 people, range from $15 to $67 million and $19 to $75 million, respectively, at the 7 percent discount rate.

Exhibit 8-13: National Annualized Rule Costs - CWSs Serving 3,301 to 10,000 People without Small System Compliance Flexibility at 3% Discount Rate (2016$)

	Low Cost Estimate			High Cost Estimate		
PWS Annual Costs	**Previous LCR**	**Final LCRR**	**Incremental**	**Previous LCR**	**Final LCRR**	**Incremental**
Sampling	$6,533,000	$9,669,000	$3,136,000	$7,169,000	$13,244,000	$6,075,000
PWS Lead Service Line Replacement	$62,546	$3,696,000	$3,634,000	$4,417,000	$28,432,000	$24,015,000
Corrosion Control Technology	$36,791,000	$40,697,000	$3,907,000	$41,686,000	$63,727,000	$22,040,000
Point-of Use Installation and Maintenance	$0	$0	$0	$0	$0	$0
Public Education and Outreach	$103,220	$3,752,000	$3,649,000	$331,000	$6,359,000	$6,028,000
Rule Implementation and Administration	$0	$156,118	$156,118	$0	$156,118	$156,118
Total Annual PWS Costs	$43,489,000	$57,970,000	$14,482,000	$53,604,000	$111,919,000	$58,314,000
State Rule Implementation and Administration	$912,000	$3,841,000	$2,931,000	$1,001,000	$4,341,000	$3,340,000
Household Lead Service Line Replacement	$17,982	$567,000	$548,621	$891,000	$4,041,000	$3,150,000
Wastewater Treatment Plant Costs	$7,826	$49,485	$41,306	$36,701	$174,179	$136,478
Total Annual Rule Costs	$44,425,000	$62,427,000	$18,002,000	$55,535,000	$120,474,000	$64,939,000

Exhibit 8-14: National Annualized Rule Costs - CWSs Serving 3,301 to 10,000 People without Small System Compliance Flexibility at 7% Discount Rate (2016$)

	Low Cost Estimate			High Cost Estimate		
PWS Annual Costs	**Previous LCR**	**Final LCRR**	**Incremental**	**Previous LCR**	**Final LCRR**	**Incremental**
Sampling	$6,450,000	$10,042,000	$3,592,000	$7,313,000	$14,590,000	$7,275,000
PWS Lead Service Line Replacement	$72,373	$3,946,000	$3,875,000	$6,220,000	$35,319,000	$29,098,000
Corrosion Control Technology	$35,071,000	$38,825,000	$3,756,000	$40,100,000	$64,364,000	$24,264,000
Point-of Use Installation and Maintenance	$0	$0	$0	$0	$0	$0
Public Education and Outreach	$140,040	$3,749,000	$3,609,000	$452,000	$6,527,000	$6,075,000
Rule Implementation and Administration	$0	$258,494	$258,494	$0	$258,494	$258,494

Total Annual PWS Costs	$41,733,000	$56,822,000	$15,090,000	$54,086,000	$121,058,000	$66,973,000
State Rule Implementation and Administration	$885,000	$3,982,000	$3,096,000	$1,010,000	$4,588,000	$3,579,000
Household Lead Service Line Replacement	$21,416	$599,000	$578,462	$1,255,000	$5,024,000	$3,768,000
Wastewater Treatment Plant Costs	$12,986	$80,784	$67,486	$61,822	$287,913	$226,091
Total Annual Rule Costs	$42,652,000	$61,485,000	$18,832,000	$56,412,000	$130,960,000	$74,547,000

EPA assessed the degree to which this alternative small system flexibility threshold would mitigate compliance costs. The Agency estimated the cost of the LCRR, if no compliance alternatives were available to small systems, and compared these values to the reported costs of this option shown in Exhibit 8-12. Exhibit 8-15 shows the cost savings, from allowing CWSs that serve 3,300 or fewer people, and all NTNCWSs compliance flexibilities, of between $10 million and $65 million across discount rates and low/high cost scenarios.

Exhibit 8-15: Comparison of Final LCRR Incremental Cost with Small System Flexibility for CWSs Serving 3,300 or Fewer People and NTNCWSs to LCRR Incremental Cost without the Small System Flexibility (2016$)

Option	Cost (2016$)	
	Low Cost Scenario	High Cost Scenario
3% Discount Rate		
Final LCRR: Small System Flexibility for CWSs serving <= 3,300 people and all NTNCWSs	$163,460,000	$363,607,000
LCRR with No Small System Flexibility	$173,634,000	$419,012,000
Cost Savings with Small System Flexibility	$10,174,000	$55,405,000
7% Discount Rate		
Final LCRR: Small System Flexibility for CWSs serving <= 3,300 people and all NTNCWSs	$170,418,000	$408,500,000
LCRR with No Small System Flexibility	$180,299,000	$473,946,000
Cost Savings with Small System Flexibility	$9,881,000	$65,446,000

As in the case of EPA's regulatory flexibility analysis for the final LCRR small system option, EPA calculated the annual revenue per CWS by using each PWS's average daily flow and the average revenue per thousand gallons delivered from the CWSS (USEPA, 2009b, Table 61). These revenue estimates were then inflated to 2016 dollars using the CPI for utilities.

Exhibit 8-16 and Exhibit 8-17 provide, for the alternative small system compliance flexibility threshold, the estimated total number of small CWSs serving 3,301 – 10,000 people, by ownership and source water type, which have incremental annual costs that exceed the 1 percent and 3 percent of annual revenue threshold values under the low and high cost scenarios. The number of CWSs in the 3,301-10,000 size category that experience an incremental cost increase greater than 1 percent of revenues, ranges from 463 to 1,486. Given that this size category contains a total of 4,974 systems, the percent of systems experiencing this incremental cost increase greater than one percent of revenues, ranges from 9.3 percent to 29.9 percent. The number of CWSs in the 3,301-10,000 size category that experience an incremental cost increase greater than three percent of revenues, ranges from 103 to 717, which represents 2.1 percent to 14.4 percent of the systems in this size category. The 1 and 3 percent ratio counts and percentages remain the same as those provided for the final LCRR in Exhibit 8-8 and Exhibit 8-9 for all other CWS size categories. Under this alternative threshold option, the total number of small CWSs, across all small entity size categories that will experience incremental annual costs of more than 1 percent of revenues, ranges from 21,588 and 25,791 (versus 21,524 to 25,483 under the final LCRR small system flexibility). The total number of CWS with annual incremental costs exceeding 3 percent of revenues, under the alternative small system flexibility option, ranges from 11,584 to 14,939 (versus 11,560 to 14,611 under the final LCRR small system flexibility).

Exhibit 8-16: Incremental Costs vs. Revenue for Small CWSs Serving 3,301-10,000 People – Low Cost Scenario

Funding	Source Water	Number of CWSs	Number of CWSs with Cost Revenue Ratio > 1%	Number of CWSs with Cost Revenue Ratio > 3%	Percent of CWSs with Cost Revenue Ratio > 1%	Percent of CWSs with Cost Revenue Ratio > 3%
Private	Ground	333	26	8	8.0%	2.4%
Private	Surface	163	9	1	5.5%	0.8%
Public	Ground	2,438	264	68	10.8%	2.8%
Public	Surface	2,040	164	26	8.0%	1.3%
Total		4,974	463	103	9.3%	2.1%

Exhibit 8-17: Incremental Costs vs. Revenue for Small CWSs Serving 3,301-10,000 People – High Cost Scenario

Funding	Source Water	Number of CWSs	Number of CWSs with Cost Revenue Ratio > 1%	Number of CWSs with Cost Revenue Ratio > 3%	Percent of CWSs with Cost Revenue Ratio > 1%	Percent of CWSs with Cost Revenue Ratio > 3%
Private	Ground	333	82	38	24.5%	11.3%
Private	Surface	163	56	21	34.6%	12.9%
Public	Ground	2,438	658	334	27.0%	13.7%
Public	Surface	2,040	690	324	33.8%	15.9%
Total		4,974	1,486	717	29.9%	14.4%

Exhibit 8-18 shows the low cost scenario distribution of the ratio of the incremental annual cost to total annual revenue for CWSs serving 3,301 to 10,000 people under the alternative small system compliance option where CWSs serving 3,300 or fewer people can select among compliance alternatives when they exceed the AL. Exhibit 8-19 provides this information for the high cost scenario. Both tables provide values broken out by ownership and source water type. The incremental annual cost to total annual revenue ratio distributions remain the same as those provided for the final LCRR in Exhibit 8-10Exhibit 8-10: Distribution of Incremental Costs vs. and Exhibit 8-11 for all other CWS size categories (systems serving 100 or fewer, 101-500, 501-1,000, and 1,001-3,300 people).

Exhibit 8-18: Distribution of Incremental Costs vs. Revenue for CWSs Serving 3,301-10,000 People - Low Cost Scenario

		Incremental Cost Revenue Ratio				
Funding	**Source Water**	**10th Percentile**	**25th Percentile**	**50th Percentile**	**75th Percentile**	**90th Percentile**
Private	Ground	0.0%	0.1%	0.5%	0.3%	0.8%
Private	Surface	0.0%	0.1%	0.3%	0.3%	0.6%
Public	Ground	0.1%	0.1%	0.6%	0.4%	1.1%
Public	Surface	0.0%	0.1%	0.3%	0.3%	0.8%

Exhibit 8-19: Distribution of Incremental Costs vs. Revenue for CWSs Serving 3,301-10,000 People - High Cost Scenario

		Incremental Cost Revenue Ratio				
Funding	**Source Water**	**10th Percentile**	**25th Percentile**	**50th Percentile**	**75th Percentile**	**90th Percentile**
Private	Ground	0.1%	0.1%	1.8%	0.9%	3.2%
Private	Surface	0.0%	0.1%	1.4%	1.6%	3.6%
Public	Ground	0.1%	0.1%	1.5%	1.9%	4.4%
Public	Surface	0.1%	0.1%	1.5%	1.9%	4.4%

8.4.7 Determination of Final Small System Requirements under the LCRR

EPA has determined that the appropriate threshold to provide flexibility to small CWS is 10,000 or fewer persons served. The Agency finds that small water systems serving 10,000 or fewer persons typically do not have the capacity to implement multiple measures simultaneously such as CCT and LSLR programs. Small CWSs and NTNCWSs tend to have more limited technical, financial, and managerial capacity to implement complex treatment technique rules such as the LCR (USEPA, 2011a). Many small PWSs face challenges in reliably providing safe drinking water to their customers and consistently meeting the requirements of the SDWA and the National Primary Drinking Water Regulations (NPDWRs) (USEPA, 2011a). The Agency determined the compliance flexibility options would be most appropriate for small water systems that serve 10,000 or fewer persons, as they are most frequently the systems that are

struggling to maintain compliance with the previous LCR and/or do not have the capacity to operate CCT in conjunction with other complex treatment technique requirements. Small water systems serving 10,000 or fewer persons have more monitoring and reporting (M&R) violations, accounting for approximately 90 percent of all M&R violations for all NPDWRs. Recurring M&R violations can obscure more important water quality problems because MCL and maximum residual disinfectant level (MRDL) violations may not be discovered if a system fails to conduct routine monitoring. M&R requirements are often the simplest compliance requirements, and systems that cannot complete these procedures may have other technical, managerial, and financial issues (USEPA, 2011a). Small system flexibilities will provide alternatives to chemical treatment as it is difficult for many small systems to find operators that have the more advanced skills necessary to implement and maintain such treatment, particularly given the limited financial and programmatic capacity of many small utilities (Kane and Tomer, 2018). EPA has concluded that these small systems can work with their Primacy Agency to identify an affordable and feasible treatment technique to reduce drinking water lead exposure. EPA expects that small systems will work with their Primacy Agency to identify the single most cost-effective measure from this list of affordable and feasible compliance options. That measure will depend upon the characteristics of the small system including the number of service connections, the number of LSLs, and the technical capacity of the system's operators.

