Appendix B

Documentation of Missouri's
2011 National Emissions Inventory Data

Missouri Department of Natural Resources
Division of Environmental Quality
Air Pollution Control Program
Jefferson City, Missouri

Public Hearing
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1.0 Introduction

The Missouri Department of Natural Resources' Air Pollution Control Program developed a comprehensive statewide emissions inventory for 2011, as required by the EPA's Air Emissions Reporting Requirements (AERR) rule published December 17, 2008. The inventory includes point, nonpoint, onroad mobile, and nonroad mobile source emissions. This document describes how the 2011 inventory is compiled and submitted to the National Emissions Inventory (NEI) through the EPA's Emission Inventory System (EIS). This report documents the 2011 inventory in detail, from its creation, quality assurance, and final summaries. It also details the qualifications and limitations of the inventory.

Various tables are included showing summarized, facility-specific, and source category-specific data. All emission amounts are given in tons per year unless otherwise noted. Blank fields and those with dashes indicate a value of zero. Fields with 0, 0.0, or 0.00 contain small values that round to zero.

2.0 Pollutants

The 2011 inventory includes emissions of the traditional criteria air pollutants (CAPs) sulfur oxides (SO_x), nitrogen oxides (NOx), carbon monoxide (CO), volatile organic compounds (VOC), coarse particulate matter (PM_{10} Primary), fine particulate matter ($PM_{2.5}$ Primary), ammonia (NH_3), and lead (Pb). Missouri also inventories speciated Hazardous Air Pollutant (HAP) emissions for certain data categories. For some data categories, particulate matter (PM) is further disaggregated to its component parts: PM_{10} Primary is the sum of PM condensable (PM CON) and PM_{10} Filterable (PM_{10} FIL), and $PM_{2.5}$ Primary is the sum of PM condensable (PM CON) and $PM_{2.5}$ Filterable ($PM_{2.5}$ FIL). Missouri's inventory does not include greenhouse gas (GHG) emissions and none of the tables in this document will summarize GHGs. Only the nonpoint fuel combustion category contains GHG emission estimates where those pollutants were already part of the tool provided by a third-party contractor.

Table 1: Statewide 2011 Emissions

	Lead	NH_3	CO	NO_X	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_2	VOC
Point Total	42.20	1,642	113,272	92,721	16,727	9,834	255,217	14,503
Nonpoint Total	1.63	115,151	124,464	14,403	831,546	124,664	995	105,932
Onroad Total		2,588	599,054	180,579	1,208	61,785	8,416	6,760
Nonroad Total	3.27	5,382	362,916	79,213	9,734	7,971	1,631	48,250
Biogenic Total			138,954	28,311				1,168,254
Missouri Total	47.10	124,764	1,338,659	395,228	859,215	204,254	266,258	1,343,699

3.0 Geographic Coverage

The 2011 emissions inventory covers the entire state of Missouri. Point source emissions are prepared at the facility level with a geographic coordinate. Nonpoint, onroad, nonroad mobile, and biogenic emissions are submitted at the county level. There are no tribal areas in Missouri, and all 115 counties and municipalities are included.

4.0 Temporal Coverage

Annual emissions are developed for point, nonpoint, onroad mobile and nonroad mobile sources. The emissions cover a continuous 12 month period from January 1 to December 31 of the reporting year. Ozone season day emissions are submitted only for point sources in the 5-county St. Louis Ozone Nonattainment area (Franklin, Jefferson, St. Charles, and St. Louis Counties and the City of St. Louis). These emission estimates detail the amount of emissions on a typical summer day during the peak ozone season from June 1 through August 31. Only the ozone precursor pollutants of NO_x, VOC and CO are reported at this temporal scale.

5.0 Staff Resources

The department's Air Pollution Control Program (APCP) Air Quality Analysis (AQA) Section, Data Management Unit, prepared the 2011 emissions inventory with assistance from other APCP units. Local agencies in the Kansas City, St. Louis County, St. Louis City, and Springfield areas did not participate in inventory collection or quality assurance, but they do assist with identification of point source facilities. The individuals making up the 2011 NEI preparation team and their responsibilities are listed below:

- Stacy Allen, Data Management Unit Chief: Oversight of point, and nonpoint source development, quality assurance, and data submission
- Jeanne Brown, Data Management Unit: Point source data entry, quality assurance, and data submission
- Josh Martin, Data Management Unit: Point source quality assurance; HAP quality assurance
- Nathan O'Neil, Data Management Unit: Point source quality assurance; nonpoint source development and data submission; mobile source development and data submission
- Mary Powell, Data Management Unit: Point source data entry and quality assurance
- Terry Stock, Data Management Unit: Point source quality assurance and nonpoint source development
- Brenda Wansing, Data Management Unit: Point source data entry, quality assurance, and data submission
- Dan Williams, Data Management Unit: Point source quality assurance and nonpoint source development
- Aaron Basham, Rules Unit: Nonpoint source quality assurance
- Mark Leath, SIP Unit: Nonpoint source quality assurance
- Paul Myers, Rules Unit: Nonpoint source quality assurance
- Stan Payne, Rules Unit: Nonpoint source quality assurance
- Shelly Reimer, Rules Unit: Nonpoint source quality assurance
- Seanmichael Stanley, Rules Unit Planning Section: Nonpoint source quality assurance

6.0 Data Collection and Handling

6.1. Point Sources

Point source data is collected from permitted facilities in the form of a report called the Emissions Inventory Questionnaire (EIQ). The EIQ is a report detailing facility operational data and estimating the amount of air pollution emitted, and its collection is governed by Missouri Statute 10 CSR 10-6.110. The facility will either submit a detailed annual "full" report, with updated calendar year operations and emissions, or a "reduced" report, which represents that their last full report emissions are a reasonable estimate for the current year, within emission change and permit tolerances. These reports are certified by the facility, but are subject to review and revision based on quality assurance performed by the state, or notification by the facility of errors in the original submission. The point data presented in this report reflects all updates made to emission reports through February 1, 2014.

The AERR definition of Type A and B point source facilities depends on the pollutant-specific PTE and location within a designated nonattainment area. Since Missouri does not maintain records of facility total potential to emit, the permit type is used to determine Type A and Type B status. Missouri has one area designated as both a moderate ozone nonattainment area and moderate PM nonattainment area, so the Type B thresholds for SO_x, VOC, NO_x, CO, Pb, PM_{10} and NH_3 are compared to permit thresholds. Per Missouri operating permit rule 10 CSR 10-6.065, Part 70 sources and Intermediate sources have uncontrolled PTE of at least one pollutant in excess of the AERR Type B thresholds. All Missouri sources with Part 70 or Intermediate operating permits are submitted as Type B sources, and they are required to complete the "full" emissions report, detailing their actual operations and emissions during the 2011 year. Emission units permitted at the facility via their construction or operating permit are included in the report, including both stack and fugitive emission releases.

A fully detailed emission report contains several elements, most of which originated and continue to exist on paper EIQ forms. The following list provides brief description of the forms available for use in completing an EIQ, and the forms themselves appear in Appendix B-1. In general, forms beginning with number one (1) provide general facility information, and forms beginning with a two (2) provide detailed annual emission calculations. More information on EIQ forms is available at http://www.dnr.mo.gov/env/apcp/moeis/emissionsreporting.htm

Form Name	Form Description	Form Number
Form 1.0 General Plant Information	General plant information, plant-wide emissions totals, signature section certifying submitted information is accurate and complete.	780-1431

Form Name	Form Description	Form Number
Form 1.1 Process Flow Diagram	Diagram identifying and linking all emission units, processes, air pollution control devices, and emission release points for a facility.	780-1619
Form 1.2 Summary of Emission Units and Related Processes	List of all emission units, associated processes, and unit operating status.	780-1620
Form 2.0 Emission Unit Information	Main emissions reporting form; separate Form 2.0 required for each significant process for which emissions are being reported.	780-1621
Form 2.0C Control Device Information	Control device information when there is a control device operative at an emission unit; separate Form 2.0C required for each control device.	780-1434
Form 2.0K Charcoal Kiln Information	Details the operations and characteristics of charcoal kilns.	780-1530
Form 2.0L Landfill Information	Form for reporting emissions from landfills.	780-1583
Form 2.0P Portable Equipment Information	Details the locations and operations for portable equipment operations including quarries, asphalt plants, and concrete batch plants.	780-1433
Form 2.0S Stack/Vent Information	Stack information for emission units where emissions from a process enter the ambient air through one or more stacks/vents.	780-1435
Form 2.0Z Ozone Season Information Form	Calculation of ozone season day emissions of VOC, NO_x, or CO; required from facilities located in the St. Louis ozone nonattainment counties of St. Louis, St. Charles, Franklin and Jefferson Counties and St. Louis City.	780-1452
Form 2.1 Fuel Combustion Worksheet	Combustion equipment itemization including equipment design rate and fuel type.	780-1436
Form 2.2 Incinerator Worksheet	Information related to the incinerator, waste material(s) incinerated, and the annual waste material throughput.	780-1438
Form 2.3 VOC Process Mass-Balance Worksheet	Calculates a VOC mass balance emission factor from one or more VOC-containing materials.	780-1440

Form Name	Form Description	Form Number
Form 2.4 Volatile Organic Liquid Loading Worksheet	Calculates an emission factor for petroleum liquid loading into tank trucks, rail cars, and barges based on AP-42.	780-1625
Form 2.5L General Liquid Storage Tank Information	Information about storage tanks.	780-1444
Form 2.7 Haul Road Fugitive Emissions Worksheet	Calculates an emission factor for unpaved haul roads based on AP-42 formula.	780-1445
Form 2.8 Storage Pile Worksheet	Calculates emission factors for activity and wind erosion from storage piles based on AP-42 formulas.	780-1446
Form 2.9 Stack Test/Continuous Emission Monitoring Worksheet	Documentation for emission factors derived from stack tests or CEM devices.	780-1447
Form 2.T Hazardous Air Pollutant Worksheet	Speciates HAP chemicals emitted at the process level; separates individual HAPs from those included in VOC/PM emissions.	780-1448
Form 3.0 Emission Fee Calculation	Summary table showing emissions from all processes.	780-1509
Form 3.0CK Emission Fee Calculation for Charcoal Kilns	Summary table showing emissions from charcoal kiln operations.	780-1508
Dry Cleaner – Non-chlorinated and Petroleum Based Solvents	Emissions calculations for dry cleaners using non-chlorinated solvent and with combined dryer capacity of 84 pounds or more.	780-1954
Form 4.0 Financial Cost Estimate	Estimate the cost of complying with air pollution regulation.	780-1622

Though paper forms were the origination of emission reporting, Missouri now has an online emission reporting system called the Missouri Emission Inventory System, or MoEIS. The data elements on the hardcopy forms have an electronic counterpart in MoEIS, though several data elements which were calculated by the user and written on the form are now automatically populated by MoEIS. For the full emission reports submitted by an AERR Type A or B facility, the report can be submitted either on paper forms or via MoEIS. Both submittals require a signature page to certify that representative emissions have been reported, to the best knowledge of the facility representative.

All data elements for full emission reports are stored in the underlying MoEIS database. For reports that are submitted on paper forms, the data is entered to the MoEIS database by the APCP staff members within a few weeks of receipt. Both the number and type of reports submitted annually are monitored to ensure proper coverage of AERR-reportable point source facilities. Paper forms were due by April 1, 2012, and MoEIS submissions were due by May 1, 2012. Late reports from AERR point source facilities were collected through reminders, enforcement actions, or site visits.

EIQ solicitations for calendar year 2011 were mailed to facilities in January 2012. A total of 2,237 EIQs were mailed statewide, of which 676 were full EIQs and 1,561 were reduced reporting forms. Of those 676 full reports, 505 facility reports are for AERR Type A or B facilities, and are included as point sources in Missouri's submittal to the NEI.

6.2 Nonpoint Sources

Nonpoint emission estimates come from a variety of input data sources, including but not limited to:

- US Census population, employment, and industrial datasets
- US Census of Agriculture activity data
- Satellite derived fire burn areas
- Energy Information Administration (EIA) annual fuel usage statistics
- EPA's Emission Inventory Improvement Program (EIIP)
- Missouri air-permitted sources

The activity data, emission factors, and control assumptions for each specific data category are outlined in Section 8. Many of the nonpoint emission categories are developed by EPA using nationally available datasets to ensure complete and consistent estimates. Those estimates are reviewed by states for accuracy of appropriateness of calculation methods, verification of input data, state-specific data input, and full geographic, temporal, and pollutant coverage. While most data is handled in Microsoft Excel or Access databases, some categories require the use of proprietary tools such as the SMARTFIRE program or Fredonia market research for solvent usage statistics. All data and documentation provided by EPA is stored electronically by Missouri. For nonpoint data categories where Missouri provides no state-specific data updates or corrections, EPA is notified that their estimate is accepted by Missouri.

6.3 Onroad Mobile

Onroad mobile data inputs include vehicle mile travelled estimates from travel planning organizations at the state and regional level. Vehicle registration data from the Missouri Department of Revenue include Vehicle Identification Numbers (VINs) that are decoded by a third-party vendor to determine the number, age, and engine types of vehicles on Missouri roads. Data from the Gateway Vehicle Inspection program is used to verify the number of inspection waivers given, retesting rate, and the pass/fail rate of inspections to ensure the amount of pollutant reduction attributed to vehicle maintenance is accounted for. All these datasets are formatted for use in EPA's approved mobile source model, the Motor Vehicle Emission Simulator (MOVES). The datasets are collected in electronic formats, manipulated electronically, and stored in MOVES table structures that allow for appropriate model runs and data submittal to EPA.

6.4 Nonroad Mobile

EPA's NONROAD model, version 2008, is used to estimate emissions from engines that are not operated on roadways. Missouri does not collect state-specific engine or vehicle population or activity data for this category of model inputs. EPA's default NONROAD emissions are accepted by Missouri after a review of their results.

Nonroad emissions from aircraft, railroads, and commercial marine vehicles are not included in the NONROAD model.

- Aircraft emission data is estimated by EPA based on Federal Aviation Administration (FAA) airport-specific activity data that is input to the Emissions Dispersion Modeling System (EDMS) to provide emission calculations. EPA provides the input activity data to states for review and comment electronically, and provides the output emissions for review by states. Missouri had no comments on the estimates, and EPA's estimate for this category was accepted.
- Railroad emission data is estimated by EPA by scaling the 2008 emission estimates to 2011 based on the ratio of 2008 to 2011 freight hauled and revenue for large, Class I railroads, and by employee hours for smaller railroads. EPA only provided documentation of how the emissions were grown, and no review of the underlying electronic datasets was done by Missouri. EPA's estimate was for this category was accepted.
- Commercial marine operations were estimated by EPA using emissions developed in 2002 and grown to 2011, accounting for industry growth and updated engine standards. Missouri did not provide state-specific estimates, and reviewed EPA's estimates as they were provided in spreadsheet form. Missouri noted the large decrease in emissions due to an updated EPA procedure to allocate more emissions to underway activities compared to port activities. Missouri accepted this new estimation technique and emissions.

7.0 Point Source Inventory

7.1 Quality Assurance Prioritization

The Data Management Unit prioritizes review of facilities that produce the most emissions, specifically facilities with a Part 70 or Intermediate operating permit. While every data element collected helps to characterize the emission estimate, the fields most directly tied to the emissions calculation are given the highest priority.

7.2 Quality Assurance Methods

The Data Management Unit's general quality assurance (QA) procedures utilize many of the techniques outlined in the EPA's Emission Inventory Improvement Program (EIIP) Technical Report Series Volume 6: Quality Assurance Procedures. The unit groups these techniques into two basic categories: Bottom-Up QA procedures and Top-Down QA procedures. Top-Down Procedures analyze groups of emissions data that share a common trait and look for outliers, in keeping with the 'Reality Check' technique. Bottom-Up procedures evaluate individual EIQs that are believed to be erroneous due to data entry errors or inconsistencies brought up by a third party. The Air Quality Analysis unit's quality assurance efforts are driven by top-down techniques, with individual EIQ improvements due to referrals from other air program staff. This allows prioritization of potential errors found and maximizes the results achievable with the available staff resources. Correction of individual reports is done based on the results of the top-down and referral reviews.

Top-down quality assurance activities begin by determining what information to pull from the MoEIS database. The lists below give the Microsoft Access queries written to identify errors, prioritize facilities, and show totals for the year. The following section describes the results of data checks that resulted in changes to facility information or emissions.

EIQ Submission (queries named "Sub")		EIQ sources covered
Sub01	EIQ submittal no production and insignificant plant-wide	All - full and reduced
Sub02	Stats on number of Reduced doing Full	All - full and reduced
Sub03	Identify reduced sites to contact to verify 5 ton trigger	Reduced
Sub04	List of permits issued versus reduced doing full	All - full and reduced
Sub05	Stats on dates EIQs received	All - full and reduced
Sub06	Comments submitted	All - full and reduced
Sub07	MoEIS usage statistics	Full
Sub08	Identify confidential EIQs	Full
Sub09	Habitual late EIQs by permit and industry type	All - full and reduced
Sub10	Number of late EIQs	All - full and reduced
Sub11	Number of EIQs not sending signed 1.0 on time	All - full and reduced
Sub12	Pull 82 hardcopy full reports to get consultant name and	Full

	excel vs PDF	

EIQ Data Format for EIS Submittal (queries named "EIS")		**EIQ sources covered**
EIS01	Check MoEIS vs EIS code tables for active codes	N/A
EIS02	Submitting new data elements	NEI P70 and INT list
EIS03	Add unit type codes for new units	NEI P70 and INT list
EIS04	Existing processes to new release point	NEI P70 and INT list
EIS05	Fill in TRI-IDs	All - full and reduced

Common Data Errors in MoEIS (queries named "Err")		**EIQ sources covered**
Err01	Check PM_{10} always greater than $PM_{2.5}$	NEI P70 and INT list
Err02	Insignificant units with throughput greater than zero	Full
Err03	Ash/sulfur content not in the emission factor	NEI P70 and INT list
Err04	Check the MoEIS emission calculation is correct	All - full and reduced
Err05	If reduced doing full, make sure throughputs were updated	Full
Err06	Check that HAP worksheets were updated	Full
Err07	Clean up fuel combustion worksheet heat content and MHDR outliers	All - full and reduced
Err08	If only PM_{10} (no $PM_{2.5}$), list sources with over 10 tons	NEI P70 and INT list
Err09	Check that combustion SCCs are reporting all combustion CAPs	Full
Err10	Missing ozone worksheets need to be added	All - full and reduced
HAP Process to Worksheet	HAP amounts that differ between worksheets and emission calculations	NEI P70 and INT list
HAPs Without Worksheets	HAPs reported with no worksheet	NEI P70 and INT list

Financial (queries named "Fin")		**EIQ sources covered**
Fin01	Total Emission fees received	All - full and reduced
Fin02	Compare 2010 and 2011 fees received	All - full and reduced

Fin03	Compare local agency fees	All - full and reduced

Total Statewide Emissions (queries named "Tot")		EIQ sources covered
Tot01	Graph P70 emissions by pollutant over last 5 years	P70
Tot02	Graph INT emissions by pollutant over last 5 years	INT
Tot03	Graph all other permit types by pollutant over last five years	Basic, Dempal & PORT
Tot04	Graph total Missouri emissions over last 5 years	All

Compare to other data sets (queries named "Ext")		EIQ sources covered
Ext01	Retrieve CAMD data and compare to MoEIS for utilities	Electric Generating Units (EGUs)
Ext02	Retrieve EIA data and compare facility layout and ash/sulf and heat cont	EGUs
Ext03	Retrieve TRI air emissions and compare to MoEIS	Full
Ext04	Compare HAP contact list from Feb 2012 to see if problems were corrected	Previous list
Ext05	Compare to emission projection spreadsheet	Large Source List
Ext06	EPA 2008 NEI Priority and pollutant addition list	NEI P70 and INT list

Emission Checks by Industry (queries named "Ind")		EIQ sources covered
Ind01	For common NAICS groups, find outliers in emissions	Full
Ind02	For common NAICS groups, run emission trends last 5 years	NEI P70 and INT list
Ind03	For elec utilities, check that PM CON is reported separately	EGUs
Ind04	Other facilities where PM CON is speciated/should be	NEI P70 and INT list

Emission Checks by facility (queries named "Fac")		EIQ sources covered
Fac01	Total facility chargeable emission change >20% and >5 tons	Full
Fac02	Total facility pollutant change >20% and >5 tons	Full
Fac03	By pollutant and process, emission changes >20% and >5 tons	Full
Fac04	High priority pollutant and process changes of >10% and >3 tons	NEI P70 and INT list

Emission Factor Checks (queries named "Ef")		EIQ sources covered
Ef01	Source of factor AP-42, compare to webfire for same SCC	NEI P70 and INT list
Ef02	Stack test or eng calc factor changes 2010 to 2011	NEI P70 and INT list
Ef03	Review stack test letters from APCP Enf staff	All - full and reduced
Ef04	EPA revised PM Efs for gas combustion	All - full and reduced

Pollutant Checks (queries named "Pol")		EIQ sources covered
Pol01	Review Lead emissions over 0.25 ton in 2011 compared to 2010	All - full and reduced
Pol02	Identify the largest facilities for NH_3, see if any major sources are missing	All - full and reduced
Pol03	Check for total HAPs reported over the VOC/PM_{10} total	Fulls

7.3 Data Checks Used

<u>Submission Checks</u>

These queries provide statistics for the 2011 EIQ submissions, and they do not result in changes in reported emissions.

<u>EIS Checks</u>

These checks ensure that Missouri's emission inventory data can be properly mapped over to EPA's EIS data formats. These checks do not result in changes to reported emissions.

Err01

This data check was performed to identify facilities reporting $PM_{2.5}$ in excess of PM_{10} and those reporting PM_{10} with no $PM_{2.5}$. Since $PM_{2.5}$ is a component of PM_{10}, emissions of $PM_{2.5}$ must be less than or equal to emissions of PM_{10}. Only one facility reported less PM_{10} than $PM_{2.5}$, and the issue was corrected after a review of the facility's data.

Err02

This check identified units marked "insignificant", but where throughput was reported along with emissions. These units were simply changed from "insignificant" to "active" status, with no change in emissions.

Err03

This check identified the AP-42 emission factors that are the result of an equation involving either an ash or sulfur term. The SCCs associated with these factors were identified. It appears all facilities were correctly including the ash or sulfur term in the emission factor, and no changes were necessary.

Err04

Manual recalculation of the emission totals for all pollutants and emission processes verified that the MoEIS-generated emissions are correct.

Err05

For any facility choosing to do a full EIQ instead of a reduced EIQ, this check verifies that they updated one or more of their emission unit totals. No facilities were updated due to this check as they all updated their data to the current year.

Err06

HAP worksheet data tends to be overlooked during facility submittals, so this check ensures that the worksheet has been updated from the previous submittal. See Section 7.4 for more details.

Err07

Fuel combustion worksheets were examined to ensure that the heat content of the fuel was correct, given the unit of measure reported. Many worksheets were updated to ensure the proper heat content was reported, which in turn updated the maximum hourly design rate of the equipment. These changes did not result in changes to emission totals.

Err08

This data check was done to identify facilities reporting PM_{10} without reporting any $PM_{2.5}$. Nine facilities reported over ten tons PM_{10} emissions with no corresponding $PM_{2.5}$ emissions. These facilities were contacted, and $PM_{2.5}$ emissions were added to their updated report.

Err09

This data check ensured that all combustion pollutants were reported for an emission unit. The data showed that nine facilities were missing at least one expected combustion pollutant for at least one unit, and the resulting new pollutants and emissions were saved via revised emission reports.

Err10

Facilities in the five-county St. Louis Ozone Nonattainment area were identified if they were missing the Ozone Season Worksheet that estimates emissions of CO, NO_x, and VOC on a typical summer day. Several facilities had this worksheet added to their report since it is estimated based on data elements found elsewhere in their report, and this additional worksheet did not change any reported annual emission totals.

HAP Process to Worksheet

This check determines which facilities have a discrepancy between the amount of HAPs reported as HAPs on worksheets and the total chargeable HAPs for 2011. See Section 7.4 for more details.

HAPs Without Worksheets

For a facility that reported over 5 tons of total HAPs, emissions were reviewed if they did not itemize emissions on the HAP worksheet. See Section 7.4 for more details.

Financial Checks

These checks tabulate emission fees that are based on reported emissions. These checks do not result in changes to reported emissions.

Total Checks

The emission total checks create graphical displays of aggregate emission trends, and do not result in reported emission changes.

Ext01

EPA's Clean Air Markets Division (CAMD) emissions data for electric generating units was compared to emissions reported to Missouri. Since these emissions are measured by continuous emissions monitors (CEMs) at the facility, and results transmitted directly to EPA, the same emissions should be reported to Missouri. Any facility with over a 20% and 5 tons difference in either NO_x or SO_x emissions was flagged for review. The four facilities that showed at least one unit meeting the review threshold reported their facility total emissions in agreement between the two systems, but the grouping of emission units differed between CAMD and MoEIS. No changes were made to emission reports since there was no net difference in emission totals.

Ext02

The Energy Information Administration (EIA) Form 860 and Form 923 data was compared to emission reports from electric generating units to ensure consistency between control devices and ash and sulfur content of fuels. Due to time constraints, this comparison was not completed.

Ext03

The 2011 Toxics Release Inventory (TRI) dataset for Missouri was compared to EIQ data. See Section 7.4 for more details.

Ext04

Facilities that had problem HAP reporting for 2010 were reviewed to ensure that problems weren't repeated in 2011. See Section 7.4 for more details.

Ext05

Missouri maintains an emission projection spreadsheet that gives estimates for facilities expected to shut down, add controls, or otherwise reduce emissions, in future years. The spreadsheet was reviewed to ensure expected emission changes were seen in reported data. Two facilities that significantly reduced emissions due to shutdowns during 2011 were verified by the comparison, and one facility that stopped using coal for a combustion process was also verified.

Ext06

Based on the 2008 NEI facility priority list shared by EPA with the states, Missouri pulled their 2011 data to see if there were significant changes, additions, or deletions that would be noted by EPA. While some of these facilities showed large changes in both CAP and HAP emissions, the changing nature of EPA's priorities from 2008 to 2011 made detailed analysis of these facilities unnecessary. Changes in facility emissions over time were examined in further quality assurance checks.

Ind01

Emission outliers were to be examined by industry types. Due to time constrains, this check was not completed.

Ind02

These checks create emission trend graphics for common industry types. These graphics do not cause changes to reported emissions.

Ind03

For electric utilities, Missouri had worked with them to adjust previous year emission reports to include condensable PM for coal combustion units. A check of their 2011 data showed those units were still reporting PM CON.

Ind04

For non-EGU facilities that EPA created PM CON emissions in the 2008 NEI, their 2011 emission reports to Missouri were reviewed to see if they should be itemizing PM CON. No facility reports were amended as a result of this comparison, as most large combustion units had begun itemizing PM CON in their reports.

Fac01

The initial goal of examining facilities with changes of 20% or 5 tons produced over 100 facilities of interest. Instead, 51 facilities with total chargeable emissions change of 30% and 15 tons from 2010 to 2011 were examined. Several changes are attributed to facility shutdowns or equipment changes, and most other changes are legitimately due to changes in activity levels at the facility. No erroneous facility total emission changes were identified.

Fac02

Facility-total pollutants PM_{10}, NO_X, SO_x, and VOC were examined for single-pollutant changes that drove emission changes from 2010 to 2011. To reduce the list from over 100 facilities to 39, only changes of 30% and 15 tons were examined. Many facilities on this list overlapped the Fac01 results, meaning facility process and production changes created the emission changes. No erroneous facility pollutant total changes were identified.

Fac03

For specific pollutants and processes, changes of 20% and 5 tons were initially reviewed to try and identify erroneous changes in throughput, emission factors, or control efficiencies. Due to the large number of records and processes involved, plus the overlap of facilities from checks Fac01 and Fac02, no emission changes at the process level were identified for detailed investigation or modification.

Fac04

For a select group of sources, the check was to identify process-specific pollutant changes of 10% or more than 3 tons. Due to the overlap of checks from the previous series of checks, and the number of processes involved, this check was not completed.

EF01

For emission factors where the source is cited as AP-42, this check attempts to verify that the emission factor is accurate. Since the webFIRE database should contain SCC-specific emission factor from AP-42, the database was compared to MoEIS emission factors for the same SCC, pollutant, and control status. One common problem with this approach is that the SCC chosen by a facility to describe an emission process should match closely to what is actually occurring, and the emission factor may not be associated with that same SCC. For cases where a facility has chosen an emission factor from a similar process, but not the exact process SCC, it becomes difficult to separate these legitimate emission factors from poorly chosen or misrepresented emission factors. No updates were made to emission factors based on this comparison. Future work with AP-42 emission factor verification will be industry and process specific to ensure groups of similar equipment are estimating emissions consistently, regardless of the source of emission factor.

EF02

For stack test factors that have changed between the 2010 and 2011 reports, the air program enforcement approved stack tests done during 2010 and 2011 were reviewed to ensure the facility used the most current test, and applied the factor correctly. The review found no concerns with the modified stack tested emission factors, and no updated emission reports were needed.

EF03

Similar to the previous check, all program reviewed and approved stack tests were examined to ensure the facility used the most recent tested emission factors, regardless of how their previous emission reports may have appeared. No updated emission reports were needed based on this check.

EF04

EPA proposed that updated emission factors for PM from natural gas combustion be considered by states prior to inventory submittal. EPA based these new factors on more recent stack tests done with an updated stack test method. Missouri data indicates that the majority of PM emission factors EPA proposes to update will result in less than a ton of emission change, and many of Missouri's large PM natural gas sources are already using site-specific emission factors. Though EPA claims these factors are higher quality than what exists in AP-42, there has not been an open opportunity for states and local agencies to review the proposed new factors. Despite the small change in PM that could result from Missouri using EPA's proposed factors, Missouri will wait for EPA to fully incorporate these updated factors to the AP-42 documents, including offering the results for state and local agency review.

Pol01

The lead monitoring network in Missouri covers all sources estimating over 0.5 tons of emissions annually, except for sources with model-demonstrated ambient impacts below the level of the standard. For Missouri, an annual review of all sources emitting over 0.5 tons of lead is completed, and 0.25 ton sources are also reviewed to ensure complete coverage of the network. All sources previously identified in 2008 through 2010 data continued reporting emissions at or above the 0.25 ton level, including power plants, lead smelters, ammunition plants, and large coal-fired boilers. This review did not result in any revised emission reports.

Pol02

The largest sources of ammonia were identified in the inventory, and all facilities in those industries were reviewed to ensure the pollutant is being included where necessary. The largest emitters are power plants with urea injection as part of a NO_x control strategy, and wastewater treatment plants. A review of facilities in these industries shows all are reporting ammonia emissions as expected, and no revised emission reports were required.

Pol03

For facilities reporting aggregate and itemized HAP pollutants, this check ensures that the HAPs are a subset of their total PM_{10} or VOC emissions, and HAPs are not greater than the PM_{10} and VOC totals. See section 7.4 for further details.

7.4 Quality Assurance of Hazardous Air Pollutant emissions

Various quality assurance checks were performed on Hazardous Air Pollutant (HAP) data reported by facilities with a Part 70 or Intermediate operating permit. The data was investigated in a different manner than the previous year. For the 2010 reporting year, facilities were marked high priority primarily because of large differences in amounts reported from 2009 to 2010. That approach yielded some positive results, but proved to be very time intensive. Additionally, sites reporting large year to year changes were often correct. A modified approach was developed, and HAP data checks performed for the 2011 reporting year fall under these general categories:

- Searches for data that cannot be correct, such as grouped HAPs reported in the fee calculations with no speciated HAP worksheets present
- Searches for data that is unlikely to be correct, such as identical HAP emissions from 2010 to 2011
- Cross-checks with other data sources, primarily the Toxic Release Inventory (TRI)

More specifically, the following checks were done to identify HAP areas of concern.

<u>Err06</u>

Data check Err06 compared hazardous air pollutant (HAP) worksheets to find those that were not updated between reporting years 2011 and 2012. Two Access queries were used to extract the necessary information, one for 2010 data and one for 2011 data. Facilities with identical information on both year's worksheets were identified, and any site with five or more tons of HAPs was marked high priority.

<u>Ext01</u>

Data check Ext01 compared SO_x and NO_x data submitted through MoEIS to data submitted directly to EPA. Some electricity generating facilities are required to use continuous emission monitoring to demonstrate compliance with the Acid Rain Program. This information is available online from EPA. Discrepancies exceeding five tons and twenty percent of total emissions were identified and marked high priority.

<u>Ext03</u>

Data check Ext03 compared HAP data submitted to the emissions inventory to submissions made to the Toxic Release Inventory (TRI). Since there is a significant amount of overlap between the two, most comparisons can be made on a chemical by chemical basis. EPA typically releases preliminary TRI data within a month of the July 1 due date. MoEIS stores TRI identification numbers for point sources, allowing a facility-total match between the two data sets. This comparison used releases reported to the TRI as Fugitive Air and Stack Air. No other TRI data was used.

Two facilities reported hazardous air pollutants to the TRI but not to the EIQ. Both were marked high priority and investigated. One facility appeared to have TRI emissions below the EIQ reporting threshold. Hazardous air pollutants were added to the other facility's report.

Ext04

Facilities that reported identical HAP worksheets for years 2009 and 2010, had HAP worksheets that didn't match the total chargeable HAP tons, or had significant differences between TRI and EIQ data were identified in early 2012. These facilities received an email explaining the potential errors and advising them that particular attention should be paid to these areas of the inventory for the 2011 reporting year. Data check Ext04 rechecked the facilities with HAPs reported on worksheets that did not match chargeable HAPs and determine if the same mistake was made again for 2011. The purpose for this step was not to identify facilities to contact, but to determine the effectiveness of using mass email as a means to improve the inventory. The QA plan already included checks for identical HAP worksheets and concurrent with TRI data.

Ext06

In May, 2012, EPA sent a spreadsheet containing 2008 NEI data to the department with pollutants that EPA considers particularly significant. Some of the emission quantities that were ultimately used by EPA in the NEI were different than what was reported by the department. Four Access queries were written to compare the data used by EPA to the data that was submitted by the department to the 2008 NEI. The first query, Ext06a, extracted the amount of each of the ten HAPs on EPA's list that the department reported as VOC or PM_{10} in 2008 for each facility on the 2011 NEI submission list. The second query, Ext06b, contained the HAPs reported in 2008 as HAPs. The third query, Ext06c, combined HAPs reported by the department as VOC or PM_{10} and HAPs reported as HAPs into one table. As part of data check Ext06, the HAPs for each facility on EPA's list were converted into an Access table. The last query, Ext06final, combined HAPs reported by the department for the 2008 NEI and the HAPs from EPA's list into one table.

A comparison of the two data sets revealed widespread and significant differences. Since addressing the discrepancies would have taken a vast amount of time, and since the data is several years old, it was decided not to pursue corrections except in the very worst case. The pollutants on the EPA list will be given special attention in another QA step, Ext03.

Pol03

Data check Pol03 compares the amount of HAPs reported as VOC or PM_{10} to the total amount of VOC and PM_{10} reported for the. An Access query, Pol03a, reports the total amounts of VOC and PM_{10} claimed at each site. A second query, Pol03b reports the total amount of HAPs reported as VOC and PM_{10} on the site's HAP worksheets. Pol3final matches the HAPs VOC and PM_{10} and total VOC and PM_{10}

by facility for comparison. Any site reporting HAPs as VOC or PM_{10} in excess of the total VOC and PM_{10} reported was noted as an error. Facilities with an excess of five tons or more were added to the high priority list.

HAP Process to Worksheet Check

Although not included in the original list of QA steps, this check was done to determine which facilities have a discrepancy between the amount of HAPs reported as HAPs on worksheets and the total chargeable HAPs for 2011. A single query, titled HAP Process to Worksheet Check, compared the two amounts. Nine facilities with a difference of five or more tons were added to the high priority list.

HAPs Without Worksheets Check

This step was also a later addition to the original QA plan. It determined which facilities reported HAPs as chargeable tons but did not have any HAP worksheets. An Access query extracted the sum of HAPs from the HAP worksheets and the sum of chargeable HAPs. The join properties were set in such a way that any facility with chargeable HAPs would be included, even if no worksheets exist. When including summations from multiple tables, Access often reports erroneous information. In this case, chargeable tons, when present, were frequently inaccurate. For any site with chargeable HAPs and no blank worksheet values, DNR staff verified the actual chargeable tons through the MoEIS website. Any facility with no HAP worksheets and five or more tons of chargeable HAPs was added to the high priority list.

After the high priority list was compiled, a detailed review was done to remove facilities that were likely correct or would not significantly impact the inventory if corrected. A total of five facilities were removed for the following reasons.

- Data for 2011 had not been submitted, and APCP staff was working with the site to get updated information.
- HAP emissions for 2010 and 2011 were identical, but other emissions were nearly identical. One site had a year to year difference of 2.6%, and another had a difference of less than 1%.
- There was no production in 2011, and the site had no operating permit.
- The company's consultant verified that 2011 data was accurate, and said that the mistake was in the 2010 data that was used for comparison.

After the preliminary review, the high priority list contained 22 facilities. Contact was made with each facility, and any reporting errors were resolved. Changes made to the inventory were documented in the facility's 2011 EIQ file.

Table 2: Point Source Emissions by Facility (tons per year)

County Number	Plant Number	Plant Name	CO	Lead	NH_3	NO_x	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_x	VOC
001	0006	AMEREN MISSOURI	0.15			0.59	0.03	0.00	0.00	0.03
003	P011	KELLER CONSTRUCTION COMPANY	6.63	0.00		0.41	2.04	0.23	0.08	0.14
007	0001	MID AMERICA BRICK	8.81			2.57	3.85	0.09	4.72	0.50
007	0002	ARCHER DANIELS MIDLAND CO	15.13			18.01	45.04	18.79	0.11	79.47
007	0003	HARBISON-WALKER REFRACTORIES	16.77			6.55	16.94	11.84	11.74	0.63
007	0012	AMEREN MISSOURI	0.01	0.00		2.36	0.03	0.03	2.71	0.00
007	0040	TEVA PHARMACEUTICALS USA INC	0.39	0.00	0.46	3.06	0.24	0.24	0.02	6.73
007	0041	VANDALIA POWER PLANT	0.20			0.95	0.02	0.00	0.06	0.08
007	0047	CERRO FLOW PRODUCTS LLC	117.43	0.02	0.00	2.50	17.12	15.11	1.34	4.61
007	0051	MEXICO PLASTIC COMPANY	0.05			0.26	0.01	0.00	0.00	133.09
007	0053	AMEREN MISSOURI	32.93			56.02	6.21	0.00	0.36	1.15
007	0054	POET BIOREFINING	54.66			45.86	26.56	0.00	0.46	48.85
009	0003	EFCO	5.49		1.18	6.53	0.93	0.50	0.04	57.09
009	0005	SAPA EXTRUSIONS NORTH AMERICA	18.02	0.00	0.69	22.59	11.53	11.27	0.93	102.96
009	0021	SCHREIBER FOODS INC	6.73	0.00	0.26	8.01	0.61	0.61	0.05	0.44
009	0052	JUSTIN BOOT COMPANY	0.00			0.00	0.00	0.00	0.00	15.47
009	0062	ARCHITECTURAL SYSTEMS INC				4.57				24.02

County Number	Plant Number	Plant Name	CO	Lead	NH_3	NO_x	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_x	VOC
009	0066	GEORGE'S INC	2.47		0.09	2.93	17.18	2.73	0.02	0.16
011	0031	LAMAR CITY ELECTRICAL GENERATION	118.81			39.11	5.10	5.10	1.70	8.24
011	0039	PRAIRIE VIEW REGIONAL WASTE FACILITY	43.85			2.34	11.03	2.00	0.82	4.92
013	0029	BUTLER MUNICIPAL POWER PLANT	0.23			2.23	0.19	0.19	0.63	0.06
017	0019	NATURAL GAS PIPELINE COMPANY	185.46		0.00	2,924.24	31.83	31.83	0.39	79.11
019	0002	COLUMBIA MUNICIPAL POWER PLANT	129.33	0.00	10.91	266.32	23.31	21.58	1,044.81	1.88
019	0004	UNIVERSITY OF MISSOURI (MU)	70.05	0.00	0.06	500.43	60.52	56.07	5,925.66	3.39
019	0005	MAGELLAN PIPELINE COMPANY LP	8.45			3.38				30.79
019	0039	HUBBELL POWER SYSTEMS, INC	4.75	0.01	0.00	6.79	4.93	0.24	0.07	20.15
019	0045	CHRISTIAN HEALTH SYSTEMS	2.78	0.00	0.02	5.03	0.37	0.36	0.55	0.33
019	0047	UNIVERSITY OF MISSOURI	0.30	0.00	0.01	1.38	0.03	0.03	0.09	2.78
019	0066	DANA LIGHT VEHICLE DRIVELINE	0.33		0.01	0.40	0.03	0.03	0.00	3.86
019	0069	QUAKER MANUFACTURING LLC	0.92			1.09	13.33	13.33	0.01	49.47
019	0077	PANHANDLE EASTERN PIPELINE	151.43			641.84	12.34	12.34	1.85	45.64
019	0091	COLUMBIA SANITARY LANDFILL	96.78	0.00		12.67	5.35	0.70	2.34	1.54
019	0105	COLUMBIA ENERGY CENTER	2.31	0.00		3.20	0.68	0.12	0.04	0.37
021	0004	KANSAS CITY POWER AND LIGHT CO	117.70	0.08	2.33	2,335.74	357.12	110.48	1,925.60	21.09
021	0009	JOHNSON CONTROLS BATTERY GROUP INC	5.65	0.19		6.73	7.37	4.02	0.40	0.44

County Number	Plant Number	Plant Name	CO	Lead	NH_3	NO_x	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_x	VOC
021	0016	LIFE LINE FOODS LLC	37.85			36.81	12.01	3.12	40.55	19.58
021	0037	ALBAUGH INC					0.00	0.00		34.99
021	0045	OMNIUM LLC	0.00			0.00	4.67	0.00	0.00	0.00
021	0046	INTERNATIONAL PAPER	4.03		0.15	4.80	0.37	0.27	0.03	3.90
021	0056	BARTLETT GRAIN COMPANY LP	1.31	0.00		1.56	12.89	1.30	0.01	0.09
021	0060	AG PROCESSING INC	1.44			1.71	35.43	10.41	0.01	270.79
021	0063	HEARTLAND REGIONAL MEDICAL CENTER EAST	5.25	0.00	0.03	6.27	0.48	0.48	0.04	0.34
021	0064	SILGAN CONTAINERS CORP	5.80	0.00		6.90	0.52	0.52	0.04	23.28
021	0078	ALTEC INDUSTRIES INC	1.98	0.01	0.08	2.37	0.85	0.44	0.07	28.67
021	0095	BLUESCOPE BUILDINGS	0.00			0.00	0.00	0.00		92.15
021	0105	ST. JOSEPH LANDFILL	29.89			1.59	12.88	1.22	0.56	7.34
021	0118	AG PROCESSING					0.49	0.00		3.18
021	0129	KANSAS CITY POWER AND LIGHT CO	20.08			1.07	0.46	0.46	0.37	0.01
023	0003	WILLIAMSVILLE MATERIALS					5.69	0.01		0.00
023	0027	JOHN J. PERSHING VA MEDICAL CENTER	1.28		0.07	4.33	0.15	0.12	0.51	0.09
023	0032	GATES CORPORATION	4.38	0.00		5.22	0.40	0.00	0.03	19.70
023	0038	BRIGGS AND STRATTON CORP	29.05	0.00	0.04	7.89	8.20	0.41	0.35	70.12
023	0042	CENTERPOINT ENERGY	111.49			108.08	1.51	1.51	0.03	5.30
023	0050	POPLAR BLUFF MUNICIPAL UTILITIES	2.71		0.09	9.94	0.15	0.14	0.13	0.56

County Number	Plant Number	Plant Name	CO	Lead	NH_3	NO_x	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_x	VOC
023	0058	BUTLER COUNTY LANDFILL	47.25			2.52	1.07	1.07	0.88	1.63
023	0062	NORDYNE LLC	0.01			0.02	0.00	0.00	0.00	42.57
027	0001	HARBISON-WALKER REFRACTORIES	0.08			0.09	0.86	0.03	0.00	0.01
027	0007	FULTON POWER PLANT	0.32		0.10	1.38	0.05	0.04	0.03	0.06
027	0010	A. P. GREEN INDUSTRIES INC	25.22			7.39	25.71	14.21	16.37	0.51
027	0019	ABB INC	4.02			5.98	2.13	0.00	0.04	69.85
027	0026	AMEREN MISSOURI	4.12			20.59	0.59	0.00	5.00	0.66
031	0002	DELTA ASPHALT INC	37.45	0.00	0.69	2.33	5.29	0.20	0.21	1.92
031	0010	SOUTHEAST MISSOURI STATE UNIVERSITY	33.00	0.00	0.00	41.25	9.02	6.05	418.00	0.28
031	0021	BUZZI UNICEM USA	7,113.12	0.00	12.69	1,129.35	393.86	218.29	331.95	242.00
031	0053	PROCTER AND GAMBLE PAPER PRODUCTS CO	185.84	0.00	1.55	101.53	49.72	0.51	1.01	248.84
031	0058	ST. FRANCIS MEDICAL CENTER	5.01		0.04	6.89	0.46	0.46	0.14	0.44
031	0061	JACKSON MUNICIPAL UTILITIES	0.36			1.35	0.02	0.02	0.00	0.04
031	0064	BIOKYOWA INC	18.89	0.00	4.81	8.39	2.57	1.71	1.15	9.31
031	0072	MONDI JACKSON	0.66			1.15	2.10	2.10	0.09	18.24
031	0081	CONSOLIDATED GRAIN AND BARGE CO					0.58	0.00		
031	0126	MID-SOUTH PRODUCTS INC					0.23	0.02		4.55
033	0001	SINCLAIR	3.25			1.30				74.56
033	0013	AGRISERVICES OF BRUNSWICK LLC WEST	0.02		0.02	0.10	15.15	1.12	0.00	0.00

County Number	Plant Number	Plant Name	CO	Lead	NH_3	NO_x	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_x	VOC
033	0022	CARROLLTON MUNICIPAL UTILITIES	2.00		0.06	10.88	0.18	0.18	0.42	7.46
033	0023	RAY-CARROLL COUNTY GRAIN GROWERS INC	0.00			0.00	4.21	0.00	0.00	0.00
033	0036	SHOW ME ETHANOL LLC	29.26			48.74	12.76	0.00	0.97	15.11
033	0037	RAY-CARROLL FUELS								0.70
035	0004	ROYAL OAK ENTERPRISES	29.19			70.20	16.01	5.15		4.19
037	0001	MARTIN MARIETTA MATERIALS					55.41	4.45		
037	0002	MARTIN MARIETTA MATERIALS LLC					1.87	0.00		
037	0003	KANSAS CITY POWER AND LIGHT CO	0.31			3.02	0.07	0.07	0.01	0.02
037	0048	PECULIAR SOUTHERN STAR CENTRAL	4.87		0.00	36.22	0.73	0.58	0.00	20.11
037	0056	DOGWOOD ENERGY FACILITY	6.08		13.89	43.24	19.82	19.82	0.29	3.18
037	0063	KANSAS CITY POWER AND LIGHT CO	39.38			24.31	3.17	3.17	0.29	1.01
039	0003	DAIRICONCEPTS	9.12	0.00	0.35	7.92	38.17	38.04	0.07	0.60
039	0012	FOAM FABRICATORS INC	1.55		0.06	1.84	0.14	0.10	0.01	30.75
045	0026	KAHOKA ELECTRIC GENERATING PLANT	0.05			0.21	0.00	0.00	0.06	0.21
045	0028	KPF STEEL FOUNDRY	0.37		0.00	0.50	1.71	0.03	0.00	1.00
047	0002	INGREDION, INC	26.86			31.98	108.85	0.34	72.97	70.91
047	0009	ARCHER DANIELS MIDLAND CO	0.51	0.00	0.02	0.61	11.15	0.90	0.00	0.03
047	0012	CCP COMPOSITES US LLC	2.41	0.00	0.09	3.09	0.53	0.22	0.02	0.70

County Number	Plant Number	Plant Name	CO	Lead	NH_3	NO_x	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_x	VOC
047	0019	FORD MOTOR CO	68.56	0.00	2.61	81.79	78.67	74.56	0.51	1,529.78
047	0025	BARTLETT GRAIN COMPANY					2.64	0.13		
047	0027	CARGILL INC				0.04	0.38	0.00	0.00	0.00
047	0032	HENRY WURST INC	0.06			1.53	0.01	0.00	0.00	22.87
047	0040	DAVIS PAINT CO	0.03			0.08	5.63	0.00	0.00	4.30
047	0052	AXEL AMERICAS, LLC	0.10			0.41	0.01	0.00	0.00	0.01
047	0059	HALLMARK CARDS INC	1.52	0.00		1.81	0.14	0.00	0.01	0.10
047	0075	TNEMEC COMPANY INC	0.00		0.00	0.00	0.22	0.00	0.00	14.53
047	0096	INDEPENDENCE POWER AND LIGHT	9.73	0.01	0.05	588.33	130.19	123.37	2,136.06	0.77
047	0122	RR DONNELLEY	1.29		0.00	1.54	0.18	0.00	0.01	23.33
047	0141	FUJIFILM MANUFACTURING USA INC	0.07			0.32	0.02	0.00	0.00	32.23
047	0175	VERTEX PLASTICS INC								0.40
047	0189	ARKEMA INC	0.51			0.85	1.51	0.05	0.00	0.78
047	2227	WATER SUPPLY DIVISION	6.97	0.00	0.23	15.72	9.01	0.60	0.13	0.71
051	0008	AMEREN MISSOURI	0.08	0.00		1.15	0.06	0.00	1.66	0.03
051	0009	UNILEVER SUPPLY CHAIN INC.	3.92			4.66	0.35	0.35	0.03	0.41
051	0028	RR DONNELLEY-JEFFERSON CITY								33.08
051	0032	MODINE MANUFACTURING COMPANY	2.51	0.08	0.10	3.03	4.47	3.17	0.02	20.03
051	0042	PHILLIPS 66 PIPELINE COMPANY	44.19			25.31				26.47

County Number	Plant Number	Plant Name	CO	Lead	NH_3	NO_x	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_x	VOC
051	0043	COMMAND WEB OFFSET MISSOURI INC	0.55			0.65	0.05	0.05	0.00	21.58
051	0049	AMEREN MISSOURI	0.07	0.00		1.07	0.06	0.00	1.54	0.03
051	0058	JEFFERSON CITY LANDFILL LLC	11.24			0.60	1.59	0.39	0.21	2.49
051	0075	AMERESCO JEFFERSON CITY LLC	94.42			21.42	5.52	0.00	1.74	4.68
053	0003	HUEBERT FIBERBOARD INC	61.86			22.84	17.26	0.00	2.57	1.79
053	0019	CATERPILLAR INC	1.23	0.02		1.47	1.71	0.12	0.01	8.73
053	0021	NORDYNE INC	0.18			0.22	0.03	0.00	0.00	5.62
053	0027	OFFICE OF ADMINISTRATION FMDC	2.53		0.10	0.97	0.23	0.23	0.15	0.17
055	0043	SLP LIGHTING CENTER								27.14
061	0010	LANDMARK MFG CORP	0.00		0.00	0.00	0.02	0.02	0.00	3.71
063	0009	MAGELLAN PIPELINE COMPANY LP	2.92			7.00	0.27	0.00	0.05	0.51
065	0038	ROYAL OAK ENTERPRISES INC	56.84	0.01	0.00	46.55	84.54	30.95	2.36	5.04
069	0010	WHITE OAK GIN COMPANY INC	0.63			0.75	8.39	0.25	0.00	0.04
069	0014	GRAVES KENNETT GIN COTTON CO INC	0.13			0.16	9.27	0.27	0.00	0.01
069	0018	FARMERS UNION GIN					31.08	0.91		
069	0027	FOUR WAY GIN COMPANY					17.71	0.38		
069	0029	CARDWELL COOPERATIVE INC					6.20	0.00		0.00
069	0034	MALDEN MUNICIPAL POWER & LIGHT	0.42		0.00	1.98	0.05	0.05	0.13	0.10

County Number	Plant Number	Plant Name	CO	Lead	NH_3	NO_x	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_x	VOC
069	0063	KENNETT GENERATING PLANT	1.74	0.00		13.42	0.21	0.21	0.30	1.24
069	0066	ST FRANCIS POWER PLANT	32.04		26.25	46.75	11.87	0.26	1.83	5.55
071	0003	AMEREN MISSOURI	2,694.05	0.00	3.04	9,891.45	2,660.87	1,712.12	57,948.73	323.14
071	0014	CANAM STEEL CORP	0.01			1.45	0.44	0.00	0.00	40.51
071	0020	STEELWELD EQUIPMENT CO INC	0.10	0.00		0.12	0.01	0.00	0.00	4.10
071	0031	GRAPHIC PACKAGING INTERNATIONAL	0.04		0.03	0.18	0.02	0.02	0.00	27.80
071	0068	MERAMEC INDUSTRIES INC	0.06			0.27	1.11	0.00	0.00	42.21
071	0080	SPARTAN SHOWCASE INC	0.35			0.42	0.06	0.00	0.00	14.12
071	0087	BULL MOOSE TUBE COMPANY	0.28			0.48	0.65	0.09	0.00	26.06
071	0131	SULLIVAN PRECISION METAL FINISHING INC	0.00			0.00	0.00	0.00	0.00	4.23
071	0132	SPORLAN VALVE DIVSION								24.14
071	0151	AEROFIL TECHNOLOGY INC	0.26			1.28	5.77	2.31	0.01	46.92
071	0153	MAGNET LLC								9.15
071	0157	PLAZE INCORPORATED	0.25			1.20	0.04	0.00	0.01	52.13
071	0173	HENNIGES AUTOMOTIVE SEALING SYSTEMS NA				0.53			0.00	14.23
071	0230	PLAZE, INC	0.62			0.73	0.06	0.00	0.00	11.84
073	0008	RR DONNELLEY - OWENSVILLE	1.55		0.06	1.85	0.14	0.14	0.01	122.75
077	0004	CARLISLE POWER TRANSMISSION PRODUCTS INC	7.90	0.00	0.30	9.51	3.39	0.84	0.55	61.25

County Number	Plant Number	Plant Name	CO	Lead	NH_3	NO_x	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_x	VOC
077	0005	CITY UTILITIES OF SPRINGFIELD MISSOURI	697.57	0.03	0.58	1,434.54	398.21	238.54	3,268.80	20.10
077	0008	BRISTOL MANUFACTURING CORP	0.27	0.00	0.01	2.15	0.16	0.02	0.01	23.70
077	0017	EUTICALS INC	1.55	0.00	0.14	6.20	1.78	0.70	0.38	6.71
077	0026	KRAFT FOODS GROUP INC	9.62	0.00	0.37	11.45	2.37	0.87	0.07	5.34
077	0028	MERCY HOSPITAL - SPRINGFIELD	12.37	0.00	0.46	11.32	1.14	1.14	0.38	1.11
077	0036	DAIRY FARMERS OF AMERICA INC	5.62	0.00	0.21	6.69	0.53	0.51	0.04	0.68
077	0039	CITY UTILITIES OF SPRINGFIELD MISSOURI	835.87	0.03	34.21	1,367.11	385.60	172.51	5,455.78	26.18
077	0047	MISSOURI STATE UNIVERSITY	6.19	0.00	0.04	7.37	0.56	0.56	0.04	0.41
077	0051	3M COMPANY	5.01	0.00	0.19	5.97	1.54	0.45	0.04	22.41
077	0116	MAGELLAN PIPELINE COMPANY LLC	16.72			6.69				41.65
077	0161	SPRINGFIELD SANITARY LANDFILL	176.32			9.40	25.00	1.47	3.29	2.32
077	0163	CITY UTILITIES OF SPRINGFIELD	0.08			0.25	0.02	0.01	0.02	0.02
077	0164	CITY UTILITIES OF SPRINGFIELD	14.59	0.00		15.11	0.57	0.57	0.08	0.40
077	0170	CITY UTILITIES OF SPRINGFIELD MISSOURI	95.42			20.74	5.39	5.39	2.11	0.00
077	0228	SUPERIOR SOLVENTS & CHEMICALS								2.84
079	0004	MODINE MANUFACTURING COMPANY	3.09		0.12	3.87	2.81	0.28	0.02	35.31
079	0027	TRENTON MUNICIPAL UTILITIES	0.51		0.00	1.92	0.03	0.03	0.61	0.07
081	0010	MAGELLAN PIPELINE COMPANY LP	14.75			35.41	1.38	0.00	0.26	2.60

County Number	Plant Number	Plant Name	CO	Lead	NH_3	NO_x	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_x	VOC
081	0015	BETHANY MUNICIPAL POWER PLANT	0.53			2.47	0.05	0.05	0.01	0.18
083	0001	KANSAS CITY POWER AND LIGHT CO	409.27	0.09	0.86	4,701.55	367.39	199.92	10,998.22	48.91
083	0011	APAC MO, INC	0.64			0.68	13.16	0.02	1.49	0.47
083	0031	TRACKER MARINE	1.12			1.33	0.49	0.00	0.01	69.30
083	0033	SCHREIBER FOODS INC	0.35		0.01	0.41	0.03	0.03	0.00	19.11
083	0046	SCHREIBER FOODS INC	0.68		0.03	0.81	0.06	0.06	0.00	44.72
087	0001	EXIDE TECHNOLOGIES	3.10	0.01	0.12	7.01	20.24	20.24	92.14	105.00
087	0016	GOLDEN TRIANGLE ENERGY	0.36		1.07	10.11	43.95	4.16	0.37	49.50
091	0005	SMITH FLOORING COMPANY	31.87			26.03	9.93	3.19	1.33	0.92
091	0011	DRS SUSTAINMENT SYSTEMS INC.	0.15		0.10	0.75	0.41	0.02	0.03	23.66
091	0037	ROYAL OAK ENTERPRISES INC	25.70	0.00	0.00	20.99	51.57	11.44	1.07	2.21
091	0038	GARNETT WOOD PRODUCTS	2,413.94			142.85	106.77	68.32	0.00	934.40
091	0046	ARMSTRONG HARDWOOD FLOORING COMPANY	12.06			2.13	6.42	0.00	1.22	44.62
091	0068	CITY OF WEST PLAINS-POWER STATION	0.21		0.01	0.85	0.07	0.00	0.02	0.02
093	0005	DOE RUN COMPANY	0.00	1.07		0.00	51.47	7.71	0.00	2.32
093	0009	DOE RUN COMPANY	25,641.21	16.88		82.49	30.73	22.43	2,199.25	11.19
095	0002	BUCKEYE TANK TERMINALS, LLC	4.75			1.90				42.64
095	0005	U. S. DEPT OF ENERGY	0.85	0.00	0.88	13.98	0.55	0.53	0.19	8.34

County Number	Plant Number	Plant Name	CO	Lead	NH_3	NO_x	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_x	VOC
095	0011	BAYER CROPSCIENCE	23.01	0.00	0.80	48.09	4.23	4.23	3.14	12.61
095	0012	CLAY AND BAILEY MFG CO	0.01	0.00		0.09	5.08	0.00	0.01	0.45
095	0017	FOLGERS COFFEE CO	140.02			20.95	10.79	0.00	7.01	35.23
095	0021	VEOLIA ENERGY KANSAS CITY INC	39.50	0.02	5.21	1,216.88	358.40	354.05	6,742.40	4.00
095	0022	KANSAS CITY POWER AND LIGHT CO	2,007.09	0.04	8.43	1,424.74	189.87	167.39	1,800.05	28.99
095	0023	KANSAS CITY POWER AND LIGHT CO	0.04	0.00		13.00	0.12	0.12	0.33	1.01
095	0026	HANSEN MUELLER KANSAS CITY ELEVATOR					0.11	0.02		
095	0030	AUDUBON MATERIALS, LLC	542.09	0.00	17.93	646.83	183.89	84.26	91.48	71.71
095	0031	KCP AND L - GREATER MO OPERATIONS	350.66	0.03	0.39	2,461.30	338.23	292.11	13,872.10	76.84
095	0037	VANCE BROTHERS INC	15.63	0.00	0.14	9.24	1.46	0.78	0.22	1.49
095	0039	BLUE RIVER TREATMENT PLANT	66.22	0.06	0.02	13.37	2.41	1.94	0.22	2.36
095	0046	ALLIANT TECHSYSTEMS INC	18.05	0.42	0.86	46.92	10.64	2.09	1.51	113.61
095	0050	INDEPENDENCE POWER AND LIGHT	24.31	0.02	0.14	525.04	305.45	271.00	4,969.73	3.54
095	0064	VANCE BROTHERS INC	0.40	0.00	0.14	4.46	0.69	0.37	0.03	0.25
095	0075	PETERSON MFG CO	0.41	0.00		0.48	0.08	0.03	0.00	1.03
095	0076	BARBER AND SONS AGGREGATES	3.38			10.39	4.96	0.82	0.18	0.27
095	0114	HALLMARK CARDS	2.08	0.00	0.06	4.35	0.19	0.19	0.01	9.51
095	0139	KANSAS CITY POWER AND LIGHT CO	11.89	0.00		24.50	0.97	0.97	0.35	0.30

County Number	Plant Number	Plant Name	CO	Lead	NH_3	NO_x	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_x	VOC
095	0178	UNILEVER	6.98		0.23	8.31	5.13	0.63	0.05	0.46
095	0191	AERO TRANSPORTATION PRODUCTS INC								70.29
095	0222	INDEPENDENCE POWER AND LIGHT	0.10			1.88	0.13	0.00	0.11	0.04
095	0223	INDEPENDENCE POWER AND LIGHT	0.88			4.00	0.49	0.00	0.05	0.04
095	0224	INDEPENDENCE POWER AND LIGHT	0.06			1.12	0.08	0.00	0.07	0.02
095	0244	TIFFANY MARBLE INC	0.00		0.00	0.00	0.00	0.00	0.00	1.21
095	0267	COURTNEY RIDGE LANDFILL, LLC	45.08			2.40	9.20	1.84	0.84	5.12
095	0272	LEE'S SUMMIT SANITARY LANDFILL	20.48			1.09	3.13	0.73	0.38	3.50
095	0273	RUMBLE RECYCLING AND DISPOSAL SERVICES	52.68			2.85	1.20	1.20	1.00	0.12
095	0321	KANSAS CITY AGGREGATE LLC					0.03	0.03		
095	2001	CARGILL INC	0.00		0.00	0.00	13.57	12.04	0.00	177.71
095	2007	CROWN CENTER REDEVELOPMENT CORPORATION	7.57	0.00	0.27	9.30	0.69	0.69	0.12	0.52
095	2054	RESEARCH MEDICAL CENTER	2.38	0.00	0.33	9.54	0.22	0.13	0.06	0.21
095	2058	COOK BROTHERS INSULATION INC	0.00							0.01
095	2087	RESEARCH MEDICAL CENTER	0.66		0.01	2.64	0.14	0.14	0.01	0.05
095	2101	SOUTHEAST LANDFILL, LLC	59.19			3.16	1.34	1.34	1.10	2.04
095	2177	INTERNATIONAL PAPER COMPANY	2.38	0.00	0.01	2.84	0.81	0.22	0.02	0.35

County Number	Plant Number	Plant Name	CO	Lead	NH_3	NO_x	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_x	VOC
095	2431	SUN CHEMICAL					0.02	0.01		0.41
097	0001	EMPIRE DISTRICT ELECTRIC CO	177.89	0.09	4.19	1,229.00	373.75	348.13	8,953.00	24.70
097	0007	DYNO NOBEL INC	1.94	0.00	2.12	7.92	3.91	0.37	0.44	1.32
097	0011	ADM MILLING COMPANY	0.10	0.00	0.00	0.12	1.90	0.68	0.00	0.01
097	0013	TAMKO BUILDING PRODUCTS INC	7.51	0.00	0.00	4.83	4.08	1.96	1.28	45.11
097	0021	ST. JOHN'S REGIONAL MEDICAL CENTER	2.02		0.00	2.41	0.18	0.18	0.01	0.13
097	0058	JUSTIN BOOT COMPANY					0.00	0.00		11.49
097	0062	EMPIRE DISTRICT ELECTRIC CO	5.40			35.00	2.99	2.98	0.00	2.88
097	0065	MODINE MANUFACTURING COMPANY	0.44			0.75	4.01	0.00	0.00	4.30
097	0089	ABLE MANUFACTURING & ASSEMBLY L.L.C.								62.39
097	0094	TAMKO BUILDING PRODUCTS INC	73.86	0.00		31.69	20.51	0.00	44.03	30.03
097	0095	ABLE MANUFACTURING CORPORATION								77.75
097	0104	EMPIRE DISTRICT ELECTRIC CO	575.86	0.00	62.02	107.60	46.35	46.35	4.30	55.97
097	0110	CARTHAGE WATER & ELECTRIC	6.28		0.42	70.67	4.42	0.76	1.72	3.56
097	0117	EAGLEPICHER TECHNOLOGIES LLC	0.21			1.00	0.05	0.00	0.01	7.94
097	0132	BEMIS PACKAGING LLC	2.48	0.00		2.95	0.22	0.22	0.02	177.59
097	0138	EBV EXPLOSIVES ENVIRONMENTAL CO	9.45	0.00	0.00	24.54	0.54	0.00	0.23	0.46
099	0002	RIVER CEMENT CO. DBA BUZZI UNICEM USA	1,168.99	0.04	5.85	1,756.58	322.25	168.46	280.98	136.58

County Number	Plant Number	Plant Name	CO	Lead	NH_3	NO_x	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_x	VOC
099	0003	DOE RUN COMPANY	18.01	21.11	0.29	9.60	7.47	4.34	15,234.48	1.71
099	0011	UNION PACIFIC RAILROAD CO	1.10			1.55	3.05	2.68	0.01	26.36
099	0012	TRAUTMAN QUARRY					3.28	0.26		0.00
099	0014	DOW CHEMICAL COMPANY, THE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.17
099	0016	AMEREN MISSOURI	1,242.97	0.00	1.40	3,441.72	686.65	246.31	28,035.60	149.10
099	0044	METAL CONTAINER CORPORATION	9.09			10.85	2.50	2.50	0.07	92.21
099	0052	ENGINEERED COIL COMPANY	0.00			0.00	0.00	0.00	0.00	5.73
099	0068	SAINT-GOBAIN CONTAINERS INC	9.24	0.20		107.22	90.86	87.03	149.07	26.36
099	0103	BUSSEN QUARRIES INC					11.42	0.22		0.00
099	0111	CARONDELET CORPORATION	4.18	0.00	0.07	6.46	16.53	0.14	0.24	27.23
099	0114	AERO METAL FINISHING				1.53	0.34	0.00	0.00	1.94
101	0002	UNIVERSITY OF CENTRAL MISSOURI	4.39			5.22	0.40	0.00	0.03	0.99
101	0009	WHITEMAN AIR FORCE BASE	19.35		0.08	26.99	2.51	0.32	1.62	12.04
101	0023	ENERSYS ENERGY PRODUCTS INC	3.50	0.02		4.21	0.94	0.08	0.33	33.50
101	0046	SHOW-ME REGIONAL LANDFILL	52.61	0.00		2.81	4.23	1.50	0.98	1.81
101	0051	HOLDEN POWER PLANT	0.64	0.00		6.78	0.84	0.84	0.54	0.59
101	0054	MASTER MARBLE INC	0.00			0.00	0.00	0.00		2.41
105	0001	INDEPENDENT STAVE CO INC	57.82	0.00	2.01	47.37	15.57	8.74	2.39	1.99

County Number	Plant Number	Plant Name	CO	Lead	NH_3	NO_x	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_x	VOC
105	0006	BRUNSWICK FRESHWATER GROUP	0.67			0.81	0.32	0.00	0.00	48.80
105	0013	DETROIT TOOL AND ENGINEERING				0.00	0.08	0.00		0.70
105	0033	RBC MANUFACTURING CORPORATION	0.27	0.00	0.00	0.32	0.22	0.02	0.00	8.02
105	0038	G3 BOATS					0.00	0.00	0.00	25.95
105	0046	TRACKER MARINE	0.00			0.00	4.13	0.00	0.00	87.85
107	0004	REMINGTON ARMS	1.80	0.00		0.20	1.12	0.41	0.01	17.04
107	0010	WINCUP	5.16	0.00	0.03	6.15	0.47	0.00	0.04	51.08
107	0038	HIGGINSVILLE MUNICIPAL POWER FACILITY	0.48		0.04	1.73	0.04	0.04	0.04	0.08
107	0050	BARTLETT GRAIN COMPANY LP	0.00			0.00	2.21	0.56	0.00	0.00
109	0002	TRANSMONTAIGNE OPERATING COMPANY L.P.	0.59			0.24				9.97
109	0004	BCP INGREDIENTS	4.07			4.87	5.90	0.75	0.07	62.34
109	0008	MO REHABILITATION CENTER	0.26	0.00	0.01	1.22	0.03	0.03	0.08	0.10
109	0036	PHILLIPS 66 COMPANY	11.12			5.56	0.00	0.00		54.01
111	0019	AYERS OIL CO								16.27
111	0025	BFI BACKRIDGE LANDFILL	43.46			2.32	5.76	0.00	0.49	3.24
113	0003	OLD MONROE ELEVATOR & SUPPLY	0.01			0.02	0.98	0.20	0.00	0.00
113	0029	BODINE ALUMINUM INC	3.27			29.53	18.27	0.00	0.04	66.12
113	0042	FARMERS ELEVATOR & SUPPLY CO	0.00			0.01	0.97	0.14	0.00	0.00

County Number	Plant Number	Plant Name	CO	Lead	NH_3	NO_x	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_x	VOC
115	0001	WALSWORTH PUBLISHING COMPANY	0.08		0.03	0.38	0.03	0.03	0.00	68.56
115	0021	MARCELINE MUNICIPAL UTILITY	0.04	0.00	0.00	0.17	0.00	0.00	0.06	0.01
117	0002	CHILLICOTHE MUNICIPAL UTILITIES	0.48	0.00		3.85	0.06	0.06	0.03	0.05
117	0012	DONALDSON CO INC	0.05	0.00	0.00	0.06	1.46	0.00	0.00	12.09
119	0017	SIMMONS FOODS INC	54.05		10.30	40.07	8.11	6.54	0.39	3.54
119	0030	WAL-MART NORTH DATA CENTER	0.41			13.30	0.09	0.00	0.23	0.27
121	0004	MACON MUNICIPAL UTILITIES	0.37			1.73	0.04	0.04	0.11	0.14
121	0027	VEOLIA ES MAPLE HILL LANDFILL, INC	44.93			2.40	3.37	1.25	0.84	1.55
121	0028	POET BIOREFINING	46.61			36.32	26.12	0.02	0.13	18.58
121	0033	MACON MUNICIPAL UTILITIES	12.06			17.69	3.26	3.26	0.29	1.04
121	0035	MACON MUNICIPAL UTILITIES	0.19			0.89	0.02	0.02	0.06	0.07
121	0036	MACON MUNICIPAL UTILITIES	0.12			0.57	0.01	0.01	0.04	0.05
123	0018	CENTERPOINT ENERGY	153.64			249.85	0.59	0.59	0.03	19.99
123	0022	VERSA-TECH INC	0.00		0.00	0.00	0.00	0.00	0.00	79.29
125	0001	KINGSFORD MANUFACTURING CO	44.57	0.02		169.64	101.73	98.71	18.43	89.43
127	0001	BASF CORPORATION	114.45	0.17	0.35	380.41	159.96	141.09	2,092.31	32.72
127	0002	MAGELLAN PIPELINE COMPANY LLC	4.28			1.71				11.42
133	0014	GATES CORPORATION	0.88			1.05	0.08	0.00	0.01	0.21

County Number	Plant Number	Plant Name	CO	Lead	NH_3	NO_x	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_x	VOC
133	0016	CONSOLIDATED GRAIN AND BARGE CO	0.00			0.00	1.79	0.11		0.00
137	0028	MONROE CITY POWER PLANT	0.27			1.23	0.08	0.00	0.08	0.09
139	0008	CHRISTY MINERALS, LLC	71.70	0.00	0.00	147.67	15.33	0.04	549.52	0.00
143	0004	NEW MADRID POWER PLANT	6,311.54	0.00	19.45	8,637.73	400.31	292.54	14,957.09	233.07
143	0008	NORANDA ALUMINUM INC	24,562.97		0.96	30.53	488.33	220.86	5,876.44	243.95
143	0012	MAHAN GIN CO	0.04			0.31	6.03	0.00	0.00	0.01
143	0013	PORTAGEVILLE FARMERS GIN INC					6.73	0.16		
143	0015	SIEGEL-ROBERT AUTOMOTIVE	0.70		0.08	7.74	0.17	0.06	0.03	33.49
143	0023	MCCORD GIN - NORTH	0.00			0.00	15.68	0.46	0.00	0.00
143	0027	CARGILL INC - NEW MADRID ELEVATOR					1.10	0.19		
143	0046	A. C. RILEY COTTON COMPANY	0.00			0.00	6.44	0.00	0.00	0.00
143	0062	BUNGE NORTH AMERICA INC	0.04		0.01	0.15	6.91	1.10	0.32	0.00
145	0005	LA-Z-BOY, INCORPORATED	0.68		0.02	0.84	1.76	1.76	0.01	17.75
145	0007	FAG BEARINGS CORPORATION	5.79		0.01	0.18	0.01	0.01	0.00	31.54
145	0044	PREMIER TURBINES	11.49			13.44	0.85	0.10	2.37	15.29
145	0049	SAGINAW SOUTHERN STAR CENTRAL	4.78			34.27	0.65	0.53	0.00	17.85
147	0005	NORTHWEST MISSOURI STATE UNIVERSITY	54.52	0.00	0.00	23.16	2.84	2.07	1.62	1.56
147	0008	ENERGIZER BATTERY MANUFACTURING INC	1.87		0.07	2.23	0.29	0.17	0.01	20.84

County Number	Plant Number	Plant Name	CO	Lead	NH_3	NO_x	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_x	VOC
147	0023	KAWASAKI MOTORS MFG CORP	111.83	0.00		8.15	22.80	11.74	0.28	147.04
147	0024	ANR PIPELINE COMPANY - TRANSCANADA CORP	223.21			931.71	18.03	18.03	0.22	37.66
147	0027	CONSUMERS OIL CO INC					0.53	0.00		0.69
147	0032	NODAWAY POWER PLANT	0.54			1.93	0.19	0.19	0.04	0.08
151	0002	CENTRAL ELECTRIC POWER COOPERATIVE	71.73	0.01	0.09	2,205.78	164.87	151.39	3,214.71	14.98
151	0050	QUAKER WINDOW PRODUCTS COMPANY	0.00			0.00	0.48	0.00	0.00	12.81
155	0024	STILL GIN AND GRAIN INC	0.00			0.00	3.21	0.14	0.00	0.00
155	0030	TRINITY MARINE PRODUCTS INC	0.35			1.76	12.43	0.05	0.01	48.05
155	0045	M-D PRODUCTS INC	2.33	0.00		2.77	0.33	0.21	0.02	10.60
155	0049	TRINITY MARINE PRODUCTS INC	0.08			0.41	0.02	0.00	0.00	53.85
155	0063	BUNGE NORTH AMERICA INC	0.00		0.00	0.00	1.71	0.17	0.00	0.00
157	0019	TG MISSOURI	0.80		0.01	4.92	3.94	0.24	0.04	109.71
157	0020	ATLAS EPS	2.32			2.58	5.76	0.00	22.89	83.69
157	0027	TNT PLASTICS INC	0.00			0.00	0.00	0.00	0.00	52.02
159	0009	PITTSBURGH-CORNING CORP	24.57			199.77	40.30	3.03	150.74	5.94
159	0012	WATERLOO INDUSTRIES INC	5.31			6.32	0.49	0.00	0.04	31.19
159	0022	ALCAN CABLE	2.73	0.00	0.10	3.25	0.25	0.25	0.02	13.77
159	0027	HAYES LEMMERZ INTERNATIONAL INC	3.82	0.00		4.55	0.50	0.00	0.03	66.77

County Number	Plant Number	Plant Name	CO	Lead	NH_3	NO_x	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_x	VOC
159	0037	TYSON FOODS INC	31.04		9.04	36.96	19.06	1.84	0.22	2.73
159	0041	MISSOURI PRESSED METALS INC	0.05		0.01	0.35	0.15	0.00	0.00	10.90
159	0047	PANHANDLE EASTERN PIPE LINE CO	362.30			1,844.10	38.17	38.17	0.47	94.93
159	0055	CENTRAL MISSOURI SANITARY LANDFILL	2.40				13.54	1.35		10.84
159	0056	EDWARDS FIBERGLASS INC								28.11
161	0006	MISSOURI UNIV. OF SCIENCE AND TECHNOLOGY	48.99	0.00	5.27	51.20	11.13	4.62	452.21	1.05
161	0039	MANCHESTER PACKAGING COMPANY	0.01			0.04	0.00	0.00	0.00	46.78
161	0054	ROLLA MUNICIPAL UTILITIES	0.05			1.97	0.06	0.06	0.04	0.08
163	0002	ASHLAND INC	19.93	0.01	2.67	295.33	43.86	7.69	1,835.57	58.76
163	0008	WAYNE B SMITH INC	0.00			0.02	9.37	0.63	0.00	0.06
163	0025	BUNGE NORTH AMERICA INC	0.02		0.00	0.02	3.72	0.56	0.00	0.00
163	0031	DYNO NOBEL INC	1.51		20.56	462.41	110.41	53.00	0.02	0.16
163	0040	EAGLE RIDGE LANDFILL	1.12				3.55	0.36		3.63
163	0047	AMEREN MISSOURI	3.05			49.65	5.64	0.00	0.34	5.08
165	0007	KANSAS CITY POWER AND LIGHT CO	1,126.77	0.11	2.13	2,480.04	504.89	407.79	290.60	9.26
165	0021	MULTI-COLOR CORPORATION	0.00		0.00	0.00	0.00	0.00	0.00	10.94
165	0028	WOODBRIDGE CORPORATION	1.39		0.01	1.65	0.13	0.13	0.01	89.80
165	2404	KCI AIRPORT - KCMO AVIATION DEPT	2.81	0.00	0.03	5.43	0.40	0.40	0.20	2.72

County Number	Plant Number	Plant Name	CO	Lead	NH_3	NO_x	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_x	VOC
165	2415	HARLEY DAVIDSON MOTOR COMPANY	4.09		0.83	6.05	0.47	0.47	0.04	19.51
165	2424	FACILITY OPERATION SERVICES LLC	5.50		0.00	18.34	0.50	0.50	0.04	0.36
169	0004	INSTALN MGMNT CMND AND FT LEONARD WOOD	15.31	0.00	9.37	46.23	3.41	0.53	3.28	8.87
171	0015	UNIONVILLE POWER PLANT	0.01	0.00	0.05	2.20	0.03	0.03	0.11	0.20
173	0001	CONTINENTAL CEMENT COMPANY LLC	467.94	0.00		788.33	81.75	0.28	101.18	82.50
173	0021	ENNIS PAINT INC					0.47	0.00		4.69
173	0037	BUCKHORN RUBBER PRODUCTS INC	0.00	0.04	0.00	0.00	11.44	11.36	0.00	6.98
175	0001	THOMAS HILL ENERGY CENTER POWER DIVISION	5,444.35	0.00	72.50	8,484.24	544.00	469.97	19,246.07	194.64
175	0010	AMEREN MISSOURI	0.05	0.00		0.71	0.04	0.00	1.03	0.02
175	0061	WILSON TRAILER SALES INC	0.00		0.00	0.00	0.24	0.24	0.00	9.75
179	0006	DOE RUN COMPANY	0.00	0.73		0.00	20.43	3.08	0.00	2.43
183	0001	AMEREN MISSOURI	710.19	0.00	0.80	7,073.99	445.74	413.52	4,899.10	156.50
183	0004	FRED WEBER INC	21.92		0.00	1.37	1.40	0.05	0.25	0.45
183	0010	BOEING COMPANY	1.70	0.00	0.06	2.03	0.36	0.15	0.01	5.66
183	0019	ST. JOSEPH HEALTH CENTER	3.36		0.02	4.85	2.95	0.36	0.10	0.30
183	0027	MEMC ELECTRONIC MATERIALS INC	9.49		2.62	11.83	7.82	4.41	0.09	6.51
183	0076	GENERAL MOTORS LLC	100.28	0.27	0.31	270.49	35.91	26.16	424.24	480.05
183	0077	O'FALLON CASTING LLC	1.55		0.96	1.85	0.14	0.14	0.01	26.09
183	0129	WOODBRIDGE CORPORATION	0.00		0.00	0.00	0.01	0.00		89.65

County Number	Plant Number	Plant Name	CO	Lead	NH_3	NO_x	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_x	VOC
183	0131	SUPERIOR HOME PRODUCTS INC	0.00			0.01	0.14	0.00	0.00	7.15
183	0184	TRUE MANUFACTURING CO	1.14	0.00		3.43	0.29	0.29	0.02	26.76
183	6003	LAMI WOOD PRODUCTS					0.00	0.00		2.94
186	0001	MISSISSIPPI LIME COMPANY	12,394.15		0.01	3,630.41	1,251.25	576.74	3,536.36	53.80
186	0022	TOWER ROCK STONE CO					14.39	0.04		0.00
186	0024	CENTERPOINT ENERGY	5.62		0.00	49.16	0.36	0.36	0.01	6.49
186	0035	LHOIST NORTH AMERICA OF MISSOURI	25.74	0.01		1,262.89	125.10	36.65	9.98	7.78
186	0044	HOLCIM (US) INC	943.31	0.01	54.27	1,975.58	429.35	194.89	170.63	279.89
187	0001	LEAD BELT MATERIALS CO INC	15.55	0.00	0.00	4.81	8.19	0.39	0.28	0.62
187	0002	VALLEY MINERALS, LLC	28.02			57.91	47.01	10.03	3.83	0.00
187	0006	IRON MOUNTAIN TRAP ROCK CO					17.17	0.00		
187	0017	PIRAMAL GLASS USA INC	4.65		3.31	363.24	93.08	45.72	19.01	6.26
187	0048	SIEGEL-ROBERT AUTOMOTIVE	0.25		7.73	4.10	0.10	0.00	0.02	20.88
187	0054	LEAD BELT MATERIALS CO INC	6.59	0.00	0.00	5.47	3.88	0.36	2.85	1.71
187	0072	BASE ROCK MINERALS INC	0.99	0.00		2.98	12.54	2.21	2.19	0.89
187	0075	FARMINGTON LIGHT & POWER	0.51		0.01	1.20	0.04	0.03	0.00	0.19
189	0010	AMEREN MISSOURI	3,843.21		1.13	4,789.24	458.51	171.92	15,281.50	105.64
189	0017	FRED WEBER, INC - NORTH STONE					25.91	1.84		
189	0020	MONSANTO WORLD	13.41	0.00	0.50	22.23	1.23	0.34	0.47	0.94