EPA has determined that it is not feasible for systems serving 10,000 or fewer people to implement the multiple treatment technique actions of optimized CCT, PE, and LSLR due to lower financial, managerial and technical capacity. The systems serving 10,000 or fewer persons have fewer professional staff than larger systems; these systems have an average of 0.4 to 2.4 full time operators and 0.5 to 2.4 managers per system, which is approximately 2 to11 times less than the average number of operators in the larger systems. Average revenues for systems serving 10,000 or fewer persons are about 4 to 170 times smaller than average revenues for large systems (USEPA, 2009a).

The consistency of many of the aspects of the final LCRR with the recommendations of the SBAR Panel further support the conclusion of the final LCRR FRFA that the final requirements are conducive to minimizing net impacts on small entities. For example, the flexibility provided to small PWSs will allow some small PWSs that would have been required to install new CCT under the previous LCR to install POU at a much lower cost. However, overall, the final LCRR will have a significant impact on small systems as measured by the incremental cost to revenue test.

8.5 Unfunded Mandates Reform Act

The UMRA (1995) seeks to protect state, local, and tribal governments from the imposition of unfunded federal mandates. In addition, the Act seeks to strengthen the partnership among the federal government and state, local, and tribal governments.

Title II of UMRA establishes requirements for federal agencies to assess the effects of their regulatory actions on state, local, and tribal governments and the private sector. Under Section 202 of UMRA, EPA generally must prepare a written statement, including a cost-benefit analysis, for final rules with "federal mandates" that may result in expenditures by state, local, and tribal governments, in the aggregate, or by the private sector, of $100 million or more in any one year, adjusted for inflation. EPA has calculated the cost of the rule in 2016 dollars, therefore, the UMRA requirements are triggered if expenditures exceed $158 million in one year.

Section 205 of UMRA generally requires EPA to identify and consider a reasonable number of regulatory alternatives and adopt the least costly, most cost-effective, or least burdensome option that achieves the objectives of the rule. The provisions of Section 205 do not apply when they are inconsistent with applicable law. Moreover, Section 205 allows EPA to adopt an alternative other than the least costly, most cost-effective, or least burdensome alternative if the Administrator publishes with the rule an explanation why that alternative was not adopted.

Before EPA establishes any regulatory requirements that may significantly or uniquely affect small governments, including tribal governments, including tribal governments, it must have developed under Section 203 of UMRA a small government agency plan. The plan must provide for notifying potentially affected small governments, enabling officials of affected small governments to have meaningful and timely input in the development of EPA regulatory proposals with significant federal intergovernmental mandates, and informing, educating, and advising small governments on compliance with the regulatory requirements.

The final LCRR does contain a federal mandate that may result in expenditures to state, local, and tribal governments, in the aggregate, or to the private sector, of $158 million or more in any one year. Under the low cost scenario, the highest annual incremental cost over the 35-year analysis period is estimated to happen in the fourth year after rule promulgation. In this year, publicly owned PWSs are expected to have undiscounted incremental costs of $559 million, privately owned PWSs are expected to have undiscounted incremental costs of $99 million, and Primacy Agencies will have undiscounted incremental costs of $103 million. Under the high cost scenario, the highest annual incremental cost over the 35-year analysis period is estimated to happen in the seventh year after rule promulgation. In this year, publicly owned PWSs are expected to have undiscounted incremental costs of $1.2 billion, privately owned PWSs are expected to have undiscounted incremental costs of $196 million, and Primacy Agencies will have undiscounted incremental costs of $20 million. Therefore, the final LCRR is subject to the requirements of Sections 202 and 205 of UMRA.

The annualized incremental costs and benefits of the final LCRR, that are borne by public, private and tribal PWSs under the low and high cost scenarios are provided in Exhibit 8-20 (3 percent discount rate) and Exhibit 8-21 (7 percent discount rate). Exhibit 8-22 and Exhibit 8-23 provide the same information for small PWSs (10,000 or fewer people).[143] As these exhibits show, public entities bare the vast majority of the costs, and their customers accrue most of the benefits, of the final LCRR. In addition to these PWS costs, as discussed in Chapter 5, under the final LCRR, Primacy Agencies will incur annualized incremental administrative costs of between $20 and $21 million (3 percent discount rate) or $21 and $22 million (7 percent discount rate). Finally, wastewater treatment plants, most of which are publicly owned, will incur an incremental annualized cost of between $1.2 million and $1.8 million (3 percent discount rate) or $1.5 and $2.6 million (7 percent discount rate).

[143] For the UMRA analysis, a small PWS is defined as one that serves 10,000 or fewer people.

Exhibit 8-20: Total Annualized Incremental Costs and Benefits at 3 Percent Discount Rate

Type of System	Low Cost Scenario	High Cost Scenario
Public PWS Incremental Annualized Costs	$107,968,000	$250,908,000
Private PWS Incremental Annualized Costs	$22,801,000	$45,596,000
Tribal PWS Incremental Annualized Costs	$1,023,000	$2,316,000
Public PWS Incremental Annualized Benefits	$193,733,000	$541,303,000
Private PWS Incremental Annualized Benefits	$28,655,000	$99,709,000
Tribal PWS Incremental Annualized Benefits	$956,000	$4,265,000

Note: Public systems include public-private partnerships. In addition, for the UMRA analysis, federally owned systems are excluded from the public costs.

Exhibit 8-21: Total Annualized Incremental Costs and Benefits at 7 Percent Discount Rate

Type of System	Low Cost Scenario	High Cost Scenario
Public PWS Incremental Annualized Costs	$111,298,000	$257,480,000
Private PWS Incremental Annualized Costs	$24,212,000	$47,922,000
Tribal PWS Incremental Annualized Costs	$1,095,000	$2,353,000
Public PWS Incremental Annualized Benefits	$34,073,000	$99,390,000
Private PWS Incremental Annualized Benefits	$5,113,000	$18,923,000
Tribal PWS Incremental Annualized Benefits	$168,000	$789,000

Note: Public systems include public-private partnerships. In addition, for the UMRA analysis, federally owned systems are excluded from the public costs.

Exhibit 8-22: Total Annualized Incremental Costs and Benefits for Small PWSs (≤ 10,000 people) at 3 Percent Discount Rate

Type of System	Low Cost Scenario	High Cost Scenario
Small Public PWS Incremental Annualized Costs	$29,915,000	$80,678,000
Small Private PWS Incremental Annualized Costs	$13,198,000	$23,293,000
Small Tribal PWS Incremental Annualized Costs	$817,000	$1,940,000
Small Public PWS Incremental Annualized Benefits	$20,649,000	$144,774,000
Small Private PWS Incremental Annualized Benefits	$3,642,000	$45,889,000
Small Tribal PWS Incremental Annualized Benefits	$488,000	$3,489,000

Note: Public systems include public-private partnerships. In addition, for the UMRA analysis, federally owned systems are excluded from the public costs.

Exhibit 8-23: Total Annualized Incremental Costs and Benefits for Small PWSs (≤10,000 people) at 7 Percent Discount Rate

Type of System	Low Cost Scenario	High Cost Scenario
Small Public PWS Incremental Annualized Costs	$32,065,000	$81,614,000
Small Private PWS Incremental Annualized Costs	$14,274,000	$24,206,000
Small Tribal PWS Incremental Annualized Costs	$883,000	$1,963,000
Small Public PWS Incremental Annualized Benefits	$3,581,000	$26,202,000
Small Private PWS Incremental Annualized Benefits	$635,000	$8,974,000
Small Tribal PWS Incremental Annualized Benefits	$85,000	$646,000

Note: Public systems include public-private partnerships. In addition, for the UMRA analysis, federally owned systems are excluded from the public costs.

8.6 Executive Order 13132: Federalism

Executive Order 13132, *Federalism* (64 FR 43255, August 10, 1999), requires EPA to develop an accountable process to ensure "meaningful and timely input by state and local officials in the development of regulatory policies that have federalism implications." "Policies that have federalism implications" are defined in the Executive Order to include regulations that have "substantial direct effects on the states, on the relationship between the national government and the states, or on the distribution of power and responsibilities among the various levels of government."

This action has federalism implications due to the substantial direct compliance costs on state or local governments. The net change in Primacy Agency related cost for state, local, and tribal governments in the aggregate is estimated to be between $19.7 and $20.8 million (3 percent discount rate) or $20.9 and $22.2 million (7 percent discount rate).

To fulfill requirements of Executive Order 13132 Section 6, EPA held a Federalism consultation on November 15, 2011 with representatives from state and local government organizations to solicit feedback on potential regulatory revisions to the LCR. In its capacity as an advisory committee to EPA, the Local Government Advisory Committee (LGAC) periodically makes recommendations and comments to the Agency on issues impacting local governments. EPA received comments that addressed sample site collection criteria and the lead sampling protocol at LSL sites.

EPA held another Federalism meeting on January 8, 2018, in Washington D.C., with 17 intergovernmental associations and several associations representing state and local governments.[144] Specifically, EPA invited the following national organizations to the Federalism meeting: the National Governors' Association, the National Conference of State Legislatures, the Council of State Governments, the National League of Cities, the United States Conference of Mayors, the National Association of Counties, the International City/County Management Association, the National Association of Towns and Townships, the County Executives of America, and the Environmental Council of States. Additionally, the Agency invited the Association of State Drinking Water Administrators, the Association of Metropolitan Water Agencies, the National Rural Water Association, the American Water

[144] For more information regarding the LCR Federalism Consultation, refer to: https://www.epa.gov/dwstandardsregulations/lcr-federalism-consultation.

Works Association, the American Public Works Association, the National School Board Association, the American Association of School Administrators, and the Western Governors' Association to participate in the meeting. EPA also held five follow-up briefings between January 8 and March 8, 2018. A total of 82 state and local governments and related associations provided input during the meetings and within 60 days after the initial meeting. Common issues discussed included LSLR, CCT, transparency and PE, tap sampling, and copper. EPA considered Federalism comments received in 2011 and 2018 when developing the final LCRR.

8.7 Executive Order 13175: Consultation and Coordination with Indian Tribal Governments

Executive Order 13175, *Consultation and Coordination with Indian Tribal Governments* (65 FR 67249, November 9, 2000), requires EPA to develop an accountable process to ensure "meaningful and timely input by tribal officials in the development of regulatory policies that have tribal implications." The Executive Order defines "policies that have tribal implications to include regulations that have "substantial direct effects on one or more Indian tribes, on the relationship between the federal government and the Indian tribes, or on the distribution of power and responsibilities between the federal government and Indian tribes."

The final LCRR has tribal implications since it may impose substantial direct compliance costs on tribal governments, and the federal government will not provide the funds necessary to pay those costs. There are 996 public water systems serving tribal communities, 87 of which are federally owned. The economic analysis of the final LCRR requirements estimated that the total annualized incremental costs placed on all systems serving tribal communities ranges from $1 – $2.4 million. While the average annual incremental cost increase per tribal system is estimated to range from $1,027 to $2,362. EPA notes that these estimated impacts will not fall evenly across all tribal systems. The final LCRR does offer regulatory relief by providing flexibility for CWSs serving 10,000 or fewer people and all NTNCWSs to choose CCT, LSLR, POU devices, and replacement of lead-bearing materials to address lead in drinking water. This flexibility may result in LCR implementation cost savings for many tribal systems since 98 percent of tribal CWSs serve 10,000 or fewer people and 17 percent of all tribal systems are NTNCWSs.

EPA consulted with tribal officials early in developing the final LCRR through EPA's American Indian Environmental Office. EPA held consultations with federally-recognized Indian tribes in 2011 and 2018. The 2018 consultations with federally-recognized Indian tribes began on January 16, 2018 and ended March 16, 2018. The first national webinar was held January 31, 2018, while the second national webinar was held February 15, 2018. A total of 48 tribal representatives participated in the two webinars. Updates on the consultation process were provided to the National Tribal Water Council upon request at regularly scheduled monthly meetings during the consultation process. Also, upon request, informational webinars were provided to the National Tribal Toxics Council's Lead Subcommittee on January 30, 2018, and EPA Region 9's Regional Tribal Operations Committee (RTOC) on February 8, 2018. Additionally, EPA received written comments from the following tribes and tribal organizations: Navajo Tribal Utility Authority, National Tribal Water Council, United South and Eastern Tribes Sovereignty Protection Fund, and Yukon River Inter-Tribal Watershed Council. A summary report of the

views expressed during tribal consultations is available in the Docket (EPA-HQ-OW-2017-0300).[145] As required by section 7(a) of the executive order, EPA's Tribal Official has certified that the requirements of the executive order have been met in a meaningful and timely manner. A copy of the certification is included in the docket for this action.

8.8 Executive Order 13045: Protection of Children from Environmental Health and Safety Risks

Executive Order 13045, Protection of Children from Environmental Health and Safety Risks (62 FR 19885, April 23, 1997), applies to any rule initiated after April 21, 1998, that 1) is determined to be "economically significant" as defined under Executive Order 12866; and 2) concerns an environmental, health, or safety risk that EPA has reason to believe may have a disproportionate effect on children. If the regulatory action meets both criteria, the EPA must evaluate the environmental, health, or safety effects of the planned rule on children, and explain why the planned regulation is preferable to other potentially effective and reasonably feasible options considered by EPA.

The final LCRR is subject to Executive Order 13045 because it is economically significant as defined in Executive Order 12866. This action's health and risk assessments are contained in Chapter 6, and the associated appendices. EPA expects that the final LCRR would provide additional protection to both children and adults who consume drinking water supplied by systems. EPA also finds that the benefits of the final LCRR, including reduced health risk, will provide significant benefits to infants and young children due to reducing exposure to lead in drinking water. This is due to the fact that developing fetuses, infants, and young children are at higher risk for the adverse neurodevelopmental effects of lead than adolescents or adults. These effects include, but are not limited to, decreases in cognitive function, as summarized in Appendix D. This increased susceptibility is due to several factors, related to both physiology and levels of exposure to lead during childhood. Physiological differences in neurodevelopment suggest that infants and young children are at higher risk due to the susceptibility of the developing brain. Additionally, there are physiological differences in lead absorption: given the same level of lead exposure, infants, and young children will absorb more lead from the gastrointestinal tract than older children or adults. Finally, there is also epidemiological evidence demonstrating that there are higher lead exposures in infants and young children relative to older children or adults, which are attributable to differences in behavior and diet.

It is important to note that the greater susceptibility in infants and young children does not minimize the risks of lead exposures in adolescents or adults. Lead is associated with numerous adverse health effects in these populations as well, including cardiovascular effects, immune system effects, and reproductive and developmental effects which are also summarized in Appendix D. In addition, lead stored in the bones of women from prior exposures can be mobilized from bone during pregnancy, leading to subsequent increases in prenatal and postnatal lead exposures in children (via transfer from the placenta and from breastmilk, respectively) (USEPA, 2013a). It follows then that reductions in exposure to women even prior to pregnancy will result in further protections for infants and children due to decreases in exposure during pregnancy. For these reasons, lead exposures throughout the lifespan are

[145] For more information regarding the tribal consultation, refer to EPA's Tribal Portal site at: http://www.epa.gov/tribal/consultation/index.htm.

of concern to human health, and the developing fetus, infant and young children are the most susceptible. Reducing lead exposures in drinking water will protect children from this increased risk.

8.9 Executive Order 13211: Actions That Significantly Affect Energy Supply, Distribution, or Use

Executive Order 13211, *Actions Concerning Regulations That Significantly Affect Energy Supply Distribution, or Use* (66 FR 28355, May 22, 2001), provides that agencies shall prepare and submit to the Administrator of the Office of Information and Regulatory Affairs, OMB, a Statement of Energy Effects for certain actions identified as "significant energy actions." Section 4(b) of Executive Order 13211 defines "significant energy actions" as "any action by an agency (normally published in the *Federal Register*) that promulgates or is expected to lead to the promulgation of a final rule or regulation, including notices of inquiry, advance notices of proposed rulemaking, and notices of proposed rulemaking: (1)(i) that is a significant regulatory action under Executive Order 12866 or any successor order, and (ii) is likely to have a significant adverse effect on the supply, distribution, or use of energy; or (2) that is designated by the Administrator of the Office of Information and Regulatory Affairs as a significant energy action."

The final LCRR is not a "significant energy action" as defined in Executive Order 13211. This rule is a significant regulatory action under Executive Order 12866; however, it is not likely to have a significant adverse effect on the supply, distribution, or use of energy, for the reasons described as follows.

8.9.1 Energy Supply

The final LCRR does not regulate power generation, either directly or indirectly, and public and private systems subject to the final LCRR does not, as a general rule, generate power. Further, the energy cost increases borne by customers of systems as a result of the final LCRR is a low percentage of the total cost of water. Therefore, power generation utilities that purchase water as part of their operations are unlikely to face any significant effects as a result of the final LCRR.

8.9.2 Energy Distribution

The final LCRR does not regulate any aspect of energy distribution and systems that are regulated by the final LCRR already have electrical service. The rule is not expected to increase peak electricity demand at systems. Therefore, EPA assumes that the existing connections are adequate and that the final LCRR has no discernible adverse effect on energy distribution.

8.9.3 Energy Use

EPA has determined that the incremental energy used to implement CCT at drinking water systems in response to the final regulatory requirements is minimal. Therefore, EPA does not expect any noticeable effect on the national levels of power generation in terms of average and peak loads.

8.10 National Technology Transfer and Advancement Act

Section 12(d) of the NTTAA of 1995 directs EPA to use voluntary consensus standards in its regulatory activities unless to do so would be inconsistent with applicable law or otherwise impractical. Voluntary consensus standards are technical standards (e.g., materials specifications, test methods, sampling procedures, and business practices) that are developed or adopted by voluntary consensus standards bodies. NTTAA directs EPA to provide Congress, through OMB, explanations when EPA decides not to use available and applicable voluntary consensus standards.

The final rule may involve existing voluntary consensus standards in that it requires additional monitoring for lead and copper. Monitoring and sample analysis methodologies are often based on voluntary consensus standards. However, the final LCRR does not change any methodological requirements for monitoring or sample analysis. EPA's approved monitoring and sampling protocols generally include voluntary consensus standards developed by agencies such as the American National Standards Institute (ANSI) and other such bodies wherever EPA deems these methodologies appropriate for compliance monitoring. EPA notes that in some cases, the final LCRR revises the required frequency and number of lead tap samples.

8.11 Executive Order 12898: Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations

Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations* (59 FR 7629, February 16, 1994), establishes federal executive policy on environmental justice. Its main provision directs federal agencies, to the greatest extent practicable and permitted by law, to make environmental justice part of their mission. Agencies must do this by identifying and addressing as appropriate any disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority populations and low-income populations in the United States.

Exhibit 8-24 provides a summary of EPA’s environmental justice analysis for the final LCRR. In evaluating baseline exposure to lead in drinking water, data indicate the possibility of a disproportionately high and adverse human health risk among minority populations and low-income populations. Higher than expected proportions of children in minority households and/or low-income households live in housing built during decades of higher LSL usage. The final LCRR seeks to reduce the health risks of exposure to lead in drinking water provided by CWS and NTNCWS. Because systems with LSLs are more likely to have an ALE or TLE and, therefore, engage in actions to reduce lead concentrations, the final rule should mitigate the baseline environmental justice concerns.