County Number	Plant Number	Plant Name	CO	Lead	NH_3	NO_x	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_x	VOC
		HEADQUARTERS								
189	0023	AMEREN MISSOURI	0.07	0.00		1.00	0.05	0.00	1.45	0.02
189	0032	MONSANTO	15.41		0.44	18.89	1.20	1.20	0.27	1.02
189	0035	ROCKWOOD PIGMENTS NA INC	7.89	0.00	0.35	11.26	3.34	0.23	5.82	0.68
189	0042	WASHINGTON UNIVERSITY	16.59	0.00	0.10	20.43	14.34	1.54	0.20	1.13
189	0057	ST. LOUIS POST-DISPATCH	0.23		0.00	0.27	0.02	0.01	0.00	12.54
189	0064	SUNNEN PRODUCTS COMPANY	1.09		0.04	1.30	0.10	0.02	0.01	5.57
189	0065	ST. LOUIS AIRPORT AUTHORITY	8.46	0.00	0.31	13.22	12.00	0.29	0.06	4.17
189	0069	THE QUIKRETE COMPANIES, INC.	0.99	0.00	0.04	1.18	10.66	0.00	0.01	0.06
189	0111	MISSOURI ASPHALT PRODUCTS, LLC	10.29	0.00		3.09	1.99	0.06	2.26	0.21
189	0141	ENERGY PETROLEUM COMPANY								7.36
189	0208	PRINTPACK INC	3.48		0.13	4.15	0.32	0.08	0.02	71.05
189	0217	METROPOLITAN ST. LOUIS SEWER DISTRICT	275.24	0.02	467.90	44.39	3.76	1.60	1.78	16.11
189	0226	GREIF-FENTON	1.45		0.00	1.72	0.13	0.00	0.01	39.65
189	0230	THE BOEING COMPANY	20.00	0.00	0.70	24.08	4.55	2.15	0.47	48.43
189	0238	ST. LOUIS LITHOGRAPHING COMPANY								18.82
189	0275	BUSSEN QUARRIES INC					9.27	0.38		
189	0276	RUPRECHT QUARRY					0.05	0.00		
189	0281	BFI MISSOURI PASS	65.11			3.47	1.48	1.48	1.22	2.24

County Number	Plant Number	Plant Name	CO	Lead	NH_3	NO_x	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_x	VOC
		LANDFILL								
189	0282	CENVEO ST. LOUIS	0.15		0.01	0.18	0.01	0.00	0.00	2.95
189	0308	IESI MO CHAMP LANDFILL	199.09			10.62	9.84	4.94	3.72	9.67
189	0310	ADVANCED DISPOSAL SERVICES	121.20			6.46	3.57	2.83	2.26	4.33
189	0312	BRIDGETON LANDFILL, LLC	216.66			11.56	4.91	4.91	4.04	7.47
189	0315	FOL TAPE LLC	0.00			0.00	0.00	0.00	0.00	29.83
189	0317	PRO-TECT MFG INC								17.70
189	0318	ST. MARYS HEALTH CENTER	5.34		0.03	6.44	0.48	0.12	0.04	0.39
189	0327	CAMIE-CAMPBELL INC								4.06
189	1012	BELT SERVICE CORP	0.00		0.00	0.00	0.97	0.00	0.00	34.67
189	1029	SSM DEPAUL HEALTH CENTER	5.48	0.00	0.03	5.54	0.52	0.51	0.49	0.36
189	1097	REICHHOLD, INC	3.85		0.15	4.58	1.14	0.17	0.06	30.71
189	1101	ST. LUKE'S HOSPITAL	5.32		0.04	6.43	0.13	0.13	0.51	0.35
189	1205	MSD, MISSOURI RIVER WWTP	7.83		103.16	89.31	0.27	0.27	3.66	11.12
189	1210	MSD, COLDWATER CREEK WWTP	0.00		90.61	0.00	0.00	0.00	0.00	0.17
189	1226	SIMPSON CONSTRUCTION MATERIALS LLC	19.17	0.00		5.68	22.85	0.70	4.17	1.82
189	1248	FRED WEBER INC. - SOUTH ASPHALT (BATCH)	20.56			1.40	1.59	0.01	0.24	0.42
189	1249	FRED WEBER INC - NORTH ASPHALT H AND B	33.57			4.64	2.01	0.00	0.82	1.48
189	1250	FRED WEBER INC. - NORTH ASPHALT B-G	15.01			1.18	0.64	0.00	0.17	0.00

County Number	Plant Number	Plant Name	CO	Lead	NH_3	NO_x	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_x	VOC
189	1489	GKN AEROSPACE NORTH AMERICA, INC.	15.46		0.59	8.10	14.23	12.26	0.20	58.61
189	1516	J.D. STREETT AND COMPANY INC								15.44
189	1520	F AND S PRINTING								48.52
195	0004	CONAGRA FOODS	5.22	0.00	0.20	7.29	6.32	0.47	0.04	1.25
195	0010	MARSHALL MUNICIPAL UTILITIES	13.02	0.01	0.06	151.36	38.47	36.76	771.74	1.44
195	0046	MID-MISSOURI ENERGY LLC	62.43			58.98	43.55	10.09	0.43	33.13
201	0003	TETRA PAK MATERIALS	0.25		0.00	0.30	0.02	0.02	0.00	31.67
201	0017	SIKESTON POWER STATION	3,253.34	0.01		2,181.60	566.45	467.53	6,047.80	16.77
201	0018	ENTERPRISE REFINED PRODUCTS COMPANY LLC								36.58
201	0021	HAVCO WOOD PRODUCTS INC	72.63	0.00	0.00	26.63	34.73	7.02	3.03	2.02
201	0073	CROWDER GIN COMPANY INC	0.03			0.22	8.32	0.24	0.00	0.01
201	0099	TEXAS EASTERN TRANSMISSION LP	17.14			391.43	1.84	1.84	0.06	7.96
201	0102	MANAC TRAILERS USA INC	0.00			0.00	1.18	0.00	0.00	14.52
201	0110	CONSTRUCTION TRAILER SPECIALISTS INC					0.00	0.00		14.40
201	8001	CONSOLIDATED GRAIN AND BARGE CO	0.32			1.50	1.59	0.12	0.01	0.08
203	0005	HARDWOODS OF MISSOURI LLC	7.79	0.00		6.36	1.84	0.23	0.32	0.22
205	0010	CERRO FLOW PRODUCTS LLC	97.15			4.29	0.21	0.00	0.03	20.36
205	0011	SHELBINA POWER PLANT	0.65			3.76	0.10	0.10	0.05	0.14

County Number	Plant Number	Plant Name	CO	Lead	NH_3	NO_x	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_x	VOC
207	0007	AMES TRUE TEMPER INC	11.89			1.31	6.90	3.45	0.06	1.22
207	0008	J. P. ROSS COTTON CO INC	0.07			0.50	23.80	0.45	0.00	0.02
207	0014	NESTLE PURINA PETCARE COMPANY	38.26	0.00		59.20	25.64	13.73	0.27	2.51
207	0018	STODDARD COUNTY COTTON CO	0.21			0.24	24.45	0.72	0.00	0.01
207	0019	W. W. WOOD PRODUCTS	0.39	0.00		2.28	8.86	0.07	0.01	197.20
207	0062	LEMONS SANITARY LANDFILL	75.23	0.00		4.01	14.91	3.03	1.40	2.59
207	0064	ESSEX POWER PLANT	0.06			2.87	0.60	0.60	0.04	0.10
209	0007	TABLE ROCK ASPHALT CONSTR CO INC					5.99	0.00		
213	0003	TABLE ROCK ASPHALT CONSTR CO INC	0.57			1.03	5.36	0.00	2.57	0.34
213	0007	ROYAL OAK ENTERPRISES	20.48	0.00		7.51	19.64	6.98	0.85	4.80
213	0048	COLLEGE OF THE OZARKS	4.35	0.00	0.12	5.54	1.90	0.04	0.48	1.53
215	0026	DAIRY FARMERS OF AMERICA INC	6.55	0.00	0.00	7.79	0.60	0.59	0.05	1.08
215	0060	WOODPRO CABINETRY INC	1.55			0.17	0.32	0.00	0.04	21.69
217	0004	3M COMPANY	23.43			27.91	2.12	0.00	0.17	250.93
217	0034	KANSAS CITY POWER AND LIGHT CO	0.00	0.00		0.66	0.01	0.01	0.01	0.00
217	0043	ADM	8.59	0.00		8.55	13.09	7.49	0.06	31.96
219	0013	SAF-HOLLAND USA	0.00				1.15	0.00		31.22
219	0036	GREIF PACKAGING LLC	0.09		0.00	0.11	0.01	0.00	0.00	11.61
219	0038	CASCADES PLASTICS INC					0.00	0.00		163.26

County Number	Plant Number	Plant Name	CO	Lead	NH_3	NO_x	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_x	VOC
221	0008	RED WING SHOE COMPANY INC								23.02
221	0018	BUCKMAN LABORATORIES INC	2.05		0.08	2.44	0.19	0.19	0.01	0.13
221	0022	PURCELL TIRE & RUBBER COMPANY	1.18			1.40	1.06	0.44	0.01	12.32
221	0031	IESI CORPORATION	11.19			0.60	2.01	0.25		4.51
225	0026	HUTCHENS INDUSTRIES	0.16		0.04	0.48	0.59	0.01	0.00	1.18
225	0040	OZARK HARDWOOD PRODUCTS LLC	18.06			1.99	6.15	0.00		
225	0045	UNDERCOVER INC	0.38			0.45	0.03	0.03	0.00	7.64
229	0001	HUTCHENS INDUSTRIES	0.51		0.10	1.32	2.39	0.04	0.01	21.28
229	0022	BLACK OAK RECYCLING & DISPOSAL FACILITY	4.30				13.03	1.30		4.62
510	0003	ANHEUSER-BUSCH INC	76.68		31.81	467.42	181.06	158.07	2,998.41	215.08
510	0017	MALLINCKRODT LLC	35.03	0.00	1.45	42.88	12.29	11.40	5.91	39.90
510	0027	PRECOAT METALS	8.06			9.60	0.73	0.00	0.06	54.63
510	0031	ADM GRAIN COMPANY	0.38			0.46	3.66	0.61	0.00	0.03
510	0038	TRIGEN-ST. LOUIS ENERGY CORP	36.17	0.00	1.73	54.87	4.73	4.73	1.16	2.67
510	0040	WASHINGTON UNIV MEDICAL SCHOOL	27.03	0.00	0.16	37.80	31.96	2.82	1.02	2.08
510	0047	FRED WEBER INC	5.29			0.52	0.05	0.00	0.06	0.11
510	0053	METROPOLITAN ST. LOUIS SEWER DISTRICT	558.38	0.18	476.95	80.58	23.77	3.45	15.47	40.20
510	0057	PROCTER AND GAMBLE	10.72		0.41	12.79	30.42	30.38	0.21	2.90
510	0063	THE DIAL CORPORATION	1.41	0.00	0.05	1.68	0.13	0.13	0.01	0.09

County Number	Plant Number	Plant Name	CO	Lead	NH_3	NO_x	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_x	VOC
510	0066	ELEMENTIS SPECIALTIES INC	4.06		0.15	4.84	13.74	0.32	0.03	68.02
510	0070	ICL PERFORMANCE PRODUCTS LP	23.24		0.48	7.05	12.56	1.14	0.12	1.12
510	0096	ELANTAS PDG, INC.	3.96		0.15	5.39	0.40	0.40	0.03	6.96
510	0097	U S PAINT CORPORATION					3.07	0.00		24.47
510	0118	JW ALUMINUM	12.93	0.00	0.00	21.65	38.23	36.64	0.16	275.65
510	0161	POLY ONE CORPORATION					0.00	0.00		0.22
510	0162	MARQUETTE TOOL AND DIE								6.10
510	0175	ST. LOUIS METALLIZING COMPANY	0.08			0.29	0.33	0.00	0.00	3.14
510	0179	ITALGRANI ELEVATOR USA	0.31		0.01	0.37	28.42	0.78	0.00	0.64
510	0204	BARNES JEWISH HOSPITAL	2.67	0.00		11.66	0.61	0.00	1.14	0.60
510	0269	SENSIENT COLORS LLC	2.18		0.08	2.62	0.38	0.20	0.08	0.15
510	0391	HERMANN OAK LEATHER CO	0.00			0.00	0.00	0.00	0.00	8.95
510	0468	LANGE-STEGMANN COMPANY	1.64		0.06	1.95	11.69	0.04	0.01	0.11
510	0697	SIGMA - ALDRICH MFG LLC	8.85		0.17	9.95	0.76	0.35	0.06	10.75
510	0808	CHEMISPHERE CORPORATION								10.03
510	0809	PQ CORPORATION (THE)	9.47	0.00	0.51	92.55	32.96	32.56	0.07	4.29
510	0938	INTERSTATE BRANDS CORP	2.56		0.05	3.56	0.23	0.23	0.02	35.44
510	1055	GOODWIN PRINTING CO.								7.01
510	1077	MID-WEST INDUSTRIAL CHEMICAL	0.00	0.00		0.00	2.14	0.00	0.00	5.14

County Number	Plant Number	Plant Name	CO	Lead	NH_3	NO_x	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_x	VOC
510	1093	BRENNTAG MID-SOUTH INC	0.00			0.00	0.00	0.00	0.00	3.95
510	1123	U. S. RINGBINDER LP					0.00	0.00		4.93
510	1280	ST. LOUIS POST DISPATCH	0.44		0.00	0.52	0.04	0.01	0.00	0.24
510	1370	NATIONAL GEOSPATIAL-INTELLIGENCE AGENCY	1.31	0.00	0.04	1.63	0.15	0.13	0.02	0.09
510	1407	SOUTHERN METAL PROCESSING	1.68			4.19	0.26	0.26	6.22	0.89
510	1460	ALLIED HEALTH CARE PRODUCTS	0.00			0.00	0.00	0.00	0.00	2.75
510	1505	ENERGY CENTER (THE)	9.77	0.00	0.37	11.77	0.89	0.89	0.08	0.65
510	1556	CONNECTOR CASTINGS	0.00	0.00	0.01	0.11	4.65	0.53	0.01	0.86
510	1642	J S ALBERICI CONSTRUCTION	0.00			0.00	1.61	0.00	0.00	6.07
510	2300	SUPERIOR SOLVENT AND CHEMICAL								2.35
510	2378	HERTZ ST. LOUIS ONE, LLC	304.66	0.00	0.00	197.04	3.98	1.69	0.05	2.57
510	2433	NEW WORLD PASTA	3.30	0.00	0.13	3.93	0.80	0.80	0.02	0.22
510	2711	ST. LOUIS UNIVERSITY	6.02		0.04	7.17	0.54	0.54	0.04	0.39
Statewide Total			113,272	42	1,642	92,721	16,727	9,834	255,217	14,503

Table 3 Point Source Ozone Season Day Emissions (pounds per day)

County Number	Plant Number	Plant Name	CO	NO_x	VOC
071	0003	AMEREN MISSOURI	15,093.09	55,437.04	1,810.64
071	0014	CANAM STEEL CORP	0.00	12.01	361.18
071	0020	STEELWELD EQUIPMENT CO INC	0.84	1.00	42.02
071	0031	GRAPHIC PACKAGING INTERNATIONAL	0.00	0.00	206.04
071	0068	MERAMEC INDUSTRIES INC	0.21	1.00	410.79
071	0080	SPARTAN SHOWCASE INC	0.00	0.00	77.43
071	0087	BULL MOOSE TUBE COMPANY	1.65	2.86	200.43
071	0131	SULLIVAN PRECISION METAL FINISHING INC	0.00	0.00	27.38
071	0132	SPORLAN VALVE DIVSION			184.35
071	0151	AEROFIL TECHNOLOGY INC	0.20	1.00	240.82
071	0153	MAGNET LLC			61.31
071	0157	PLAZE INCORPORATED	2.52	12.00	496.22
071	0173	HENNIGES AUTOMOTIVE SEALING SYSTEMS NA		2.80	41.83
071	0230	PLAZE, INC	3.36	4.00	112.78
099	0002	RIVER CEMENT CO. DBA BUZZI UNICEM USA	6,422.65	9,649.45	968.79
099	0003	DOE RUN COMPANY	98.81	52.90	9.35
099	0011	UNION PACIFIC RAILROAD CO	9.60	12.82	243.36
099	0012	TRAUTMAN QUARRY			0.00
099	0014	DOW CHEMICAL COMPANY, THE	0.00	0.00	6.69
099	0016	AMEREN MISSOURI	7,348.02	20,366.24	881.15
099	0044	METAL CONTAINER CORPORATION	99.17	118.06	542.64
099	0052	ENGINEERED COIL COMPANY	0.00	0.00	36.73
099	0068	SAINT-GOBAIN CONTAINERS INC	50.17	588.43	145.12
099	0103	BUSSEN QUARRIES INC			0.00
099	0111	CARONDELET CORPORATION	14.93	28.50	200.12
099	0114	AERO METAL FINISHING		11.83	11.91

County Number	Plant Number	Plant Name	CO	NO_x	VOC
183	0001	AMEREN MISSOURI	4,858.89	48,695.56	1,070.67
183	0004	FRED WEBER INC	229.28	14.33	4.70
183	0010	BOEING COMPANY	4.20	5.00	44.40
183	0019	ST. JOSEPH HEALTH CENTER	20.48	60.32	4.58
183	0027	MEMC ELECTRONIC MATERIALS INC	51.34	64.28	28.05
183	0076	GENERAL MOTORS LLC	439.66	1,153.77	4,216.30
183	0077	O'FALLON CASTING LLC	6.72	8.00	132.00
183	0129	WOODBRIDGE CORPORATION	0.00	0.00	692.21
183	0131	SUPERIOR HOME PRODUCTS INC	0.00	0.00	55.78
183	0184	TRUE MANUFACTURING CO	4.20	5.00	204.65
183	6003	LAMI WOOD PRODUCTS			30.28
189	0010	AMEREN MISSOURI	24,250.76	29,073.78	644.43
189	0020	MONSANTO WORLD HEADQUARTERS	33.74	72.70	2.52
189	0023	AMEREN MISSOURI	1.51	21.99	0.53
189	0032	MONSANTO	131.95	459.02	12.56
189	0035	ROCKWOOD PIGMENTS NA INC	42.21	60.00	3.62
189	0042	WASHINGTON UNIVERSITY	270.19	959.88	69.88
189	0057	ST. LOUIS POST-DISPATCH	1.68	2.00	70.12
189	0064	SUNNEN PRODUCTS COMPANY	3.36	4.00	45.19
189	0065	ST. LOUIS AIRPORT AUTHORITY	34.83	99.43	88.54
189	0069	THE QUIKRETE COMPANIES, INC.	8.40	10.00	0.55
189	0111	MISSOURI ASPHALT PRODUCTS, LLC	152.70	45.81	3.13
189	0141	ENERGY PETROLEUM COMPANY			43.10
189	0208	PRINTPACK INC	21.84	26.00	572.25
189	0217	METROPOLITAN ST. LOUIS SEWER DISTRICT	1,693.84	273.20	99.55
189	0226	GREIF-FENTON	12.60	15.00	341.57
189	0230	THE BOEING COMPANY	74.72	155.56	274.17

County Number	Plant Number	Plant Name	CO	NO_x	VOC
189	0238	ST. LOUIS LITHOGRAPHING COMPANY			139.01
189	0281	BFI MISSOURI PASS LANDFILL	360.00	19.20	12.45
189	0282	CENVEO ST. LOUIS	0.00	0.00	0.00
189	0308	IESI MO CHAMP LANDFILL	1,095.00	58.40	52.49
189	0310	ADVANCED DISPOSAL SERVICES	667.50	35.60	23.50
189	0312	BRIDGETON LANDFILL, LLC	1,192.50	63.60	40.26
189	0315	FOL TAPE LLC	0.00	0.00	197.24
189	0317	PRO-TECT MFG INC			180.00
189	0318	ST. MARYS HEALTH CENTER	21.84	26.00	1.43
189	0327	CAMIE-CAMPBELL INC			27.40
189	1012	BELT SERVICE CORP	0.00	0.00	320.10
189	1029	SSM DEPAUL HEALTH CENTER	36.96	36.70	2.42
189	1097	REICHHOLD, INC	21.00	25.00	180.01
189	1101	ST. LUKE'S HOSPITAL	29.40	35.00	1.92
189	1205	MSD, MISSOURI RIVER WWTP	45.17	487.11	61.58
189	1210	MSD, COLDWATER CREEK WWTP	0.00	0.00	0.88
189	1226	SIMPSON CONSTRUCTION MATERIALS LLC	278.91	82.69	26.41
189	1248	FRED WEBER INC. - SOUTH ASPHALT (BATCH)	316.13	21.10	6.48
189	1249	FRED WEBER INC - NORTH ASPHALT H AND B	474.69	65.20	20.96
189	1250	FRED WEBER INC. - NORTH ASPHALT B-G	166.24	13.19	0.05
189	1489	GKN AEROSPACE NORTH AMERICA, INC.	40.32	23.25	366.71
189	1516	J.D. STREETT AND COMPANY INC			84.67
189	1520	F AND S PRINTING			381.50
510	0003	ANHEUSER-BUSCH INC	468.57	2,857.63	1,313.26
510	0017	MALLINCKRODT LLC	239.92	443.05	364.28
510	0027	PRECOAT METALS	63.00	75.00	395.69

County Number	Plant Number	Plant Name	CO	NO_x	VOC
510	0031	ADM GRAIN COMPANY	2.52	3.00	0.16
510	0038	TRIGEN-ST. LOUIS ENERGY CORP	136.92	181.60	10.01
510	0040	WASHINGTON UNIV MEDICAL SCHOOL	53.63	234.42	16.35
510	0047	FRED WEBER INC	51.93	4.62	1.07
510	0053	METROPOLITAN ST. LOUIS SEWER DISTRICT	10,833.63	1,849.17	526.63
510	0057	PROCTER AND GAMBLE	184.01	219.20	24.35
510	0063	THE DIAL CORPORATION	6.72	8.00	0.44
510	0066	ELEMENTIS SPECIALTIES INC	22.68	27.00	402.73
510	0070	ICL PERFORMANCE PRODUCTS LP	131.32	48.28	6.63
510	0096	ELANTAS PDG, INC.	21.32	28.22	41.18
510	0097	U S PAINT CORPORATION			169.05
510	0118	JW ALUMINUM	71.65	120.00	1,546.71
510	0161	POLY ONE CORPORATION			2.12
510	0162	MARQUETTE TOOL AND DIE			40.00
510	0175	ST. LOUIS METALLIZING COMPANY	0.00	0.00	20.00
510	0179	ITALGRANI ELEVATOR USA	2.52	3.00	0.16
510	0204	BARNES JEWISH HOSPITAL	43.54	196.73	12.30
510	0269	SENSIENT COLORS LLC	8.40	10.14	0.58
510	0391	HERMANN OAK LEATHER CO	0.00	0.00	57.26
510	0468	LANGE-STEGMANN COMPANY	9.24	11.00	0.62
510	0697	SIGMA - ALDRICH MFG LLC	45.36	49.50	52.73
510	0808	CHEMISPHERE CORPORATION			75.16
510	0809	PQ CORPORATION (THE)	52.65	509.24	23.60
510	0938	INTERSTATE BRANDS CORP	15.96	22.60	381.82
510	1055	GOODWIN PRINTING CO.			65.64
510	1077	MID-WEST INDUSTRIAL CHEMICAL	0.00	0.00	39.60
510	1093	BRENNTAG MID-SOUTH INC	0.00	0.00	30.41

County Number	Plant Number	Plant Name	CO	NO_x	VOC
510	1123	U. S. RINGBINDER LP			38.17
510	1280	ST. LOUIS POST DISPATCH	0.84	1.00	0.05
510	1370	NATIONAL GEOSPATIAL-INTELLIGENCE AGENCY	4.66	10.04	0.71
510	1407	SOUTHERN METAL PROCESSING	12.19	30.49	6.47
510	1460	ALLIED HEALTH CARE PRODUCTS	0.00	0.00	19.70
510	1505	ENERGY CENTER (THE)	26.51	36.08	2.13
510	1556	CONNECTOR CASTINGS	0.00	0.99	6.54
510	1642	J S ALBERICI CONSTRUCTION	0.00	0.00	54.38
510	2300	SUPERIOR SOLVENT AND CHEMICAL			18.03
510	2378	HERTZ ST. LOUIS ONE, LLC	1,970.52	1,277.58	16.94
510	2433	NEW WORLD PASTA	18.48	22.00	1.21
510	2711	ST. LOUIS UNIVERSITY	32.76	39.00	2.14
Areawide Total			80,771.43	176,897.19	23,988.89

8.0 Nonpoint Source Inventory

Nonpoint emissions estimates were developed by EPA for the 2011 inventory. Where appropriate, Missouri accepted these estimates with no modifications and has provided the documentation generated by EPA.

When it was determined that emissions from Missouri may be substantially different than EPA estimates, state specific information was used to produce more accurate data. For some source categories, this was done by modifying the numbers produced by EPA. In other instances, estimates were developed by DNR.

Additional nonpoint emissions estimates were developed by contractors hired by CenSARA (Central States Air Resources Agencies). The following source categories used emissions estimates developed by CenSARA contractors: Agricultural Pesticide, Industrial, Commercial, Institutional, and Residential Fuel Combustion, and Oil and Gas Drilling.

The different documentation sources vary in style and organization. Each subsection was left in its original formatting.

This 2011 inventory does not include biogenic or geogenic emissions. The inventory does not include the nonpoint categories for wildfire which are in the event inventory.

8.1 Agricultural Pesticide

CenSARA hired a contractor to develop Agricultural Pesticide emissions for the region. Documentation of the methods used can be found in Appendix B-2.

8.2 Agricultural Tilling

The Missouri DNR accepted EPA's estimates of emissions for this source category. The documentation below was developed by EPA. Subsection g contains Missouri's audit of EPA's estimate.

a. Source Category Description

Fugitive dust emissions from agricultural tilling include the airborne soil particulate emissions produced during the preparation of agricultural lands for planting. Fugitive dust emissions from agricultural tilling were estimated for PM_{10}-PRI, PM_{10}-FIL, $PM_{2.5}$-PRI, and $PM_{2.5}$-FIL. Since there are no PM-CON emissions for this category, PM_{10}-PRI emissions are equal to PM_{10}-FIL emissions and $PM_{2.5}$-PRI emissions are equal to $PM_{2.5}$-FIL.

For this source category, the following SCC was assigned:

SCC	SCC Level 1	SCC Level 2	SCC Level 3	SCC Level 4
2801000003	Miscellaneous Area Sources	Agriculture Production - Crops	Agriculture - Crops	Tilling

Particulate emissions from agricultural tilling were computed by multiplying a crop specific emissions factor by an activity factor, as discussed below.

b. Emission Factor Equation

The county-level emissions factors for agricultural tilling (in lbs per acre) are specific to the crop and tilling type and were calculated using the following equation:[1,2]

$$EF = 4.8 \times k \times s^{0.6} \times p_{crop,tilling\ type}$$

where:

k = dimensionless particle size multiplier (PM_{10} = 0.21; $PM_{2.5}$ = 0.042),

s = silt content of surface soil (%),

p = number of passes or tillings in a year for a given crop and tillage type.

The silt content of surface soil is defined as the percentage of particles (mass basis) of diameter smaller than 75 micrometers (μm) found in the soil to a depth of 10 centimeters (cm). Silt contents were assigned by comparing the United States Department of Agriculture (USDA) surface soil survey map to a USDA county map and assigning a soil type to each county. The table below shows silt content assumed for each soil type.

Silt Content for Soil Types in USDA Surface Soil Map

Soil Type	Silt Content (%)
Silt Loam	52
Sandy Loam	33
Sand	12
Loamy Sand	12
Clay	29
Clay Loam	29
Organic Material	10-82
Loam	40

The table below shows the number of passes or tillings in a year for each crop for conservation use and conventional use.[3] No till, mulch till, and ridge till tillage systems are classified as conservation use, while 0 to 15 percent residue and 15 to 30 percent residue tillage systems are classified as conventional use.

Number of Passes or Tillings per Year.

Crop	Conservation Use	Conventional Use
Barley	3	5
Beans and Peas	3	3
Canola	3	3
Corn	2	6
Cotton	5	8
Cover	1	1
Fallow	1	1
Fall-seeded Wheat	3	5
Forage	3	3
Hay	3	3
Oats	3	5
Peanuts	3	3
Permanent Pasture	1	1
Potatoes	3	3
Rice	5	5
Rye	3	5
Sorghum	1	6
Soybeans	1	6
Spring Wheat	1	4
Sugarbeets	3	3
Sugarcane	3	3
Sunflowers	3	3
Tobacco	3	3

c. Activity

The basis of agricultural tilling emission estimates was the number of acres of crops tilled in each county by crop type and tillage type. These data were obtained from the *2008 National Crop Residue Management Survey*, developed by the Conservation Technology Information Center (CTIC).[4] Data summaries are available on the CTIC web site at: http://www.ctic.purdue.edu/CRM/. The five types of tilling for which emission estimates were calculated are:

Conservation Till	Conventional Till
No till/strip till	0 to 15 percent residue till (Intensive Till)
Mulch till	15 to 30 percent residue till (Reduced till)
Ridge till	

Note that the 2008 activity data for highly erodible land (HEL) overlap the other crop-type-specific data. Therefore, the HEL and Treated HEL data are not included in the calculation of emissions estimates. A summary of national-level acres planted in 2008 for each tilling type are presented in the table below. Due to data nondisclosure agreements with CTIC, the EPA cannot release the county-level tillage data by crop type.

Acres Planted by Tillage Type, Fallow and Pasture in 2008

Tillage System	**Actual National Number of Acres Planted in 2008 (million acres)**
Conservation	
No-Till/Strip Till	74.86
Ridge-Till	2.32
Mulch-Till	49.43
Conventional	
Reduced-Till (15-30% cover)	63.31
Intensive-Till (<15% cover)	105.13
Total	295.05

The following equation was used to determine the emissions from agricultural tilling for 2008.[1,2] The county-level activity data are the acres of land tilled for a given crop and tilling type. The equation is adjusted to estimate PM_{10} and $PM_{2.5}$ emissions using the following parameters: a particle size multiplier, the silt content of the surface soil, the number of tillings per year for a given crop and tilling type, and the acres of land tilled for a given crop and tilling type.

$$E = \Sigma c \times k \times s^{0.6} \times p_{crop,tilling\ type} \times a_{crop,tilling\ type}$$

where: E = PM_{10}-FIL or $PM_{2.5}$-FIL emissions

c = constant 4.8 lbs/acre-pass

k = dimensionless particle size multiplier (PM_{10}=0.21; $PM_{2.5}$=0.042)

s = percent silt content of surface soil, defined as the mass fraction of particles smaller than 75 µm diameter found in soil to a depth of 10 cm

p = number of passes or tillings in a year

a = acres of land tilled (activity data)

e. Controls

No controls were accounted for in the emission estimations.

f. 2011 Updates

Since the CTIC has not prepared an updated National Crop Residue Management (CRM) Survey for 2011, activity data for this category were updated using growth factors derived from state-level USDA statistics on various crop types.[5] These growth factors were then matched by state and crop type and applied to the 2008 activity data at the county level. See the table below for how USDA and CRM categories were matched.

Crosswalk between Crop Residue Management Category and USDA Data

CRM Category	USDA Data Items
Barley	BARLEY - ACRES HARVESTED
Beans and Peas	SUM OF BEANS AND PEAS HARVESTED
Canola	CANOLA - ACRES HARVESTED
Corn	CORN, GRAIN - ACRES HARVESTED

CRM Category	USDA Data Items
Cotton	COTTON - ACRES HARVESTED
Cover	TOTAL ACRES HARVESTED
Fallow	TOTAL ACRES HARVESTED
Forage	FORAGE, ALFALFA, HAY - ACRES HARVESTED
Hay	FORAGE (EXCL ALFALFA), HAY - ACRES HARVESTED
Oats	OATS - ACRES HARVESTED
Peanuts	PEANUTS - ACRES HARVESTED
Permanent Pasture	TOTAL ACRES HARVESTED
Potatoes	POTATOES - ACRES HARVESTED
Rice	RICE - ACRES HARVESTED
Rye	RYE - ACRES HARVESTED
Sorghum	SORGHUM, GRAIN - ACRES HARVESTED
Soybeans	SOYBEANS - ACRES HARVESTED
Sugarbeets	SUGARBEETS - ACRES HARVESTED
Sugarcane	SUGARCANE, SUGAR & SEED - ACRES HARVESTED
Sunflower	SUNFLOWER - ACRES HARVESTED
Tobacco	TOBACCO - ACRES HARVESTED
Wheat	WHEAT - ACRES HARVESTED
Winter Wheat	WHEAT, WINTER - ACRES HARVESTED

In addition, for those categories where a specific state/crop combination match was not made, the number of acres tilled were grown using a growth factor based on the total number of farm acres in those states.

g. QA/QC

Missouri audited EPA's estimate by:

1. Data: Efforts were made to locate references 1 and 2 below in order to verify the following equations:

   $EF = 4.8 \times k \times s^{0.6} \times p_{crop,tilling\ type}$
   $E = \Sigma c \times k \times s^{0.6} \times p_{crop,tilling\ type} \times a_{crop,tilling\ type}$ and

   However, the electronic versions of the references were unable to be located. In the 4th edition of AP-42, the emission factor for PM_{10} was calculated by taking $1.01*s^{0.6}$, which is quite close to the emission factor from the 1st equation above, when 0.21 is used for the k-value as is specified in the documentation ($1.008 * s^{0.6}$), therefore the equations seem appropriate.

   The Silt Content Table lists the silt content of various soil classifications. The silt contents for Missouri counties appear to be one of two different values, either 28.8 or 52.0. The Silt Content Table indicates, that 52.0 is the silt content for silt loam soil; however no soil classification in the Silt Content Table has a silt content of 28.8. Both clay and clay loam have values of 29% silt content in the Silt Content Table, so it's assumed that the counties in Missouri that were assigned 28.8% silt content have soil classification of one of these two categories. ***Missouri would suggest revising the Silt Content Table, if the value of 28.8% is being used for silt content instead of 29.0%***. Also, the method of picking one soil classification for each county is acceptable if the majority of the cropland in the county is that particular soil classification, but this may not always be the case. Although acceptable, it is also noted that it rarely would be the case that all cropland in a county is of the same soil classification, ***and for future NEIs if resources permit, Missouri suggests using weighted percentages for soil classifications to develop the silt content percentage for each county, as this would likely yield more accurate values.***

   USDA quick stats (reference 5) were checked to determine how reasonable the values were for the number of acres tilled in the entire state. USDA data indicates that in 2011 a total of 13,338,000 acres of field crops were harvested. Adding each individual county in the NEI worksheets gives a total of 10,383,135. These values are roughly 25% apart from each other, which raises some concerns, but Missouri is unable to check the data used in the worksheets for accuracy because the CRM county level data is not publicly available. Nonetheless, Missouri accepts EPA's data and has no changes to the NEI results for this source category.

2. Math: In the emissions worksheet the math for several counties was manually spot-checked by multiplying the emission factor by the number of acres tilled and all numbers that were checked manually agreed with the numbers in the table. However, due to the fact that the CRM data is not publicly available, Missouri was unable to verify the calculations used to develop the lbs./acre emission factors for each county. ***If resources permit for future NEIs, Missouri suggests that EPA release the actual calculations for the emissions factor for at least one county in each state so that they can be reviewed and verified at the state level during the QA process.*** Nonetheless, Missouri accepts EPA's calculations and has no changes to the NEI results for this source category.

3. Method: Growth of 2008 crop harvest numbers to 2011 seems like a reasonable method in theory. However, the method of growing 2008 emissions to 2011 emissions based on comparing the 2008 CRM data to the 2011 USDA data could be improved upon by comparing data sets from the same source to ensure consistency in the data sources when developing the growth factors. A quick comparison of 2008 USDA data to 2011 USDA data shows that total field crop acres harvested in Missouri decreased by roughly 350,000 acres (~2.5%), yet when comparing the 2008 emissions sector *Agriculture – Crops and Livestock Dust* to the 2011 NEI for this agriculture-tilling category you will see that emissions in 2011 are calculated at about 1.8% higher than the emissions that were calculated in 2008. Comparing the 2008 and 2011 county level acres tilled data in EPA's worksheets for these two NEIs shows an increase in total acres tilled from

2008 to 2011 for Missouri, which corresponds to the slight increase in the emission estimate for 2011. This increase in total tilled acres is an artifact of the methodology used to create the growth factors by comparing data from two different sources. Nonetheless, Missouri accepts EPA's methodology and has no changes to the NEI results for this source category.

h. References

1. *The Role of Agricultural Practices in Fugitive Dust Emissions*, T.A. Cuscino, Jr., et al., California Air Resources Board, Sacramento, CA, June 1981.

2. Memorandum from Chatten Cowherd of Midwest Research Institute, to Bill Kuykendal of the U.S. Environmental Protection Agency, Emission Factor and Inventory Group, and W.R. Barnard of E.H. Pechan & Associates, Inc., September 1996.

3. *Agricultural Activities Influencing Fine Particulate Matter Emissions*, Woodard, Kenneth R., Midwest Research Institute, March 1996.

4. *National Crop Residue Management Survey*, Conservation Technology Information Center, 2008 http://www.ctic.purdue.edu/CTIC/CTIC.html .

5. USDA Quickstats 2.0, http://quickstats.nass.usda.gov/, Accessed April 2012.

8.3 Agriculture Fertilizer Application

The Missouri DNR accepted EPA's estimates of emissions for this source category. EPA provided no documentation of the category, so the data was checked for reasonableness.

List of SCCs Included:

SCC	Level One	Level Two	Level Three	Level Four
2801700001	Miscellaneous Area Sources	Agriculture Production - Crops	Fertilizer Application	Anhydrous Ammonia
2801700002	Miscellaneous Area Sources	Agriculture Production - Crops	Fertilizer Application	Aqueous Ammonia
2801700003	Miscellaneous Area Sources	Agriculture Production - Crops	Fertilizer Application	Nitrogen Solutions
2801700004	Miscellaneous Area Sources	Agriculture Production - Crops	Fertilizer Application	Urea
2801700005	Miscellaneous Area Sources	Agriculture Production - Crops	Fertilizer Application	Ammonium Nitrate
2801700006	Miscellaneous Area Sources	Agriculture Production - Crops	Fertilizer Application	Ammonium Sulfate
2801700007	Miscellaneous Area Sources	Agriculture Production - Crops	Fertilizer Application	Ammonium Thiosulfate
2801700010	Miscellaneous Area Sources	Agriculture Production - Crops	Fertilizer Application	N-P-K (multi-grade nutrient fertilizers)
2801700011	Miscellaneous Area Sources	Agriculture Production - Crops	Fertilizer Application	Calcium Ammonium Nitrate
2801700012	Miscellaneous Area Sources	Agriculture Production - Crops	Fertilizer Application	Potassium Nitrate
2801700013	Miscellaneous Area Sources	Agriculture Production - Crops	Fertilizer Application	Diammonium Phosphate
2801700014	Miscellaneous Area Sources	Agriculture Production - Crops	Fertilizer Application	Monoammonium Phosphate
2801700015	Miscellaneous Area Sources	Agriculture Production - Crops	Fertilizer Application	Liquid Ammonium Polyphosphate
2801700099	Miscellaneous Area Sources	Agriculture Production - Crops	Fertilizer Application	Miscellaneous Fertilizers

List of Pollutants:

SourceClassificationCode	PollutantCode
2801700001	NH_3
2801700002	NH_3
2801700003	NH_3
2801700004	NH_3

SourceClassificationCode	PollutantCode
2801700005	NH_3
2801700006	NH_3
2801700007	NH_3
2801700010	NH_3
2801700011	NH_3
2801700012	NH_3
2801700013	NH_3
2801700014	NH_3
2801700015	NH_3
2801700099	NH_3

List of Missouri Counties Included

All but one of Missouri's 115 counties are included in the estimate file. St. Louis City, an urban area, is not included as it has no agricultural activity.

List of Emission Factors

The activity for each SCC and county is listed in the "Reporting Period" table. Combined with the "Emissions" table total emissions field, the emission factor for each SCC can be calculated (it is not explicitly given).

SCC	SCC Level Four	EF	EF Numerator	EF Denominator
2801700001	Anhydrous Ammonia	0.0486	KG	TON
2801700003	Nitrogen Solutions	0.0971	KG	TON
2801700004	Urea	0.182	KG	TON
2801700005	Ammonium Nitrate	0.0243	KG	TON
2801700006	Ammonium Sulfate	0.121	KG	TON
2801700007	Ammonium Thiosulfate	0.0304	KG	TON
2801700010	N-P-K (multi-grade nutrient fertilizers)	0.0243	KG	TON
2801700011	Calcium Ammonium Nitrate	0.0243	KG	TON
2801700013	Diammonium Phosphate	0.0607	KG	TON
2801700014	Monoammonium Phosphate	0.0607	KG	TON
2801700015	Liquid Ammonium Polyphosphate	0.0607	KG	TON
2801700099	Miscellaneous Fertilizers	0.0729	KG	TON

Emission Summary

SCC	SCC Description	2008 NH_3 kg	2011 NH_3 kg	Difference	Percent Difference
2801700001	Anhydrous Ammonia	6,508,195.69	6,667,800.11	159,604.42	2%
2801700003	Nitrogen Solutions	8,222,267.30	5,431,111.59	(2,791,155.71)	-34%
2801700004	Urea	19,551,950.55	18,886,390.18	(665,560.37)	-3%
2801700005	Ammonium Nitrate	1,659,824.69	1,098,153.70	(561,670.99)	-34%
2801700006	Ammonium Sulfate	759,576.49	889,572.72	129,996.23	17%
2801700007	Ammonium Thiosulfate	41,721.99	34,842.65	(6,879.34)	-16%
2801700010	N-P-K (multi-grade nutrient fertilizers)	488,699.96	281,237.57	(207,462.40)	-42%
2801700011	Calcium Ammonium Nitrate	-	355.88	355.88	-
2801700013	Diammonium Phosphate	2,618,123.49	2,146,871.10	(471,252.39)	-18%
2801700014	Monoammonium Phosphate	536,826.86	598,113.86	61,287.00	11%
2801700015	Liquid Ammonium Polyphosphate	60,483.64	72,731.82	12,248.18	20%
2801700099	Miscellaneous Fertilizers	237,664.43	3,048,347.85	2,810,683.41	1183%
	Statewide Total	40,685,335.09	39,155,529.02	(1,529,806.08)	-4%

8.4 Industrial and Commercial/Institutional (ICI) and Residential Fuel Combustion

Missouri worked with CenSARA's contractor who built the entire nonpoint fuel combustion emissions estimate. Documentation is provided in Appendix B-3. The CenSARA tool does not estimate residential wood combustion. Residential Wood Combustion emissions are described in section 8.23.

8.5 Agriculture Livestock Waste

The Missouri DNR accepted EPA's estimates of emissions for this source category. The documentation below was developed by EPA.

<u>Source Category Description</u>

Livestock refers to domesticated animals intentionally reared for the production of food, fiber, or other goods or for the use of their labor. The definition of livestock in this category includes beef cattle, dairy cattle, ducks, geese, goats, horses, poultry, sheep, and swine.

Due to resource constraints at EPA, 2011 emissions are assumed to be the same as 2008 emissions. The approach to calculating emissions for the assigned SCCs consisted of four general steps, as follows:

- Determining county-level population of animals for 2007.
- For beef, dairy, poultry, and swine, apportioning animal populations to a manure management train (MMT) for each county. Animal populations for ducks, geese, goats, horses, and sheep were not apportioned to MMTs.
- Modifying the emission factor files provided with the CMU Ammonia Model v. 3.6 to ensure that every county had an assigned emission factor.[1]
- Using the CMU Ammonia Model v. 3.6 to calculate ammonia emissions based on the updated county-level animal populations and emission factors.

For this source category, the following SCCs were assigned:

SCC	**Descriptor 2**	**Descriptor 4**	**Descriptor 7**	**Descriptor 8**
2805001100	Miscellaneous Area Sources	Agriculture Production - Livestock	Beef cattle - finishing operations on feedlots (drylots)	Confinement
2805001200	Miscellaneous Area Sources	Agriculture Production - Livestock	Beef cattle - finishing operations on feedlots (drylots)	Manure handling and storage
2805001300	Miscellaneous Area Sources	Agriculture Production - Livestock	Beef cattle - finishing operations on feedlots (drylots)	Land application of manure

SCC	Descriptor 2	Descriptor 4	Descriptor 7	Descriptor 8
2805002000	Miscellaneous Area Sources	Agriculture Production - Livestock	Beef cattle production composite	Not Elsewhere Classified
2805003100	Miscellaneous Area Sources	Agriculture Production - Livestock	Beef cattle - finishing operations on pasture/range	Confinement
2805007100	Miscellaneous Area Sources	Agriculture Production - Livestock	Poultry production - layers with dry manure management systems	Confinement
2805007300	Miscellaneous Area Sources	Agriculture Production - Livestock	Poultry production - layers with dry manure management systems	Land application of manure
2805008100	Miscellaneous Area Sources	Agriculture Production - Livestock	Poultry production - layers with wet manure management systems	Confinement
2805008200	Miscellaneous Area Sources	Agriculture Production - Livestock	Poultry production - layers with wet manure management systems	Manure handling and storage
2805008300	Miscellaneous Area Sources	Agriculture Production - Livestock	Poultry production - layers with wet manure management systems	Land application of manure
2805009100	Miscellaneous Area Sources	Agriculture Production - Livestock	Poultry production - broilers	Confinement
2805009200	Miscellaneous Area Sources	Agriculture Production - Livestock	Poultry production - broilers	Manure handling and storage

SCC	Descriptor 2	Descriptor 4	Descriptor 7	Descriptor 8
2805009300	Miscellaneous Area Sources	Agriculture Production - Livestock	Poultry production - broilers	Land application of manure
2805010100	Miscellaneous Area Sources	Agriculture Production - Livestock	Poultry production - turkeys	Confinement
2805010200	Miscellaneous Area Sources	Agriculture Production - Livestock	Poultry production - turkeys	Manure handling and storage
2805010300	Miscellaneous Area Sources	Agriculture Production - Livestock	Poultry production - turkeys	Land application of manure
2805018000	Miscellaneous Area Sources	Agriculture Production - Livestock	Dairy cattle composite	Not Elsewhere Classified
2805019100	Miscellaneous Area Sources	Agriculture Production - Livestock	Dairy cattle - flush dairy	Confinement
2805019200	Miscellaneous Area Sources	Agriculture Production - Livestock	Dairy cattle - flush dairy	Manure handling and storage
2805019300	Miscellaneous Area Sources	Agriculture Production - Livestock	Dairy cattle - flush dairy	Land application of manure
2805021100	Miscellaneous Area Sources	Agriculture Production - Livestock	Dairy cattle - scrape dairy	Confinement
2805021200	Miscellaneous Area Sources	Agriculture Production - Livestock	Dairy cattle - scrape dairy	Manure handling and storage
2805021300	Miscellaneous Area Sources	Agriculture Production - Livestock	Dairy cattle - scrape dairy	Land application of manure
2805022100	Miscellaneous Area Sources	Agriculture Production -	Dairy cattle - deep pit dairy	Confinement

SCC	Descriptor 2	Descriptor 4	Descriptor 7	Descriptor 8
		Livestock		
2805022200	Miscellaneous Area Sources	Agriculture Production - Livestock	Dairy cattle - deep pit dairy	Manure handling and storage
2805022300	Miscellaneous Area Sources	Agriculture Production - Livestock	Dairy cattle - deep pit dairy	Land application of manure
2805023100	Miscellaneous Area Sources	Agriculture Production - Livestock	Dairy cattle - drylot/pasture dairy	Confinement
2805023200	Miscellaneous Area Sources	Agriculture Production - Livestock	Dairy cattle - drylot/pasture dairy	Manure handling and storage
2805023300	Miscellaneous Area Sources	Agriculture Production - Livestock	Dairy cattle - drylot/pasture dairy	Land application of manure
2805025000	Miscellaneous Area Sources	Agriculture Production - Livestock	Swine production composite	Not Elsewhere Classified (see also 28-05-039, -047, -053)
2805030000	Miscellaneous Area Sources	Agriculture Production - Livestock	Poultry Waste Emissions	Not Elsewhere Classified (see also 28-05-007, -008, -009)
2805030007	Miscellaneous Area Sources	Agriculture Production - Livestock	Poultry Waste Emissions	Ducks
2805030008	Miscellaneous Area Sources	Agriculture Production - Livestock	Poultry Waste Emissions	Geese
2805035000	Miscellaneous Area Sources	Agriculture Production - Livestock	Horses and Ponies Waste Emissions	Not Elsewhere Classified

SCC	Descriptor 2	Descriptor 4	Descriptor 7	Descriptor 8
2805039100	Miscellaneous Area Sources	Agriculture Production - Livestock	Swine production - operations with lagoons (unspecified animal age)	Confinement
2805039200	Miscellaneous Area Sources	Agriculture Production - Livestock	Swine production - operations with lagoons (unspecified animal age)	Manure handling and storage
2805039300	Miscellaneous Area Sources	Agriculture Production - Livestock	Swine production - operations with lagoons (unspecified animal age)	Land application of manure
2805040000	Miscellaneous Area Sources	Agriculture Production - Livestock	Sheep and Lambs Waste Emissions	Total
2805045000	Miscellaneous Area Sources	Agriculture Production - Livestock	Goats Waste Emissions	Not Elsewhere Classified
2805047100	Miscellaneous Area Sources	Agriculture Production - Livestock	Swine production - deep-pit house operations (unspecified animal age)	Confinement
2805047300	Miscellaneous Area Sources	Agriculture Production - Livestock	Swine production - deep-pit house operations (unspecified animal age)	Land application of manure
2805053100	Miscellaneous Area Sources	Agriculture Production - Livestock	Swine production - outdoor operations (unspecified animal age)	Confinement

Activity Data

County-level animal numbers for 2007 were obtained from the U.S. Department of Agriculture's 2007 Census of Agriculture report.[2] For Virginia, the county-level census data includes animal populations from Virginia's 39 independent cities. For some counties and states, census data was withheld to avoid disclosing data for individual farms. However, the total national-level animal numbers and most state-level animal numbers for each livestock type reported in the Census include those animal numbers not disclosed at the county-level. When available, state-level animal numbers from the USDA NASS online database were used for states with undisclosed animal numbers in the 2007 Census of Agriculture.[3] To determine the total number of undisclosed animals, disclosed county-level animal numbers for each livestock type were summed and subtracted from the total state animal numbers. The total undisclosed animal population for a specific livestock type was then allocated to those counties reporting undisclosed data based on the number of farms raising that livestock in each county.[2] If the state-level data was undisclosed and not available in the NASS database, then national animal numbers were used to determine undisclosed state numbers. The disclosed county-level data was then summed and subtracted from the state-level data to determine animal numbers not disclosed at the county-level. These numbers were then allocated to those counties reporting undisclosed data based on the number of farms raising that livestock in each county.

County-level animal numbers were apportioned to manure management trains. A MMT consists of an animal confinement area (e.g., drylot, pasture, flush, scrape); components used to store, process, or stabilize the manure (e.g., anaerobic lagoons, deep pits); and a land application site where manure is used as a fertilizer source.[4] The apportionment was based on county-level MMT percentages derived from the CMU Ammonia Model. For each livestock type, the county-level number of animals in each MMT was divided by the total county-level animal population for that livestock type to calculate the percentage of total animals managed by each MMT. In cases where the county-level numbers were zero in the 2002 CMU Ammonia Model input files, the county was assigned state-level MMT percentages. The county-level animal population for each livestock type from the 2007 Census of Agriculture was multiplied by the MMT percentages to determine the total number of animals in each MMT in 2007. Animal populations for ducks, geese, goats, horses, and sheep were not apportioned to MMTs.

Cattle reported as "Other Cattle" in the 2007 Census of Agriculture were divided between dairy cattle and beef cattle at the county-level using percent allocations derived from county-level dairy and beef cattle reported in the 2007 Census of Agriculture and corrected for undisclosed data. The animal numbers from "Other Cattle" apportioned to dairy and beef cattle were used to create the Dairy Cattle – Composite and Beef Cattle – Composite activity input files for the CMU Ammonia Model.

County-level pullet numbers reported in the 2007 Census of Agriculture were used to create the Poultry – Composite activity input file for the CMU Ammonia Model.

Emission Factors

The emission factor for the poultry composite categories was obtained from an EPA report and is reported in the corresponding table below.[4] The county-level emission factors for the beef composite and dairy composite categories were developed using beef and dairy cattle emission factors provided with the 2002 CMU Model. Specifically, weighted average emission factors were calculated based on the number of beef or dairy cattle in each MMT from the 2002 CMU Model activity files and the emission factor assigned to each MMT. All other emission factors were provided with the CMU Ammonia Model v.3.6. The emission factors for some counties in the CMU Ammonia Model files were zero. To ensure that all counties with animal populations were assigned emissions factors, the emission factor input files provided with the CMU Ammonia Model were modified. For all counties with an emission factor of zero, the emission factor was replaced with the state average emission factor. If all counties in the state had emission factors of zero, then the county emission factor was replaced with the national average emission factor. The state average emission factor was calculated by summing the counties with non-zero emission factors in the state and dividing the total by the number of counties in that state with non-zero emission factors. The national average emission factor was calculated by summing the counties with non-zero emission factors in the nation and dividing the total by the number of counties in the nation with non-zero emission factors.

<u>Emissions</u>

The livestock activity files provided with the CMU Ammonia Model v.3.6 were replaced with the updated county-level animal population files and modified emissions files. County-level ammonia emissions were then calculated by running the model.

<u>Sample Calculations</u>

Allocation of Undisclosed Data

From the 2007 Census of Agriculture, the total national number of beef cattle in Alabama is 678,949. The total number of beef cattle disclosed at the county-level is 388,827.

Total number of beef cattle undisclosed at the county-level = 678,949 - 338,827 = 340,122

From the 2007 Census of Agriculture, the total number of farms in Alabama not disclosing beef cattle numbers is 10,518.

Average beef cattle per farm not disclosing data = 340,122 / 10,518 = 32.3

For 2007, Baldwin County, Alabama beef cattle data was not disclosed. The total number of farms with beef cattle in Baldwin County is 343.

Estimated number of beef cattle in Baldwin County = 32.3 x 343 = 11,092

Manure Management Train

From the 2002 CMU Ammonia Model input files, Chilton County, Alabama had 79 beef cattle under drylot management and 18,900 beef cattle under pasture management in 2002.

Total beef cattle = 79 + 18,900 = 18,979

% of beef cattle under drylot management = 79 / 18,979 = 0.42

% of beef cattle under pasture management = 18,900 / 18,979 = 99.58

The total number of beef cattle for Chilton County reported in the 2007 Census of Agriculture is 7,939.

Number of beef cattle under drylot management in 2007 = 7,939 x 0.0042 = 33

Number of beef cattle under pasture management in 2007 = 7,939 x 0.9958 = 7,906

"Other Cattle"

For Clay County, Alabama, the 2007 Census of Agriculture reports the number of "Other Cattle" as 5,471, the number of dairy cattle as 216, and the number of beef cattle as 9,096.

Total beef and dairy cattle reported = 216 + 9,096 = 9,312

% of other cattle assigned to beef cattle = (9,096/9,312)*100 = 97.68

% of other cattle assigned to dairy cattle = (216/9,312)*100 = 2.32

Other cattle allocated to beef cattle = 5,471 x .9768 = 5,344

Other cattle allocated to dairy cattle = 5,471 x 0.0232 = 127

<u>QA/QC</u>

EPA proposes to use 2008 emissions for 2011 emissions due to budget constraints. The 2008 emissions are based upon population data from the 2007 Census of Agriculture. Current estimates of livestock and poultry populations can be obtained from United States Department of Agriculture, National Agricultural Statistics Service, Missouri Field Office.[6] Current estimates for major categories of livestock and poultry populations are general three (3) to ten (10) percent lower than those found in the 2007 census. This population difference is not expected to alter the overall emissions enough to justify running the CMU Ammonia Model v. 3.6.

References

1. Cliff Davidson, Peter Adams, Ross Strader, Rob Pinder, Natalie Anderson, Marian Goebes, and Josh Ayers. The Environmental Institute, Carnegie Mellon University, *CMU Ammonia Model v.3.6*., 2004, at http://www.cmu.edu/ammonia/, accessed 25 April 2009.

2. U.S. Department of Agriculture, *2007 Census of Agriculture*, at http://www.agcensus.usda.gov/, accessed 30 April 2009.

3. U.S. Department of Agriculture, National Agricultural Statistics Service, at http://www.nass.usda.gov/Data_and_Statistics/Quick_Stats/, accessed 28 January 2010.

4. U.S. Environmental Protection Agency, *National Emission Inventory – Ammonia Emissions from Animal Agricultural Operations*, Revised Draft Report, 22 April 2005, p. 4-6, at http://www.epa.gov/ttn/chief/net/2002inventory.html, accessed 5 May 2009.

5. Jonathan Dorn, E.H. Pechan & Associates. 2009. A weighted average emission factor calculated using data from the 2002 CMU Ammonia Model v.3.6.

6. U.S. Department of Agriculture, National Agricultural Statistics Service, Missouri Field Office, at http://www.nass.usda.gov/Statistics_by_State/Missouri/Publications/Current_Estimates/index.asp, accessed 7 December 2012.

Livestock Emission Factors

Description	Pollutant Code	Emission Factor	Emission Factor Unit	Emission Factor Reference
Beef Cattle - Composite	NH_3	county-specific	kg NH_3/cow/month	5
Beef Cattle - Drylot Operation - Confinement	NH_3	9.45E-01	kg NH_3/cow/month	1
Beef Cattle - Drylot Operation - Land Application	NH_3	state-specific	kg NH_3/cow/month	1
Beef Cattle - Drylot Operation - Manure Storage	NH_3	3.78E-04	kg NH_3/cow/month	1
Beef Cattle - Pasture Operation - Confinement	NH_3	county-specific	kg NH_3/cow/month	1
Dairy Cattle - Composite	NH_3	county-specific	kg NH_3/cow/month	5
Dairy Cattle - Deep Pit Dairy Confinement	NH_3	2.42E+00	kg NH_3/cow/month	1
Dairy Cattle - Deep Pit Dairy Land Application	NH_3	state-specific	kg NH_3/cow/month	1
Dairy Cattle - Deep Pit Dairy Manure Storage	NH_3	1.13E-01	kg NH_3/cow/month	1
Dairy Cattle - Drylot Dairy Confinement	NH_3	state-specific	kg NH_3/cow/month	1
Dairy Cattle - Drylot Dairy Land Application	NH_3	state-specific	kg NH_3/cow/month	1
Dairy Cattle - Drylot Dairy Manure Storage	NH_3	state-specific	kg NH_3/cow/month	1
Dairy Cattle - Flush Dairy Confinement	NH_3	2.00E+00	kg NH_3/cow/month	1

Description	Pollutant Code	Emission Factor	Emission Factor Unit	Emission Factor Reference
Dairy Cattle - Flush Dairy Land Application	NH_3	state-specific	kg NH_3/cow/month	1
Dairy Cattle - Flush Dairy Manure Storage	NH_3	state-specific	kg NH_3/cow/month	1
Dairy Cattle - Scrape Dairy Confinement	NH_3	state-specific	kg NH_3/cow/month	1
Dairy Cattle - Scrape Dairy Land Application	NH_3	state-specific	kg NH_3/cow/month	1
Dairy Cattle - Scrape Dairy Manure Storage	NH_3	state-specific	kg NH_3/cow/month	1
Ducks	NH_3	7.67E-02	kg NH_3/duck/month	1
Geese	NH_3	7.67E-02	kg NH_3/goose/month	1
Goats	NH_3	5.29E-01	kg NH_3/goat/month	1
Horses	NH_3	1.02E+00	kg NH_3/horse/month	1
Poultry - Broiler Operation - Confinement	NH_3	8.32E-03	kg NH_3/bird/month	1
Poultry - Broiler Operation - Land Application	NH_3	6.80E-03	kg NH_3/bird/month	1
Poultry - Broiler Operation - Manure Storage	NH_3	1.51E-03	kg NH_3/bird/month	1
Poultry - Composite	NH_3	2.00E-02	kg NH_3/bird/month	4
Poultry - Layers - Dry Manure Operation - Confinement	NH_3	3.36E-02	kg NH_3/bird/month	1
Poultry - Layers - Dry Manure Operation - Land Application	NH_3	county-specific	kg NH_3/bird/month	1
Poultry - Layers - Wet Manure Operation - Confinement	NH_3	9.45E-03	kg NH_3/bird/month	1
Poultry - Layers - Wet Manure Operation - Land Application	NH_3	county-specific	kg NH_3/bird/month	1
Poultry - Layers - Wet Manure Operation - Manure Storage	NH_3	county-specific	kg NH_3/bird/month	1
Poultry - Turkey Operation - Confinement	NH_3	3.78E-02	kg NH_3/bird/month	1
Poultry - Turkey Operation - Land Application	NH_3	3.40E-02	kg NH_3/bird/month	1
Poultry - Turkey Operation - Storage	NH_3	6.80E-03	kg NH_3/bird/month	1
Sheep	NH_3	2.65E-01	kg NH_3/sheep/month	1
Swine - Composite	NH_3	county-specific	kg NH_3/pig/month	1
Swine - Deep Pit Operation - Confinement	NH_3	2.65E-01	kg NH_3/pig/month	1
Swine - Deep Pit Operation - Land Application	NH_3	county-specific	kg NH_3/pig/month	1
Swine - Lagoon Operation - Confinement	NH_3	2.27E-01	kg NH_3/pig/month	1
Swine - Lagoon Operation - Land Application	NH_3	county-specific	kg NH_3/pig/month	1
Swine - Lagoon Operation - Manure Storage	NH_3	county-specific	kg NH_3/pig/month	1
Swine - Outdoor Operation - Confinement	NH_3	county-specific	kg NH_3/pig/month	1

8.6 Aviation Gasoline Distribution: Stage I

The Missouri DNR accepted EPA's estimates of emissions for this source category. The documentation below was developed by EPA.

a. Source Category Description

Aviation gasoline (also called "AvGas") is the only aviation fuel that contains tetraethyl lead (TEL) as a knock-out component for small reciprocating, piston-engine crafts in civil aviation.[1] Commercial and military aviation rarely use this fuel. AvGas is shipped to airports and is filled into bulk terminals, and then into tanker trucks. These processes fall under the definition of stage I, displacement vapors during the transfer of gasoline from tank trucks to storage tanks, and vice versa. These processes are subject to EPA's maximum available control technology (MACT) standards for gasoline distribution.[2]

For this source category, the following SCC was assigned:

SCC	SCC Level 1	SCC Level 2	SCC Level 3	SCC Level 4
2501080050	Storage and Transport	Petroleum and Petroleum Product Storage	Airports : Aviation Gasoline	Stage 1: Total

b. Activity Data

The amount of AvGas consumed was obtained from the Petroleum Supply Annual for designated Petroleum Administration Districts, or PADs.[3] A nationwide total of 5,603,000 barrels of AvGas were consumed in 2008.[3] (The EPA used the same activity values for the 2011 as they did for the 2008 NEI due to limited resources.) This information was used to calculate national-level emissions estimates for one criteria pollutant and ten hazardous air pollutants (HAPs). Assumptions for bulk plant processes are summarized in the corresponding table below.

c. Emission Factors

Emission factors were provided by ESD and EIG publications.[1,4,5,6]

d. Emissions

In general, national-level emissions were calculated by multiplying AvGas consumption by the appropriate emission factors and then summing emissions. The national-level emission estimates were first allocated based on consumption reported for each PAD, and then allocated to the counties within the PADs based on 2008 Landing-Take Off (LTO) data for general aviation flights.[7] General aviation flights were used in this allocation because they are the primary consumers of AvGas.

There are five PADs across the United States[3]

PAD 1 comprises seventeen states plus the District of Columbia along the Atlantic Coast;
PAD 2 comprises fifteen states in the Midwest;
PAD 3 comprises six states in South Central U.S.;
PAD 4 comprises five states in the Rocky Mountains; and
PAD 5 comprises seven states along the West Coast.

Summary of AvGas Consumed and LTOs by PAD in 2008

PAD	AvGas Consumed (barrels)	LTOs
1	1,039,000	17,588,837
2	1,652,000	16,520,073
3	2,021,000	9,883,668
4	158,000	3,311,438
5	733,000	12,641,441
	5,603,000	**59,945,457**

e. Sample Calculations

National-Level Calculations

Amount of AvGas consumed in 2008 (barrels) = 5,603,000

Conversion: *1 barrel = 42 gallons*

1 gallon = 3.78 liters

1 kg = 2.205 lb

1 kg = 1,000,000 mg

1 ton = 2000 lb

Step 1 - Convert AvGas consumption into gallons using conversion factors.

Amount of AvGas consumed in 2008 (gallons) = 5,603,000 barrels * 42 gallons/barrel
Amount of AvGas consumed in 2008 (gallons) = 235,326,000

Step 2 - Use the gallons of AvGas consumed and apply the non-fugitive VOC emission factors in the corresponding table below to calculate non-fugitive VOC estimates.

Unloading/Tank Filling: tank fill VOC emissions = 0.009021383 LB/GAL * 235,326,000 GAL / 2,000 LB/TON
Unloading/Tank Filling: tank fill VOC emissions = **1,061.48** tpy

Unloading/Tank Filling: Storage tank VOC emissions = 0.003605215 LB/GAL * 235,326,000 GAL / 2,000 LB/TON
Unloading/Tank Filling: Storage tank VOC emissions = **424.20** tpy

Tank Truck Filling - Composite VOC Emissions = 0.010306575 LB/GAL * 235,326,000 GAL * / 2,000 LB/TON
Tank Truck Filling - Composite VOC Emissions = **1,212.70** tpy

Storage Tank - Breathing losses VOC Emissions = 0.001694117 LB/GAL * 235,326,000 GAL * / 2,000 LB/TON
Storage Tank - Breathing losses VOC Emissions = **199.33** tpy

Total non-fugitive VOC emissions = 1,061.48 tpy + 424.20 tpy + 1,212.70 tpy + 199.33 tpy = **2,897.72** tpy

Step 3 - Use the assumptions in and the fugitive VOC emission factors in the corresponding tables below to generate fugitive VOC emissions.

AvGas - Fugitive from valves VOC Emissions = (# Bulk Plant Equivalents)*(#valves/plant)*EF*days
AvGas - Fugitive from valves VOC Emissions = (2442 plants) * (50 valves/plant) * (0.573201882 LB/valve/day)* 300 days / 2,000 LB/TON

AvGas - Fugitive from valves VOC Emissions = **10,498.19** tpy

AvGas - Fugitive from pumps VOC Emissions = (# Bulk Plant Equivalents)*(#pumps/plant)* (#seals/pump) * EF * days

AvGas - Fugitive from pumps VOC Emissions = (2442 plants) * (2 pumps/plant) * (4 seals/pump) * (5.952481079 LB/seal/day)* 300 days / 2,000 LB/TON

AvGas - Fugitive from pumps VOC Emissions = **17,443.15** tpy

Total fugitive VOC emissions = 10,498.19 tpy + 17,443.15 tpy

Total fugitive VOC emissions = **27,941.34** tpy

Step 4 - Sum the fugitive and non-fugitive VOC emissions together for total VOC emissions.

Total VOC emissions = 2,897.72 tpy + 27,941.34 tpy = **30,839.06** tpy

Step 5 - Apply the speciation emission factors in the corresponding table below for tetraethyl lead, 2,2,4-trimethylpentane, benzene, cumene, ethylbenzene, hexane, naphthalene, toluene, and xylene to calculate HAP emissions.

Tetraethyl Lead emissions = 30,839.06 tpy VOC * 9.78 E-6 = **0.30** tpy
2,2,4-Trimethylpentane emissions = 30,839.06 tpy VOC * 0.008 = **246.71** tpy
Benzene emissions = 30,839.06 tpy VOC * 0.009 = **277.55** tpy
Cumene emissions = 30,839.06 tpy VOC * 0.0001 = **3.08** tpy
Ethylbenzene emissions = 30,839.06 tpy VOC * 0.0010 = **30.84** tpy
Hexane emissions = 30,839.06 tpy VOC * 0.0160 = **493.43** tpy
Naphthalene emissions = 30,839.06 tpy VOC * 0.0005 = **15.42** tpy
Toluene emissions = 30,839.06 tpy VOC * 0.0130 = **400.91** tpy
Xylene emissions = 30,839.06 tpy VOC * 0.005 = **154.20** tpy

Step 6 - Use the ethylene dichloride emission factor in the corresponding table below to calculate ethylene dichloride emissions.

Ethylene dichloride emissions = 235,326,000 GAL * 2.167E-6 LB/GAL * TON/2000 LB = **0.25** tpy

Assumptions Used For Bulk Terminals Using AvGas

Parameter	Data	Reference
Number of Bulk Plant Equivalents (U.S.)	2,442 plants	1
Number of valves per bulk plant	50 valves/plant	
Number of pumps per bulk plant	2 pumps/plant	
Number of seals per bulk plant	4 seals/pump	
Number of days per year used	300 days	

VOC Emission Factors

Pollutant	Emission Source	Emission Factor	Emission Factor Units	Factor Reference
VOC	Aviation Gas Unloading/ Tank Filling - tank fill	0.009021383	LB/GAL AvGas	1
	Aviation Gas Unloading/ Tank Filling - Storage tank working	0.003605215		
	Aviation Gas Tank Truck Filling - Composite	0.010306575		
	Aviation Gas Storage Tank - Breathing losses	0.001694117		
	Aviation Gas - Fugitive from valves	0.573201882	LB/valve/day	
	Aviation Gas - Fugitive from pumps	5.952481079	LB/seal/day	

HAP Emission Factors

<table>
<tr><th>Pollutant</th><th>Emission Source</th><th>Emission Factor</th><th>Emission Factor Units</th><th>Factor Reference</th></tr>
<tr><td>Ethylene Dichloride</td><td>All processes</td><td>2.167 E-6</td><td>LB/GAL AvGas</td><td>4</td></tr>
<tr><td>Tetraethyl Lead (TEL)</td><td>All processes</td><td>9.78 E-6</td><td>LB/LB VOC</td><td>1</td></tr>
<tr><td>2,2,4-Trimethylpentane</td><td>All processes</td><td>0.0080</td><td rowspan="8">LB/ LB VOC</td><td rowspan="2">5</td></tr>
<tr><td>Benzene</td><td>All processes</td><td>0.0090</td></tr>
<tr><td>Cumene</td><td>All processes</td><td>0.0001</td><td>6</td></tr>
<tr><td>Ethylbenzene</td><td>All processes</td><td>0.0010</td><td rowspan="5">5</td></tr>
<tr><td>Hexane</td><td>All processes</td><td>0.0160</td></tr>
<tr><td>Naphthalene</td><td>All processes</td><td>0.0005</td></tr>
<tr><td>Toluene</td><td>All processes</td><td>0.0130</td></tr>
<tr><td>Xylene</td><td>All processes</td><td>0.0050</td></tr>
</table>

<u>Example Calculations for Wake County, NC</u>

Wake County VOC emissions = (National VOC emissions) * (PAD 1 consumption/Total consumption) * (Wake County LTOs/PAD 1 LTOs)

Wake County VOC emissions = (30,839.06 tpy) * (1,039,000 bbl/5,603,000 bbl) * (95,234 LTOs/17,588,837 LTOs)

Wake County VOC emissions = **30.96** tpy

Wake County Benzene Emissions = (Wake County VOC emissions)*(Benzene Emission Factor)

Wake County Benzene Emissions = (30.96 tpy VOC) * (0.0090 LB benzene/ LB VOC)* (2000 LB VOC/2000 LB benzene)

Wake County Benzene Emissions = **0.28** tpy

f. References

1. TRC Environmental Corporation. *Estimation of Alkylated Lead Emissions, Final Report*. Prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. RTP, NC 1993.

2. U.S. Environmental Protection Agency. National Emission Standards for Source Categories: Gasoline Distribution (Stage I). 40 CFR Part 63. Office of Air Quality Planning and Standards. RTP, NC. February 28, 1997. Pages 9087-9093.

3. Energy Information Administration. *Petroleum Annual Supply, 2008*. Tables 3, 5, 7, 9, and 11. U.S. Department of Energy. Washington, D.C. June 2009. (Internet address: http://www.eia.doe.gov/oil_gas/petroleum/data_publications/petroleum_supply_annual/psa_volume1/psa_volume1.html)

4. U.S. Environmental Protection Agency. *Locating and Estimating Air Emissions from Sources of Ethylene Dichloride*. EPA-450/4-84-007d. RTP, NC. March 1984.

5. Memorandum from Greg LaFlam and Tracy Johnson (PES) to Stephen Shedd (EPA/OAQPS). *Speciated Hazardous Air Pollutants - Baseline Emissions and Emissions Reductions Under the Gasoline Distribution NESHAP*. August 9, 1996.

6. Personal Communication via e-mail from Stephen Shedd (EPA/OAQPS) to Laurel Driver (EPA/OAQPS). E-mail dated May 29, 2002.

7. [LTObyCtyandSCC.mdb], electronic file from Laurel Driver, U.S. Environmental Protection Agency, OAQPS, to U.S. Environmental Protection Agency, OAQPS, November 12, 2009. Aircraft operations data compiled from FAA's Terminal Area Forecasts (TAF) and 5010 Forms.

8.7 Aviation Gasoline Distribution: Stage II

The Missouri DNR accepted EPA's estimates of emissions for this source category. The documentation below was developed by EPA.

a. Source Category Description

Aviation gasoline (also called "AvGas") is the only aviation fuel that contains tetraethyl lead (TEL) as a knock-out component for small reciprocating, piston-engine crafts in civil aviation.[1] Commercial and military aviation rarely use this fuel. AvGas is shipped to airports and is filled into bulk terminals, and then into tanker trucks. These processes fall under the definition of stage I are subject to EPA's maximum available control technology (MACT) standards for gasoline distribution.[2] Stage II, discussed here, involves the transfer of fuel from the tanker trucks into general aviation aircraft.

For this source category, the following SCC was assigned:

SCC	SCC Level 1	SCC Level 2	SCC Level 3	SCC Level 4
2501080100	Storage and Transport	Petroleum and Petroleum Product Storage	Airports : Aviation Gasoline	Stage 2: Total

b. Activity Data

The amount of AvGas consumed was obtained from the Petroleum Supply Annual for designated Petroleum Administration Districts, or PADs.[3] A nationwide total of 5,603,000 barrels of AvGas were consumed in 2008.[3] (The EPA used the same activity values for the 2011 as they did for the 2008 NEI due to limited resources.) This information was used to calculate national-level emissions estimates for one criteria pollutant and ten hazardous air pollutants (HAPs).

c. Emission Factors

Emission factors were provided by ESD and EIG publications.[1,4,5,6]

d. Emissions

In general, national-level emissions were calculated by multiplying AvGas consumption by the appropriate emission factors and then summing emissions. The national-level emission estimates were first allocated based on consumption reported for each PAD, and then allocated to the counties within the PADs based on 2008 Landing-Take Off (LTO) data for general aviation flights.[7] General aviation flights were used in this allocation because they are the primary consumers of AvGas.

There are five PADs across the United States[3]

PAD 1 comprises seventeen states plus the District of Columbia along the Atlantic Coast;
PAD 2 comprises fifteen states in the Midwest;
PAD 3 comprises six states in South Central U.S.;
PAD 4 comprises five states in the Rocky Mountains; and
PAD 5 comprises seven states along the West Coast.

Summary of AvGas Consumed and LTOs by PAD in 2008

PAD	AvGas Consumed (barrels)	LTOs
1	1,039,000	17,588,837
2	1,652,000	16,520,073
3	2,021,000	9,883,668
4	158,000	3,311,438
5	733,000	12,641,441
	5,603,000	**59,945,457**

e. Sample Calculations

National-Level Calculations

Amount of AvGas consumed in 2008 (barrels) = 5,603,000

Conversion: *1 barrel = 42 gallons*

1 gallon = 3.78 liters

1 kg = 2.205 lb

1 kg = 1,000,000 mg

1 ton = 2000 lb

Step 1 - Convert AvGas consumption into gallons using conversion factors.

Amount of AvGas consumed in 2008 (gallons) = 5,603,000 barrels * 42 gallons/barrel
Amount of AvGas consumed in 2008 (gallons) = 235,326,000

Step 2 - Use the gallons of AvGas consumed and apply the refueling VOC emission factors from the corresponding table below to first calculate refueling VOC estimates.

AvGas Refueling VOC emissions = (1.36 E-2 LB/gal AvGas) * 235,326,000 gallons * 1 ton/2000 LB

AvGas Refueling VOC emissions = **1,600.22** tpy

Step 3 - Apply the speciation emission factors in the corresponding table below for 2,2,4-trimethylpentane, benzene, cumene, ethylbenzene, hexane, naphthalene, toluene, and xylene to calculate HAP emissions.

2,2,4-Trimethylpentane emissions = 1,600.22 tpy VOC * 0.008 = **12.80** tpy
Benzene emissions = 1,600.22 tpy VOC * 0.009 = **14.40** tpy
Cumene emissions = 1,600.22 tpy VOC * 0.0001 = **0.16** tpy
Ethylbenzene emissions = 1,600.22 tpy VOC * 0.0010 = **1.60** tpy
Hexane emissions = 1,600.22 tpy VOC * 0.0160 = **25.60** tpy
Naphthalene emissions = 1,600.22 tpy VOC * 0.0005 = **0.80** tpy
Toluene emissions = 1,600.22 tpy VOC * 0.0130 = **20.80** tpy
Xylene emissions = 1,600.22 tpy VOC * 0.005 = **8.00** tpy

Step 6 - Use the ethylene dichloride and tetraethyl lead emission factors in the corresponding table below to calculate ethylene dichloride emissions.

Ethylene dichloride emissions = 235,326,000 GAL * 1.883 E-6 LB/GAL * TON/2000 LB = **0.22** tpy
Tetraethyl lead emissions = 235,326,000 GAL * 1.327E-7 LB/GAL * TON/2000 LB = **0.015** tpy

VOC Emission Factor

Pollutant	Emission Source	Emission Factor	Emission Factor Units	Factor Reference
VOC	Fuel Transfer from Tanker Trucks to General Aviation Aircraft	0.0136	LB/GAL AvGas	1

HAP Emission Factors

<table>
<tr><th>Pollutant</th><th>Emission Source</th><th>Emission Factor</th><th>Emission Factor Units</th><th>Factor Reference</th></tr>
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<tr><td>2,2,4-Trimethylpentane</td><td>All processes</td><td>0.0080</td><td rowspan="9">LB/ LB VOC</td><td rowspan="2">5</td></tr>
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<tr><td>Cumene</td><td>All processes</td><td>0.0001</td><td>6</td></tr>
<tr><td>Ethylbenzene</td><td>All processes</td><td>0.0010</td><td rowspan="6">5</td></tr>
<tr><td>Hexane</td><td>All processes</td><td>0.0160</td></tr>
<tr><td>Naphthalene</td><td>All processes</td><td>0.0005</td></tr>
<tr><td>Toluene</td><td>All processes</td><td>0.0130</td></tr>
<tr><td>Xylene</td><td>All processes</td><td>0.0050</td></tr>
</table>

Example Calculations for Wake County, NC

Wake County VOC emissions = (National VOC emissions) * (PAD 1 consumption/Total consumption) * (Wake County LTOs/PAD 1 LTOs)

Wake County VOC emissions = (1,600.22 tpy) * (1,039,000 bbl/5,603,000 bbl) * (95,234 LTOs/17,588,837 LTOs)

Wake County VOC emissions = **1.61** tpy

Wake County Benzene Emissions = (Wake County VOC emissions)*(Benzene Emission Factor)

Wake County Benzene Emissions = (1.61 tpy VOC) * (0.0090 LB benzene/ LB VOC)* (2000 lb VOC/2000 lb benzene)

Wake County Benzene Emissions = **0.014** tpy

f. References

1. TRC Environmental Corporation. *Estimation of Alkylated Lead Emissions, Final Report*. Prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. RTP, NC 1993.

2. U.S. Environmental Protection Agency. National Emission Standards for Source Categories: Gasoline Distribution (Stage I). 40 CFR Part 63. Office of Air Quality Planning and Standards. RTP, NC. February 28, 1997. Pages 9087-9093.

3. Energy Information Administration. *Petroleum Annual Supply, 2008*. Tables 3, 5, 7, 9, and 11. U.S. Department of Energy. Washington, D.C. June 2009. (Internet address: http://www.eia.doe.gov/oil_gas/petroleum/data_publications/petroleum_supply_annual/psa_volume1/psa_volume1.html)

4. U.S. Environmental Protection Agency. *Locating and Estimating Air Emissions from Sources of Ethylene Dichloride*. EPA-450/4-84-007d. RTP, NC. March 1984.

5. Memorandum from Greg LaFlam and Tracy Johnson (PES) to Stephen Shedd (EPA/OAQPS). *Speciated Hazardous Air Pollutants - Baseline Emissions and Emissions Reductions Under the Gasoline Distribution NESHAP*. August 9, 1996.

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7. [LTObyCtyandSCC.mdb], electronic file from Laurel Driver, U.S. Environmental Protection Agency, OAQPS, to U.S. Environmental Protection Agency, OAQPS, November 12, 2009. Aircraft operations data compiled from FAA's Terminal Area Forecasts (TAF) and 5010 Forms.

8.8 Commercial Cooking

The Missouri DNR accepted EPA's estimates of emissions for this source category. The documentation below was developed by EPA. Subsection f contains Missouri's audit of EPA's estimate.

a. Source Category Description

Commercial cooking emissions are for five source categories based on equipment type. Emissions estimates are for all types of meat cooked in a particular piece of equipment. Deep fat frying of french fries was also included.