The final rule is not expected to have disproportionately high and adverse human health or environmental effects on minority populations and low-income populations. The final revisions should result in enhanced CCT and more LSLRs conducted by water systems with higher baseline lead concentrations that will increase the level of health protection for all affected populations. The LSLR provision may be less likely than the CCT provision to address baseline health risk disparity among low-income populations because LSLR may not be affordable for low-income households. There are, however, federal and state programs that may be used to fund LSLR programs including the cost of LSLR for customer-owned LSLs. These include but are not limited to the Drinking Water State Revolving Fund

(DWSRF), Water Infrastructure Finance and Innovation Act (WIFIA) Program, Water Infrastructure Improvements for the Nation (WIIN) Act of 2016 grant programs, and United States Department of Housing and Urban Development's (HUD) Community Development Block Grant (CDBG) Program (USEPA, 2019c). The benefit-cost analysis of the rule indicates that CCT changes will account for most of the benefits. Therefore, health risk reduction benefits will be more uniformly distributed among populations with high baseline health risks including minority and low-income households. Thus, the final LCRR meets the intent of the federal policy requiring incorporation of environmental justice into federal agency missions.

Exhibit 8-24: Summary of Environmental Justice Evaluation Topics, Methods, and Findings

Evaluation Topic	Evaluation Method	Findings
Are population groups of concern (e.g., minority and low-income populations) disproportionately exposed to lead and copper in drinking water delivered by drinking water systems?	Case study of blood lead levels and minority status. Statistical analysis of child population by household income and minority status and housing vintage (proxy for lead service lines).	Higher blood lead levels observed among minority populations. Higher proportion of low-income children in older housing likely to have lead service lines.
Are minority and low-income populations disproportionately affected by the LCRR?	Illustrative estimates and discussion of health risk reductions for rule provisions.	System-wide changes that benefit all customers will also benefit minority and low-income populations. Household-level changes that depend on ability-to-pay will leave low-income households with disproportionately higher health risks.
Do the LCRR effects create or mitigate baseline environmental justice concerns?	Evaluate whether minority or low-income households with disproportionate baseline risk are likely to benefit from health risk reductions.	In general, the final rule should reduce health risks primarily at systems with lead service lines, which could address baseline disproportionate risk.

Source: Abt Associates (2019), available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov.

8.12 Consultations with the Science Advisory Board, National Drinking Water Advisory Council, and the Secretary of Health and Human Services

8.12.1 Consultation with Science Advisory Board

As required by Section 1412(e) of the SDWA, in 2011, EPA sought an evaluation of current scientific data to determine whether partial LSLR effectively reduce water lead levels. When the LCR was promulgated in 1991, large water systems, serving greater than 50,000 people, were required to install CCT and small and medium water systems, serving 50,000 or fewer people, if samples exceeded the AL for lead or copper (USEPA, 1991). If the lead AL was not met after installing CCT, water systems were required to replace 7 percent of their LSLs annually. If a system could demonstrate they did not have control of the

entire LSL, the system was allowed to replace only the portion of the LSL under its control. The 2000 revisions to the LCR broadened this partial replacement provision allowing water systems in general, if they exceeded the AL, to replace only the portion of the LSL that the water system owned and to replace the customer's portion of the LSL at the customer's expense. This practice is known as a partial LSLR.

EPA asked the SAB to evaluate the current scientific data on the following five partial LSLR issues: 1) associations between partial LSLR and blood lead levels in children; 2) lead tap water sampling data before and after partial LSLR; 3) comparisons between partial and full LSLR; 4) partial LSLR techniques; and 5) the impact of galvanic corrosion. EPA identified several studies for the SAB to review while the SAB selected additional studies for their evaluation. The SAB deliberated and sought input from public meetings held on March 30 and 31, 2011 and during a public conference call on May 16, 2011. The SAB's final report, titled "SAB Evaluation of the Effectiveness of Partial Lead Service Line Replacements" was approved by the SAB on July 19, 2011, and transmitted to the EPA Administrator on September 28, 2011.

The SAB determined that the quality and quantity of data was inadequate to fully evaluate the effectiveness of partial LSLR in reducing drinking water lead concentrations. Both the small number of studies and the limitations within these studies (i.e., lack of comparability between studies, small sample size) barred a comprehensive assessment of partial LSLR efficacy. However, despite the limitations, the SAB concluded that partial LSLRs have not been shown to reliably reduce drinking water lead levels in the short-term of days to months, and potentially even longer. Additionally, partial LSLR is often associated with elevated drinking water lead levels in the short-term. The available data suggested that the elevated drinking water lead levels after the partial LSLR tend to stabilize over time to lower than or to levels similar to before the partial LSLR. Therefore, the SAB concluded that available data suggest that partial LSLR's may pose a risk to the population due to short-term elevations in drinking water lead concentrations after a partial LSLR which last for an unknown period. Considering the SAB's findings on partial LSLR, EPA determined that partial LSLRs should no longer be allowed when water systems exceed the AL for lead, and EPA considers full replacement of the LSL beneficial (USEPA, 2011b).

Following the LCRR proposal, the SAB elected to review the scientific and technical basis of the proposed rule on March 30, 2020. The SAB drinking water sub workgroup deliberated on this topic at a public teleconference held on May 11, 2020. The SAB provided advice and comments in its June 12, 2020 report (USEPA, 2020). SAB comments were similar to those raised by public commenters. A copy of the report is included in the docket for the rule at EPA-HQ-OW-2017-0300 at www.regulations.gov.

8.12.2 **Consultation with National Drinking Water Advisory Council**

The NDWAC is a Federal Advisory Committee that supports EPA in performing its duties and responsibilities related to the national drinking water program and was created through a provision in the SDWA in 1974. In accordance with Section 1446 of the SDWA, EPA consulted with the NDWAC on efforts to develop revisions to the LCR. These consultations are further described in this section.

8.12.2.1 ***2011 NDWAC Consultation***

EPA consulted with the NDWAC on July 21-22, 2011, to provide updates on the proposed LCRR and solicit feedback on potential regulatory options under consideration. On November 18, 2011, EPA held a public teleconference with the NDWAC to discuss a study completed by the Centers for Disease Control

and Prevention (CDC) as well as to address the SAB's evaluations regarding partial LSLR. In December 2011, the NDWAC held a 2-day public meeting to address various issues associated with drinking water protection including actions to assist small water systems. The NDWAC provided EPA with recommendations on the potential LCR regulatory revisions, which are outlined in a letter dated December 23, 2011 (NDWAC, 2011).

8.12.2.2 ***2013 NDWAC Consultation***

In December 2013, EPA met with the NDWAC in Washington, D.C. to provide a national drinking water program update (USEPA, 2013b). EPA provided background on the LCRR and highlighted for the NDWAC five areas in which EPA was considering a range of regulatory revisions and seeking detailed stakeholder input. The five areas were: 1) sample site selection criteria for tap monitoring, 2) lead sampling protocol, 3) copper PE, 4) measures to ensure OCCT, and 5) LSLR. The public also had an opportunity to provide information to the NDWAC on issues they were concerned about and wanted to be considered in the rule revisions. During this meeting, EPA formally requested that NDWAC form a working group to support EPA in the development of the LCRR. The NDWAC unanimously voted on forming this working group. A summary of these Lead and Copper Rule Working Group (LCRWG) meetings are provided in the next section.

8.12.2.3 ***2014 – 2015 NDWAC LCRWG Meetings***

The NDWAC formed the LCRWG to provide additional advice to EPA on potential options for the LCRR. The 15-member LCRWG consisted of representatives from water systems, states, health agencies, and public interest groups. The group held seven in-person meetings from March 2014 through June 2015, participated in multiple conference calls, and spent time outside these meetings to provide input to the NDWAC on the five key issues that EPA identified during the December 2013 NDWAC meeting. The LCRWG also provided additional recommendations on other areas such as expanded lead PE and outreach and the need to engage other stakeholders that include the health community (USEPA, 2016).

The LCRWG provided their final report, including recommendations, to the larger NDWAC committee in August 2015 (NDWAC, 2015a) and presented their recommendations to the NDWAC in November 2015. The NDWAC accepted the LCRWG recommendations and submitted their recommendation via letter to EPA on December 15, 2015 (NDWAC, 2015b).

In the report, the NDWAC acknowledged that reducing lead exposure is a shared responsibility among consumers, the government, PWSs, building owners, and public health officials. In addition, they recognized that creative financing is necessary to reach the LSL removal goals, especially for disparate and vulnerable communities. The NDWAC advised EPA to maintain the LCR as a treatment technique rule but with enhanced improvements. The NDWAC qualitatively considered costs before finalizing its recommendations, emphasizing that PWSs and states should focus efforts where the greatest public health protection can be achieved, incorporating their anticipated costs in their capital improvement program or the requests for DWSRFs. The LCRWG outlined an extensive list of recommendations for the LCRR including establishing a goal-based LSLR program, strengthening the lead PE and outreach provision to provide a more sustained and open approach to communication, strengthening CCT requirements, and tailoring WQPs to the specific CCT plan for each water system.

The report the NDWAC provided for EPA also included recommendations for renewed collaborative commitments between government and all levels of the public from state and local agencies, to other stakeholders and consumers while recognizing EPA's leadership role in this area. These complementary actions as well as a detailed description of the provisions for the NDWAC's recommendations for the proposed rule can be found in the "Report of the Lead and Copper Rule Working Group to the National Drinking Water Advisory Council" (NDWAC, 2015a). One member of the NDWAC working group provided a dissenting opinion (Parents for Nontoxic Alternatives, 2015). EPA took into consideration the NDWAC's recommendations and the dissenting opinion when developing the final revisions to the LCR.

8.12.2.4 ***2019 NDWAC Consultation***

On December 4-5, 2019, EPA held a NDWAC meeting in Washington, D.C. where EPA presented the proposed LCRR. In the presentation, the major LCRR were highlighted (e.g., the LSL inventory, the new TL of 10 µg/L, and new sampling protocols). The presentation focused on six key areas: identifying areas most impacted, strengthening treatment requirements, replacing LSLs, increasing sampling reliability, improving risk communication, and protecting children in schools. EPA reiterated the LCRR was developed with extensive consultation from state, local and tribal partners to identify actions that would reduce elevated levels of lead in drinking water. EPA reaffirmed its commitment to transparency and improved communication to the public.

8.12.3 **Consultation with Health and Human Services**

In accordance with Section 1412(d) of the SDWA, on June 12, 2019, EPA consulted with the Department of Health and Human Services (HHS) on the proposed rule. EPA presented an overview of the proposed revisions to the LCR and discussed in more detail, with HHS representatives; the lead tap sampling protocol; the establishment of the lead TL; school and child cares sampling requirements and educational materials; the cost of LSLR to homeowners; enhancements to CCT and WQP monitoring; and the development of plumbing materials contaminant leaching standards. A summary of this meeting is available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov. EPA also received and considered comments from the HHS through the inter-agency review process for the proposed rule.

EPA again consulted with HHS on the final rule requirements under consideration on July 28, 2020. EPA presented the potential changes the Agency had made to the regulatory requirements of the rule after proposal for six key areas including a summary of public comments, and the rationale for the final rule requirement. The six areas included: 1) the TL and AL, 2) tap sampling requirements for LSL systems, 3) LSLR goal rate after a lead TLE, 4) mandatory LSLR rate after a lead ALE, 5) the small system flexibility threshold, and 6) CWS monitoring for lead in drinking water in schools and child cares. EPA also presented the benefits and costs of the proposed and final rules and improvements to the costing information made in response to public comments and its impact on the cost and benefits estimate from proposal. EPA received and considered comments from the HHS for both the proposal and final rules.

8.13 References

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9 Other Options Considered

9.1 Introduction

This chapter presents other options the United States Environmental Protection Agency (EPA) considered when developing the final Lead and Copper Rule revisions (LCRR) related to:

- the lead in drinking water sampling program at schools and licensed child cares,
- the lead tap sampling requirements for systems with lead service lines (LSLs),
- LSL and galvanized requiring replacement locational information to be made publicly available, and
- providing small system flexibility to community water systems (CWSs) that serve a population of 3,300 or fewer.

Exhibit 9-1 provides a summary of the final requirements and other option(s) considered for these four areas.

Exhibit 9-1: Summary of Other Options Considered for the Final LCRR

Area	Other Option Considered	Final LCRR
Lead in Drinking Water Sampling Program at Schools and Licensed Child Cares	Mandatory program: • 20 percent of elementary and secondary schools and licensed child cares tested annually. • 5 samples per school. • 2 samples per licensed child care. On request program: • Elementary and secondary schools and licensed child cares would be tested on request. • 5 samples per school. • 2 samples per licensed child care.	Mandatory program is, one five-year round of lead sampling:[1] • 20 percent of elementary schools and licensed child cares tested annually. • 5 samples per school. • 2 samples per licensed child care. On request program is implemented at secondary schools during the five year round of initial mandatory sampling at elementary schools and child cares, and in all schools and child cares following the one round of mandatory sampling :[2] • Maximum required sampling under on request program: 20 percent of schools and licensed child cares tested annually. • 5 samples per elementary and secondary school. • 2 samples per licensed child care.

Area	Other Option Considered	Final LCRR
Lead Tap Sampling Requirements for Systems with LSLs	• Systems with LSLs collect 100 percent of their samples from LSLs sites, if available. • Samples are first liter, collected after 6-hour minimum stagnation time.	• Systems with LSLs collect 100 percent of their samples from LSLs sites, if available. • Samples are fifth liter, collected after 6-hour minimum stagnation time.
Publicly Available LSL Locational Information	Systems report the exact street address of LSLs.	Systems report a location identifier (e.g., street, intersection, landmark) for LSLs.
Small System Flexibility	CWSs that serve 3,300 or fewer people, and all NTNCWSs, are provided compliance flexibility when they exceed the AL.	CWSs that serve 10,000 or fewer people, and all NTNCWSs, are provided compliance flexibility when they exceed the AL.

Acronyms: AL = action level, CWS = community water system; LCRR = Lead and Copper Rule revisions; LSL = lead service line; NTNCWS = non-transient, non-community water system.
Note:
[1] Under the final LCRR, the mandatory program for elementary schools and licensed child cares is assumed to be conducted during years 4 – 8 of the 35-year analysis period.
[2] Under the final LCRR, the on request program will for secondary schools is assumed to be conducted during years 4 – 35 of the 35-year analysis period. The on request program for elementary schools and licensed child cares is assumed to be conducted during years 9 – 35 of the 35-year analysis period.

The remainder of this chapter is organized as follows:

- **Section 9.2** includes a description of alternative options for the public education (PE) and lead in drinking water sampling program at schools and licensed child cares, associated costs, and a comparison of costs to the final rule requirements.
- **Section 9.3** includes an alternative first liter draw lead tap sampling protocol for LSL systems, associated costs and benefits, and a comparison of costs and benefits to the final rule requirements.
- **Section 9.4** provides another option related to information that must be made publicly available regarding the location of customer-owned portions of LSLs.
- **Section 9.5** discusses the proposed rule small system compliance flexibility threshold for CWSs that serve 3,300 or fewer people compared to the final rule, which provides flexibility to CWSs that serve 10,000 or fewer people.

9.2 Public Education and Sampling in Schools and Child Cares Option

EPA is requiring all CWSs to conduct a sampling and PE program for schools and licensed child cares that they serve. As detailed in Section 3.11 of Chapter 3, under the final LCRR, CWSs must:

- Sample elementary schools and licensed child cares once during the first five years of rule implementation (20 percent per year). Elementary schools and child cares may refuse the sampling, but the water system must document this refusal or non-response to the Primacy Agency. After the one round, or five years, of mandatory sampling CWSs switch to an "on request" program, whereby they annually contact these facilities about their testing program

and sample only those facilities that request this sampling. The on request program also applies to secondary schools and starts during the first year of rule implementation. The mandatory sampling phase of the program does not apply to secondary schools. In addition, CWSs are not required to conduct on request sampling at more than 20 percent of schools and licensed child cares annually. Under both programs, systems must collect five samples from each school and two from each child care and will conduct annual outreach to schools and child cares.

- Conduct PE that includes providing each tested facility the most recent version of the *3Ts for Reducing Lead in Drinking Water in Schools and Child Care Facilities: A Training, Testing, and Taking Action Approach (Revised Manual)* (USEPA, 2018), hereafter referred to as the 3Ts, or a subsequent guidance.
- Provide the sampling results to the school or child care, the Primacy Agency and the state and local health department.
- Provide an annual report of their testing program to their Primacy Agency.

EPA proposed a mandatory program in which systems would continue to sample 20 percent of K-12 schools and licensed child cares every year. EPA also considered an "on request" option that would contain similar components of the mandatory program under the proposed LCRR but would limit the testing program to K-12 schools or licensed child cares served by the system that request testing in response to the system's annual offer to test their facility.

Exhibit 9-2 compares the three options for schools and child cares by frequency and number of samples.

Exhibit 9-2: Comparison of Three Options Considered for the Lead in Drinking Water Sampling Program at Schools and Child Cares

Option	Facility Type	Frequency	Number of Samples
Final Rule	Secondary Schools	On request only	5
	Elementary Schools	20 percent of schools and licensed child cares tested for first 5 years, then on request thereafter	5
	Licensed Child Cares		2
Proposed LCRR	Schools (K-12)	Every 5 years (or 20% of facilities per year)	5
	Licensed Child Cares		2
On Request Option	Schools (K-12)	On request	5
	Licensed Child Cares		2

Exhibit 9-3 includes a comparison of annualized costs of the three options. The development of unit costs and unit cost equations used in the SafeWater Lead and Copper Rule (LCR) model for the final LCRR are described in Chapter 5, Section 5.3.2.5.

For the "on request" option, EPA assumed that five percent of schools and licensed child cares per year would elect to participate in the sampling program and that CWSs would contact each facility annually

to determine its interest in the program in lieu of developing a sampling schedule for each facility. CWSs would only be required to sample at those facilities that requested this sampling. See "Derivation of School_Child Care Inputs_Final Rule.xlsx," which is available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov, for detailed costing assumptions for the required testing program under the final rule.

As shown in Exhibit 9-3, the final rule combines elements of the mandatory and on request programs and is less costly than the mandatory testing option under the proposed rule but more costly than the "on request" option. The costs of the final rule and the "on request" option is highly dependent on the percentage of facilities that request to participate in the sampling program. In addition, there is a great degree of uncertainty regarding the percentage of facilities that will request this sampling and how this interest may fluctuate over time. The low/high cost scenarios do not provide a range for school sampling costs because this requirement occurs at all CWSs regardless of LSL or corrosion control treatment (CCT) status and 90th percentile lead tap sample value. EPA did not estimate the net benefits from the three school sampling options, which could result if schools or individuals undertake averting behaviors to reduce lead exposure in response to the information obtained by the sampling program.

For the final rule, EPA combined the proposed and alternative options by incorporating both mandatory and on request sampling. EPA anticipates that after the first sampling cycle, schools and child cares will better understand the importance of lead testing and be more likely to implement their own programs based on the 3Ts. However, facilities interested in further assistance will have the opportunity to be tested for lead by the water system on request.

Exhibit 9-3: National Annualized Costs for School Sampling Options (2016$)

Option	Annualized Cost at 3% Discount Rate		Annualized Cost at 7% Discount Rate	
	Low Cost Scenario	High Cost Scenario	Low Cost Scenario	High Cost Scenario
Final Rule: • Elementary Schools/Licensed Child Cares: Mandatory Program for one round of monitoring followed by On Request Program • Secondary Schools: On Request Program	$12,582,000	$12,960,000	$14,461,000	$14,969,000
Proposed LCRR: Mandatory Program	$27,751,000	$28,268,000	$27,221,000	$27,875,000
Other Option Considered: On Request Program	$9,501,000	$9,729,000	$9,279,000	$9,567,000

9.3 Lead Tap Sampling Requirements for Systems with Lead Service Lines

As detailed in Chapter 3, Section 3.3.2.2, the final rule requires that tap samples at LSL sites must be fifth liter draws versus the first liter samples as required by the previous rule. Additionally, the final rule requires that all tap samples be collected from sites with LSLs in those systems that have LSLs. Note that first liter sampling requirements for non-LSL systems and non-LSL sites have not been changed by the revised rule.[146]

EPA determined the fifth liter is the most appropriate sample for sites served by an LSL because a fifth liter sample is more likely than a first liter sample to represent water that has been in contact with the LSL during the stagnation period. In locations with LSLs, the fifth liter sample is a better indicator of the effectiveness of CCT and the need for lead service line replacement (LSLR) because it better represents corrosion from LSLs. The first-draw sample represents water that has traveled through the service line but that has sat in contact with the plumbing materials inside the home prior to the tap for the stagnation period. The first-draw is an effective sampling technique to identify lead corrosion from taps, solder, pipes, and fittings within the home but is not as likely to represent corrosion from LSLs.

EPA also considered requiring the collection of a first liter sample, as was proposed and required under the previous LCR. Under the first-liter option, LSL systems would be required to collect all their samples from sites served by LSLs, if available, but would collect a first-liter sample from these sites as opposed to a fifth liter sample. Under both the first liter option and final rule, EPA set a new trigger level (TL) of 10 µg/L whereby a system with a lead 90th percentile level above 10 µg/L but at or below the existing

[146] LSL systems that do not have sufficient LSL sites to draw all compliance samples from are allowed, under the revised rule, to sample from non-LSL sites to make up the remainder of their required compliance tap samples for the tap sampling period.

action level (AL) of 15 µg/L (i.e., has a trigger level exceedance or TLE) would be subject to additional requirements.