For this source category, the following SCCs were assigned:

Source Classification Code	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four
2302002100	Industrial Processes	Food and Kindred Products: SIC 20	Commercial Cooking - Charbroiling	Conveyorized Charbroiling
2302002200	Industrial Processes	Food and Kindred Products: SIC 20	Commercial Cooking - Charbroiling	Under-fired Charbroiling
2302003000	Industrial Processes	Food and Kindred Products: SIC 20	Commercial Cooking - Frying	Deep Fat Frying
2302003100	Industrial Processes	Food and Kindred Products: SIC 20	Commercial Cooking - Frying	Flat Griddle Frying
2302003200	Industrial Processes	Food and Kindred Products: SIC 20	Commercial Cooking - Frying	Clamshell Griddle Frying

b. Emission Factors and Equation

The emission factors used to estimate commercial cooking emissions for the 2011 NEI were developed by dividing SCC and pollutant-specific national emissions from the 2002 NEI by 2002 population to obtain per capita emission factors for each SCC and pollutant. These emission factors were developed and reviewed by an ERTAC advisory panel composed of state and EPA personnel (Contact: Roy Huntley, huntley.roy@epa.gov). The PM-CON emission factors were derived by subtracting PM_{10}-FIL from PM_{10}-PRI and the $PM_{2.5}$-PRI emission factors were derived by adding $PM_{2.5}$-FIL and PM-CON. The resulting emission factors are listed in the corresponding table below.

c. Activity Data

The activity data used to estimate emissions from commercial cooking was 2010 county-level population data, which was obtained from the US Census Bureau's county-level population estimates for the 2010 Census.[1] The per capita emission factors were then multiplied by the 2010 county-level population estimates.

d. Control Factors

While no control factors were directly applied to develop the 2011 NEI, the 2002 emissions used to calculate the per capita emission factors used in the 2011 NEI include controls on chain-driven commercial charbroiling in the South Coast Air Quality Management District (SCAQMD) in California. Thus, the effect of these controls from the 2002 NEI will lead to slightly lower emissions nationwide in this category for the 2011 NEI, rather than a more substantial reduction in emissions just in the SCAQMD area.

e. Sample Calculations

Emissions are calculated for each county using emission factors and activity as:

$$E_{x,p} = A_x \times EF_{x,p}$$

where:

$E_{x,p}$ = annual emissions for category x and pollutant p;

A_x = 2010 county-level population data associated with category x;

$EF_{x,p}$ = emission factor for category x and pollutant p (lb/person).

Example:

Using conveyorized charbroiling in Allegheny County, PA as an example:

According to the US Census Bureau, the population on April 1, 2010 is 1,223,348

The emission factor for PM_{10}-PRI is 0.0498 lb/person

$E_{PM10\text{-}PRI}$ = 1,223,348 people × 0.0498 lb PM_{10}-PRI/person

= 60,918 lb PM_{10}-PRI or 30.5 ton PM_{10}-PRI

f. QA/QC

1. Source Data – population, EF
   Population data listed in the spreadsheet and database were compared to 2010 Missouri population data listed on the US Census Bureau's website and is accurate both at the county level in total population.

2. Calculations
   Calculations for Missouri county emissions using the per capita emission factors and county populations were checked and confirmed to be accurate using Excel functions and comparisons.

3. Overall – This is a sound method for estimating emissions from commercial cooking facilities. Missouri has no more specific EF or county-allocation methods.

g. References

1. DOC, 2011: U.S. Department of Commerce, Bureau of the Census, *County Intercensal Estimates (2000-2010)*, Washington, DC. http://www.census.gov/popest/data/intercensal/county/county2010.html

Commercial Cooking Emission Factors Developed by ERTAC

SCC	SCC description	Pollutant Code	Factor Numeric Value	Factor Unit Numerator	Factor Unit Denominator
2302002100	Conveyorized Charbroiling	100027	1.326E-05	LB	EACH
2302002200	Under-fired Charbroiling	100027	6.385E-05	LB	EACH
2302002100	Conveyorized Charbroiling	100414	7.668E-05	LB	EACH
2302002200	Under-fired Charbroiling	100414	5.312E-04	LB	EACH
2302002100	Conveyorized Charbroiling	100425	3.730E-04	LB	EACH
2302002200	Under-fired Charbroiling	100425	2.747E-03	LB	EACH
2302002100	Conveyorized Charbroiling	106445	7.003E-06	LB	EACH
2302002200	Under-fired Charbroiling	106445	4.214E-05	LB	EACH
2302002100	Conveyorized Charbroiling	107062	2.682E-05	LB	EACH
2302002200	Under-fired Charbroiling	107062	2.183E-04	LB	EACH
2302002100	Conveyorized Charbroiling	108883	3.597E-04	LB	EACH
2302002200	Under-fired Charbroiling	108883	2.496E-03	LB	EACH
2302002100	Conveyorized Charbroiling	108952	4.421E-05	LB	EACH
2302002200	Under-fired Charbroiling	108952	3.063E-04	LB	EACH
2302002100	Conveyorized Charbroiling	120127	5.943E-06	LB	EACH
2302002200	Under-fired Charbroiling	120127	1.914E-05	LB	EACH
2302003100	Flat Griddle Frying	120127	8.487E-06	LB	EACH
2302002100	Conveyorized Charbroiling	123386	1.466E-04	LB	EACH
2302002200	Under-fired Charbroiling	123386	1.113E-03	LB	EACH
2302002100	Conveyorized Charbroiling	129000	8.852E-06	LB	EACH
2302002200	Under-fired Charbroiling	129000	3.587E-05	LB	EACH

SCC	SCC description	Pollutant Code	Factor Numeric Value	Factor Unit Numerator	Factor Unit Denominator
2302003100	Flat Griddle Frying	129000	3.139E-05	LB	EACH
2302002100	Conveyorized Charbroiling	130498292	2.709E-04	LB	EACH
2302002200	Under-fired Charbroiling	130498292	7.911E-04	LB	EACH
2302003100	Flat Griddle Frying	130498292	2.589E-04	LB	EACH
2302002100	Conveyorized Charbroiling	1330207	7.799E-07	LB	EACH
2302002200	Under-fired Charbroiling	1330207	1.560E-06	LB	EACH
2302002100	Conveyorized Charbroiling	191242	1.309E-06	LB	EACH
2302002200	Under-fired Charbroiling	191242	2.542E-06	LB	EACH
2302002100	Conveyorized Charbroiling	193395	1.278E-06	LB	EACH
2302002200	Under-fired Charbroiling	193395	1.723E-06	LB	EACH
2302002100	Conveyorized Charbroiling	206440	6.484E-06	LB	EACH
2302002200	Under-fired Charbroiling	206440	2.638E-05	LB	EACH
2302003100	Flat Griddle Frying	206440	2.371E-05	LB	EACH
2302002100	Conveyorized Charbroiling	208968	2.476E-05	LB	EACH
2302002200	Under-fired Charbroiling	208968	6.372E-05	LB	EACH
2302003100	Flat Griddle Frying	208968	4.886E-06	LB	EACH
2302002100	Conveyorized Charbroiling	50000	7.796E-04	LB	EACH
2302002200	Under-fired Charbroiling	50000	5.876E-03	LB	EACH
2302002100	Conveyorized Charbroiling	50328	1.450E-06	LB	EACH
2302002200	Under-fired Charbroiling	50328	2.332E-06	LB	EACH
2302003100	Flat Griddle Frying	50328	1.154E-06	LB	EACH
2302002100	Conveyorized Charbroiling	56553	1.772E-06	LB	EACH

SCC	SCC description	Pollutant Code	Factor Numeric Value	Factor Unit Numerator	Factor Unit Denominator
2302002200	Under-fired Charbroiling	56553	5.432E-06	LB	EACH
2302003100	Flat Griddle Frying	56553	2.918E-06	LB	EACH
2302002100	Conveyorized Charbroiling	71432	1.006E-03	LB	EACH
2302002200	Under-fired Charbroiling	71432	7.351E-03	LB	EACH
2302002100	Conveyorized Charbroiling	75070	5.562E-04	LB	EACH
2302002200	Under-fired Charbroiling	75070	4.242E-03	LB	EACH
2302002100	Conveyorized Charbroiling	83329	1.613E-06	LB	EACH
2302002200	Under-fired Charbroiling	83329	2.776E-06	LB	EACH
2302003100	Flat Griddle Frying	83329	1.357E-06	LB	EACH
2302002100	Conveyorized Charbroiling	84742	4.140E-06	LB	EACH
2302002200	Under-fired Charbroiling	84742	2.413E-05	LB	EACH
2302002100	Conveyorized Charbroiling	85018	2.771E-05	LB	EACH
2302002200	Under-fired Charbroiling	85018	8.647E-05	LB	EACH
2302003100	Flat Griddle Frying	85018	6.021E-05	LB	EACH
2302002100	Conveyorized Charbroiling	86737	6.408E-06	LB	EACH
2302002200	Under-fired Charbroiling	86737	2.003E-05	LB	EACH
2302003100	Flat Griddle Frying	86737	6.484E-06	LB	EACH
2302002100	Conveyorized Charbroiling	91203	1.135E-04	LB	EACH
2302002200	Under-fired Charbroiling	91203	2.649E-04	LB	EACH
2302003100	Flat Griddle Frying	91203	1.308E-04	LB	EACH
2302002100	Conveyorized Charbroiling	92524	1.271E-05	LB	EACH
2302002200	Under-fired Charbroiling	92524	2.613E-05	LB	EACH

SCC	SCC description	Pollutant Code	Factor Numeric Value	Factor Unit Numerator	Factor Unit Denominator
2302003100	Flat Griddle Frying	92524	2.788E-06	LB	EACH
2302002100	Conveyorized Charbroiling	95476	6.167E-05	LB	EACH
2302002200	Under-fired Charbroiling	95476	4.387E-04	LB	EACH
2302002100	Conveyorized Charbroiling	95487	3.482E-06	LB	EACH
2302002200	Under-fired Charbroiling	95487	2.111E-05	LB	EACH
2302002100	Conveyorized Charbroiling	98862	4.991E-06	LB	EACH
2302002200	Under-fired Charbroiling	98862	3.250E-05	LB	EACH
2302002100	Conveyorized Charbroiling	CO	4.245E-02	LB	EACH
2302002200	Under-fired Charbroiling	CO	1.350E-01	LB	EACH
2302003000	Deep Fat Frying	CO	0.000E+00	LB	EACH
2302003100	Flat Griddle Frying	CO	1.269E-02	LB	EACH
2302003200	Clamshell Griddle Frying	CO	0.000E+00	LB	EACH
2302002200	Under-fired Charbroiling	NO_X	0.000E+00	LB	EACH
2302002100	Conveyorized Charbroiling	PM_{10}-FIL	1.648E-04	LB	EACH
2302002200	Under-fired Charbroiling	PM_{10}-FIL	1.048E-03	LB	EACH
2302003100	Flat Griddle Frying	PM_{10}-FIL	2.727E-04	LB	EACH
2302003200	Clamshell Griddle Frying	PM_{10}-FIL	1.981E-05	LB	EACH
2302002100	Conveyorized Charbroiling	PM_{10}-PRI	4.980E-02	LB	EACH
2302002200	Under-fired Charbroiling	PM_{10}-PRI	3.528E-01	LB	EACH
2302003000	Deep Fat Frying	PM_{10}-PRI	0.000E+00	LB	EACH
2302003100	Flat Griddle Frying	PM_{10}-PRI	1.031E-01	LB	EACH
2302003200	Clamshell Griddle Frying	PM_{10}-PRI	6.994E-03	LB	EACH

SCC	SCC description	Pollutant Code	Factor Numeric Value	Factor Unit Numerator	Factor Unit Denominator
2302002100	Conveyorized Charbroiling	$PM_{2.5}$-FIL	1.597E-04	LB	EACH
2302002200	Under-fired Charbroiling	$PM_{2.5}$-FIL	1.013E-03	LB	EACH
2302003100	Flat Griddle Frying	$PM_{2.5}$-FIL	2.074E-04	LB	EACH
2302003200	Clamshell Griddle Frying	$PM_{2.5}$-FIL	1.685E-05	LB	EACH
2302002100	Conveyorized Charbroiling	$PM_{2.5}$-PRI	4.979E-02	LB	EACH
2302002200	Under-fired Charbroiling	$PM_{2.5}$-PRI	3.527E-01	LB	EACH
2302003000	Deep Fat Frying	$PM_{2.5}$-PRI	0.000E+00	LB	EACH
2302003100	Flat Griddle Frying	$PM_{2.5}$-PRI	1.030E-01	LB	EACH
2302003200	Clamshell Griddle Frying	$PM_{2.5}$-PRI	6.991E-03	LB	EACH
2302002100	Conveyorized Charbroiling	PM-CON	4.963E-02	LB	EACH
2302002200	Under-fired Charbroiling	PM-CON	3.517E-01	LB	EACH
2302003000	Deep Fat Frying	PM-CON	0.000E+00	LB	EACH
2302003100	Flat Griddle Frying	PM-CON	1.028E-01	LB	EACH
2302003200	Clamshell Griddle Frying	PM-CON	6.974E-03	LB	EACH
2302002200	Under-fired Charbroiling	SO_2	0.000E+00	LB	EACH
2302002100	Conveyorized Charbroiling	VOC	1.206E-02	LB	EACH
2302002200	Under-fired Charbroiling	VOC	4.148E-02	LB	EACH
2302003000	Deep Fat Frying	VOC	1.261E-02	LB	EACH
2302003100	Flat Griddle Frying	VOC	5.943E-03	LB	EACH
2302003200	Clamshell Griddle Frying	VOC	2.316E-04	LB	EACH

8.9 Fugitive Dust: Construction Activities Roads

The Missouri DNR accepted EPA's estimates of emissions for this source category. The documentation below was developed by EPA. Missouri's audit of EPA's estimate can be found near the end of this section.

a. Source Category Description

Emissions from road construction activity are a function of the acreage disturbed for road construction. Road construction activity is developed from data obtained from the Federal Highway Administration (FHWA). Fugitive dust emissions from road construction were estimated for PM_{10}-PRI, PM_{10}-FIL, $PM_{2.5}$-PRI, and $PM_{2.5}$-FIL. Since there are no PM-CON emissions for this category, PM_{10}-PRI emissions are equal to PM_{10}-FIL emissions and $PM_{2.5}$-PRI emissions are equal to $PM_{2.5}$-FIL.

For this category, the following SCC was assigned:

Source Classification Code	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four
2311030000	Industrial Processes	Construction: SIC 15 - 17	Road Construction	Total

b. Activity Data

The Federal Highway Administration has *Highway Statistics, Section IV - Highway Finance, Table SF-12A, State Highway Agency Capital Outlay*[1] for 2008 which outlines spending by state in several different categories. For this SCC, the following columns are used: New Construction, Relocation, Added Capacity, Major Widening, and Minor Widening. These columns are also differentiated according to the following six classifications:

1. Interstate, urban
2. Interstate, rural
3. Other arterial, urban
4. Other arterial, rural
5. Collectors, urban
6. Collectors, rural

The State expenditure data are then converted to new miles of road constructed using $/mile conversions obtained from the North Carolina Department of Transportation (NCDOT) in 2000. A conversion of $4 million/mile is applied to the interstate expenditures. For expenditures on other arterial and collectors, a conversion factor of $1.9 million/mile is applied, which corresponds to all other projects.

The new miles of road constructed are used to estimate the acreage disturbed due to road construction. The total area disturbed in each state is calculated by converting the new miles of road constructed to acres using an acres disturbed/mile conversion factor for each road type as given in the table below:

Spending per Mile and Acres Disturbed per Mile by Highway Type

Road Type	Thousand Dollars per mile	Total Affected Roadway Width (ft)*[3]	Acres Disturbed per mile[3]
Urban Areas, Interstate	4,000	125	15.2
Rural Areas, Interstate	4,000	125	15.2
Urban Areas, Other Arterials	1,900	125	15.2
Rural Areas, Other Arterials	1,900	105	12.7
Urban Areas, Collectors	1,900	81	9.8
Rural Areas, Collectors	1,900	65	7.9
*Total Affected Roadway Width = (lane width (12 ft) * number of lanes) + (shoulder width * number of shoulders) + area affected beyond road width (25 ft)			

The acres disturbed per mile data shown in the table above is calculated by multiplying the total affected roadway width (including all lanes, shoulders, and areas affected beyond the road width) by one mile and converting the resulting land area to acres. Building permits[2] are used to allocate the state-level acres disturbed by road construction to the county. A ratio of the number of building starts in each county to the total number of building starts in each state is applied to the state-level acres disturbed to estimate the total number of acres disturbed by road construction in each county.

c. Emission Factors

Initial PM_{10} emissions from construction of roads are calculated using an emission factor of 0.42 tons/acre-month.[3] This emission factor represents the large amount of dirt moved during the construction of roadways, reflecting the high level of cut and fill activity that occurs at road construction sites. The duration of construction activity for road construction is assumed to be 12 months.

Regional variances in construction emissions are corrected using soil moisture level and silt content. These correction parameters are applied to initial PM_{10} emissions from road construction to develop the final emissions inventory.

To account for the soil moisture level, the PM_{10} emissions are weighted using the 30-year average precipitation-evaporation (PE) values from Thornthwaite's PE Index. Average precipitation evaporation values for each State were estimated based on PE values for specific climatic divisions within a State.[3]

To account for the silt content, the PM_{10} emissions are weighted using average silt content for each county. A data base containing county-level dry silt values was complied. These values were derived by applying a correction factor developed by the California Air Resources Board to convert wet silt values to dry silt values.[4]

The equation for PM_{10} emissions corrected for soil moisture and silt content is:

$$Corrected\ E_{PM10} = Initial\ \mathrm{E}_{PM10} \times \frac{24}{PE} \times \frac{S}{9\%}$$

where: Corrected E_{PM10} = PM_{10} emissions corrected for soil moisture and silt content,

PE = precipitation-evaporation value for each State,

S = % dry silt content in soil for area being inventoried.

Once PM_{10} adjustments have been made, $PM_{2.5}$ emissions are set to 10% of PM_{10}. Primary PM emissions are equal to filterable emissions since there are no condensable emissions from road construction.

d. Example Calculation

$\text{Emissions}_{PM10} = \sum(HD_{rt} \text{ x } MC_{rt} \text{ x } AC_{rt}) \text{ x } (HS_{County} / HS_{State}) \text{ x } EF_{Adj} \text{ x } M$

Where HD_{rt} = Highway Spending for a specific road type

MC_{rt} = Mileage conversion for a specific road type

AC_{rt} = Acreage conversion for a specific road type

HS_{County} = Housing Starts in a given county

HS_{State} = Housing Starts in a given State

EF_{Adj} = Adjusted PM_{10} Emission Factor

M = duration of construction activity

As an example in 2010, in Newport County, Rhode Island, acres disturbed and PM_{10} emissions from urban interstate and urban other arterial road construction are calculated as follows:

$\text{Emissions}_{PM10} = \sum(HD_{rt} \text{ x } MC_{rt} \text{ x } AC_{rt}) \text{ x } (HS_{County} / HS_{State}) \text{ x } EF_{Adj} \text{ x } M$

= (\$35,474/\$4,000/mi x 15.2 acres/mi) * (187/1058) + (\$21,332/\$1,600/mi x 15.2 acres/mi) * (187/1058)

= 54 acres x 0.28ton/acre-month x 12 months

= 181.4 tons PM_{10}

Where EF_{Adj} is calculated as follows:

$$EF_{Adj} = 0.42 \text{ ton/acre-month} * (24/110.1 * 33/9)$$
$$= 0.28 \text{ ton/acre-month}$$

e. QA/QC

Missouri audited EPA's estimate by:

1. Data: Missouri added a sentence to the Source Category Description indicating the pollutants for which estimates were created using this method for the non-residential construction category.

   Missouri checked the first reference listed to verify 2008 funding spent by Missouri and verified it matches the information included in EPA's worksheets. Missouri also checked the building permits data from the Census Bureau, and verified that the 2008 number for building permits matched the data in EPA's worksheets. ***It is noted that 2010 building starts data is now available, and might be more representative of the activity in 2011 than the 2008 data.***

   Missouri notes that the North Carolina Department of Transportation (NCDOT) figures for $/mile include no reference citation. ***Missouri suggests adding a reference to these figures so that they can be verified.***

   Missouri also made efforts to verify the emission factor of 0.42 tons PM_{10}/acre-month, which was used for non-residential construction. Missouri was unable to locate the report cited in the references for this value; however, Missouri was able to find other State's that cite this same reference and used this same emission factor to develop PM emissions inventories for road construction activity. Also, the equation used to correct for silt content and soil moisture content was verified in the student manual of APTI course 419b. Missouri made no changes to EPA's NEI results for this source category based on the review of the data.

2. Math: Missouri reviewed the calculations and formulas in EPA's worksheets and found no mathematical or formula errors. Missouri made no changes to EPA's NEI results for this source category based on the review of the math.

3. Method: Missouri evaluated the reasonableness of the method. In general, the method of developing the activity data and emissions seems reasonable.

   It is noted that in comparing the 2008 NEI data to the 2011 NEI data for PM emissions from road construction, that there is a 312 percent increase. This is largely due to the increase in funding spent on road construction, as the funding spent in Missouri on road construction categories, as reported by the Federal Highway Administration (FHWA), increased by more than three-fold from 2006 to 2008, and therefore the emissions increase seems reasonable. It is noted that this is the 2011 NEI and the activity data is based on 2008 funding levels. While not preferred, there is no more recent year of funding levels available on FHWA's website, and therefore, it seems reasonable to use 2008 funding levels for the activity data calculations. ***However, if newer versions of this NEI are created and more recent funding levels become available on FHWA's***

website, then Missouri would suggest using the more recent data at that time, as it would likely be more representative of the 2011 road construction data.

It is noted that the NCDOT figures for converting funding spent to miles of road built was obtained in 2000. Due to inflation, it is possible that these figures are no longer representative of the cost per mile of road constructed. ***Missouri suggests that in future NEIs, if resources permit, the PPI index could be looked at for road construction or another similar category for both 2000 and the year for which the NEI is being calculated and through comparison of these two PPIs, an adjustment factor could be developed to account for inflation since 2000 and be applied to the $/mile figures.***

Additionally it is noted that Missouri counties have one of two different silt content ratios (52% or 28.8%). The method of picking one soil classification for each county is acceptable if the majority of the land in the county is that particular soil classification, but this may not always be the case. Although acceptable, it is also noted that it rarely would be the case that all land in a county is of the same soil classification, ***and for future NEIs if resources permit, Missouri suggests using weighted percentages for soil classifications to develop the silt content percentage for each county, as this would likely yield more accurate values.*** While Missouri has several suggestions for how the method used in the emission estimation for this source category could be improved upon, no changes were made to EPA's NEI results for this source category based on the review of the method.

f. References

1. 2008 Highway Spending : http://www.fhwa.dot.gov/policyinformation/statistics/2008/sf12a.cfm

2. 2008 Building Permits data from US Census "BPS01", http://www.census.gov/support/USACdataDownloads.html

3. Midwest Research Institute. Improvement of Specific Emission Factors (BACM Project No. 1). Prepared for South Coast Air Quality Management District. March 29, 1996.

4. Campbell, 1996: Campbell, S.G., D.R. Shimp, and S.R. Francis. *Spatial Distribution of PM-10 Emissions from Agricultural Tilling in the San Joaquin Valley*, pp. 119-127 in Geographic Information Systems in Environmental Resources Management, Air and Waste Management Association, Reno, NV. 1996.

8.10 Fugitive Dust: Construction Activities Non-residential

The Missouri DNR accepted EPA's estimates of emissions for this source category. The documentation below was developed by EPA. Subsection e contains Missouri's audit of EPA's estimate.

a. Source Category Description

Emissions from non-residential construction activity are a function of the acreage disturbed for non-residential construction. Fugitive dust emissions from non-residential construction were estimated for PM_{10}-PRI, PM_{10}-FIL, $PM_{2.5}$-PRI, and $PM_{2.5}$-FIL. Since there are no PM-CON emissions for this category, PM_{10}-PRI emissions are equal to PM_{10}-FIL emissions and $PM_{2.5}$-PRI emissions are equal to $PM_{2.5}$-FIL.

For this source category, the following SCC was assigned:

Source Classification Code	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four
2311020000	Industrial Processes	Construction: SIC 15 - 17	Heavy Construction	Total

b. Activity Data

Annual Value of Construction Put in Place in the U.S[1] has the 2011 National Value of Non-residential construction. The national value of non-residential construction put in place (in millions of dollars) was allocated to counties using county-level non-residential construction (NAICS Code 2362) employment data from 2009, which was obtained from *County Business Patterns*[2] *(CBP)*. Because some counties employment data was withheld due to privacy concerns, the following procedure was adopted:

1. State totals for the known county level employees was subtracted from the number of employees reported in the state level version of CBP. This results in the total number of withheld employees in the state.
2. A starting guess of the midpoint of the range code was used (so for instance in the 1-19 employees range, a guess of 10 employees would be used) and a state total of the withheld counties was computed.
3. A ratio of guessed employees (Step 2) to withheld employees (Step 1) was then used to adjust the county level guesses up or down so the state total of adjusted guesses should match state total of withheld employees (Step 1)

Once the number of employees was developed for each county, this number was divided by the total number of employees in the country to get a national allocation factor. The national allocation factor was then multiplied by the 2011 National Value of Non-residential construction in order to estimate the value of non-residential construction in each county. Then in order to estimate the acres disturbed in each county, the value of non-residential construction in each county was multiplied by the adjusted 2011 ratio for acres per $\$10^6$, which was developed by the method below.

In 1999 a figure of 2 acres/$\$10^6$ was developed. The Bureau of Labor Statistics *Producer Price Index*[3] lists costs of the construction industry from 1999-2011.

2011 acres per $\$10^6$ = 1999 acres per $\$10^6$ x (1999 PPI / 2011 PPI)

=2 acres/$\$10^6$ * (132.9 / 229.3)

= 1.159 acres per $\$10^6$

c. Emission Factors

Initial PM_{10} emissions from construction of non-residential buildings are calculated using an emission factor of 0.19 tons/acre-month[4]. The duration of construction activity for non-residential construction is assumed to be 11 months. Since there are no condensable emissions, primary PM emissions are equal to filterable emissions. Once PM_{10}-PRI emissions are developed, $PM_{2.5}$-PRI emissions are estimated by applying a particle size multiplier of 0.10 to PM_{10}-PRIemissions.

Regional variances in construction emissions are corrected using soil moisture level and silt content. These correction parameters are applied to initial PM_{10} emissions from non-residential construction to develop the final emissions inventory.

To account for the soil moisture level, the PM_{10} emissions are weighted using the 30-year average precipitation-evaporation (PE) values from Thornthwaite's PE Index. Average precipitation evaporation values for each State were estimated based on PE values for specific climatic divisions within a State.[4]

To account for the silt content, the PM_{10} emissions are weighted using average silt content for each county. A data base containing county-level dry silt values was complied. These values were derived by applying a correction factor developed by the California Air Resources Board to convert wet silt values to dry silt values.[5]

The equation for PM_{10} emissions corrected for soil moisture and silt content is:

$$\textit{Corrected } E_{PM10} = \textit{Initial } \mathrm{E}_{PM10} \times \frac{24}{PE} \times \frac{S}{9\%}$$

where: Corrected E_{PM10} = PM_{10} emissions corrected for soil moisture and silt content,

PE = precipitation-evaporation value for each State,

S = % dry silt content in soil for area being inventoried.

Once PM_{10} adjustments have been made, $PM_{2.5}$ emissions are set to 10% of PM_{10}.

d. Example Calculation

$\text{Emissions}_{PM10} = N_{Spending}$ x (Emp_{county} / $Emp_{National}$) x Apd x EF_{Adj} x M

Where $N_{Spending}$ = National spending on non-residential construction (million dollars)

Emp_{county} = County level employment in non-residential construction

$Emp_{National}$ = National level employment in non-residential construction

Apd = Acres per million dollars (national data)

EF_{Adj} = Adjusted PM_{10} emission factor (ton/acre-month)

M = duration of construction activity (months)

As an example, in Grand Traverse County, Michigan, 2011 acres disturbed and PM_{10} emissions from non-residential construction are calculated as follows:

$$\text{Emissions}_{PM10} = 269{,}045 \times 10^6 \text{ \$} \times (130/651{,}996) \times 1.159 \text{ acres}/10^6\text{\$} \times EF_{Adj} \times M$$

$$= 62.2 \text{ acres} \times 0.059 \text{ ton/acre-month} \times 11 \text{ months}$$

$$= 40.4 \text{ tons } PM_{10}$$

Where EF_{Adj} is calculated as follows:

$$EF_{Adj} = 0.19 \text{ ton/acre-month} * (24/103.6 * 12/9)$$
$$= 0.059 \text{ ton/acre-month}$$

e. QA/QC

Missouri audited EPA's estimate by:

1. Data: Missouri added a sentence to the Source Category Description indicating the pollutants for which estimates were created using this method for the non-residential construction category. Missouri also added language to the activity data section in this document to more clearly explain the method of determining the number of acres disturbed by non-residential construction in each county.

   Missouri checked the first reference listed to verify the annual value of the non-residential construction put in place in the U.S. and compared this to the values included in EPA's worksheet. ***The values for non-residential construction included on reference 1 do not match the values in EPA's worksheet. It is possible that the data has been updated since EPA developed their worksheet. It is also possible that EPA added other categories that were not included in reference 1, such as public safety, sewer and waste disposal, water supply, conservation, and development and these categories make up the difference; however, if this is the case it should be noted both in this documentation and on the EPA worksheet. If the data has changed since the worksheet was developed or if this is an error, then the numbers***

currently included in reference 1 should be entered into the worksheet so that the current/accurate data is used for the NEI results. The updated numbers are input to the spreadsheet and used for calculations of the number of acres disturbed.

Missouri checked the second reference listed to verify the employment numbers used for Missouri. After researching the data, it was determined that the employment data from 2009, was used in the EPA worksheets. Missouri verified the total number of employees and spot checked several counties and no discrepancies between the data included on EPA's worksheet and the 2009 employment data were found. Missouri also added language to the activity data section of this document to explain that the employment data is for 2009. ***It is noted that 2010 employment data is now available, and for Missouri the total number of employees in the non-residential construction category has reduced by over 4,000 from 2009 to 2010, which is over 20 percent and would have a significant impact on the estimation of emissions if the 2010 data was used instead of 2009.***

This documentation states that in 1999 a figure of 2 acres/$\$10^6$ was developed. This documentation does not cite a reference for this figure. ***Missouri suggests citing a reference for this figure so that it can be verified by people reviewing the document.*** Further the EPA worksheet, which contains the values that were used to adjust this ratio from 1999 to 2011, uses PPI data from the Bureau of Labor Statistics for the non-residential maintenance and repair category. Missouri reviewed the PPI data from 1999 to 2011 for the non-residential maintenance and repair category and found no discrepancies between the values included in EPA's worksheet and the values reported by the Bureau of Labor Statistics.

Missouri also made efforts to verify the emission factor of 0.19 tons PM_{10}/acre-month, which was used for non-residential construction. Missouri was unable to locate the report cited in the references for this value; however, Missouri was able to find other State's that cite this same reference and used this same emission factor to develop PM emissions inventories for non-residential construction activity.

Also, the equation used to correct for silt content and soil moisture content was verified in the student manual of APTI course 419b.

2. Math: Missouri reviewed the calculations and formulas in EPA's worksheets and found no mathematical or formula errors. As stated above, several changes were made to the documentation that more clearly state the method of calculating the acres of soil disturbed; however Missouri made no changes to EPA's NEI results for this source category based on the review of the math.

3. Method: Missouri evaluated the reasonableness of the method. In general, the method of developing the activity data and emissions seems reasonable.

As noted above in the review of the data, the method of adjusting the ratio of acres/$\$10^6$ from 1999 to 2011, uses PPI data from the non-residential maintenance and repair category. It is noted that PPI data from the for non-residential construction is not available for years prior to 2010, and therefore could not be used to adjust the 1999 figure; however, the category BNEW (new construction) is available from 1999 through 2011, and Missouri believes that the PPI from the new construction category might better characterize the PPI for the non-residential construction category than the non-residential maintenance and repair category. Logic would indicate that the materials and labor for new construction would more closely relate to non-residential construction than the materials and labor for the maintenance and repair of non-residential facilities. ***Missouri adjusted the 1999 – 2011 PPI data from the new construction category (BNEW) in order to adjust the 1999 figure to 2011 for acres/$\$10^6$. The estimated acres disturbed per million dollars spent went from 1.15 to 1.30, and with the revised private construction put in place, the total national acreage disturbed went from 311,871 to 337,915 acres.***

Additionally it is noted that Missouri counties have one of two different silt content ratios (52% or 28.8%). The method of picking one soil classification for each county is acceptable if the majority of the cropland in the county is that particular soil classification, but this may not always be the case. Although acceptable, it is also noted that it rarely would be the case that all cropland in a county is of the same soil classification, ***and for future NEIs if resources permit, Missouri suggests using weighted percentages for soil classifications to develop the silt content percentage for each county, as this would likely yield more accurate values.*** While Missouri has several suggestions for how the method used in the emission estimation for this source category could be improved upon, no changes were made to EPA's NEI results for this source category based on the review of the method.

e. References

1. Annual Value of Construction Put in Place: http://www.census.gov/const/C30/priv2011.pdf

2. County Business Patterns: http://www.census.gov/econ/cbp/index.html

3. Bureau of Labor Statistics: http://data.bls.gov/pdq/SurveyOutputServlet Table BMNR

4. Midwest Research Institute. Improvement of Specific Emission Factors (BACM Project No. 1). Prepared for South Coast Air Quality Management District. March 29, 1996.

5. Campbell, 1996: Campbell, S.G., D.R. Shimp, and S.R. Francis. *Spatial Distribution of PM-10 Emissions from Agricultural Tilling in the San Joaquin Valley*, pp. 119-127 in Geographic Information Systems in Environmental Resources Management, Air and Waste Management Association, Reno, NV. 1996.

8.11 Fugitive Dust: Construction Activities Residential

The Missouri DNR accepted EPA's estimates of emissions for this source category. The documentation below was developed by EPA. Subsection e contains Missouri's audit of EPA's estimate.

a. Source Category Description

Emissions from residential construction activity are a function of the acreage disturbed and volume of soil excavated for residential construction. Residential construction activity is developed from data obtained from the U.S. Department of Commerce (DOC)'s Bureau of the Census. Fugitive dust emissions from residential construction were estimated for PM_{10}-PRI, PM_{10}-FIL, $PM_{2.5}$-PRI, and $PM_{2.5}$-FIL. Since there are no PM-CON emissions for this category, PM_{10}-PRI emissions are equal to PM_{10}-FIL emissions and $PM_{2.5}$-PRI emissions are equal to $PM_{2.5}$-FIL.

For this source category, the following SCC was assigned:

Source Classification Code	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four
2311010000	Industrial Processes	Construction: SIC 15 - 17	General Building Construction	Total

b. Activity Data

There are two activity calculations performed for this SCC, acres of surface soil disturbed and volume of soil removed for basements.

b.1. Surface soil disturbed

The US Census Bureau has 2010 data for *Housing Starts - New Privately Owned Housing Units Started*[1] which provides regional level housing starts based on the groupings of the following unit types: 1 unit, 2-4 units, 5 or more units. A consultation with the Census Bureau in 2002 gave a breakdown estimated at 36.84 percent of the housing starts being for 2 unit structures, and 63.16 percent being for 3 and 4 unit structures. The 2-4 unit category was then divided into 2-units, and 3-4 units based on these percentages. To get the number of structures for each grouping, the 1 unit category was divided by 1, the 2 unit category was divided by 2, and the 3-4 unit category was divided by 3.5. The 5 or more unit category listed may be made up of more than one structure. *New Privately Owned Housing Units Authorized Unadjusted Units*[2] gives a conversion factor to determine the ratio of units to structures in the 5 or more unit category. For example if a county has one 40 unit apartment building, the ratio would be 40/1. If there are 5 different 8 unit buildings in the same project, the ratio would be 40/5. Structures started by category are then calculated at a regional level. The table *Annual Housing Units Authorized by Building Permit*[3] has 2010 building permit data at the county level. This data was used by comparing the building permit data by unit type at the county level to the regional level to determine the ratio of county building permits to regional building permits by unit type. This ratio was then applied to allocate the regional housing starts data to the county level by unit type. This results in county level housing starts by unit type. The following surface areas were assumed disturbed for each unit type:

Surface Soil disturbed per unit type

1-Unit	1/4 acre/structure
2-Unit	1/3 acre/structure
Apartment	1/2 acre/structure

The 3-4 unit category was considered to be an apartment. Multiplication of housing starts to soil removed results in number of acres disturbed for each unit category.

b.2. Basement soil removal

To calculate basement soil removal, 2010 *Characteristics of New Houses*[4] is used to estimate the percentage of 1 unit structures that have a basement (on the regional level). The county level estimate of number of 1 unit starts is multiplied by the percent of 1 unit houses in the region that have a basement to get the number of basements in a county. Basement volume is calculated by assuming a 2000 square foot house has a basement dug to a depth of 8 feet (making 16,000 ft^3 per basement). An additional 10% is added for peripheral dirt bringing the total to 17,600 ft^3 per basement.

c. Emission Factors

Initial PM_{10} emissions from construction of single family, two family, and apartments structures are calculated using the emission factors given in the table below. The duration of construction activity for houses is assumed to be 6 months and the duration of construction for apartments is assumed to be 12 months.

Emission Factors for Residential Construction[5]

Type of Structure	Emission Factor	Duration of Construction
Apartments	0.11 tons PM_{10}/acre-month	12 months
2-Unit Structures	0.032 tons PM_{10}/acre-month	6 months
1-Unit Structures w/o Basements	0.032 tons PM_{10}/acre-month	6 months
1-unit Structures with Basements	0.011 tons PM_{10}/acre-month	6 months
	0.059 tons PM_{10}/1000 cubic yards	

Regional variances in construction emissions are corrected using soil moisture level and silt content. These correction parameters are applied to initial PM_{10} emissions from residential construction to develop the final emissions inventory.

To account for the soil moisture level, the PM_{10} emissions are weighted using the 30-year average precipitation-evaporation (PE) values from Thornthwaite's PE Index. Average precipitation evaporation values for each State were estimated based on PE values for specific climatic divisions within a State.

To account for the silt content, the PM_{10} emissions are weighted using average silt content for each county. A data base containing county-level dry silt values was compiled. These values were derived by applying a correction factor developed by the California Air Resources Board to convert wet silt values to dry silt values.[6]

The equation for PM_{10} emissions corrected for soil moisture and silt content is:

$$Corrected\ E_{PM10} = Initial\ \mathrm{E}_{PM10} \times \frac{24}{PE} \times \frac{S}{9\%}$$

where: Corrected E_{PM10} = PM_{10} emissions corrected for soil moisture and silt content,

PE = precipitation-evaporation value for each State,

S = % dry silt content in soil for area being inventoried.

Once PM_{10} adjustments have been made, PM2.5-FIL emissions are estimated by applying a particle size multiplier of 0.10 to PM_{10}-FIL emissions[7]. Primary PM emissions are equal to filterable emissions since there are no condensable emissions from residential construction.

d. Example Calculation

PM_{10} Emissions = $\sum$(A_{unit} x $T_{construction}$ x EF_{unit}) x Adj_{PM}

Where $A_{unit} = HS_{Unit}$ x SM_{Unit}

HS_{Unit} = Regional Housing Starts x (county building permits/Regional building permits)

SM_{Unit} = Area or volume of soil moved for the given unit type

$T_{Construction}$ = Construction time (in months) for given unit type

EF_{Unit} = Unadjusted emission factor for PM_{10} for the given unit type

Adj_{PM} = PM Adjustment factor

As an example, in Beaufort County, North Carolina, 2010 acres disturbed and PM_{10} emissions from 1-unit housing starts without a basement are calculated as follows:

A_{unit} = 247,000 x (211/232,280) x $0.907_{\text{(Fraction without basement)}}$ * 0.25 acres/unit

= 203 units * 0.25 acres/unit = 50.9 acres

Adj_{PM} = (24/110.1) * (10/9) = 0.242

PM_{10} Emissions = (50.9 acres x 6 months x 0.032 tons PM_{10}/acre-month) x 0.242 = 2.37 tons PM_{10}

e. QA/QC

Missouri audited EPA's estimate by:

4. Data: Missouri added a sentence to the Source Category Description indicating the pollutants for which estimates were created using this method for the residential construction category. Missouri reviewed EPA's worksheets and the Activity data section of this document, and made several changes to the

language in section b.1, to more accurately describe the methods that were used to determine the amount of soil disturbed through residential construction in each county. Specifically, when referring to breaking down the 2-4 unit category, this document originally said that 1/3 were 2-unit structures and 2/3 were 3-unit or 4-unit structures based on 2002 Census Bureau data, Missouri inserted the actual percentages that EPA used in their worksheets in order to provide more clarity. Additionally, when referring to the method of determining the number of structures for apartment buildings, Missouri changed the order in which the ratio was stated for the amount of structures for a given number of units to more clearly state this method. Language was also added to more clearly state how the EPA's worksheets used the building permit data to convert regional level housing starts to county level housing starts. Finally, in keeping with the language used in section b.1, the title of first table was changed from soil "removed" to soil "disturbed".