The next two sections present estimates for the percent of systems with a TLE or action level exceedance (ALE) (see Section 9.3.1) and the likelihood that an individual tap sample exceeds 15 µg/L (see Section 9.3.2) based on first liter samples for LSL systems. These estimates are also compared to those developed for the final LCRR fifth liter sampling requirements that are described in detail in Chapter 4, Section 4.3.5.1. Section 9.3.3 presents the calculated costs and benefits associated with the first liter option and the final LCRR fifth liter sampling requirements. This analysis shows that the fifth liter sampling methodology in the final rule is more effective than the first liter alternative approach in identifying systems with elevated levels of lead. More systems with LSLs are expected to exceed the AL or TL under this approach and to take actions to reduce drinking water exposure to lead.

9.3.1 Percent of Systems with No TLE or ALE, a TLE, and ALE Based on First Liter Option

As explained in Section 4.3.5.1, EPA recognizes that uncertainties in the 90th percentile tap sampling data could have a significant impact on estimated costs and benefits of the final LCRR. To provide a range of costs and benefits that reflects this uncertainty, EPA generated a "low" and "high" estimate of system placement into 90th percentile bins (i.e., bins representing systems with lead 90th percentile values ≤ 10 µg/L, a TLE, or an ALE) based on the first liter tap sampling methodology. The values were developed with the following steps.

Step 1 – Identified "Low" and "High" 90th percentile level: EPA reviewed the lead 90th percentile data from all 38,707 CWSs that reported to Safe Drinking Water Information System/Federal version (SDWIS/Fed) for tap sampling conducted between 2007 and 2015. EPA identified a subset of 4,424 systems with known LSL status. This subset of 4,424 systems was used for the remainder of the analysis described below.[147] See Chapter 4, Section 4.3.5.1 for a description of this dataset. EPA selected the minimum lead 90th percentile level between 2007 and 2015 for the "low" estimate and the maximum lead 90th percentile for the "high" estimate from each CWS.

Step 2 – Designated systems by LSL status: EPA summarized data separately based on LSL status.

Step 3 – Identified systems with reported lead 90th percentile results and known LSL status: EPA identified which systems had at least one reported lead 90th percentile data point in SDWIS/Fed between 2007 and 2015 and known LSL status. This subset was used for the remainder of the analysis described in Steps 4 and 5.

Step 4 – Applied adjustment factor to LSL systems: As described in Chapter 4, Section 4.3.5.1, EPA calculated a "low" and a "high" multiplier based on data from Slabaugh et al., 2015 which it applied to the lead 90th percentile level for systems with known LSLs to simulate the expected increase in lead 90th percentile levels associated with the requirement for LSL systems to collect all tap samples from LSL sites as opposed to collecting a minimum of 50 percent from LSL sites, as required under the previous

[147] For the original analysis in support of the proposed rule, data on known LSL status was available for 3,870 systems. For the final rule, additional state data were available to EPA for use in the analyses. Specifically, EPA added data from California, Louisiana, Michigan, and Nevada and included updated information for Illinois, North Carolina, Ohio, and Wisconsin. This additional state data allowed EPA to expand the universe of systems with known LSL status to 4,424, for use in the final rule analysis.

rule. EPA combined the low and high adjustment factors from Slabaugh et al. (2015) with the low and high 90th percentile values to produce a "low" and "high" likelihood of being in each 90th percentile category. As a summary, the assumptions for the "low" and "high" percent of CWSs with No TLE or ALE, a TLE, and ALE are as follows:

- "Low" estimate: minimum 90th percentile lead value from matched SDWIS/Fed dataset from 2007 to 2015, and low multiplier (1.004) for 90th percentile values for LSL systems.
- "High" estimate: maximum 90th percentile lead value from matched SDWIS/Fed dataset from 2007 to 2015, and high multiplier (1.35) for 90th percentile values for LSL systems.

Step 5 – Estimated the Percentage of CWSs in Each Category: Based on Steps 1 through 4, each CWS in the analysis was assigned to the category of: 1) no TLE or ALE, 2) a TLE, or 3) an ALE based on their LSL status.

Exhibit 9-4 presents the "low" and "high" estimated percentage of systems in each lead 90th percentile category for the first-liter sample option and the final LCRR. As explained earlier, this analysis was based on data from CWSs with known LSL status that also reported at least one 90th percentile value to SDWIS/Fed between 2007 and 2015. Note that the estimated percent values for non-LSL systems under the first liter option and final LCRR are equal, given that under both regulatory options first liter samples are taken from non-LSL locations. Comparing the LSL system percentages under the first liter option and final LCRR supports EPA's decision to require fifth liter sampling at LSL locations. Because LSL systems under the final LCRR must collect a fifth liter tap sample from LSL sites that better represents that potentially higher lead levels from the LSL versus the first liter samples which only capture the households interior plumbing, the percent of systems with TLEs and ALE are much higher under the final LCRR than under the alternative first liter option. Based on the "low estimate" analysis, EPA found that overall the percentage of LSL systems with an ALE would be approximately six times higher under the final LCRR than the first liter option. The "high estimate" analysis indicates that the percentage of systems with LSLs exceeding the AL would be more than 1.5 times higher under the final LCRR than the first liter option. EPA also estimated a larger percentage of systems would have a TLE under the final LCRR as compared to the first liter option under the "low estimate." The calculated number of TLEs at LSL systems under the "high estimate" was greater under the first liter option than under the final LCRR because so many of the systems in the TLE category under the first liter option moved into the higher ALE category under the final LCRR requirements.

Exhibit 9-4: Percent of Non-LSL Systems and LSL Systems under the First and Fifth Liter Tap Sampling Protocols with No TLE or ALE, a TLE, and an ALE[1-3]

Category	Non-LSL Systems	LSL Systems	
		First Liter Option	Final LCRR
Low Estimate			
No TLE/ALE (P90 ≤10 µg/L)	**97%**	**98%**	**89%**
≤ 5 µg/L	*94%*	*83%*	*77%*
>5 and ≤10 µg/L	*3%*	*15%*	*13%*
TLE (10 µg/L < P90 ≤ 15 µg/L)	**0%[4]**	**1%**	**5%**
ALE (P90 > 15 µg/L)	**2%**	**0%[5]**	**6%**
High Estimate			
No TLE/ALE (P90 ≤10 µg/L)	**87%**	**66%**	**58%**
≤ 5 µg/L	*68%*	*36%*	*40%*
>5 and ≤10 µg/L	*19%*	*30%*	*18%*
TLE (10 µg/L < P90 ≤ 15 µg/L)	**7%**	**17%**	**12%**
ALE (P90 > 15 µg/L)	**6%**	**18%**	**30%**

Acronyms: ALE = action level exceedance; CWS = community water system; LSL = lead service line; P90 = lead 90th percentile; TLE = trigger level exceedance.

Notes:

[1] Includes CWSs with known LSL status that also reported at least one 90th percentile value to SDWIS/Fed between 2007 and 2015.

[2] For additional detail on the number and percent of CWSs with TLEs and/or ALEs, see files "Derivation of Initial P90 Categorization_ First Liter Option.xlsx" and "Derivation of Initial P90 Categorization_Final Rule.xlsx," available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov.

[3] Totals may not add due to independent rounding.

[4] This percentage is equal to 0.47 percent when expressed with more significant figures.

[5] This percentage is equal to 0.39 percent when expressed with more significant figures.

9.3.2 Likelihood of individual lead tap samples being > 15 µg/L

Under the first liter option and final LCRR, water systems must undertake "find-and-fix" actions in response to any single lead tap sample that is above 15 µg/L (see Chapter 3, Section 3.4.5 for additional detail). In the above assessment of the percent of systems with no TLE or ALE, a TLE, and an ALE the Agency was able to use SDWIS/Fed 90th percentile data. However, the SDWIS/Fed database does not have the underlying individual tap sample data that would allow EPA to estimate the likelihood of an individual sample exceeding 15 µg/L. Therefore, EPA used the 2019 State of Michigan compliance monitoring dataset which has individual sample values for both fifth and first liter tap samples.[148] EPA used the Michigan data to analyze the likelihood of a single tap sample being above 15 µg/L for the final LCRR based on system size, LSL status, and the three lead 90th percentile categories of: 1) no TLE or ALE,

[148] In the proposed rule, the Six-Year Review 3 (SYR3) data were also used to estimate the likelihood of an individual sample exceeding the AL. However, for the final rule, EPA obtained data from the State of Michigan that included first and fifth liter results. These data were ultimately considered to be more complete and appropriate for use in the estimates in support of the final rule for the likelihood of samples exceeding the AL because the SYR3 did not identify LSL systems or include fifth liter data. The data from Michigan include actual fifth liter sample results using a protocol that is consistent with the final rule.

2) a TLE, or 3) an ALE. As previously discussed, both the first liter option and final rule require LSL systems to collect all their samples from available LSL sites. The first liter option and final LCRR differ in that the final rule requires LSL systems to collect a fifth liter sample; whereas, the first liter option retained the previous rule's tap sampling requirements for all systems. Thus, for the analysis of this option, first liter samples from the Michigan dataset were used for all systems (i.e., those with and without LSLs). EPA used the following steps:

Step 1 – Categorized Michigan systems as with or without LSLs based on compliance monitoring data as follows: Because LSL status impacts first liter tap sample results, EPA chose to stratify the Michigan data by LSL status and calculated the likelihood of first liter exceedances for both LSL and non-LSL systems. In order to do this EPA had to identify the LSL status for the systems in the Michigan dataset. Because the State of Michigan's LCR requires systems with LSLs to take compliance samples from LSL sites and that both first and fifth liter samples to be taken at those LSL sites EPA could make the following assumptions to differentiate systems in the data set by their LSL status:

- EPA assumed 132 CWSs have LSLs because the system provided first and fifth liter lead samples as required by Michigan's new regulation and were identified as having LSLs in their online inventory information (Michigan EGLE, 2020).
- EPA assumed 251 CWSs have no LSLs because the system submitted only first liter data and did not report any LSLs in the online inventory information.

Note that in the development of the percent of individual lead tap samples being > 15 µg/L, fifth liter samples are only used to determine LSL status in the Michigan data.

Step 2 – Calculated lead 90th percentile levels: EPA calculated lead 90th percentile values using the first liter sampling data for all systems (those with and without LSLs). The purpose of this step was to categorize each dataset by: 1) no TLE or ALE, 2) a TLE, or 3) an ALE so that the likelihood of an individual tap sample being above 15 µg/L could be calculated for each 90th percentile category separately.

Step 3 – Calculated the likelihood of an individual tap sample > 15 µg/L: Once the samples were placed in the appropriate lead 90th percentile category, EPA used the first liter data to calculate the proportion of samples above 15 µg/L.

The results presented in Exhibit 9-5 indicate that systems with LSLs had a lower estimated likelihood of having a sample above 15 µg/L when they had a lead ALE (19.7 percent) or TLE (4.5 percent) compared to those without LSLs (22.7 percent for those with an ALE and 15.4 percent with a TLE). Some of the system size strata with no ALE/TLE, a TLE, and an ALE contained very few to no samples (e.g., systems with LSLs serving ≤ 3,300 people with a TLE); thus, EPA combined the size categories and included the likelihoods for all systems by LSL stratum, i.e., with LSLs and without LSLs, as inputs in the SafeWater LCR model.

Exhibit 9-6 includes a comparison of the estimated percentages of LSL systems having an individual lead tap sample result that is above 15 µg/L under the first liter option and final LCRR. Based on this comparison, under the final LCRR, EPA estimated a higher percentage of lead tap samples will exceed 15 µg/L for LSL systems with a ALE and TLE than under the first liter option. Conversely, a slightly higher percentage (about an additional 0.5 percent) of samples are estimated to exceed 15 µg/L for systems without a TLE or ALE under the first liter option than the final rule. This is most likely due to the larger

number of samples taken by systems classified as having no TLE/ALE under the first liter option (2,664 samples) compared to the final rule (1,897 samples).

Note that the percentages for non-LSL systems are the same for the first liter option and final rule because both use the same sampling protocol. Only the requirements for LSL systems differ between the two. As previously discussed, under the final rule, systems must collect a fifth liter samples from LSL sites as opposed to a first liter sample. Thus, non-LSL systems are not included in Exhibit 9-6.

Exhibit 9-5: Likelihood of an Individual First Liter Lead Tap Sample Result Above 15 µg/L Based on Michigan CWSs Data Stratified by System 90th Percentile, LSL Status, and Population Served for the First Liter Option

LSL Status	System Size	Number of Michigan individual first liter lead samples associated with calculated P90 values that were:			Number of Michigan individual first liter lead tap samples > 15 µg/L associated with calculated P90 values that were:			Percent of Michigan individual first liter lead tap samples > 15 µg/L associated with calculated P90 values that were:		
		≤10 µg/L (No TLE/ALE)	10 µg/L < P90 ≤ 15 µg/L (TLE)	>15 µg/L (ALE)	≤10 µg/L (No TLE/ALE)	10 µg/L < P90 ≤ 15 µg/L (TLE)	>15 µg/L (ALE)	≤10 µg/L (No TLE/ALE)	10 µg/L < P90 ≤ 15 µg/L (TLE)	>15 µg/L (ALE)
		A	B	C	D	E	F	G = D/A	H=E/B	I=F/C
Has LSLs	≤3,300	229	14	37	1	0	12	0.4%	0.0%	32.4%
	3,301 – 50,000	1,893	48	134	35	3	21	1.8%	6.3%	15.7%
	>50,000	542	4	2	9	0	1	1.7%	0.0%	50.0%
	Total	**2,664**	**66**	**173**	**45**	**3**	**34**	**1.7%**	**4.5%**	**19.7%**
No LSLs	≤3,300	1,509	26	22	3	4	5	0.2%	15.4%	22.7%
	3,301 – 50,000	1,104	0	0	6	0	0	0.5%	0.0%	0.0%
	>50,000	258	0	0	1	0	0	0.4%	0.0%	0.0%
	Total	**2,871**	**26**	**22**	**10**	**4**	**5**	**0.3%**	**15.4%**	**22.7%**

Acronyms: ALE = action level exceedance; TLE = trigger level exceedance; P90 = lead 90th percentile; SYR3 = Six-Year Review 3.

Notes:

1. Excludes CWSs for which LSL status is unknown and incomplete system datasets that were defined as those that did not have the minimum number of samples required for reduced monitoring under the previous LCR.
2. For additional detail on the number and percent of samples in the Michigan dataset that were greater than 15 µg/L, see file "Derivation of Probability_Sample_Above_15_ First Liter Option.xlsx," available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov.

Exhibit 9-6: Likelihoods of a First Liter Individual Lead Tap Sample Result Above 15 µg/L for LSL Systems under the First Liter Option Compared to the Likelihoods of a Fifth Liter Individual Lead Tap Sample Result Above 15 µg/L for LSL Systems under the Final LCRR

Category		First Liter Option				Final Rule			
		≤ 3,300	3,301-50,000	> 50,000	Total	≤ 3,300	3,301-50,000	> 50,000	Total
Number of Michigan individual lead tap samples associated with calculated P90 values that were:	P90 >15 µg/L (ALE)	37	134	2	**173**	48	246	84	**378**
	10 µg/L < P90 ≤ 15 µg/L (TLE)	14	48	4	**66**	0	444	184	**628**
	P90 ≤10 µg/L (No ALE/TLE)	229	1,893	542	**2,664**	232	1,385	280	**1,897**
Number of Michigan individual lead tap samples > 15 µg/L associated with calculated P90 values that were:	P90 >15 µg/L (ALE)	12	21	1	**34**	22	56	18	**96**
	10 µg/L < P90 ≤ 15 µg/L (TLE)	0	3	0	**3**	0	27	11	**38**
	P90 ≤10 µg/L (No ALE/TLE)	1	35	9	**45**	1	20	2	**23**
Percent of Michigan individual lead tap samples > 15 µg/L associated with calculated P90 values that were:	>15 µg/L (ALE)	32.4%	15.7%	50.0%	**19.7%**	45.8%	22.8%	21.4%	**25.4%**
	10 µg/L < P90 ≤ 15 µg/L (TLE)	0.0%	6.3%	0.0%	**4.5%**	0.0%	6.1%	6.0%	**6.1%**
	P90 ≤10 µg/L (No ALE/TLE)	0.4%	1.8%	1.7%	**1.7%**	0.4%	1.4%	0.7%	**1.2%**

Acronyms: ALE = action level exceedance; TLE = trigger level exceedance; P90 = lead 90th percentile.

Notes:

General: Includes results for LSL systems only. The requirements for non-LSL systems are the same under the proposed and final LCRR.

1. Excludes CWSs for which LSL status is unknown and incomplete datasets that were defined as those that did not have the minimum number of samples required for reduced monitoring under the previous LCR.
2. For additional detail on the proposed LCRR and final LCRR, refer to files "Derivation of Probability_Sample_Above_15_First Liter Option.xlsx" and "Derivation of Probability_Sample_Above_15_Final LCRR.xlsx," respectively, which are available in the docket at EPA-HQ-OW-2017-0300 at www.regulations.gov.

9.3.3 Costs and Benefits Comparison

As discussed in Section 9.3.1, the final rule, which requires a fifth liter sample to be collected at LSL sites, is expected to yield higher lead results. These higher lead values will result in a greater number of systems conducting one or more treatment technique requirements than under the previous rule and first liter options.

Exhibit 9-7 and Exhibit 9-8 provide the range of the incremental annualized rule costs and benefits, under both the low and high cost scenarios, for the first liter option and final LCRR at a 3 percent and 7 percent discount rate, respectively. EPA estimated that water systems will have higher total benefits under the final rule compared to the first liter option. EPA also estimated that the cost of the final rule will be higher compared to the first liter option because more water systems will be required to conduct additional tap sampling and treatment technique requirements in response to higher measured fifth liter tap sample lead levels.

Exhibit 9-7: National Annualized Incremental Rule Costs at 3 Percent Discount Rate for the First Liter Option and Final LCRR (2016$)

Benefit/Cost Category	First Liter Option		Final LCRR	
	Low Cost Scenario	High Cost Scenario	Low Cost Scenario	High Cost Scenario
Total Annual Rule Costs	$126,819,000	$283,609,000	$160,571,000	$335,481,000
Total Annual PWS Costs	$101,641,000	$241,286,000	$131,792,000	$298,820,000
Total Annual Benefits	$116,828,000	$566,338,000	$223,344,000	$645,276,000

Acronyms: LCRR = Lead and Copper Rule revisions; PWS = public water system.

Exhibit 9-8: National Annualized Incremental Rule Costs at 7 Percent Discount Rate for the First Liter Option and Final LCRR (2016$)

Benefit/Cost Category	First Liter Option		Final LCRR	
	Low Cost Scenario	High Cost Scenario	Low Cost Scenario	High Cost Scenario
Total Annual Rule Costs	$131,149,000	$313,725,000	$167,333,000	$372,460,000
Total Annual PWS Costs	$104,412,000	$261,177,000	$136,605,000	$330,908,000
Total Annual Benefits	$20,353,000	$105,772,000	$39,353,000	$119,102,000

Acronyms: LCRR = Lead and Copper Rule revisions; PWS = public water system.

9.4 Reporting of LSL-Related Information

Under the final LCRR, EPA is requiring water systems to make their LSL inventory publicly available and to provide a locational identifier for any LSLs and galvanized requiring replacement, such as the street, intersection, or a landmark. See Section 3.5.1.2 in Chapter 3 for more information about this

requirement. Public disclosure of areas served by LSLs would increase transparency and consumer awareness relative to the previous rule but would not identify LSL status at individual properties.

EPA considered an option in which systems with LSLs would be required to publicly report the exact address of the LSL to further increase transparency and consumer awareness and potentially prompt customers to participate in LSLR programs. Under this option, water systems would also have be required to conduct an inventory of LSLs and inform customers if they have an LSL.

The final rule requires systems to provide a general locational identifier in the publicly available inventory. The publicly available inventory will provide communities with updated information regarding the total number of LSLs, galvanized requiring replacement, unknown, and non-LSLs, as well as the general areas where LSLs are most numerous. In addition, prospective homebuyers can use the publicly accessible inventory to determine whether and how to work with the homeowner, real estate agent, or home inspector to identify the service line material composition before the time of sale. In addition, although EPA has determined not to establish a federal requirement to provide specific addresses in the inventory, water systems may elect to do so and Primacy Agencies may require it.

EPA anticipates that the costs between the two options would be similar because the system would use the same method for making the LSL publicly available and the specificity of the locational information would not impact the cost.