Missouri also evaluated the values in in the first table. Missouri notes that there is no reference cited for the values in this table. The following website is the California Air Resources Board's CARB's method for determining fugitive dust emissions from building construction, updated 1997: http://www.arb.ca.gov/ei/areasrc/fullpdf/full7-7prev.pdf. Missouri notes that 1-unit structures in CARB;'s method range from 1/7 of an acre disturbed to 1/5 of an acre disturbed, both of which are less than the value in Table 1 of 1/4 of an acre disturbed per 1-unit structure. ***Missouri suggests that a source be cited that was used to obtain the values in this table so that the values can be verified.***

Similarly, the values in second table were evaluated by Missouri. Missouri was unable to locate the report cited in the references for the values in this table. However, CARB's method of determining these emissions cites the exact same source, and uses instead a value of 0.11 tons PM_{10} per acre-month for all building types. ***Missouri suggests that the values in the second table be verified.***

Also, the equation used to correct for silt content and soil moisture content was verified in the student manual of APTI course 419b. As noted above, Missouri has several suggestions for how the data used in this emission estimation method could be improved upon; however, no changes were made to EPA's NEI results for this source category. Only changes to this narrative documentation were made.

5. Math: Two counties were missing from the county soil disturbed worksheet (29085 Hickory County and 29223 Wayne County). The lookup tables in the emissions calculations for these two counties used the same county soil disturbed data as the counties with the next lowest County FIPS Code. This resulted in calculations for these two counties matching identically to the emissions calculations from Henry and Washington Counties, respectively. This is an obvious mistake; however, since the state doesn't have the county level building permit data and these two counties are not included on the CO2010A worksheet, this error cannot be corrected by the State. ***Missouri suggests that EPA find the building permit data for these two counties and adjust the values in the worksheets to correct this error.***

   Missouri manually verified the emission calculations in EPA's worksheet for numerous counties in Missouri. All of the manually calculated emission values agreed with the final values in EPA's worksheet, except for the two discrepancies listed above for Hickory and Wayne Counties. Further, Missouri evaluated the formulas in EPA's excel worksheet for this source category and found no errors in any of the formulas, but the lookup tables in the emissions calculations worksheet could be enhanced by using "FALSE" as the range_lookup argument because doing so would return an error for counties that are not included on the soil disturbed worksheet as opposed to using the data for the county with the next lowest FIPS. ***As stated above, several changes were made to the documentation that more clearly state the actual method of calculating the area of soil surface disturbed, and Missouri strongly suggests that EPA correct the errors for Hickory and Wayne Counties.*** However, Missouri was unable to make any changes to EPA's NEI results for this source category based on the review of the math.

6. Method: Missouri evaluated the reasonableness of the method. In general, the method of developing the activity data and emissions seems reasonable. However, the method of determining the number of structures included in the 5 or more unit structures and applying the same amount of acreage disturbed for each of such structures, regardless of the actual number of units in the structure seems like it could be improved upon. Logic indicates that structures with more units will inherently disturb more soil than structures with fewer units. ***Missouri would suggest obtaining an average number of units per structure by region or county for the 5 or more unit category and then apply a derived factor to this average in order to more accurately estimate the area disturbed for the 5 or more unit category.*** Additionally it is noted that Missouri counties have one of two different silt content ratios (52% or 28.8%). The method of picking one soil classification for each county is acceptable if the majority of the cropland in the county is that particular soil classification, but this may not always be the case. Although acceptable, it is also noted that it rarely would be the case that all cropland in a county is of the same soil classification, ***and for future NEIs if resources permit, Missouri suggests using weighted percentages for soil classifications to develop the silt content percentage for each county, as this would likely yield more accurate values.*** While Missouri has several suggestions for how the method used in the emission estimation for this source category could be improved upon, no changes were made to EPA's NEI results for this source category.

f. References

1. New Privately Owned Housing Units Started for 2010 (Not seasonally adjusted), available at: http://www.census.gov/const/startsua.pdf

2. Table 2au. New Privately Owned Housing Units Authorized - Unadjusted Units for Regions, Divisions, and States, Annual 2010, available at: http://www.census.gov/const/C40/Table2/tb2u2010.txt

3. Annual Housing Units Authorized by Building Permits CO2010A, purchased from US Department of Census

4. Type of Foundation in New One-Family Houses Completed, available at: http://www.census.gov/const/C25Ann/sftotalfoundation.pdf

5. Midwest Research Institute. Improvement of Specific Emission Factors (BACM Project No. 1). Prepared for South Coast Air Quality Management District. March 29, 1996.

6. Campbell, 1996: Campbell, S.G., D.R. Shimp, and S.R. Francis. *Spatial Distribution of PM-10 Emissions from Agricultural Tilling in the San Joaquin Valley*, pp. 119-127 in Geographic Information Systems in Environmental Resources Management, Air and Waste Management Association, Reno, NV. 1996.

7. "Proposed Revisions to Fine Fraction Ratios Used for AP-42 Fugitive Dust Emission Factors," C. Cowherd, J. Donaldson and R. Hegarty, Midwest Research Institute; D. Ono, Great Basin UAPCD. http://www.epa.gov/ttn/chief/conference/ei15/session14/cowherd.pdf

8.12 Fugitive Dust: Mining and Quarrying

The Missouri DNR developed the following estimate of emission from this source category.

a. ***Source Category Description***

Mining and quarrying activities produce particulate emissions due to the variety of processes used to extract the ore and associated overburden, including drilling and blasting, loading and unloading, and overburden replacement. Fugitive dust emissions for mining and quarrying operations are the sum of emissions from the mining of metallic and nonmetallic ores and coal. Each of these mining operations has specific emission factors accounting for the different means by which the resources are extracted.

For this source category the following SCC was assigned:

Source Classification Code	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four
2325000000	Industrial Processes	Mining and Quarrying: SIC 14	All Processes	Total

b. ***Emission Factors and Equations***

Metallic Ore Mining

The emissions factor for metallic ore mining includes overburden removal, drilling and blasting, and loading and unloading activities. The TSP emission factors developed for copper ore mining are applied to all three activities with PM_{10}/TSP ratios of 0.35 for overburden removal, 0.81 for drilling and blasting, and 0.43 for loading and unloading operations.[1] The emissions factor equation for metallic ore mining is:

$$EF_{mo} = EF_o + (B \times EF_b) + EF_l + EF_d$$

where, EF_{mo} = metallic ore mining emissions factor (lbs/ton)

EF_o = PM_{10} open pit overburden removal emission factor for copper ore (lbs/ton)

B = fraction of total ore production that is obtained by blasting at metallic ore mines

EF_b = PM_{10} drilling/blasting emission factor for copper ore (lbs/ton)

EF_l = PM_{10} loading emission factor for copper ore (lbs/ton)

EF_d = PM_{10} truck dumping emission factor for copper ore (lbs/ton)

Applying the copper ore mining TSP emissions factors[2] and PM_{10}/TSP ratios yields the following metallic ore mining emissions factor:

$$EF_{mo} = 0.0003 + (0.57625 \times 0.0008) + 0.022 + 0.032 = 0.0548 \text{ lbs/ton}$$

Non-Metallic Ore Mining

The emissions factor for non-metallic ore mining includes overburden removal, drilling and blasting, and loading and unloading activities. The emissions factor is based on western surface coal mining operations.

$$EF_{nmo} = EFv + (D \times EF_r) + EF_a + 0.5\,(EF_e + EF_t)$$

where, EF_{nmo} = non-metallic ore mining emissions factor (lbs/ton)

EF_v = PM_{10} open pit overburden removal emission factor at western surface coal mining operations (lbs/ton)

D = fraction of total ore production that is obtained by blasting at non-metallic ore mines

EF_r = PM_{10} drilling/blasting emission factor at western surface coal mining operations (lbs/ton)

EFa = PM_{10} loading emission factor at western surface coal mining operations (lbs/ton)

EFe = PM_{10} truck unloading: end dump-coal emission factor at western surface coal mining operations (lbs/ton)

EFt = PM_{10} truck unloading: bottom dump-coal emission factor at western surface coal mining operations (lbs/ton)

Applying the TSP emissions factors developed for western surface coal mining operations from AP-42[3] and a PM_{10}/TSP ratio of 0.4[4] yields the following non-metallic ore mining emissions factor:

$$EF_{nmo} = 0.225 + (0.61542 \times 0.00005) + 0.05 + 0.5\,(0.0035 + 0.033) = 0.293 \text{ lbs/ton}$$

Coal Mining

The emissions factor for coal mining includes overburden removal, drilling and blasting, loading and unloading and overburden replacement activities. The amount of overburden material handled is assumed to equal ten times the quantity of coal mined and coal unloading is assumed to split evenly between end-dump and bottom-dump operations. The emissions factor equation for coal mining is:

$$EF_c = (10 \times (EF_{to} + EF_{or} + EF_{dt})) + EF_v + EF_r + EF_a + (0.5 \times (EF_e + EF_t))$$

where, EF_c = coal mining emissions factor (lbs/ton)

EF_{to} = PM_{10} emission factor for truck loading overburden at western surface coal mining operations (lbs/ton of overburden)

EF_{or} = PM_{10} emission factor for overburden replacement at western surface coal mining operations (lbs/ton of overburden)

EF_{dt} = PM_{10} emission factors for truck unloading: bottom dump-overburden at western surface coal mining operations (lbs/ton of overburden)

EF_v = PM_{10} open pit overburden removal emission factor at western surface coal mining operations (lbs/ton)

EF_r = PM_{10} drilling/blasting emission factor at western surface coal mining operations (lbs/ton)

EF_a = PM_{10} loading emission factor at western surface coal mining operations (lbs/ton)

EF_e = PM_{10} truck unloading: end dump-coal emission factor at western surface coal mining operations (lbs/ton)

EF_t = PM_{10} truck unloading: bottom dump-coal emission factor at western surface coal mining operations (lbs/ton)

Applying the PM_{10} emissions factors developed for western surface coal mining operations[3] yields the following coal mining emissions factor:

$$EF_c = (10 \times (0.015 + 0.001 + 0.006)) + 0.225 + 0.00005 + 0.05 + (0.5 \times (0.0035 + 0.033)) = 0.513 \text{ lbs/ton}$$

PM-FIL emissions factors are assumed to be the same as PM-PRI emissions factors; however, in reality, there is a small amount of PM-CON emissions included in the PM-PRI emissions but insufficient data exists to tease out the PM-CON portion. In 2006, the EPA adopted new $PM_{2.5}/PM_{10}$ ratios for several fugitive dust categories and concluded that the $PM_{2.5}/PM_{10}$ ratios for fugitive dust categories should be in the range of 0.1 to 0.15.[5]

Consequently, a ratio of 0.125 was applied to the PM_{10} emissions factors to estimate $PM_{2.5}$ emissions factors for mining and quarrying. A summary of emissions factors is presented in the table below.

Summary of Emission Factors

Mining Type	Pollutant Code	Factor Numeric Value	Factor Unit Numerator	Factor Unit Denominator
Coal	PM_{10}-PRI	0.513	LB	TON
Coal	PM_{10}-FIL	0.513	LB	TON
Coal	$PM_{2.5}$-PRI	0.064	LB	TON
Coal	$PM_{2.5}$-FIL	0.064	LB	TON
Metallic	PM_{10}-PRI	0.0548	LB	TON
Metallic	PM_{10}-FIL	0.0548	LB	TON
Metallic	$PM_{2.5}$-PRI	0.0068	LB	TON
Metallic	$PM_{2.5}$-FIL	0.0068	LB	TON
Non-Metallic	PM_{10}-PRI	0.293	LB	TON
Non-Metallic	PM_{10}-FIL	0.293	LB	TON
Non-Metallic	$PM_{2.5}$-PRI	0.037	LB	TON
Non-Metallic	$PM_{2.5}$-FIL	0.037	LB	TON

c. *Activity*

Emissions were estimated by obtaining state-level metallic and non-metallic crude ore handled at surface mines from the U.S. Geologic Survey (USGS)[6] and mine specific coal production data for surface mines from the Energy Information Administration (EIA)[7]. Since some of the USGS metallic and non-metallic minerals waste data associated with ore production are withheld to avoid disclosing company proprietary data, an allocation procedure was developed to estimate the withheld data. For states with withheld waste data, the state fraction of national ore production was multiplied by the national undisclosed waste value to estimate the state withheld data. In addition, the USGS only reports metallic and non-metallic minerals production data separately at the national-level (e.g., the production data is combined at the state-level). To estimate metallic versus non-metallic ore production and associated waste at the state-level, the state-level total production and waste data were multiplied by the national metallic or non-metallic percentage of total production.

d. *Activity Allocation Procedure*

State-level metallic and non-metallic crude ore and associated waste handled was allocated to the county-level using employment. Specifically, state-level activity data was multiplied by the ratio of county- to state-level number of employees in the metallic and non-metallic mining industries (see table below for a list of NAICS codes).

NAICS Codes for Metallic and Non-Metallic Mining

NAICS Code	Description
2122	Metal Ore Mining
212210	Iron Ore Mining
21222	Gold Ore and Silver Ore Mining
212221	Gold Ore Mining
212222	Silver Ore Mining
21223	Copper, Nickel, Lead, and Zinc Mining
212231	Lead Ore and Zinc Ore Mining
212234	Copper Ore and Nickel Ore Mining
21229	Other Metal Ore Mining
212291	Uranium-Radium-Vanadium Ore Mining
212299	All Other Metal Ore Mining
2123	Nonmetallic Mineral Mining and Quarrying
21231	Stone Mining and Quarrying
212311	Dimension Stone Mining and Quarrying
212312	Crushed and Broken Limestone Mining and Quarrying
212313	Crushed and Broken Granite Mining and Quarrying
212319	Other Crushed and Broken Stone Mining and Quarrying
21232	Sand, Gravel, Clay, and Ceramic and Refractory Minerals Mining and Quarrying
212321	Construction Sand and Gravel Mining
212322	Industrial Sand Mining
212324	Kaolin and Ball Clay Mining
212325	Clay and Ceramic and Refractory Minerals Mining
21239	Other Nonmetallic Mineral Mining and Quarrying
212391	Potash, Soda, and Borate Mineral Mining
212392	Phosphate Rock Mining
212393	Other Chemical and Fertilizer Mineral Mining
212399	All Other Nonmetallic Mineral Mining

Employment data was obtained from the U.S. Census Bureau's 2009 County Business Patterns (*CBP*).[8] Due to concerns with releasing confidential business information, the *CBP* does not release exact numbers for a given

NAICS code if there are enough data that individual businesses could be identified. Instead a series of range codes is used. To estimate withheld counties the following procedure was used for each NAICS code being computed.

1. County level data for counties with known employment were totaled by state.
2. #1 subtracted from the state total reported in state-level *CBP*.
3. Each of the withheld counties is assigned the midpoint of the range code (e.g., A:1-19 employees would be assigned 10).
4. These midpoints are then summed to the state level.
5. #2 is divided by #4 as an adjustment factor to the midpoints.
6. #5 is multiplied by #3 to get the adjusted county-level employment.

For example, take the 2006 *CBP* data for NAICS 31-33 (Manufacturing) in Maine provided in the table below.

2006 County Business Pattern for NAICS 31-33 in Maine

fipsstate	fipscty	naics	empflag	emp
23	001	31----		6774
23	003	31----		3124
23	005	31----		10333
23	007	31----		1786
23	009	31----		1954
23	011	31----		2535
23	013	31----		1418
23	015	31----	F	0
23	017	31----		2888
23	019	31----		4522
23	021	31----		948
23	023	31----	I	0
23	025	31----		4322
23	027	31----		1434
23	029	31----		1014
23	031	31----		9749

1. The total of employees not including counties 015 and 023 is 52801.
2. The state-level *CBP* reports 59322 employees for NAICS 31----. The difference is 6521.
3. County 015 is given a midpoint of 1750 (since range code F is 1000-2499) and County 023 is given a midpoint of 17500.
4. State total for these two counties is 19250.
5. 6521/19250 = 0.33875.
6. The adjusted employment for county 015 is 1750*0.33875 = 592.82. County 023 has an adjusted employment of 17500*0.33875 = 5928.18.

In the event that data at the state level is withheld, a similar procedure is first performed going from the U.S. level to the state level. For example, known state-level employees are subtracted from the U.S. total yielding the total withheld employees. Next the estimated midpoints of the withheld states are added together and compared (by developing a ratio) to the U.S. total withheld employees. The midpoints are then adjusted by the ratio to give an improved estimate of the state total.

e. *Controls*

No controls were accounted for in the emissions estimation.

f. *Emissions Equation and Sample Calculation*

Fugitive dust emissions for mining and quarrying operations are the sum of emissions from the mining of metallic and nonmetallic ores and coal:

$$E = E_m + E_n + E_c$$

where, E = PM_{10} emissions from mining and quarrying operations

E_m = PM_{10} emissions from metallic ore mining operations

E_n = PM_{10} emissions from non-metallic ore mining

E_c = PM_{10} emissions from coal mining operations

Four specific activities are included in the emissions estimate for mining and quarrying operations: overburden removal, drilling and blasting, loading and unloading, and overburden replacement. Not included are the transfer and conveyance operations, crushing and screening operations, and storage since the dust emissions from these activities are assumed to be well controlled. Emissions for each activity are calculated using the following equation:

$$E = EF \times A$$

where, $E = PM_{10}$ emissions from operation (e.g., metallic ore, non-metallic ore, or coal mining; lbs)

EF = emissions factor associated with operation (lbs/ton)

A = ore handled in mining operation (tons)

As an example, in 2009 Autauga County, Alabama handled 456,346 tons of metallic ore and associated waste, 714,718 tons of non-metallic ore and associated waste, and 0 tons of coal. Mining and quarrying PM_{10}-PRI emissions for Autauga County are:

$$E_{PM10\text{-}PRI,\ Autauga\ County} = [(456{,}346\times0.0548) + (714{,}718\times0.293) + (0\times0.513)]/2000 = 117 \text{ tons}$$

The division by 2000 is to convert from pounds to tons.

g. *References*

1. United States Environmental Protection Agency. *Generalized Particle Size Distributions for Use in Preparing Size-Specific Particulate Emissions Inventories*, EPA-450/4-86-013, July 1986.

2. United States Environmental Protection Agency, *National Air Pollutant Emission Trends Procedure Document for 1900-1996*, EPA-454/R-98-008, May 1998.

3. United States Environmental Protection Agency, AP-42, Fifth Edition, Volume 1, Chapter 11: Mineral Products Industry, Section 11.9: Western Surface Coal Mining, available at http://www.epa.gov/ttn/chief/ap42/ch11/final/c11s09.pdf (accessed November 2011).

4. United States Environmental Protection Agency, *AIRS Facility Subsystem Source Classification Codes and Emission Factor Listing for Criteria Air Pollutants*, EPA-450/4-90-003, March 1990.

5. Midwest Research Institute, *Background Document for Revisions to Fine Fraction Ratios Used for AP-42 Fugitive Dust Emission Factors*, MRI Project No. 110397, November 2006, available at http://www.epa.gov/ttnchie1/ap42/ch13/bgdocs/b13s02.pdf (accessed December 2011).

6. United States Geologic Survey, "Minerals Yearbook 2009", http://minerals.usgs.gov/minerals/pubs/commodity/m&q/index.html#myb (accessed April 2012).

7. Energy Information Administration, "Production by Company and Mine - 2009", http://www.eia.gov/coal/data.cfm#production (accessed April 2012).

8. U.S. Census Bureau, 2009 County Business Patterns, available at http://www.census.gov/econ/cbp/download/index.htm (accessed April 2012)

8.13 Fugitive Dust: Mining and Quarrying Lead Ore

The Missouri DNR developed the following estimate of emissions from this source category.

a. Source Category Description

Lead ore mining and milling is the process by which lead ore deposits are extracted and processed for transport to primary lead smelting and refining. The USGS[1] demonstrates that six lead mines operate in Missouri, and their emissions are reported as part of the point or nonpoint data category for the National Emissions Inventory (NEI). The Air Emissions Reporting Rule[2] (AERR) §51.50 instructs states to submit point source data on the three-year cycle for those sources with potential to emit over specific pollutant thresholds. Two of the six mines in Missouri meet the point source threshold (see section C.). Detailed information on those two operations is submitted based on AERR requirements, including the list of emission generating equipment, control devices, and emission release points. Four of the mines, and their associated milling operations, do not meet the requirements to be submitted as point sources, so their emission estimates are provided as a county-total nonpoint category.

For this nonpoint source category, the following source classification code (SCC) was created specifically at the request of Missouri:

List of nonpoint SCC codes

SCC	SCC Level 1	SCC Level 2	SCC Level 3	SCC Level 4
2325060000	Industrial Processes	Mining and Quarrying: SIC 10	Lead Ore Mining and Milling	Total

b. Estimation Method

Missouri chose between two methods to develop emissions for this category: use emission inventory data collected from specific, stationary mining and milling sites, or use surrogate mining activity data with emission assumptions.

The Emission Inventory Improvement Program[4] (EIIP) Volume 3, Chapter 1 describes area source (now known as nonpoint source) emission estimation methods states can choose from. To obtain the most accurate inventory, the most specific data collected and quality assured is preferable to surrogate activity data that is allocated to the geographic region of interest. For the lead mining and milling category, these facilities have reported emissions directly to the state of Missouri as described in section c. Using quality assured facility-reported data ensures that the inventory is developed in a bottom-up fashion, as opposed to a top-down method where activity data from a much larger geographic region is used to estimate emissions and allocated down to the county level.

c. Source Identification

The list of all lead mining and milling sites are listed in the corresponding tables below. The lists are extracted from emission inventory data collected for Missouri sources subject to 10 CSR 10-6.110[3], for Standard Industrial Classification (SIC) 1031 – Lead and Zinc Ores. These sources obtain operating permits under 10 CSR 10-6.065[3] based on their potential to emit. Nonpoint sources are those with Basic operating permits whose potential to emit do not meet the AERR point source requirements.

List of Nonpoint Lead Ore Mining and Milling Facilities

County	Plant Id	Plant Name	Site Name	SIC	Operating Permit
Reynolds	0004	DOE RUN COMPANY	SWEETWATER MINE/MILL	1031	Basic
Reynolds	0005	DOE RUN COMPANY-BRUSHY CREEK MINE/MILL	VIBURNUM (BRUSHY CREEK)	1031	Basic
Iron	0017	DOE RUN COMPANY	VIBURNUM DIVISION (CENTRAL)	1031	Basic
Iron	0023	DOE RUN COMPANY	CASTEEL MINE	1031	Basic
Iron	0031	K AND D CRUSHING	CASTEEL MINE	1031	Basic
Washington	0041	K AND D CRUSHING	29 MINE AREA	1031	Basic

List of Point Source Lead Ore Mining and Milling Facilities

County	Plant Id	Plant Name	Site Name	SIC	Operating Permit
Reynolds	0006	DOE RUN COMPANY	BUNKER (FLETCHER MINE)	1031	Part 70
Iron	0005	DOE RUN COMPANY	BUICK MILL	1031	Part 70

Additional searches were performed on Missouri databases to search for other mining or milling operations. Name searches for “lead”, “ore”, “milling”, “mining”, and other iterations returned various other facilities who were investigated, but their permit documents excluded lead ore as their primary activity. The archive of all Missouri permit documents was searched for the same terms, but returned only facilities in tables above. A search of any other facility reporting lead emissions provided another list to review, but their permit documents and SICs quickly eliminated them from consideration. The lists above comprehensively cover the lead ore mining and milling category.

d. External Data Source Comparison for Lead

EPA’s Toxics Release Inventory[5] (TRI) was consulted as an external database to compare lead emissions as reported to Missouri against those reported to EPA. Missouri collects emission inventory data from all permitted sources on the schedule outlined in 10 CSR 10-6.110, including the nonpoint sources with Basic operating permits. This

Lead Emission Comparison

County	Plant Id	Plant Name	Site Name	Missouri Inventory Lead Emissions (tons per year)	TRI Lead Emissions (tons per year)
Reynolds	0004	DOE RUN COMPANY	SWEETWATER MINE/MILL	0.29	1.45
Reynolds	0005	DOE RUN COMPANY-BRUSHY CREEK MINE/MILL	VIBURNUM (BRUSHY CREEK)	0.70	.99
Iron	0017	DOE RUN COMPANY	VIBURNUM DIVISION (CENTRAL)	0.18	0
Iron	0023	DOE RUN COMPANY	CASTEEL MINE	0.20	NA
Iron	0031	K AND D CRUSHING	CASTEEL MINE	0.20	NA
Washington	0041	K AND D CRUSHING	29 MINE AREA	0.0044	NA

e. Emissions

The emission reports from the nonpoint facilities listed include both PM and lead emissions. The point source SCC codes used in these reports are:

SCC	SCC Description
30501049	Wind Erosion: Exposed Areas
30502001	Primary Crushing
30502002	Secondary Crushing/Screening
30502006	Miscellaneous Operations: Screen/Convey/Handling
30502009	Blasting: General
30502010	Drilling
30502011	Hauling
30502031	Truck Unloading
30502032	Truck Loading: Conveyor
30502507	Storage Piles
30301012	Raw Material Storage Piles
30301013	Raw Material Transfer
30303009	Raw Material Handling and Transfer

The emissions to be reported in the nonpoint category List of Nonpoint Lead Ore Mining and Milling Facilities are summed in the Lead Emission Comparison Table so they can be allocated to the county level.

f. References

1. USGS Commodity Statistics and Information 2012 http://minerals.usgs.gov/minerals/pubs/commodity/lead/mcs-2012-lead.pdf
2. USEPA's Air Emissions Reporting Rule, published December 4, 2008. http://www.epa.gov/ttnchie1/aerr/
3. Missouri Code of State Regulations. http://www.sos.mo.gov/adrules/csr/current/10csr/10c10-6a.pdf

4. Emission Inventory Improvement Program, EIIP Technical Report Series 3- Area Sources 2001. http://www.epa.gov/ttn/chief/eiip/techreport/volume03/index.html
5. USEPA's Toxics Release Inventory (TRI) 2011 TRI Data Explorer. http://www.epa.gov/TRI/

8.14 Fugitive Dust Paved Roads

The Missouri DNR accepted EPA's estimates of emissions for this source category. The documentation below was developed by EPA.

a. ***Source Category Description***

Mining and quarrying activities produce particulate emissions due to the variety of processes used to extract the ore and associated overburden, including drilling and blasting, loading and unloading, and overburden replacement. Fugitive dust emissions for mining and quarrying operations are the sum of emissions from the mining of metallic and nonmetallic ores and coal. Each of these mining operations has specific emission factors accounting for the different means by which the resources are extracted.

For this source category the following SCC was assigned:

Source Classification Code	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four
2325000000	Industrial Processes	Mining and Quarrying: SIC 14	All Processes	Total

b. ***Emission Factors and Equations***

Metallic Ore Mining

The emissions factor for metallic ore mining includes overburden removal, drilling and blasting, and loading and unloading activities. The TSP emission factors developed for copper ore mining are applied to all three activities with PM_{10}/TSP ratios of 0.35 for overburden removal, 0.81 for drilling and blasting, and 0.43 for loading and unloading operations.[1] The emissions factor equation for metallic ore mining is:

$$EF_{mo} = EF_o + (B \times EF_b) + EF_l + EF_d$$

where, EF_{mo} = metallic ore mining emissions factor (lbs/ton)

EF_o = PM_{10} open pit overburden removal emission factor for copper ore (lbs/ton)

B = fraction of total ore production that is obtained by blasting at metallic ore mines

EF_b = PM_{10} drilling/blasting emission factor for copper ore (lbs/ton)

EF_l = PM_{10} loading emission factor for copper ore (lbs/ton)

EF_d = PM_{10} truck dumping emission factor for copper ore (lbs/ton)

Applying the copper ore mining TSP emissions factors[2] and PM_{10}/TSP ratios yields the following metallic ore mining emissions factor:

$$EF_{mo} = 0.0003 + (0.57625 \times 0.0008) + 0.022 + 0.032 = 0.0548 \text{ lbs/ton}$$

Non-Metallic Ore Mining

The emissions factor for non-metallic ore mining includes overburden removal, drilling and blasting, and loading and unloading activities. The emissions factor is based on western surface coal mining operations.

$$EF_{nmo} = EFv + (D \times EF_r) + EF_a + 0.5\ (EF_e + EF_t)$$

where, EF_{nmo} = non-metallic ore mining emissions factor (lbs/ton)

EF_v = PM_{10} open pit overburden removal emission factor at western surface coal mining operations (lbs/ton)

D = fraction of total ore production that is obtained by blasting at non-metallic ore mines

EF_r = PM_{10} drilling/blasting emission factor at western surface coal mining operations (lbs/ton)

EFa = PM_{10} loading emission factor at western surface coal mining operations (lbs/ton)

EFe = PM_{10} truck unloading: end dump-coal emission factor at western surface coal mining operations (lbs/ton)

EFt = PM_{10} truck unloading: bottom dump-coal emission factor at western surface coal mining operations (lbs/ton)

Applying the TSP emissions factors developed for western surface coal mining operations from AP-42[3] and a PM_{10}/TSP ratio of 0.4[4] yields the following non-metallic ore mining emissions factor:

$$EF_{nmo} = 0.225 + (0.61542 \times 0.00005) + 0.05 + 0.5\ (0.0035 + 0.033) = 0.293 \text{ lbs/ton}$$

Coal Mining

The emissions factor for coal mining includes overburden removal, drilling and blasting, loading and unloading and overburden replacement activities. The amount of overburden material handled is assumed to equal ten times the quantity of coal mined and coal unloading is assumed to split evenly between end-dump and bottom-dump operations. The emissions factor equation for coal mining is:

$$EF_c = (10 \times (EF_{to} + EF_{or} + EF_{dt})) + EF_v + EF_r + EF_a + (0.5 \times (EF_e + EF_t))$$

where, EF_c = coal mining emissions factor (lbs/ton)

EF_{to} = PM_{10} emission factor for truck loading overburden at western surface coal mining operations (lbs/ton of overburden)

EF_{or} = PM_{10} emission factor for overburden replacement at western surface coal mining operations (lbs/ton of overburden)

EF_{dt} = PM_{10} emission factors for truck unloading: bottom dump-overburden at western surface coal mining operations (lbs/ton of overburden)

EF_v = PM_{10} open pit overburden removal emission factor at western surface coal mining operations (lbs/ton)

EF_r = PM_{10} drilling/blasting emission factor at western surface coal mining operations (lbs/ton)

EF_a = PM_{10} loading emission factor at western surface coal mining operations (lbs/ton)

EF_e = PM_{10} truck unloading: end dump-coal emission factor at western surface coal mining operations (lbs/ton)

EF_t = PM_{10} truck unloading: bottom dump-coal emission factor at western surface coal mining operations (lbs/ton)

Applying the PM_{10} emissions factors developed for western surface coal mining operations[3] yields the following coal mining emissions factor:

$$EF_c = (10 \times (0.015 + 0.001 + 0.006)) + 0.225 + 0.00005 + 0.05 + (0.5 \times (0.0035 + 0.033)) = 0.513 \text{ lbs/ton}$$

PM-FIL emissions factors are assumed to be the same as PM-PRI emissions factors; however, in reality, there is a small amount of PM-CON emissions included in the PM-PRI emissions but insufficient data exists to tease out the PM-CON portion. In 2006, the EPA adopted new $PM_{2.5}/PM_{10}$ ratios for several fugitive dust categories and concluded that the $PM_{2.5}/PM_{10}$ ratios for fugitive dust categories should be in the range of 0.1 to 0.15.[5] Consequently, a ratio of 0.125 was applied to the PM_{10} emissions factors to estimate $PM_{2.5}$ emissions factors for mining and quarrying. A summary of emissions factors is presented in the table below.

Summary of Emission Factors

Mining Type	Pollutant Code	Factor Numeric Value	Factor Unit Numerator	Factor Unit Denominator
Coal	PM_{10}-PRI	0.513	LB	TON
Coal	PM_{10}-FIL	0.513	LB	TON
Coal	$PM_{2.5}$-PRI	0.064	LB	TON
Coal	$PM_{2.5}$-FIL	0.064	LB	TON
Metallic	PM_{10}-PRI	0.0548	LB	TON
Metallic	PM_{10}-FIL	0.0548	LB	TON
Metallic	$PM_{2.5}$-PRI	0.0068	LB	TON
Metallic	$PM_{2.5}$-FIL	0.0068	LB	TON
Non-Metallic	PM_{10}-PRI	0.293	LB	TON
Non-Metallic	PM_{10}-FIL	0.293	LB	TON
Non-Metallic	$PM_{2.5}$-PRI	0.037	LB	TON
Non-Metallic	$PM_{2.5}$-FIL	0.037	LB	TON

c. *Activity*

Emissions were estimated by obtaining state-level metallic and non-metallic crude ore handled at surface mines from the U.S. Geologic Survey (USGS) [6] and mine specific coal production data for surface mines from the Energy Information Administration (EIA) [7]. Since some of the USGS metallic and non-metallic minerals waste data associated with ore production are withheld to avoid disclosing company proprietary data, an allocation procedure was developed to estimate the withheld data. For states with withheld waste data, the state fraction of national ore production was multiplied by the national undisclosed waste value to estimate the state withheld data. In addition, the USGS only reports metallic and non-metallic minerals production data separately at the national-level (e.g., the production data is combined at the state-level). To estimate metallic versus non-metallic ore production and associated waste at the state-level, the state-level total production and waste data were multiplied by the national metallic or non-metallic percentage of total production.

d. ***Activity Allocation Procedure***

State-level metallic and non-metallic crude ore and associated waste handled was allocated to the county-level using employment. Specifically, state-level activity data was multiplied by the ratio of county- to state-level number of employees in the metallic and non-metallic mining industries (see table below for a list of NAICS codes).

NAICS Codes for Metallic and Non-Metallic Mining

NAICS Code	Description
2122	Metal Ore Mining
212210	Iron Ore Mining
21222	Gold Ore and Silver Ore Mining
212221	Gold Ore Mining
212222	Silver Ore Mining
21223	Copper, Nickel, Lead, and Zinc Mining
212231	Lead Ore and Zinc Ore Mining
212234	Copper Ore and Nickel Ore Mining
21229	Other Metal Ore Mining
212291	Uranium-Radium-Vanadium Ore Mining
212299	All Other Metal Ore Mining
2123	Nonmetallic Mineral Mining and Quarrying
21231	Stone Mining and Quarrying
212311	Dimension Stone Mining and Quarrying
212312	Crushed and Broken Limestone Mining and Quarrying
212313	Crushed and Broken Granite Mining and Quarrying
212319	Other Crushed and Broken Stone Mining and Quarrying
21232	Sand, Gravel, Clay, and Ceramic and Refractory Minerals Mining and Quarrying
212321	Construction Sand and Gravel Mining
212322	Industrial Sand Mining
212324	Kaolin and Ball Clay Mining
212325	Clay and Ceramic and Refractory Minerals Mining
21239	Other Nonmetallic Mineral Mining and Quarrying
212391	Potash, Soda, and Borate Mineral Mining
212392	Phosphate Rock Mining
212393	Other Chemical and Fertilizer Mineral Mining
212399	All Other Nonmetallic Mineral Mining

Employment data was obtained from the U.S. Census Bureau's 2009 County Business Patterns (*CBP*).[8] Due to concerns with releasing confidential business information, the *CBP* does not release exact numbers for a given NAICS code if there are enough data that individual businesses could be identified. Instead a series of range codes is used. To estimate withheld counties the following procedure was used for each NAICS code being computed.

7. County level data for counties with known employment were totaled by state.
8. #1 subtracted from the state total reported in state-level *CBP*.
9. Each of the withheld counties is assigned the midpoint of the range code (e.g., A:1-19 employees would be assigned 10).
10. These midpoints are then summed to the state level.
11. #2 is divided by #4 as an adjustment factor to the midpoints.
12. #5 is multiplied by #3 to get the adjusted county-level employment.

For example, take the 2006 *CBP* data for NAICS 31-33 (Manufacturing) in Maine provided in the table below.

2006 County Business Pattern for NAICS 31-33 in Maine

fipsstate	fipscty	naics	empflag	emp
23	001	31----		6774
23	003	31----		3124
23	005	31----		10333
23	007	31----		1786
23	009	31----		1954
23	011	31----		2535
23	013	31----		1418
23	015	31----	F	0
23	017	31----		2888
23	019	31----		4522
23	021	31----		948
23	023	31----	I	0
23	025	31----		4322
23	027	31----		1434

fipsstate	fipscty	naics	empflag	emp
23	029	31----		1014
23	031	31----		9749

7. The total of employees not including counties 015 and 023 is 52801.
8. The state-level *CBP* reports 59322 employees for NAICS 31----. The difference is 6521.
9. County 015 is given a midpoint of 1750 (since range code F is 1000-2499) and County 023 is given a midpoint of 17500.
10. State total for these two counties is 19250.
11. 6521/19250 = 0.33875.
12. The adjusted employment for county 015 is 1750*0.33875 = 592.82. County 023 has an adjusted employment of 17500*0.33875 = 5928.18.

In the event that data at the state level is withheld, a similar procedure is first performed going from the U.S. level to the state level. For example, known state-level employees are subtracted from the U.S. total yielding the total withheld employees. Next the estimated midpoints of the withheld states are added together and compared (by developing a ratio) to the U.S. total withheld employees. The midpoints are then adjusted by the ratio to give an improved estimate of the state total.

e. *Controls*

No controls were accounted for in the emissions estimation.

f. *Emissions Equation and Sample Calculation*

Fugitive dust emissions for mining and quarrying operations are the sum of emissions from the mining of metallic and nonmetallic ores and coal:

$$E = E_m + E_n + E_c$$

where, E = PM_{10} emissions from mining and quarrying operations

E_m = PM_{10} emissions from metallic ore mining operations

E_n = PM_{10} emissions from non-metallic ore mining

E_c = PM_{10} emissions from coal mining operations

Four specific activities are included in the emissions estimate for mining and quarrying operations: overburden removal, drilling and blasting, loading and unloading, and overburden replacement. Not included are the transfer and conveyance operations, crushing and screening operations, and storage since the dust emissions from these activities are assumed to be well controlled. Emissions for each activity are calculated using the following equation:

$$E = EF \times A$$

where, E = PM_{10} emissions from operation (e.g., metallic ore, non-metallic ore, or coal mining; lbs)

EF = emissions factor associated with operation (lbs/ton)

A = ore handled in mining operation (tons)

As an example, in 2009 Autauga County, Alabama handled 456,346 tons of metallic ore and associated waste, 714,718 tons of non-metallic ore and associated waste, and 0 tons of coal. Mining and quarrying PM_{10}-PRI emissions for Autauga County are:

$$E_{\text{PM10-PRI, Autauga County}} = [(456{,}346 \times 0.0548) + (714{,}718 \times 0.293) + (0 \times 0.513)]/2000 = 117 \text{ tons}$$

The division by 2000 is to convert from pounds to tons.

g. *References*

1. United States Environmental Protection Agency. *Generalized Particle Size Distributions for Use in Preparing Size-Specific Particulate Emissions Inventories*, EPA-450/4-86-013, July 1986.

2. United States Environmental Protection Agency, *National Air Pollutant Emission Trends Procedure Document for 1900-1996*, EPA-454/R-98-008, May 1998.

3. United States Environmental Protection Agency, AP-42, Fifth Edition, Volume 1, Chapter 11: Mineral Products Industry, Section 11.9: Western Surface Coal Mining, available at http://www.epa.gov/ttn/chief/ap42/ch11/final/c11s09.pdf (accessed November 2011).

4. United States Environmental Protection Agency, *AIRS Facility Subsystem Source Classification Codes and Emission Factor Listing for Criteria Air Pollutants*, EPA-450/4-90-003, March 1990.

5. Midwest Research Institute, *Background Document for Revisions to Fine Fraction Ratios Used for AP-42 Fugitive Dust Emission Factors*, MRI Project No. 110397, November 2006, available at http://www.epa.gov/ttnchie1/ap42/ch13/bgdocs/b13s02.pdf (accessed December 2011).

6. United States Geologic Survey, "Minerals Yearbook 2009", http://minerals.usgs.gov/minerals/pubs/commodity/m&q/index.html#myb (accessed April 2012).

7. Energy Information Administration, "Production by Company and Mine - 2009", http://www.eia.gov/coal/data.cfm#production (accessed April 2012).

8. U.S. Census Bureau, 2009 County Business Patterns, available at http://www.census.gov/econ/cbp/download/index.htm (accessed April 2012)

8.15 Fugitive Dust: Unpaved Roads

The Missouri DNR accepted EPA's estimates of emissions for this source category. No documentation was provided by EPA.

8.16 Asphalt Plants

The Missouri DNR developed the following estimate of emissions from this source category.

a. Source Category Description

Asphalt plants operate throughout the state to provide materials for public and private road paving. The Air Emissions Reporting Rule[2] (AERR) §51.50 instructs states to submit point source data on the three-year cycle for those sources with potential to emit over specific pollutant thresholds. Of the 110 asphalt plants in Missouri, 12 are submitted as point sources. Detailed information on those 12 operations is submitted based on AERR requirements, including the list of emission generating equipment, control devices, and emission release points. 98 of the facilities, and their associated asphalt operations, do not meet the requirements to be submitted as point sources, so their emission estimates are provided as a county-total nonpoint category.

For this nonpoint source category, the following source classification code (SCC) will report nonpoint asphalt plant emissions:

List of nonpoint SCC codes

SCC	SCC Level 1	SCC Level 2	SCC Level 3	SCC Level 4
2306000000	Industrial Processes	Petroleum Refining: SIC 29	All Processes	Total

b. Estimation Method

Missouri chose between two methods to develop emissions for this category: use emission inventory data collected from specific, stationary asphalt plants, or use surrogate activity data with emission assumptions.