EPA did not quantify the potential benefits of either option. The following is a qualitative discussion of the potential impacts of disclosure of addresses of homes with LSLs in a publicly available LSL inventory may have on real estate markets which may affect the net benefits of these options. Lu et al. (2019) provide a summary of the disclosure requirements at the state and municipality level based on a recent Environmental Defense Fund (EDF) (2019) report. There are four states that require sellers to disclose the presence of lead in plumbing.[149] An additional 20 or more states require disclosure if the seller considers the lead pipe to be in an "unsafe condition" or "environmental hazard or defect."[150] Kentucky, Minnesota and New York require the disclosure of any available water test results. EDF (2019) found that only three cities (Cincinnati, OH; Philadelphia, PA; and Washington, D.C.) have lead pipe disclosure requirements for landlords.

In terms of real estate transactions, a conceptual argument exists that the public disclosure of LSL locations may impact real estate prices, and this, in turn, may provide incentives to replace LSLs or undertake other averting behaviors, such as using water filtration. Upon entering a real estate transaction both parties have reservation prices. For seller/landlords, the reservation price is the lowest price they would be willing to accept from a buyer/renter. For buyer/renters, the reservation price is the highest price they would be willing to pay a seller/landlord. A real estate transaction is expected to take place when the buyer/renter reservation price meets or exceeds the seller/landlord reservation price. If buyers and sellers are aware of LSLs at a given property, they can adjust their reservation prices

[149] The four states are Connecticut, Pennsylvania, Delaware, and New York.

[150] Washington, D.C; Illinois; Michigan, New Mexico, North Carolina, South Carolina, and Wisconsin require the disclosure of pipe material (lead not specifically addressed) or lead pipes if seller determines conditions unsafe. Another 20 states require disclosure of general environmental hazards.

accordingly. Getting this information is often costly, however, for buyers and sellers in individual transactions.

Sellers may adjust their reservation price higher if there is no LSL, or lower if the property does have an LSL. This information will also be available to buyers. With public disclosure of LSL locations, the buyer/renter would know with certainty if a property has an LSL, and they may adjust their reservation price higher – i.e., find the property more valuable - if there was no LSL present.

Public disclosure may therefore allow sellers to attract a premium for homes without LSLs, which provides an incentive for LSLR or other averting behaviors like installing filtration. For properties that do have LSLs, if the expected increase in the market price of the property (or increase in the value of the expected stream of rental income) is higher than the cost of LSLR (including any non-monetary costs), we would expect the property owner to replace the LSL prior to marketing the property. If the cost of replacing the LSL is more than can be recovered in increased property value, we would not expect them to be replaced by the seller prior to marketing the property. In either case, buyers and renters are making a more informed decision about where to buy or live. Without public disclosure, sellers will be less able to attract a premium for homes without LSLs and will have less incentive to remove existing LSLs prior to sale.

There is limited empirical evidence regarding the effect of public information about LSL status on the real estate market. A recent study by Theising (2019) looked at the impact on real estate values on home prices in Madison, Wisconsin from 2000 to 2015. During this period, Madison mandated all LSLs be replaced and that homeowners pay the cost of replacing the private portion of the line. In all, a little over 5,700 properties had their LSLs replaced. Using a hedonic framework on cross-sectional variation in property sales prices, Theising estimated that a home with an LSLR saw a 3.6 percent increase from its pre-LSLR value. For the median assessed price of a home with an LSL in Madison in 2000, a 3.6 percent effect is equivalent to $5,914. Given that the average private LSLR cost was $1,340, homeowner's benefits from a private return of over 300 percent. Taking into account the additional average public remediation cost borne by the city, of $1,997, this price effect estimate implies an overall return on total investment of more than 75 percent. These results show that LSLR can have a positive impact on residential real estate values. However, as the author notes, Madison is unique in that the city mandated LSLRs, and new homeowners would therefore have faced the cost of replacement if the LSLs were not replaced prior to sale. Therefore, the level of capitalization found in Madison may not be found in other locations where LSLR is not mandated.

An unpublished study by Blackhurst (2018) explored whether the expected presence of LSLs was correlated with property sale prices in Pittsburg, PA. They found that properties with LSLs sold for about 5 percent% less, indicating a lower price of $9,700 on average. However, properties with LSLs may be systematically different than those without—for example, they are typically older—and the study did not control for a sufficiently large set of property attributes to isolate the effect of LSLs. Therefore, the results do not represent the causal effect that the presence of LSLs have on property values and may not indicate willingness to pay for LSLR.

Lu et al. (2019) recruited participants to participate in one of three studies that involved hypothetical scenarios for buying or renting a home. The studies included:

1. A scenario where the participant has applied to rent a home and the landlord has accepted their application and provided them with a disclosure about the presence of LSLs,
2. A scenario where the participant made an offer to buy a home that was accepted, and the seller provided them with a disclosure about the presence of LSLs, and
3. A scenario where the participant made an offer to buy a home that was accepted, and their housing inspector identified the presence of LSLs.

In the first study, which involved renters, participants were most willing to ask the landlord to replace the LSL, followed by looking for another home. In the home-buying studies, the authors found a high willingness to adopt behaviors that would require the seller to replace the LSLs. Interestingly, they found that explicit recommendations by the buyer's home inspector to replace the LSL did not result in a higher willingness to act, and in some cases, the opposite effect was observed. The main limitation of the Lu et al. (2019) study is that it is based on participant responses to hypothetical scenarios, and as they point out, "real-world home renting and home buying situations are much more complex, and they involve real investments of time and money."

EPA also looked at the impact of lead paint disclosures on real estate prices as additional evidence of the possible positive impact on LSL replacement rates associated with publicly disclosing LSL locations. Section 1018 of the Residential Lead-Based Paint Hazard Reduction Act of 1992 directed the United States Department of Housing and Urban Development (HUD) and EPA to require the disclosure of known information on lead-based paint and lead-based paint hazards before the sale or lease of most housing built before 1978. Under the resulting EPA requirements, sellers and landlords must disclose lead-based paint and lead-based paint hazards and provide available reports to buyers or renters. Home buyers also have a 10-day period to conduct a lead-based paint inspection or risk assessment at their own expense, and may withdraw their offer during that period [151].

Billings and Schnepel (2017) estimated the benefits, in terms of increased property values, that were achieved for homes that participated in a HUD-funded program and remediated lead-based paint hazards that were identified by inspections. They found that each dollar spent on remediation resulted in an increase of the sales price by $2.60. Thus, purchasers were willing to pay a significant premium, above the cost of lead paint remediation, to purchase a home with the lead paint hazard already removed.

The available evidence from the studies outlined above (Lu et al., (2019), Theising (2019), and Blackhurst (2018) assessing impacts from LSLs and Billings and Schnepel (2017) looking at the impact of lead paint removal) provides indications that prospective buyers and renters value reductions in risks associated with LSLs. Therefore, the public disclosure of LSL locations can create an incentive, through increased property values, to replace LSLs. In making LSLR decisions, owner-occupants can be expected to weigh both their own benefits from reduced risks and the present value of any increase in future sales price against the cost of LSLR. For owners that are in the process of selling or renting their homes, LSLR is most likely in instances where replacement costs are likely to be recovered through a higher sale price or stream of rental income.

[151] HUD and EPA Lead Disclosure Rule at, respectively, 24 CFR 35, subpart A, especially, section 35.90(a); and 40 CFR 745, subpart F, especially section 745.110(a).

9.5 Small System Flexibility

As discussed in Chapter 3, Section 3.2.2, the final LCRR includes significant flexibility for CWSs that serve 10,000 or fewer people, and all non-transient non-community water system (NTNCWSs). If these water systems have a lead 90th percentile above the AL, they can choose from the following four options to reduce the concentration of lead in their water:

1. Fully replace all LSLs within 15 years.[152]
2. Optimize existing CCT or install new CCT.
3. Install and maintain point-of-use (POU) devices at all locations being served.
4. Replace lead-bearing plumbing materials for systems that have control over their entire plumbing system and no unknown, galvanized, or LSLs.[153] This option was not assessed in the cost-benefit analysis.

Exhibit 9-9 and Acronyms: CWS = community water system; LCRR = Lead and Copper Rule revisions; NTNCWS = non-transient non-community water system (NTNCWS).

provide the range of the estimated incremental annualized rule costs and benefits, under both the low and high cost scenarios, for the final LCRR and the alternative small system flexibility threshold of systems serving 3,300 or fewer persons at a 3 percent and 7 percent discount rate, respectively.

Exhibit 9-9: National Annualized Incremental Rule Costs at 3 Percent Discount Rate for the Final LCRR and the Alternative Small System Flexibility Threshold Considered (2016$)

Benefit/Cost Category	Final LCRR: Small System Flexibility for CWSs serving ≤10,000 people and all NTNCWSs		Small System Flexibility: CWSs serving ≤ 3,300 people and all NTNCWSs	
	Low Cost Scenario	High Cost Scenario	Low Cost Scenario	High Cost Scenario
Total Annual Rule Costs	$160,571,000	$335,481,000	$163,460,000	$363,607,000
Total Annual PWS Costs	$131,792,000	$298,820,000	$134,013,000	$322,711,000
Total Annual Benefits	$223,344,000	$645,276,000	$226,970,000	$675,533,000

Acronyms: CWS = community water system; LCRR = Lead and Copper Rule revisions; NTNCWS = non-transient non-community water system (NTNCWS).

[152] Primacy Agencies may, under the final LCRR, require small CWSs serving 10,000 or fewer people and NTNCWSs to remove more than 7 percent of LSLs per year, i.e., replace all LSLs within 15 years. However, for modeling purposes the EPA assumed 7 percent per year.

[153] Under the proposed LCRR, replacement of lead-bearing materials was limited to NTNCWSs. EPA revised this allowance to include CWSs in response to public comment that indicated in certain circumstances replacement of all lead-bearing plumbing material might be an effective option for the small CWSs to reduce drinking water lead exposure, when they have no LSLs, galvanized, or lead status unknown service lines, and have control over all of the plumbing materials in the system.

Exhibit 9-10: National Annualized Incremental Rule Costs at 7 Percent Discount Rate for the Final LCRR and the Alternative Small System Flexibility Threshold Considered (2016$)

Benefit/Cost Category	Final LCRR: Small System Flexibility for CWSs serving ≤ 10,000 people and all NTNCWSs		Small System Flexibility: CWSs serving ≤3,300 people and all NTNCWSs	
	Low Cost Scenario	High Cost Scenario	Low Cost Scenario	High Cost Scenario
Total Annual Rule Costs	$167,333,000	$372,460,000	$170,418,000	$408,500,000
Total Annual PWS Costs	$136,605,000	$330,908,000	$138,993,000	$361,732,000
Total Annual Benefits	$39,353,000	$119,102,000	$40,038,000	$125,285,000

Acronyms: CWS = community water system; LCRR = Lead and Copper Rule revisions; NTNCWS = non-transient non-community water system.

9.6 References

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