The Emission Inventory Improvement Program[4] (EIIP) Volume 3, Chapter 1 describes area source (now known as nonpoint source) emission estimation methods states can choose from. To obtain the most accurate inventory, the most specific data collected and quality assured is preferable to surrogate activity data that is allocated to the geographic region of interest. For the asphalt plant category, these facilities have reported emissions directly to the state of Missouri as described in section c. Using quality assured facility-reported data ensures that the inventory is developed in a bottom-up fashion, as opposed to a top-down method where activity data from a much larger geographic region is used to estimate emissions and allocated down to the county level.

c. Source Identification

The names of all asphalt sites are listed in the corresponding tables above. The lists are extracted from emission inventory data collected for Missouri sources subject to 10 CSR 10-6.110[3]. Any facility reporting an SCC for asphalt plant , is included in these lists. Nonpoint sources are those with Basic (BAS) or Intermediate (INT) operating permits whose potential to emit do not meet the AERR point source requirements. Other facilities with no operating permits (NOP) are included because they have voluntarily taken limits via a construction permit. Facilities with a construction permit are required to submit emission reports to the state.

Missouri had 33 asphalt plants that reported their 2011 Missouri emissions under a portable number. They can move their equipment to different counties in the state (and also out of state). The asphalt emissions from the portable equipment are approximately a third of the total nonpoint emissions for Missouri. This is a significant amount and it was decided to include these emissions in the inventory. These emissions are proportioned to the counties that reported asphalt emissions. The distribution of the portable emissions is weighted based upon the amount of reported nonpoint emissions from the stationary sources in each county.

List of Nonpoint Asphalt Facilities

County	Plant ID	Plant Name	Site Name

County	Plant ID	Plant Name	Site Name
29001	0002	W. L. MILLER COMPANY	KIRKSVILLE PLANT
29009	0042	HUTCHENS CONSTRUCTION COMPANY	PURDY PLANT
29019	0065	APAC MISSOURI	PLANT 03
29023	0021	DELTA ASPHALT INC	POPLAR BLUFF PLANT
29027	0054	CHRISTENSEN ASPHALT	KINGDOM CITY
29027	P028	APAC MISSOURI	MILLERSBURG - PLANT 15
29029	0016	APAC MISSOURI	PLANT 8 - LINN CREEK
29037	0032	APAC KANSAS INC	HARRISONVILLE ASPHALT PLANT
29043	0005	LEO JOURNAGAN CONSTRUCTION CO	OZARK
29047	0182	IDEKER INC	MOSBY
29047	2219	SUPERIOR ASPHALT COMPANY INC	KANSAS CITY
29047	2221	CARTER-WATERS CORPORATION	SKILES FACILITY
29051	0040	ASPHALT PRODUCTS INC	JEFFERSON CITY PLANT
29055	0048	ASPHALT PRODUCTS INC	CRAWFORD LIME
29055	P027	N. B. WEST CONTRACTING CO INC	BOURBON
29071	0202	MID MISSOURI ASPHALT LLC	ST. CLAIR
29071	P123	N. B. WEST CONTRACTING CO INC	PACIFIC PLANT
29077	0131	APAC MISSOURI	WILLARD PLANT 2
29077	0259	BLEVINS ASPHALT CONSTRUCTION CO INC	HWY 60
29079	0014	TRENTON STREET DEPARTMENT	TRENTON STREET DEPARTMENT
29083	0011	APAC MO, INC	TIGHTWAD (LEESVILLE) QUARRY
29091	0077	FOSTER REDI-MIX	PLANT #1 WEST PLAINS
29091	0083	PACE CONSTRUCTION	DOSS & HARPER QUARRY
29095	0003	J. M. FAHEY CONSTRUCTION COMPANY	TRACY PLANT
29095	0061	APAC KANSAS	SUGAR CREEK PLANT
29095	0089	SUPERIOR ASPHALT INC	LEE'S SUMMIT PLANT
29095	0176	SUPERIOR BOWEN ASPHALT CO LLC	MANCHESTER ROAD SITE
29095	0192	SUPERIOR BOWEN ASPHALT COMPANY LLC	LEE'S SUMMIT (PLANT 3)
29095	2052	SUPERIOR ASPHALT PORTABLE PLANT	KANSAS CITY
29095	2440	HOT MIX MATERIALS INC	85TH ST
29097	0017	CARTHAGE CRUSHED LIMESTONE	CARTHAGE CRUSHED LIMESTONE
29097	0139	SWIFT CONSTRUCTION COMPANY INC	JOPLIN PLANT
29097	0146	BLEVINS ASPHALT CONSTRUCTION CO INC	CARTHAGE - CIVIL WAR ROAD
29099	0007	FRED WEBER INC	FESTUS ASPHALT PLANT
29099	0098	FRED WEBER INC	TRAUTMAN ASPHALT PLANT
29099	0146	PACE CONSTRUCTION CO	ANTONIA ASPHALT PLANT
29099	P094	N. B. WEST CONTRACTING CO INC	HOUSE SPRINGS ASPHALT
29101	0031	HILTY QUARRIES INC	WARRENSBURG II QUARRY
29105	0027	WILLARD QUARRIES INC	SLEEPER QUARRY
29113	0032	G & M CONCRETE AND ASPHALT CO INC	TROY PLANT
29113	0069	PACE CONSTRUCTION CO	CENTRAL-MOSCOW MILLS

County	Plant ID	Plant Name	Site Name
29119	0024	HUTCHENS CONSTRUCTION COMPANY	BELLA VISTA FACILITY
29139	0025	PACE CONSTRUCTION CO	DANVILLE PLANT
29143	0003	DELTA ASPHALT INC	NEW MADRID PLANT
29151	0037	HIGGINS QUARRY LLC	MUENKS QUARRY SITE
29157	0032	LAFARGE WEST INC	PERRYVILLE ASPHALT
29159	0002	APAC-MISSOURI	SEDALIA QUARRY & ASPHALT
29159	0038	MID-MISSOURI LIMESTONE INC	HOUSTONIA QUARRY
29161	0009	ASPHALT PRODUCTS INC	ROLLA PLANT
29161	0034	MELROSE QUARRY AND ASPHALT LLC	ROLLA
29165	2402	SUPERIOR BOWEN ASPHALT CO LLC	144TH (PLANT 2)
29165	2422	SUPERIOR BOWEN ASPHALT CO LLC	KCI
29169	0027	WILLARD QUARRIES COMPANY INC	ST. ROBERT QUARRY
29173	0019	C. B. ASPHALT INC	HUNTINGTON PLANT (PLANT #4)
29175	0049	APAC MISSOURI	PLANT #5
29183	0096	PACE CONSTRUCTION CO	ST. CHARLES PLANT
29187	0001	LEAD BELT MATERIALS CO INC	PARK HILLS
29187	0072	BASE ROCK MINERALS INC	BONNE TERRE PLANT
29189	0040	PACE CONSTRUCTION CO.	JEFFERSON BARRICKS PLANT
29189	0201	PACE CONSTRUCTION CO	ANTIRE QUARRY PLANT
29189	1521	PACE CONSTRUCTION CO	FLORISSANT
29189	1523	MISSOURI VALLEY ASPHALT LLC	BRIDGETON
29195	0005	APAC MISSOURI	MARSHALL PLANT
29207	0001	ASA ASPHALT INC	ADVANCE
29213	0003	TABLE ROCK ASPHALT CONSTR CO INC	HWY 248 QUARRY
29777	0016	LEO JOURNAGAN CONSTRUCTION CO	LEO JOURNAGAN CONSTRUCTION CO
29777	0059	LEO JOURNAGAN CONSTRUCTION CO	LEO JOURNAGAN CONSTRUCTION CO
29777	0061	APAC MISSOURI	APAC MISSOURI
29777	0093	APAC MISSOURI	PORTABLE PLANT #403
29777	0150	APAC MISSOURI	APAC MISSOURI
29777	0157	APAC MISSOURI	MASTERS JACKSON/SPRINGFIELD DIV. PORT #2
29777	0232	C. B. ASPHALT INC	PLANT #6
29777	0269	C. B. ASPHALT INC	PLANT #7
29777	0310	DELTA ASPHALT INC	CEDAR RAPIDS PORTABLE
29777	0352	NORRIS ASPHALT PAVING CO	NORRIS ASPHALT PAVING CO
29777	0361	FRED WEBER INC	FRED WEBER INC
29777	0363	W. L. MILLER CO	W. L. MILLER CO
29777	0396	APAC MISSOURI	CMI-ASPHALT
29777	0414	APAC MISSOURI	APAC MISSOURI
29777	0439	APAC MISSOURI	APAC-CENTRAL
29777	0441	C. B. ASPHALT INC	C. B. ASPHALT INC

County	Plant ID	Plant Name	Site Name
29777	0447	HERZOG CONTRACTING	HERZOG CONTRACTING
29777	0501	PACE CONSTRUCTION COMPANY	PACE CONSTRUCTION COMPANY
29777	0518	FRED WEBER INC	PORTABLE CMI #1
29777	0520	C. B. ASPHALT INC	PLANT # 9
29777	0521	HILTY QUARRIES INC	HILTY QUARRIES INC
29777	0525	LEO JOURNAGAN CONSTRUCTION CO	LEO JOURNAGAN CONSTRUCTION CO
29777	0546	NORRIS ASPHALT PAVING CO	PLANT 500
29777	0547	LAKE ASPHALT PAVING AND CONSTRUCTION	LAKE ASPHALT PAVING AND CONSTRUCTION
29777	0549	LEO JOURNAGAN CONSTRUCTION CO	10-009
29777	0552	APAC-SHEARS	APAC-SHEARS
29777	0562	IDEKER INC	IDEKER INC
29777	0564	PACE CONSTRUCTION CO	PACE CONSTRUCTION CO
29777	0581	APAC MISSOURI	APAC MISSOURI
29777	0657	A.E. SIMPSON CONSTRUCTION	PORTABLE ASPHALT
29777	0658	MAGRUDER PAVING LLC	PORTABLE ASPHALT
29777	0661	FRED WEBER INC	PORTABLE CMI #2
29777	0667	MAGRUDER PAVING	MAGRUDER PAVING

List of Point Source Asphalt Facilities

County	Plant ID	Plant Name	Site Name
29003	P011	KELLER CONSTRUCTION COMPANY	ST. JOSEPH
29031	0002	DELTA ASPHALT INC	CAPE GIRARDEAU
29095	0037	VANCE BROTHERS INC	BRIGHTON
29095	0064	VANCE BROTHERS INC	CHELSEA
29183	0004	FRED WEBER INC	O'FALLON ASPHALT PLANT
29187	0054	LEAD BELT MATERIALS CO INC	BONNE TERRE
29189	0111	MISSOURI ASPHALT PRODUCTS, LLC	WEST LAKE QUARRY & MATERIAL CO
29189	1226	SIMPSON CONSTRUCTION MATERIALS LLC	VALLEY PARK
29189	1248	FRED WEBER INC. - SOUTH ASPHALT (BATCH)	SOUTH ASPHALT
29189	1249	FRED WEBER INC - NORTH ASPHALT H AND B	NORTH ASPHALT, H&B
29189	1250	FRED WEBER INC. - NORTH ASPHALT B-G	NORTH ASPHALT, B-G
29510	0047	FRED WEBER INC	ASPHALT PLANT

d. Controls and Emission Factors

Almost all controls at a typical Missouri asphalt plant are for PM emissions. These controls are for haul roads and storage piles which are watered to keep the dust down.

The source of emission factors for the asphalt operations is almost exclusively from AP-42or FIRE. Haul road and storage pile worksheets are also used to determine emission factors. Formulas in these worksheets are pulled from AP-42.

e. Emissions

The emission reports from the nonpoint facilities listed include the pollutants in the table below. HAPs are not included except for Lead which Missouri collects from all sources. HAPs, when they are reported, are usually reported as a sum total and not broken out into specific pollutants. None of the 98 non-point sources on our list reported NH_3.

List of Pollutants

Pollutant Name
PM_{10}-PRI
$PM_{2.5}$-PRI
SO_2
NO_X
VOC
CO
Lead

List of Asphalt SCCs and Description

SCC	Description Level 1	Description Level 2	Description Level 3	Description Level 4
30500201	Industrial Processes	Mineral Products	Asphalt Concrete	Rotary Dryer: Conventional Plant (see 3-05-002-50 to -53 for subtypes)
30500202	Industrial Processes	Mineral Products	Asphalt Concrete	Batch Mix Plant: Hot Elevs, Screens, Bins&Mixer (also see -45 thru -47
30500203	Industrial Processes	Mineral Products	Asphalt Concrete	Storage Piles
30500204	Industrial Processes	Mineral Products	Asphalt Concrete	Cold Aggregate Handling
30500205	Industrial Processes	Mineral Products	Asphalt Concrete	Drum Dryer: Drum Mix Plant (see 3-05-002-55 thru -63 for subtypes)
30500206	Industrial Processes	Mineral Products	Asphalt Concrete	Asphalt Heater: Natural Gas
30500207	Industrial Processes	Mineral Products	Asphalt Concrete	Asphalt Heater: Residual Oil
30500208	Industrial Processes	Mineral Products	Asphalt Concrete	Asphalt Heater: Distillate Oil
30500209	Industrial Processes	Mineral Products	Asphalt Concrete	Asphalt Heater: LPG
30500211	Industrial Processes	Mineral Products	Asphalt Concrete	Rotary Dryer Conventional Plant with Cyclone ** use 3-05-002-01 w/CTL
30500212	Industrial Processes	Mineral Products	Asphalt Concrete	Heated Asphalt Storage Tanks
30500213	Industrial Processes	Mineral Products	Asphalt Concrete	Storage Silo
30500214	Industrial Processes	Mineral Products	Asphalt Concrete	Truck Load-out
30500216	Industrial Processes	Mineral Products	Asphalt Concrete	Cold Aggregate Feed Bins
30500217	Industrial Processes	Mineral Products	Asphalt Concrete	Cold Aggregate Conveyors and Elevators
30500231	Industrial Processes	Mineral Products	Asphalt Concrete	Hot Bins and Screens: Continuous Process
30500240	Industrial Processes	Mineral Products	Asphalt Concrete	Mixers: Batch Process (also see -45 thru -47 for combos w/scr,bins
30500245	Industrial	Mineral	Asphalt	Batch Mix Plant: Hot Elevators, Screens, Bins, Mixer & NG Rot Dryer

SCC	Description Level 1	Description Level 2	Description Level 3	Description Level 4
	Processes	Products	Concrete	
30500246	Industrial Processes	Mineral Products	Asphalt Concrete	Batch Mix Plant: Hot Elevators, Screens, Bins, Mixer& #2 Oil Rot Dryer
30500247	Industrial Processes	Mineral Products	Asphalt Concrete	Batch Mix Plant: Hot Elevs, Scrns, Bins, Mixer& Waste/Drain/#6 Oil Rot
30500251	Industrial Processes	Mineral Products	Asphalt Concrete	Batch Mix Plant: Rotary Dryer, Natural Gas-Fired (also see -45)
30500252	Industrial Processes	Mineral Products	Asphalt Concrete	Batch Mix Plant: Rotary Dryer, Oil-Fired (also see -46)
30500255	Industrial Processes	Mineral Products	Asphalt Concrete	Drum Mix Plant: Rotary Drum Dryer / Mixer, Natural Gas-Fired
30500257	Industrial Processes	Mineral Products	Asphalt Concrete	Drum Mix Plant: Rotary Drum Dryer / Mixer, Natural Gas, Counterflow
30500258	Industrial Processes	Mineral Products	Asphalt Concrete	Drum Mix Plant: Rotary Drum Dryer / Mixer, #2 Oil-Fired
30500259	Industrial Processes	Mineral Products	Asphalt Concrete	Drum Mix Plant: Rotary Drum Dryer / Mixer, #2 Oil-Fired, Parallel Flow
30500260	Industrial Processes	Mineral Products	Asphalt Concrete	Drum Mix Plant: Rotary Drum Dryer / Mixer, #2 Oil-Fired, Counterflow
30500261	Industrial Processes	Mineral Products	Asphalt Concrete	Drum Mix Plant: Rotary Drum Dryer/Mixer, Waste/Drain/#6 Oil-Fired
30500263	Industrial Processes	Mineral Products	Asphalt Concrete	Drum Mix Pl: Rotary Drum Dryer/Mixer, Waste/Drain/#6 Oil, Counterflow
30500290	Industrial Processes	Mineral Products	Asphalt Concrete	Haul Roads: General
30500298	Industrial Processes	Mineral Products	Asphalt Concrete	Other Not Classified
30500299	Industrial Processes	Mineral Products	Asphalt Concrete	See Comment **
30505005	Industrial Processes	Mineral Products	Asphalt Processing (Blowing)	Asphalt Storage (Prior to Blowing)
30505022	Industrial Processes	Mineral Products	Asphalt Processing (Blowing)	Asphalt Heater: Distillate Oil

The emissions to be reported in the nonpoint category for facilities List of Nonpoint Asphalt Facilities are summed to the county level in the table below.

Nonpoint County Total Emissions for Asphalt Processes (tons per year)

StateFIPs	County	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_2	NO_X	VOC	CO	Lead
29001	ADAIR	1.13	0.60	0.30	0.36	0.17	1.05	
29009	BARRY	1.62	0.41	1.10	2.15	0.54	1.95	
29019	BOONE	5.04	0.40	0.11	5.34	2.91	11.25	
29023	BUTLER	8.59	1.98	3.46	4.87	3.44	9.66	0.0017
29027	CALLAWAY	6.86	1.24	9.77	13.55	5.62	11.96	
29037	CASS	6.23	0.46	3.00	4.79	3.73	2.85	

StateFIPs	County	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_2	NO_X	VOC	CO	Lead
29043	CHRISTIAN	2.39	0.04	1.01	6.60	7.62	29.43	
29047	CLAY	19.57	0.59	1.05	8.33	9.31	30.64	
29051	COLE	1.55	0.08	4.93	4.01	5.69	8.56	
29055	CRAWFORD	10.76		1.70	7.79	4.25	7.64	0.0001
29071	FRANKLIN	4.17	0.20	7.24	5.58	2.32	9.86	0.0003
29077	GREENE	9.96	0.68	0.43	13.62	8.47	32.73	0.0001
29079	GRUNDY	2.27	0.17	0.11	0.58	0.26	0.29	
29083	HENRY	5.03		2.44	0.95	0.61	0.79	
29091	HOWELL	6.66	0.00	3.66	3.49	2.39	0.56	
29095	JACKSON	30.71	1.14	8.27	26.59	27.86	83.08	
29097	JASPER	24.42	0.95	0.69	11.45	7.47	21.02	
29099	JEFFERSON	19.76	0.00	10.83	2.15	0.53	4.64	
29101	JOHNSON	0.97		12.59	2.63	1.02	4.10	
29105	LACLEDE	3.26	0.13	0.57	2.43	1.32	5.12	0.0009
29113	LINCOLN	3.76		7.86	10.13	6.88	11.72	0.0001
29119	MCDONALD	0.91		2.42	1.96	1.07	4.13	0.0007
29139	MONTGOMERY	2.96		0.03	0.24	0.15	0.15	
29143	NEW MADRID	0.79		0.05	0.49	0.15	7.03	
29151	OSAGE	1.33		3.14	0.96	0.43	1.67	
29157	PERRY	4.29	0.01	1.12	1.28	0.67	0.55	
29159	PETTIS	8.27	0.62	5.36	6.10	1.16	18.25	
29161	PHELPS	6.03	0.72	0.51	1.75	2.03	15.80	
29165	PLATTE	5.99		0.97	7.63	8.55	28.16	
29169	PULASKI	12.05	0.43	0.67	4.16	5.43	17.66	0.0003
29173	RALLS	8.73		3.88	10.05	1.50	2.28	
29175	RANDOLPH	2.27		0.82	2.33	1.26	4.86	
29183	ST. CHARLES	15.35		0.52	2.22	0.72	5.59	
29187	ST. FRANCOIS	9.88	0.28	3.61	5.45	1.57	19.55	0.0003
29189	ST. LOUIS CO.	8.07		25.33	19.21	8.75	54.26	
29195	SALINE	0.60	0.14	0.11	5.16	2.81	10.87	
29207	STODDARD	2.49	0.42	5.37	6.25	2.55	18.57	
29213	TANEY	1.58		4.19	1.44	0.42	0.71	
Total		266.30	11.68	139.21	214.06	141.63	498.97	0.0045

e. QA/QC

Quality assurance and quality checks were performed on the 2011 Emission Inventory Questionnaires as they were submitted. Any suspected faulty data was critically inspected by inventory staff and corrected as needed with the cooperation of the facilities. Other quality checks of the inventories were done on the data by staff throughout the year and for previous reporting years.

8.17 Gas Stations: Stage II

EPA created the national estimate for this category. As of February 28, 2014, there is no documentation provided by EPA for the development of this inventory. The county-total emission values were reviewed by Missouri and accepted.

8.18 Gasoline Distribution: Stage I

The Missouri DNR accepted EPA's estimates of emissions for this source category. The documentation below was developed by EPA.

a. Source Category Description

Stage I gasoline distribution includes the following gasoline emission points: 1) bulk terminals; 2) pipeline facilities; 3) bulk plants; 4) tank trucks; and 5) service stations. Emissions from Stage I gasoline distribution occur as gasoline vapors are released into the atmosphere. These Stage I processes are subject to EPA's maximum available control technology (MACT) standards for gasoline distribution.[1]

Emissions from gasoline distribution at bulk terminals and bulk plants take place when gasoline is loaded into a storage tank or tank truck, from working losses (for fixed roof tanks), and from working losses and roof seals (for floating roof tanks). Working losses consist of both breathing and emptying losses. Breathing losses are the expulsion of vapor from a tank vapor space that has expanded or contracted because of daily changes in temperature and barometric pressure; these emissions occur in the absence of any liquid level change in the tank. Emptying losses occur when the air that is drawn into the tank during liquid removal saturates with hydrocarbon vapor and expands, thus exceeding the fixed capacity of the vapor space and overflowing through the pressure vacuum valve.[2]

Emissions from tank trucks in transit occur when gasoline vapor evaporates from (1) loaded tank trucks during transportation of gasoline from bulk terminals/plants to service stations, and (2) empty tank trucks returning from service stations to bulk terminals/plants.[3] Pipeline emissions result from the valves and pumps found at pipeline pumping stations and from the valves, pumps, and storage tanks at pipeline breakout stations. Stage I gasoline distribution emissions also occur when gasoline vapors are displaced from storage tanks during unloading of gasoline from tank trucks at service stations (Gasoline Service Station Unloading) and from gasoline vapors evaporating from service station storage tanks and from the lines going to the pumps (Underground Storage Tank Breathing and Emptying).

The following SCCs are included in Stage I Gasoline Distribution:

SCC	SCC Level 1	SCC Level 2	SCC Level 3	SCC Level 4

2501050120	Storage and Transport	Petroleum and Petroleum Product Storage	Bulk Terminals: All Evaporative Losses	Gasoline
2501055120	Storage and Transport	Petroleum and Petroleum Product Storage	Bulk Plants: All Evaporative Losses	Gasoline
2501060051	Storage and Transport	Petroleum and Petroleum Product Storage	Gasoline Service Stations	Stage 1: Submerged Filling
2501060052	Storage and Transport	Petroleum and Petroleum Product Storage	Gasoline Service Stations	Stage 1: Splash Filling
2501060053	Storage and Transport	Petroleum and Petroleum Product Storage	Gasoline Service Stations	Stage 1: Balanced Submerged Filling
2501060201	Storage and Transport	Petroleum and Petroleum Product Storage	Gasoline Service Stations	Underground Tank: Breathing and Emptying
2505030120	Storage and Transport	Petroleum and Petroleum Product Transport	Truck	Gasoline
2505040120	Storage and Transport	Petroleum and Petroleum Product Transport	Pipeline	Gasoline

b. Bulk Terminals and Pipelines

There are no generally accepted activity-based VOC emission factors for the pipelines and bulk terminals sectors because they are generally treated as point sources whose emissions are estimated using site-specific information. For example, emission estimates for bulk terminal storage tanks are typically derived from tank specific parameters that are input into the TANKS program.[4] Therefore, for bulk terminals and pipelines, EPA estimated 2008 national VOC emissions by multiplying 1998 national estimates developed in support of the Gasoline Distribution MACT standard[5] by the 2008 to 1998 ratio of the national volume of wholesale gasoline supplied (For 2011, EPA used 2008 emission estimates due to resource constraints). The gasoline supply information was obtained from Table 2 in Volume I of Petroleum Supply Annual 2008.[6]

Estimation of National 2008 VOC Emissions for Pipelines and Bulk Terminals

Category	1998 Post-MACT Control Emissions (Mg)	Mg to Ton Conversion Factor	1998 Emissions (tons)	Ratio of 2008 to 1998 Gasoline Supplied	2008 Emissions (tons)
Pipelines	79,830	1.1023	87,997	(8,989 thousand barrels per day / 8,253 thousand barrels per day) = 1.089	95,844
Bulk Terminals	137,555	1.1023	151,627		165,149

To estimate HAP emissions, EPA applied national average speciation profiles to the VOC emission estimates.[7] The table below presents these speciation profiles and the national bulk terminal and pipeline HAP emission estimates (note that unless otherwise noted, all emission values reported in this section exclude estimates for Puerto Rico and the U.S. Virgin Islands). EPA used total VOC emission estimates, so emissions represent total emissions. Where necessary, States should perform point source subtractions to obtain nonpoint emissions. The following describes how total national VOC estimates were allocated to counties.

HAP Speciation Profiles and 2008 Bulk Terminal and Pipeline Emissions

HAP	Pollutant Code	Percentage of VOC Emissions	Reference	2008 National Emissions (tons)	
				Bulk Terminals	Pipelines
Benzene	71432	0.27	7	4.46E+02	2.59E+02
2,2,4-Trimethylpentane	540841	0.75	7	1.24E+03	7.19E+02
Cumene	98828	0.012	7	1.98E+01	1.15E+01
Ethyl Benzene	100414	0.053	7	8.75E+01	5.08E+01
n-Hexane	110543	1.8	7	2.97E+03	1.73E+03
Naphthalene	91203	0.00027	7	4.46E-01	2.59E-01
Toluene	108883	1.4	7	2.31E+03	1.34E+03
Xylenes	1330207	0.56	7	9.25E+02	5.37E+02

For both categories, EPA allocated national VOC and HAP emissions for these categories in a two-step manner. First, EPA allocated emissions based on 2008 gasoline supply data reported by the U.S. Department of Energy (DOE). Next, EPA allocated emissions based on employment data reported in the 2007 County Business Patterns.[8]

For pipelines, EPA allocated emissions to Petroleum Administration for Defense (PAD) Districts based on the total amount of finished motor gasoline moved by pipeline in each PAD in year 2008. There are five PAD Districts across the United States: PAD District 1 comprises seventeen states plus the District of Columbia along the Atlantic Coast; PAD District 2 comprises fifteen states in the Midwest; PAD District 3 comprises six states in South Central U.S.; PAD District 4 comprises five states in the Rocky Mountains; and PAD District 5 comprises seven states along the West Coast. These data, which are displayed in the table below, are reported in Table 35 of Volume 1 of Petroleum

Supply Annual 2008.[9] Next, EPA allocated pipeline emissions in each PAD District to counties based on County Business Patterns employment data. Because employment data for NAICS code 48691 (Pipeline Transportation of Refined Petroleum Products) are often withheld due to confidentiality reasons, EPA used the number of employees in NAICS code 42471 (Petroleum Bulk Stations and Terminals) for this allocation. To better account for the location of refined petroleum pipelines, however, EPA did not allocate any activity to States which had employees in this NAICS code, but did not have employees in NAICS code 48691 (i.e., District of Columbia, Idaho, Maine, New Hampshire, Vermont, and West Virginia).

Movement of Finished Motor Gasoline by Pipeline Between PAD Districts, 2008

	From I	From II	From III	From IV	From V
To I	n/a	393	333,462	0	0
To II	70,895	n/a	99,167	7,442	0
To III	0	9,193	n/a	0	0
To IV	0	8,680	5,778	n/a	0
To V	0	0	25,453	9,287	n/a

For bulk terminals, EPA first allocated national emissions to States based on the 2008 refinery, bulk terminal, and natural gas plant stocks of motor gasoline reported for each State in Table 33 of Volume 1 of DOE's Petroleum Supply Annual 2008 (see table below).[9] Next, EPA allocated emissions in each State to counties based on the number of NAICS code 42471 (Petroleum Bulk Stations and Terminals) employees reported in the 2007 County Business Patterns.[8]

Refinery, Bulk Terminal, and Natural Gas Plant Stocks of Motor Gasoline, 2008

State	Motor Gasoline (Thousand Barrels)	State	Motor Gasoline (Thousand Barrels)
Alabama	1,090	Montana	872
Alaska	616	Nebraska	658
Arizona	470	Nevada	102
Arkansas	819	New Hampshire	0
California	460	New Jersey	2,956
Colorado	748	New Mexico	350
Connecticut	0	New York	1,469
Delaware	105	North Carolina	1,724
District of Columbia	0	North Dakota	291
Florida	1,877	Ohio	2,724
Georgia	1,724	Oklahoma	1,245
Hawaii	12	Oregon	525
Idaho	181	Pennsylvania	3,595
Illinois	1,940	Rhode Island	0
Indiana	2,464	South Carolina	720
Iowa	1,090	South Dakota	283

State	Motor Gasoline (Thousand Barrels)	State	Motor Gasoline (Thousand Barrels)
Kansas	2,347	Tennessee	923
Kentucky	1,045	Texas	9,530
Louisiana	5,209	Utah	793
Maine	374	Vermont	31
Maryland	31	Virginia	1,285
Massachusetts	0	Washington	1,902
Michigan	1,772	West Virginia	183
Minnesota	1,305	Wisconsin	704
Mississippi	1,580	Wyoming	910
Missouri	491		

It is important to reiterate that the above discussion addresses the calculation of total VOC emissions. The 2008 point source NEI reports VOC emissions related to bulk terminal and pipeline processes. To obtain nonpoint emissions, States should subtract the 2008 point source VOC emission estimates from the total VOC emission estimates reported here. The relevant point source SCCs are listed in the two tables below.

Pipeline Point Source SCCs

SCC	SCC Level 1	SCC Level 2	SCC Level 3	SCC Level 4
40600501	Petroleum and Solvent Evaporation	Transportation and Marketing of Petroleum Products	Pipeline Petroleum Transport - General - All Products	Pipeline Leaks
40600502	Petroleum and Solvent Evaporation	Transportation and Marketing of Petroleum Products	Pipeline Petroleum Transport - General - All Products	Pipeline Venting
40600503	Petroleum and Solvent Evaporation	Transportation and Marketing of Petroleum Products	Pipeline Petroleum Transport - General - All Products	Pump Station
40600504	Petroleum and Solvent Evaporation	Transportation and Marketing of Petroleum Products	Pipeline Petroleum Transport - General - All Products	Pump Station Leaks

Bulk Terminal Point Source SCCs

SCC	SCC Level 1	SCC Level 2	SCC Level 3	SCC Level 4
40400101	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Gasoline RVP 13: Breathing Loss (67000 Bbl Capacity) - Fixed Roof Tank
40400102	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Gasoline RVP 10: Breathing Loss (67000 Bbl Capacity) - Fixed Roof Tank
40400103	Petroleum and	Petroleum Liquids	Bulk Terminals	Gasoline RVP 7:

SCC	SCC Level 1	SCC Level 2	SCC Level 3	SCC Level 4
	Solvent Evaporation	Storage (non-Refinery)		Breathing Loss (67000 Bbl. Capacity) - Fixed Roof Tank
40400104	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Gasoline RVP 13: Breathing Loss (250000 Bbl Capacity)-Fixed Roof Tank
40400105	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Gasoline RVP 10: Breathing Loss (250000 Bbl Capacity)-Fixed Roof Tank
40400106	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Gasoline RVP 7: Breathing Loss (250000 Bbl Capacity) - Fixed Roof Tank
40400107	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Gasoline RVP 13: Working Loss (Diam. Independent) - Fixed Roof Tank
40400108	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Gasoline RVP 10: Working Loss (Diameter Independent) - Fixed Roof Tank
40400109	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Gasoline RVP 7: Working Loss (Diameter Independent) - Fixed Roof Tank
40400110	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Gasoline RVP 13: Standing Loss (67000 Bbl Capacity)-Floating Roof Tank
40400111	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Gasoline RVP 10: Standing Loss (67000 Bbl Capacity)-Floating Roof Tank
40400112	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Gasoline RVP 7: Standing Loss (67000 Bbl Capacity)- Floating Roof Tank
40400113	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-	Bulk Terminals	Gasoline RVP 13: Standing Loss

SCC	SCC Level 1	SCC Level 2	SCC Level 3	SCC Level 4
		Refinery)		(250000 Bbl Cap.) - Floating Roof Tank
40400114	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Gasoline RVP 10: Standing Loss (250000 Bbl Cap.) - Floating Roof Tank
40400115	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Gasoline RVP 7: Standing Loss (250000 Bbl Cap.) - Floating Roof Tank
40400116	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Gasoline RVP 13/10/7: Withdrawal Loss (67000 Bbl Cap.) - Float Rf Tnk
40400117	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Gasoline RVP 13/10/7: Withdrawal Loss (250000 Bbl Cap.) - Float Rf Tnk
40400118	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Gasoline RVP 13: Filling Loss (10500 Bbl Cap.) - Variable Vapor Space
40400119	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Gasoline RVP 10: Filling Loss (10500 Bbl Cap.) - Variable Vapor Space
40400120	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Gasoline RVP 7: Filling Loss (10500 Bbl Cap.) - Variable Vapor Space
40400131	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Gasoline RVP 13: Standing Loss - Ext. Floating Roof w/ Primary Seal
40400132	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Gasoline RVP 10: Standing Loss - Ext. Floating Roof w/ Primary Seal
40400133	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Gasoline RVP 7: Standing Loss - External Floating Roof w/ Primary Seal
40400141	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Gasoline RVP 13: Standing Loss - Ext. Floating Roof w/ Secondary Seal
40400142	Petroleum and	Petroleum Liquids	Bulk Terminals	Gasoline RVP 10:

SCC	SCC Level 1	SCC Level 2	SCC Level 3	SCC Level 4
	Solvent Evaporation	Storage (non-Refinery)		Standing Loss - Ext. Floating Roof w/ Secondary Seal
40400143	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Gasoline RVP 7: Standing Loss - Ext. Floating Roof w/ Secondary Seal
40400148	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Gasoline RVP 13/10/7: Withdrawal Loss - Ext. Float Roof (Pri/Sec Seal)
40400150	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Miscellaneous Losses/Leaks: Loading Racks
40400151	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Valves, Flanges, and Pumps
40400152	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Vapor Collection Losses
40400153	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Vapor Control Unit Losses
40400161	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Gasoline RVP 13: Standing Loss - Int. Floating Roof w/ Primary Seal
40400162	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Gasoline RVP 10: Standing Loss - Int. Floating Roof w/ Primary Seal
40400163	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Gasoline RVP 7: Standing Loss - Internal Floating Roof w/ Primary Seal
40400171	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Gasoline RVP 13: Standing Loss - Int. Floating Roof w/ Secondary Seal
40400172	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Gasoline RVP 10: Standing Loss - Int. Floating Roof w/ Secondary Seal
40400173	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Gasoline RVP 7: Standing Loss - Int. Floating Roof w/ Secondary Seal

SCC	SCC Level 1	SCC Level 2	SCC Level 3	SCC Level 4
40400178	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Gasoline RVP 13/10/7: Withdrawal Loss - Int. Float Roof (Pri/Sec Seal)

c. Bulk Plants

EPA calculated VOC emissions from bulk plants by developing an average emission factor from the bulk plant motor gasoline VOC emissions and throughput data developed in support of the Gasoline Distribution MACT standards.[2,5] To estimate 2008 national VOC emissions, the VOC emission factor (8.62 pounds of VOC per 1,000 gallons) was applied to the estimated national volume of gasoline passing through bulk plants in 2008. The volume of bulk plant gasoline throughput was assumed to be 9 percent of total gasoline consumption.[10] Total gasoline consumption for 2008 was assumed to be the same as the volume of finished motor gasoline supplied as reported on the U.S. Energy Information Administration's Petroleum Navigator website.[11] The resulting national VOC emission estimate was then allocated to counties based on employment data for NAICS code 42471 (Petroleum Bulk Stations and Terminals). To estimate benzene emissions from bulk plants, EPA multiplied VOC emission estimates by county-level speciation profiles calculated from the annual onroad refueling (Stage 2) emissions from the 2008 NEI NMIM results.[12] All other HAPs were estimated by multiplying VOC emissions by the national average speciation profiles displayed in the table below.

Bulk Plant HAP Speciation Profiles and Total Emission Estimates

Pollutant	Pollutant Code	Emission Factor	Reference	National Emissions (tpy)
VOC	VOC	8.62 lb./1,000 gallons	2 and 5	5.35E+04
2,2,4-Trimethylpentane	540841	0.75% of VOC	7	4.01E+02
Cumene	98828	0.012% of VOC	7	6.41E+00
Ethyl Benzene	100414	0.053% of VOC	7	2.83E+01
n-Hexane	110543	1.8% of VOC	7	9.62E+02
Naphthalene	91203	0.00027% of VOC	7	1.44E-01
Toluene	108883	1.4% of VOC	7	7.48E+02
Xylenes	1330207	0.56% of VOC	7	2.99E+02
Benzene	71432	county-specific % of VOC	12	3.94E+02

It is important to reiterate that the above discussion addresses the calculation of total VOC emissions. The 2008 point source NEI reports VOC emissions related to bulk plants. To obtain nonpoint emissions, States should subtract the 2008 point source VOC emission estimates from the total VOC emission estimates reported here. The relevant point source SCCs are listed in the table below.

Bulk Plant Point Source SCCs

SCC	SCC Level 1	SCC Level 2	SCC Level 3	SCC Level 4
40400201	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Plants	Gasoline RVP 13: Breathing Loss (67000 Bbl Capacity) - Fixed Roof Tank
40400202	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Plants	Gasoline RVP 10: Breathing Loss (67000 Bbl Capacity) - Fixed Roof Tank
40400203	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Plants	Gasoline RVP 7: Breathing Loss (67000 Bbl. Capacity) - Fixed Roof Tank
40400204	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Plants	Gasoline RVP 13: Working Loss (67000 Bbl. Capacity) - Fixed Roof Tank
40400205	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Plants	Gasoline RVP 10: Working Loss (67000 Bbl. Capacity) - Fixed Roof Tank
40400206	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Plants	Gasoline RVP 7: Working Loss (67000 Bbl. Capacity) - Fixed Roof Tank
40400207	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Plants	Gasoline RVP 13: Standing Loss (67000 Bbl Cap.) - Floating Roof Tank
40400208	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Plants	Gasoline RVP 10: Standing Loss (67000 Bbl Cap.) - Floating Roof Tank
40400209	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Plants	Gasoline RVP 7: Standing Loss (67000 Bbl Cap.) - Floating Roof Tank
40400210	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Plants	Gasoline RVP 13/10/7: Withdrawal Loss (67000 Bbl Cap.) - Float Rf Tnk

SCC	SCC Level 1	SCC Level 2	SCC Level 3	SCC Level 4
40400211	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Plants	Gasoline RVP 13: Filling Loss (10500 Bbl Cap.) - Variable Vapor Space
40400212	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Plants	Gasoline RVP 10: Filling Loss (10500 Bbl Cap.) - Variable Vapor Space
40400213	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Plants	Gasoline RVP 7: Filling Loss (10500 Bbl Cap.) - Variable Vapor Space
40400231	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Plants	Gasoline RVP 13: Standing Loss - Ext. Floating Roof w/ Primary Seal
40400232	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Plants	Gasoline RVP 10: Standing Loss - Ext. Floating Roof w/ Primary Seal
40400233	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Plants	Gasoline RVP 7: Standing Loss - External Floating Roof w/ Primary Seal
40400241	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Plants	Gasoline RVP 13: Standing Loss - Ext. Floating Roof w/ Secondary Seal
40400242	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Plants	Gasoline RVP 10: Standing Loss - Ext. Floating Roof w/ Secondary Seal
40400243	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Plants	Gasoline RVP 7: Standing Loss - Ext. Floating Roof w/ Secondary Seal
40400248	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Plants	Gasoline RVP 10/13/7: Withdrawal Loss - Ext. Float Roof (Pri/Sec Seal)
40400250	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Plants	Loading Racks
40400251	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Plants	Valves, Flanges, and Pumps

SCC	SCC Level 1	SCC Level 2	SCC Level 3	SCC Level 4
40400252	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Plants	Miscellaneous Losses/Leaks: Vapor Collection Losses
40400253	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Plants	Miscellaneous Losses/Leaks: Vapor Control Unit Losses
40400261	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Plants	Gasoline RVP 13: Standing Loss - Int. Floating Roof w/ Primary Seal
40400262	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Plants	Gasoline RVP 10: Standing Loss - Int. Floating Roof w/ Primary Seal
40400263	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Plants	Gasoline RVP 7: Standing Loss - Internal Floating Roof w/ Primary Seal
40400271	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Plants	Gasoline RVP 13: Standing Loss - Int. Floating Roof w/ Secondary Seal
40400272	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Plants	Gasoline RVP 10: Standing Loss - Int. Floating Roof w/ Secondary Seal
40400273	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Plants	Gasoline RVP 7: Standing Loss - Int. Floating Roof w/ Secondary Seal
40400278	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Plants	Gasoline RVP 10/13/7: Withdrawal Loss - Int. Float Roof (Pri/Sec Seal)
40400401	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Petroleum Products - Underground Tanks	Gasoline RVP 13: Breathing Loss
40400402	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Petroleum Products - Underground Tanks	Gasoline RVP 13: Working Loss
40400403	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Petroleum Products - Underground Tanks	Gasoline RVP 10: Breathing Loss
40400404	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Petroleum Products - Underground Tanks	Gasoline RVP 10: Working Loss

SCC	SCC Level 1	SCC Level 2	SCC Level 3	SCC Level 4
40400405	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Petroleum Products - Underground Tanks	Gasoline RVP 7: Breathing Loss
40400406	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Petroleum Products - Underground Tanks	Gasoline RVP 7: Working Loss
40600101	Petroleum and Solvent Evaporation	Transportation and Marketing of Petroleum Products	Tank Cars and Trucks	Gasoline: Splash Loading **
40600126	Petroleum and Solvent Evaporation	Transportation and Marketing of Petroleum Products	Tank Cars and Trucks	Gasoline: Submerged Loading **
40600131	Petroleum and Solvent Evaporation	Transportation and Marketing of Petroleum Products	Tank Cars and Trucks	Gasoline: Submerged Loading (Normal Service)
40600136	Petroleum and Solvent Evaporation	Transportation and Marketing of Petroleum Products	Tank Cars and Trucks	Gasoline: Splash Loading (Normal Service)
40600141	Petroleum and Solvent Evaporation	Transportation and Marketing of Petroleum Products	Tank Cars and Trucks	Gasoline: Submerged Loading (Balanced Service)
40600144	Petroleum and Solvent Evaporation	Transportation and Marketing of Petroleum Products	Tank Cars and Trucks	Gasoline: Splash Loading (Balanced Service)
40600147	Petroleum and Solvent Evaporation	Transportation and Marketing of Petroleum Products	Tank Cars and Trucks	Gasoline: Submerged Loading (Clean Tanks)

d. Tank Trucks in Transit

The EPA calculated VOC emissions from Tank Trucks in Transit by multiplying county-level tank truck gasoline throughput by a 0.06 lb of VOC per 1,000 gallon emission factor. As noted in the table below, this emission factor is the sum of the individual emission factors reported in the Gasoline Distribution EIIP guidance document for gasoline-filled trucks (traveling to service station/bulk plant for delivery) and vapor-filled trucks (traveling to bulk terminal/plant for reloading).[3] County-level gasoline consumption was estimated by summing county-level onroad and nonroad estimates. County-level onroad consumption was estimated by subtracting the NMIM-derived national nonroad consumption from the EIA's estimate of finished motor gasoline supplied and then allocating to counties using NMIM-derived onroad county-level CO_2 emissions.[11,13] County-level nonroad consumption was estimated by allocating NMIM-derived state/SCC-level nonroad gasoline consumption to the county-level based on nonroad county/SCC-level CO_2 emissions.[13] Gasoline throughput for tank trucks was computed by multiplying the county-level gasoline consumption estimates by a factor of 1.09 to account for gasoline that is transported more than once in a given area (i.e., transported from bulk terminal to bulk plant and then from bulk plant to service station).[10] Benzene emission estimates were calculated by multiplying county-level NMIM speciation profiles by the VOC emission estimates.[12] Emissions for the remaining HAPs were calculated by multiplying VOC emissions by the national speciation profiles presented in the second table below.

Tank Trucks in Transit VOC Emission Factors

	VOC Emission Factor
Vapor-Filled Trucks	0.055 lb/1,000 gallons
Gasoline Filled Trucks	0.005 lb/1,000 gallons
Total	**0.06 lb/1,000 gallons**

Tank Trucks in Transit HAP Speciation Profiles and Total Emission Estimates

Pollutant	Pollutant Code	Emission Factor	Reference	National Emissions (tpy)
VOC	VOC	0.06 lb./1,000 gallons	3	4.51E+03
2,2,4-Trimethylpentane	540841	0.75% of VOC	7	3.38E+01
Cumene	98828	0.012% of VOC	7	5.41E-01
Ethyl Benzene	100414	0.053% of VOC	7	2.39E+00
n-Hexane	110543	1.8% of VOC	7	8.11E+01
Naphthalene	91203	0.00027% of VOC	7	1.22E-02
Toluene	108883	1.4% of VOC	7	6.31E+01
Xylenes	1330207	0.56% of VOC	7	2.52E+01
Benzene	71432	county-specific % of VOC	12	3.13E+01

It is important to reiterate that the above discussion addresses the calculation of total VOC emissions. The 2008 point source NEI reports VOC emissions related to tank trucks in transit. To obtain nonpoint emissions, States should subtract the 2008 point source VOC emission estimates from the total VOC emission estimates reported here. The relevant point source SCCs are listed in the table below.

Tank Trucks in Transit Point Source SCCs

SCC	SCC Level 1	SCC Level 2	SCC Level 3	SCC Level 4
40400154	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Tank Truck Vapor Leaks
40400254	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Plants	Tank Truck Vapor Losses
40600162	Petroleum and Solvent Evaporation	Transportation and Marketing of Petroleum Products	Tank Cars and Trucks	Gasoline: Loaded with Fuel (Transit Losses)
40600163	Petroleum and Solvent Evaporation	Transportation and Marketing of Petroleum Products	Tank Cars and Trucks	Gasoline: Return with Vapor (Transit Losses)

e. Underground Storage Tank (UST) Breathing and Emptying

The EPA calculated VOC emissions from UST breathing and emptying by multiplying county-level total gasoline consumption, calculated as described above in the Tank Trucks in Transit section, by the 1 lb/1,000 gallons emission factor recommended by the Gasoline Distribution EIIP guidance document.[3] With the exception of benzene, HAP emissions were estimated by multiplying VOC emissions by the national HAP speciation profiles listed in the table below. To estimate benzene emissions, EPA multiplied VOC emissions by county-level speciation profiles from NMIM.[12]

Underground Storage Tank (UST) Breathing and Emptying Emissions

Pollutant	Pollutant Code	Emission Factor	Reference	National Emissions (tpy)
VOC	VOC	1 lb./1,000 gallons	3	6.89E+04
2,2,4-Trimethylpentane	540841	0.75% of VOC	7	5.17E+02
Cumene	98828	0.012% of VOC	7	8.27E+00
Ethyl Benzene	100414	0.053% of VOC	7	3.65E+01
n-Hexane	110543	1.8% of VOC	7	1.24E+03
Naphthalene	91203	0.00027% of VOC	7	1.86E-01
Toluene	108883	1.4% of VOC	7	9.65E+02
Xylenes	1330207	0.56% of VOC	7	3.86E+02
Benzene	71432	county-specific % of VOC	12	4.78E+02

It is important to reiterate that the above discussion addresses the calculation of total VOC emissions. The 2008 point source NEI reports VOC emissions related to UST breathing and emptying. To obtain nonpoint emissions, States should subtract the 2008 point source VOC emission estimates from the total VOC emission estimates reported here. The relevant point source SCCs are listed in the table below.

UST Breathing and Emptying Point Source SCCs

SCC	SCC Level 1	SCC Level 2	SCC Level 3	SCC Level 4
40600307	Petroleum and Solvent Evaporation	Transportation and Marketing of Petroleum Products	Gasoline Retail Operations - Stage I	Underground Tank Breathing and Emptying
40600707	Petroleum and Solvent Evaporation	Transportation and Marketing of Petroleum Products	Consumer (Corporate) Fleet Refueling - Stage I	Underground Tank Breathing and Emptying

f. Gasoline Service Station Unloading

The EPA estimated uncontrolled VOC emissions from unloading of gasoline into service station tanks from county-level total gasoline consumption estimates, calculated as described above in the Tank Trucks in Transit section, and the following AP-42 equation:

$$L = (12.46 \times S \times P \times M)/T$$

where:

L = uncontrolled loading loss of liquid loaded (in lb/1,000 gallons)

S = saturation factor;

P = true vapor pressure of liquid loaded (pounds per square inch absolute);

M = molecular weight of vapors (lbs per lb/mole); and

T = temperature of liquid loaded (Rankine).[14]

This equation requires geographic-specific information. This information includes the saturation factor, which differs by method of loading (e.g., submerged filling), Reid vapor pressure (RVP), temperature, and true vapor pressure of gasoline.

Gasoline RVP values were obtained from the NMIM 2008 database. Because NMIM is a county-level database that reports RVP values by month, EPA developed county-level monthly gasoline consumption estimates by multiplying annual county gasoline consumption by monthly allocation factors. State-level monthly allocation factors were developed from monthly gasoline sales data reported in the Federal Highway Administration's Highway Statistics

$$P = \exp\left\{\begin{array}{l}\left[0.7553 - \left(\dfrac{413.0}{T + 459.6}\right)\right] S^{0.5} \log_{10}(RVP) - \left[1.854 - \left(\dfrac{1{,}042}{T + 459.6}\right)\right] S^{0.5} \\ + \left[\left(\dfrac{2{,}416}{T + 459.6}\right) - 2.013\right] \log_{10}(RVP) - \left(\dfrac{8{,}742}{T + 459.6}\right) + 15.64\end{array}\right\}$$

2008.[15] Geographic-specific information on the temperature of gasoline and the method of loading were obtained from a Stage I and II gasoline emission inventory study prepared for the EIIP.[16]

The true vapor pressure of gasoline was estimated for each county/month using the following equation:

where:

P	=	Stock true vapor pressure, in pounds per square inch absolute.
T	=	Stock temperature, in degrees Fahrenheit.
RVP	=	Reid vapor pressure, in pounds per square inch.
S	=	Slope of the ASTM distillation curve at 10 percent evaporated, in degrees Fahrenheit per percent (assumed that S = 3.0 for gasoline per Figure 7.1-14a of AP-42).[17]

This equation was used to calculate monthly county-level true vapor pressure estimates. In cases where more than one filling method was assumed to apply in a county (e.g., due to vapor balancing requirement applying to a portion of a county's total gasoline throughput due to a throughput exemption), EPA developed two sets of calculations for each month, one for each filling method.

The EIIP study regional stock temperature information was used to estimate the temperature of gasoline in each county in each month (see table below).[16]

Temperature Data Used in Estimating True Vapor Pressure (ºF)

Region	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
1 (Northeast)	46	44	44	48	57	64	70	73	70	64	60	51
2 (Southeast)	66	67	69	74	78	81	80	81	80	77	69	60
3 (Southwest)	60	61	62	66	73	78	81	84	82	78	71	62
4 (Midwest)	33	35	40	47	55	62	71	73	68	65	64	63
5 (West)	50	52	62	66	73	76	80	83	86	84	73	60
6 (Northwest)	49	50	50	52	57	62	67	72	68	60	49	42

Region 1: Alaska, Connecticut, Delaware, DC, Illinois, Indiana, Kentucky, Maine, Maryland, Massachusetts, Michigan, New Hampshire, New Jersey, New York, Ohio, Pennsylvania, Rhode Island, Vermont, Virginia, West Virginia, Wisconsin

Region 2: Alabama, Arkansas, Florida, Georgia, Hawaii, Louisiana, Mississippi, N. Carolina, S. Carolina, Tennessee

Region 3: Arizona, New Mexico, Oklahoma, Texas

Region 4: Colorado, Iowa, Kansas, Minnesota, Missouri, Montana, Nebraska, N. Dakota, S. Dakota, Wyoming

Region 5: California, Nevada, Utah

Region 6: Idaho, Oregon, Washington

The EPA incorporated the effect of Stage I Gasoline Service Station vapor balancing controls based on the county-level control efficiency values (either 90 or 95 percent) that were compiled for the EIIP study.[16] The table below presents the HAP speciation profiles and total VOC and HAP emission estimates calculated using these procedures.

Emissions are reported by SCC based on the filling methods used in each county as determined from the EIIP study: SCC 2501060051 (Submerged Filling); SCC 2501060052 (Splash Filling); and SCC 2501060053 (Balanced Submerged Filling).

Stage I Service Station Unloading HAP Speciation Profiles and Total Emission Estimates

Pollutant	Pollutant Code	Emission Factor	Reference	National Emissions (tpy)
VOC	VOC	Equation 1	14	3.82E+05
2,2,4-Trimethylpentane	540841	0.75% of VOC	7	2.86E+03
Cumene	98828	0.012% of VOC	7	4.58E+01
Ethyl Benzene	100414	0.053% of VOC	7	2.02E+02
n-Hexane	110543	1.8% of VOC	7	6.87E+03
Naphthalene	91203	0.00027% of VOC	7	1.03E+00
Toluene	108883	1.4% of VOC	7	5.35E+03
Xylenes	1330207	0.56% of VOC	7	2.14E+03
Benzene	71432	county-specific % of VOC	12	2.97E+03

It is important to reiterate that the above discussion addresses the calculation of total VOC emissions. The 2008 point source NEI reports VOC emissions related to service station unloading. To obtain nonpoint emissions, States should subtract the 2008 point source VOC emission estimates from the total VOC emission estimates reported here. The relevant point source SCCs are listed in the three tables below below.

Service Station Unloading: Submerged Fill Point Source SCCs

SCC	SCC Level 1	SCC Level 2	SCC Level 3	SCC Level 4
40600302	Petroleum and Solvent Evaporation	Transportation and Marketing of Petroleum Products	Gasoline Retail Operations - Stage I	Submerged Filling w/o Controls
40600702	Petroleum and Solvent Evaporation	Transportation and Marketing of Petroleum Products	Consumer (Corporate) Fleet Refueling - Stage I	Submerged Filling w/o Controls

Service Station Unloading: Splash Fill Point Source SCCs

SCC	SCC Level 1	SCC Level 2	SCC Level 3	SCC Level 4
40600301	Petroleum and Solvent Evaporation	Transportation and Marketing of Petroleum Products	Gasoline Retail Operations - Stage I	Splash Filling
40600701	Petroleum and Solvent Evaporation	Transportation and Marketing of Petroleum Products	Consumer (Corporate) Fleet Refueling - Stage I	Splash Filling

Service Station Unloading: Balanced Submerged Fill Point Source SCCs

SCC	SCC Level 1	SCC Level 2	SCC Level 3	SCC Level 4
40600305	Petroleum and Solvent Evaporation	Transportation and Marketing of Petroleum Products	Gasoline Retail Operations - Stage I	Unloading **
40600306	Petroleum and Solvent Evaporation	Transportation and Marketing of Petroleum Products	Gasoline Retail Operations - Stage I	Balanced Submerged Filling
40600706	Petroleum and Solvent Evaporation	Transportation and Marketing of Petroleum Products	Consumer (Corporate) Fleet Refueling - Stage I	Balanced Submerged Filling

Unloading emissions might also be reported in the point source inventory under SCC 40600399 (Gasoline Retail Operations – Stage I, Not Classified).

g. Example Emission Calculations

Bulk Terminals

2008 national benzene emissions = VOC emissions x HAP speciation factor

1.65E+05 tons x 0.0027

4.46E+02 tons

Pipelines

2008 national cumene emissions = VOC emissions x HAP speciation factor

9.58E+04 tons x 0.00012

1.15E+01 tons

Bulk Plants

2008 national VOC emissions

= national gasoline consumption x proportion passing through bulk plants x VOC emission factor

= 137,801,370 thousand gallons x 0.09 x 8.62 lbs. VOC/thousand gallons

= 1.07E+08 lbs. / 2000 lbs.

= 5.35E+04 tons

Tank Trucks in Transit

2008 Alamance County, North Carolina VOC emissions

= total county gasoline consumption x (1+proportion of gasoline transported twice) x VOC emission factor

= 61,446 thousand gallons x (1+0.09) x 0.06 lbs. VOC/thousand gallons

= 4.02E+03 lbs. / 2000 lbs.

= 2.01E+00 tons

UST Breathing and Emptying

2008 Alamance County, North Carolina VOC emissions

= total county gasoline consumption x VOC emission factor

= 61,466 thousand gallons x 1 lb. VOC/thousand gallons

= 6.15E+04 lbs. / 2000 lbs.

= 30.73E+00 tons

Stage I Gasoline Service Station Unloading - uncontrolled VOC emissions in July for balanced submerged fill unloading in Alamance County, NC

= annual county consumption x proportion of annual gasoline sold in July x VOC emission factor

= 61,466 thousand gallons x 0.1087 x VOC emission factor

= 6,681 thousand gallons x ((12.46 x saturation factor x true vapor pressure x vapor molecular weight) / temperature))

= 6,681 thousand gallons x ((12.46 x 1.0 x 6.309 x 67.811) / 540)

= 65,950 lbs

Incorporate effect of control (vapor balancing requirement)

= Uncontrolled emissions x ((100-CE)/100)

= 65,950 lbs x ((100-90)/100)

= 6,595 lbs / 2,000 lbs

= 3.30E+00 tons

h. References

1. U.S. Environmental Protection Agency, “National Emission Standards for Source Categories: Gasoline Distribution (Stage I), 40 CFR Part 63.” Office of Air Quality Planning and Standards, February 28, 1997. Pages 9087-9093.

2. U.S. Environmental Protection Agency, "Gasoline Distribution Industry (Stage I)-Background Information for Proposed Standards," EPA-453/R94-002a, Office of Air Quality Planning and Standards, January 1994.

3. Eastern Research Group, Inc., "Volume III: Chapter 11, Gasoline Marketing (Stage I and Stage II), Revised Final," prepared for the Emission Inventory Improvement Program, January 2001.

4. U.S. Environmental Protection Agency, “TANKS Emission Estimation Software,” Office of Air Quality Planning and Standards, Emission Inventory Group, available from http://www.epa.gov/ttn/chief/software/tanks/index.html, last updated October 29, 2004.

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8. U.S. Department of Commerce, Bureau of the Census, County Business Patterns 2007, retrieved from http://www.census.gov/econ/cbp/index.html, released July 2009.

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11. U.S. Department of Energy, Energy Information Administration, Petroleum Navigator – Product Supplied, available from http://tonto.eia.doe.gov/dnav/pet/pet_cons_psup_dc_nus_mbblpd_a.htm, accessed January 2010.

12. Benzene speciation profiles calculated by Jonathan Dorn, E.H. Pechan and Associates, Inc. from county-level VOC and benzene emissions developed from a 2008 NMIM run. The NMIM run was performed by John Van Bruggen, E.H. Pechan and Associates, Inc., January 2010.

13. 2008 NMIM runs performed by John Van Bruggen and Melissa Spivey, E.H. Pechan and Associates, Inc., January 2010.

14. U.S. Environmental Protection Agency, "Compilation of Air Pollutant Emission Factors, AP-42, Fifth Edition, Volume I: Stationary Point and Area Sources, Section 5.2 Transportation and Marketing of Petroleum Liquids," Office of Air Quality Planning and Standards, January 1995.

15. Federal Highway Administration, “Monthly Gasoline/Gasohol Reported by States,” Table MF-33GA in *Highway Statistics 2008*, Office of Highway Policy Information, available from http://www.fhwa.dot.gov/policyinformation/statistics/2008/, accessed January 2010.

16. Pacific Environmental Services, Inc., "Draft Summary of the Analysis of the Emissions Reported in the 1999 NEI for Stage I and Stage II Operations at Gasoline Service Stations," prepared for the U.S. Environmental Protection Agency and the Emission Inventory Improvement Program, September 2002.

17. U.S. Environmental Protection Agency, “Compilation of Air Pollutant Emission Factors, AP-42, Fifth Edition, Volume I: Stationary Point and Area Sources, Chapter 7: Liquid Storage Tanks,” Office of Air Quality Planning and Standards, Emission Inventory Group, September 1997.

8.19 Open Burning: Household Waste and Municipal Solid Waste

The Missouri DNR accepted EPA's estimates of emissions for this source category. The documentation below was developed by EPA.

a. Source Category Description

Open burning of residential municipal solid waste (MSW) is the purposeful burning of MSW in outdoor areas. Criteria air pollutant (CAP) and hazardous air pollutant (HAP) emission estimates for MSW burning are a function of the amount of waste burned per year.

For this source category, the following SCC was assigned:

SCC	SCC Level 1	SCC Level 2	SCC Level 3	SCC Level 4
2610030000	Waste Disposal, Treatment, and Recovery	Open Burning	Residential	Household Waste (use 26-10-000-xxx for Yard Wastes)

b. Activity Data

The amount of household MSW burned was estimated using data from EPA's report *Municipal Solid Waste Generation, Recycling, and Disposal in the United States: Facts and Figures for 2010*.[1,2] The report presents the total mass of waste generated from the residential and commercial sectors in the United States by type of waste for the calendar year 2010. According to the EPA report, residential waste generation accounts for 55-65 percent of the total waste from the residential and commercial sectors.[3] For the calculation of per capita household waste subject to burning, the median value of 60 percent was assumed. This information was used to calculate a daily estimate of the per capita household waste subject to burning of 1.94 lbs/person/day. Non-combustible waste, such as glass and metals, was not considered to be waste subject to burning. Burning of yard waste is included in SCC 2610000100 and SCC 2610000400; therefore, it is not part of residential MSW. Approximately 25 to 32 percent of all waste that is subject to open burning is actually burned.[4,5] A median value of 28 percent is assumed to be burned in all counties in the United States.

Since open burning is generally not practiced in urban areas, only the rural population of each county was assumed to practice open burning. The ratio of urban to rural population was obtained from 2010 U.S. Census data.[6] This ratio was then multiplied by the 2010 U.S. Census Bureau estimate of the population in each county to obtain the county-level rural population for 2010.[7] The county-level rural population was then multiplied by the per capita household waste subject to burning to determine the amount of rural household MSW generated in each county in 2010.

c. Controls

Controls for residential MSW burning are generally in the form of a ban on open burning of waste in a given municipality or county. Counties that were more than 80% urban were assumed not to practice any open burning. Therefore, criteria pollutant and HAP emissions from residential municipal solid waste burning are zero in these counties. In addition, the State of Colorado implemented a state-wide ban on open burning. Emissions from open burning of residential waste in all Colorado counties were assumed to be zero.

d. Emission Factors

Emission factors are reported in the table below. Emission factors for CAPs were developed by the U.S. Environmental Protection Agency (EPA) in consultation with the Eastern Regional Technical Advisory Committee and based primarily on the AP-42 report.[8,9] Emission factors for HAPs are from an EPA Control Technology Center report and emission factors for 17 dioxin congeners were obtained from an EPA dioxin report.[10,11]

Emission Factors for Open Burning of Residential MSW (2610030000)

Pollutant	Pollutant Code	Emission Factor (lb/ton)	Emission Factor Reference	Emission Factor Verification
CO	CO	8.50E+01	Reference 9	Correct
NO_X	NO_X	6.00E+00	Reference 9	Correct
PM_{10}-FIL	PM_{10}-FIL	3.80E+01	Reference 8	Could not access reference paper.
PM_{10}-PRI	PM_{10}-PRI	3.80E+01	Reference 8	Could not access reference paper.
$PM_{2.5}$-FIL	$PM_{2.5}$-FIL	3.48E+01	Reference 8	Could not access reference paper.
$PM_{2.5}$-PRI	$PM_{2.5}$-PRI	3.48E+01	Reference 8	Could not access reference paper.
SO_2	SO_2	1.00E+00	Reference 9	Correct
VOC	VOC	8.56E+00	Reference 8	Could not access reference paper.
1,2,3,4,6,7,8-heptachlorodibenzofuran	67562394	2.48E-07	Reference 11	Could not find emission factor in reference paper.
1,2,3,4,6,7,8-heptachlorodibenzo-p-dioxin	35822469	7.96E-08	Reference 11	Could not find emission factor in reference paper.
1,2,3,4,7,8,9-heptachlorodibenzofuran	55673897	3.00E-08	Reference 11	Could not find emission factor in reference paper.
1,2,3,4,7,8-hexachlorodibenzofuran	70648269	2.28E-07	Reference 11	Could not find emission factor in reference paper.
1,2,3,4,7,8-hexachlorodibenzo-p-dioxin	39227286	1.28E-08	Reference 11	Could not find emission factor in reference paper.
1,2,3,6,7,8-hexachlorodibenzofuran	57117449	7.70E-08	Reference 11	Could not find emission factor in reference paper.
1,2,3,6,7,8-hexachlorodibenzo-p-dioxin	57653857	1.94E-08	Reference 11	Could not find emission factor in reference paper.
1,2,3,7,8,9-hexachlorodibenzofuran	72918219	5.00E-09	Reference 11	Could not find emission factor in reference paper.
1,2,3,7,8,9-hexachlorodibenzo-p-dioxin	19408743	3.80E-08	Reference 11	Could not find emission factor in reference paper.

Pollutant	Pollutant Code	Emission Factor (lb/ton)	Emission Factor Reference	Emission Factor Verification
1,2,3,7,8-pentachlorodibenzofuran	57117416	7.44E-08	Reference 11	Could not find emission factor in reference paper.
1,2,3,7,8-pentachlorodibenzo-p-dioxin	40321764	1.62E-08	Reference 11	Could not find emission factor in reference paper.
1,2,4-trichlorobenzene	120821	1.95E-04	Reference 10	Doesn't match Table 4.4
1,4-dichlorobenzene	106467	6.65E-05	Reference 10	Doesn't match Table 4.4
2,3,4,6,7,8-hexachlorodibenzofuran	60851345	1.24E-07	Reference 11	Could not find emission factor in reference paper.
2,3,4,7,8-pentachlorodibenzofuran	57117314	1.30E-07	Reference 11	Could not find emission factor in reference paper.
2,3,7,8-tetrachlorodibenzofuran	51207319	9.12E-08	Reference 11	Could not find emission factor in reference paper.
2,3,7,8-tetrachlorodibenzo-p-dioxin	1746016	5.40E-09	Reference 11	Could not find emission factor in reference paper.
Acenaphthene	83329	1.54E-03	Reference 10	Contaminants not listed in Table 4.4 were assumed to be correct and data results averaged.
Acenaphthylene	208968	2.26E-02	Reference 10	Matches value in Table 4.4
Acetalaldehyde	75070	8.57E-01	Reference 10	Not in paper anywhere
Acrolein	107028	6.19E-02	Reference 10	Contaminants not listed in Table 4.4 were assumed to be correct and data results averaged.
Anthracene	120127	3.66E-03	Reference 10	Contaminants not listed in Table 4.4 were assumed to be correct and data results averaged.
Benz[a]anthracene	56553	4.48E-03	Reference 10	Contaminants not listed in Table 4.4 were assumed to be correct and data results averaged.
Benzene	71432	2.48E+00	Reference 10	Contaminants not listed in Table 4.4 were assumed to be correct and data results averaged.
Benzo[a]pyrene	50328	4.24E-03	Reference 10	Contaminants not listed in Table 4.4 were assumed to be correct and data results averaged.
Benzo[b]fluoranthene	205992	5.26E-03	Reference 10	Contaminants not listed in Table 4.4 were assumed to be correct and data results averaged.
Benzo[g,h,i,]Perylene	191242	3.95E-03	Reference 10	Contaminants not listed in Table 4.4 were assumed to be correct and data results averaged.
Benzo[k]fluoranthene	207089	2.05E-03	Reference 10	Contaminants not listed in Table 4.4 were assumed to be correct and data results averaged.
Chlorobenzene	108907	8.48E-04	Reference 10	Contaminants not listed in Table 4.4 were assumed to be correct and data results averaged.

Pollutant	Pollutant Code	Emission Factor (lb/ton)	Emission Factor Reference	Emission Factor Verification
Chrysene	218019	5.07E-03	Reference 10	Contaminants not listed in Table 4.4 were assumed to be correct and data results averaged.
Dibenzo[a,h]anthracene	53703	6.46E-04	Reference 10	Contaminants not listed in Table 4.4 were assumed to be correct and data results averaged.
Fluoranthene	206440	8.14E-03	Reference 10	Contaminants not listed in Table 4.4 were assumed to be correct and data results averaged.
Fluorene	86737	7.31E-03	Reference 10	Contaminants not listed in Table 4.4 were assumed to be correct and data results averaged.
Hexachlorobenzene	118741	4.40E-05	Reference 10	Matches value in Table 4.4
Hydrochloric Acid	7647010	5.68E-01	Reference 10	Matches value in Table 4.4 but why not using the highest value as compared to the lowest?
Hydrogen Cyanide	74908	9.36E-01	Reference 10	Matches value in Table 4.4
Indeno[1,2,3-c,d]pyrene	193395	3.75E-03	Reference 10	
Naphthalene	91203	3.51E-02	Reference 10	Matches value in Table 4.4
Octachlorodibenzofuran	39001020	7.28E-08	Reference 11	Could not find emission factor in reference paper.
Octachlorodibenzo-p-dioxin	3268879	9.94E-08	Reference 11	Could not find emission factor in reference paper.
Pentachlorophenol	87865	1.06E-04	Reference 10	Contaminants not listed in Table 4.4 were assumed to be correct and data results averaged.
Phenanthrene	85018	1.46E-02	Reference 10	Matches value in Table 4.4
Phenol	108952	2.80E-01	Reference 10	Matches value in Table 4.4
Polychlorinated Biphenyls	1336363	5.72E-03	Reference 10	Contaminants not listed in Table 4.4 were assumed to be correct and data results averaged.
Pyrene	129000	9.66E-03	Reference 10	Contaminants not listed in Table 4.4 were assumed to be correct and data results averaged.
Styrene	100425	1.48E+00	Reference 10	Matches value in Table 4.4

e. Emissions

County-level criteria pollutant and HAP emissions were calculated by multiplying the total amount of residential municipal solid waste burned per year by an emission factor.

f. Example Calculations

VOC emissions in Autauga County, Alabama from open burning of residential MSW:

Population of Autauga County in 2010 = 54,571

Rural fraction of Autauga County population = 0.42

Per capita MSW generated (lb/person/day) = 1.9435

Fraction of rural population that burns MSW = 0.28

Number of days in a year = 365

Factor to convert from lbs to tons = 1/2000

2010 MSW burning activity in Autauga County = 54,571 * 0.42 * 1.9435 * 0.28 * 365 * 1/2000

2010 MSW activity in Autauga County = 2,276 tons

VOC emissions = MSW burned * VOC emission factor

VOC emission factor = 8.56 lb/ton

VOC emissions from MSW burning in Autauga County = 2,276 tons * 8.56 lbs/ton * 1 ton/2000 lbs

VOC emissions from MSW burning in Autauga County in 2010 = 9.74 tons

g. QA/QC

I. Methodology

The methodology was reviewed and understood with no questions. EIIP information was also reviewed and survey information may be beneficial to update Missouri emission factors.

II. Data

The data was checked for the listed emission factors in the emission factor table above. Please see column 5 of that table for emission factor review comments. Many emission factors could be found, some could not be replicated from the Reference documents available. Despite these shortcomings, the amount of time to find replacement emission factors is prohibitive, so EPA's factors will be accepted for 2011. ***For future NEI submittals, Missouri will spend more time on verification of emission factors and retrieving reference materials.***

III. Math

The formulas from the excel spreadsheet data were check and verified with no discrepancies.

IV. Overall

Missouri will accept EPA's estimates for the residential municipal solid waste burning category despite unverified emission factors.

h. References

1. U.S. Environmental Protection Agency, *Municipal Solid Waste Generation, Recycling, and Disposal in the United States: Facts and Figures for 2010*, "Table 1. Materials Generated in the Municipal Waste Stream, 1960 to 2010," December 2011, available at http://www.epa.gov/epawaste/nonhaz/municipal/pubs/2010_MSW_Tables_and_Figures_508.pdf (accessed April 2012).

2. U.S. Environmental Protection Agency, *Municipal Solid Waste Generation, Recycling, and Disposal in the United States: Facts and Figures for 2010*, "Table 2. Materials Recovered in the Municipal Waste Stream, 1960 to 2010," December 2011, available at http://www.epa.gov/epawaste/nonhaz/municipal/pubs/2010_MSW_Tables_and_Figures_508.pdf (accessed April 2012).

3. U.S. Environmental Protection Agency, *Municipal Solid Waste Generation, Recycling, and Disposal in the United States: Facts and Figures for 2010—Fact Sheet*," p. 4,December 2011, available at http://www.epa.gov/epawaste/nonhaz/municipal/pubs/msw_2010_rev_factsheet.pdf (accessed April 2012).

4. U.S. Environmental Protection Agency, Region V. "Emission Characteristics of Burn Barrels." Prepared by Two Rivers Regional Council of Public Officials and Patrick Engineering, Inc. June 1994.

5. *Garbage Burning in Rural Minnesota: Key Results and Findings*, prepared by Zenith Research Group for Minnesota Pollution Control Agency, June 2010, available at http://www.pca.state.mn.us/index.php/view-document.html?gid=14316 (accessed June 10, 2011).

6. U.S. Census Bureau, Decennial Censuses, 2010 Census: SF1, Table P2

7. U.S. Census Bureau. *Annual Estimates of the Resident Population for the United States, Regions, States, and Puerto Rico: April 1, 2010 to July 1, 2011 (NST-EST2011-01),* available at http://www.census.gov/popest/data/national/totals/2011/index.html (accessed April 2012).

8. Huntley, Roy, U.S. Environmental Protection Agency, "state_comparison ERTAC SS_version7_3 Oct 20 2009 [electronic file]," November 5, 2009.

9. United States Environmental Protection Agency, Office of Air Quality Planning and Standards. *Compilation of Air Pollutant Emission Factors, AP-42, Fifth Edition, Volume I: Stationary Point and Area Sources, Section 2.5 Open Burning*. Research Triangle Park, NC. October 1992.

10. U.S. Environmental Protection Agency, Control Technology Center. "Evaluation of Emissions from the Open Burning of Household Waste in Barrels." EPA-600/R-97-134a. November 1997.

11. United States Environmental Protection Agency, Office of Research and Development. *Exposure and Human Health Reassessment of 2,3,7,8-Tetrachlorodibenzeno-p-Dioxin (TCCD) and Related Compounds. Part I: Estimating Exposure to Dioxin-Like Compounds. Volume 2: Sources of Dioxin-Like Compounds in the United States*. EPA/600/P-00/001Ab. Washington D.C. March 2001.

8.20 Open Burning: Land Clearing Debris

The Missouri DNR accepted EPA's estimates of emissions for this source category, but added Hazardous Air Pollutant data to EPA's Criteria Air Pollutant data. The documentation below was developed by EPA.

a. Source Category Description

Open burning of land clearing debris is the purposeful burning of debris, such as trees, shrubs, and brush, from the clearing of land for the construction of new buildings and highways. Criteria air pollutant (CAP) and hazardous air pollutant (HAP) emission estimates from open burning of land clearing debris are a function of the amount of material or fuel subject to burning per year.

For this source category, the following SCC was assigned:

SCC	SCC Level 1	SCC Level 2	SCC Level 3	SCC Level 4
2610000500	Waste Disposal, Treatment, and Recovery	Open Burning	All Categories	Land Clearing Debris (use 28-10-005-000 for Logging Debris Burning)

b. Activity Data

The amount of material burned was estimated using the county-level total number of acres disturbed by residential, non-residential, and road construction. County-level weighted loading factors were applied to the total number of construction acres to convert acres to tons of available fuel.

<u>Acres Disturbed from Residential Construction</u>

The US Census Bureau has 2010 data for *Housing Starts - New Privately Owned Housing Units Started*[1] which provides regional level housing starts based on the groupings of 1 unit, 2-4 units, 5 or more units. A consultation with the Census Bureau in 2002 gave a breakdown of approximately 1/3 of the housing starts being for 2 unit structures, and 2/3 being for 3 and 4 unit structures. The 2-4 unit category was divided into 2-units, and 3-4 units based on this ratio. To determine the number of structures for each grouping, the 1 unit category was divided by 1, the 2 unit category was divided by 2, and the 3-4 unit category was divided by 3.5. The 5 or more unit category may be made up of more than one structure. *New Privately Owned Housing Units Authorized Unadjusted Units*[2] gives a conversion factor to determine the ratio of structures to units in the 5 or more unit category. For example if a county has one 40 unit apartment building, the ratio would be 40/1. If there are 5 different 8 unit buildings in the same project, the ratio would be 40/5. Structures started by category are then calculated at a regional level. The table *Annual Housing Units Authorized by Building Permit*[3] has 2010 data at the county level to allocate regional housing starts to the county level. This results in county level housing starts by number of units. The following surface areas were assumed disturbed for each unit type:

Surface Acres Disturbed per Unit Type

1-Unit	1/4 acre/structure
2-Unit	1/3 acre/structure
Apartment	1/2 acre/structure

The 3-4 unit and 5 or more unit categories were considered to be apartments. Multiplication of housing starts to surface acres disturbed results in total number of acres disturbed for each unit category.

<u>Acres Disturbed from Non-Residential Construction</u>

Annual Value of Construction Put in Place in the U.S[4] has the 2011 National Value of Non-residential construction. The national value of non-residential construction put in place (in millions of dollars) was allocated to counties using county-level non-residential construction (NAICS Code 2362) employment data obtained from *County Business Patterns*[5] *(CBP)*. Because some county employment data was withheld due to privacy concerns, the following procedure was adopted:

4. State totals for the known county level employees were subtracted from the number of employees reported in the state level version of CBP. This results in the total number of withheld employees in the state.

5. A starting estimate of the midpoint of the range code was used (so for instance in the 1-19 employees range, an estimate of 10 employees would be used) and a state total of the withheld counties was computed.

6. A ratio of estimated employees (Step 2) to withheld employees (Step 1) was then used to adjust the county level estimates up or down so the state total of adjusted guesses should match state total of withheld employees (Step 1)

In 1999 a figure of 2 acres/$\$10^6$ was developed. The Bureau of Labor Statistics *Producer Price Index*[6] lists costs of the construction industry from 1999-11

$$\begin{aligned}\text{2011 acres per } \$10^6 &= \text{1999 acres per } \$10^6 \text{ x (1999 PPI / 2011 PPI)}\\ &= 2 \text{ acres/}\$10^6 \text{ (132.9 / 229.3)}\\ &= 1.159 \text{ acres per } \$10^6\end{aligned}$$

Acres Disturbed by Road Construction

The Federal Highway Administration provides data on spending by state in several different categories of road construction and maintenance in *Highway Statistics, Section IV - Highway Finance, Table SF-12A, State Highway Agency Capital Outlay*[7] for 2008. (Note that this table has not been available in subsequent versions of *Highway Statistics*. Thus, 2008 is the latest data currently available.) For this SCC, the following sets of data (or columns) are used: New Construction, Relocation, Added Capacity, Major Widening, and Minor Widening. Each of these data sets are also differentiated according to the following six roadway classifications:

1. Interstate, urban
2. Interstate, rural
3. Other arterial, urban
4. Other arterial, rural
5. Collectors, urban
6. Collectors, rural

The State expenditure data are then converted to new miles of road constructed using $/mile conversions obtained from the North Carolina Department of Transportation (NCDOT) in 2000. A conversion of $4 million/mile was applied to the interstate expenditures. For expenditures on other arterial and collectors, a conversion factor of $1.9 million/mile was applied, which corresponds to all other projects.

The new miles of road constructed are used to estimate the acreage disturbed due to road construction. The total area disturbed in each state was calculated by converting the new miles of road constructed to acres using an acres disturbed/mile conversion factor for each road type as given in the table below:

Spending per Mile and Acres Disturbed per Mile by Highway Type

Road Type	Thousand Dollars per mile	Acres Disturbed per mile
Urban Areas, Interstate	4000	15.2
Rural Areas, Interstate	4000	15.2
Urban Areas, Other Arterials	1900	15.2
Rural Areas, Other Arterials	1900	12.7
Urban Areas, Collectors	1900	9.8
Rural Areas, Collectors	1900	7.9

County-level building permits data are used to allocate the state-level acres disturbed by road construction to the county.[8] A ratio of the number of building starts in each county to the total number of building starts in each state was applied to the state-level acres disturbed to estimate the total number of acres disturbed by road construction in each county.

Converting Acres Disturbed to Tons of Land Clearing Debris Burned

Version 2 of the Biogenic Emissions Land cover Database (BELD2) within EPA's Biogenic Emission Inventory System (BEIS) was used to identify the acres of hardwoods, softwoods, and grasses in each county. The table below presents the average fuel loading factors by vegetation type. The average loading factors for slash hardwood and slash softwood were adjusted by a factor of 1.5 to account for the mass of tree that is below the soil surface that would be subject to burning once the land is cleared.[9] Weighted average county-level loading factors were calculated by multiplying the average loading factors by the percent contribution of each type of vegetation class to the total land area for each county.

Fuel Loading Factors by Vegetation Type

Vegetation Type	Unadjusted Average Fuel Loading Factor (Ton/acre)	Adjusted Average Fuel Loading Factor (Ton/acre)
Hardwood	66	99
Softwood	38	57
Grass	4.5	Not Applicable

The total acres disturbed by all construction types was calculated by summing the acres disturbed from residential, non-residential, and road construction. The county-level total acres disturbed were then multiplied by the weighted average loading factor to derive tons of land clearing debris.

c. Controls

Controls for land clearing debris burning are generally in the form of a ban on open burning of waste in a given municipality or county. Counties that were more than 80% urban were assumed not to practice any open burning. Therefore, criteria pollutant and HAP emissions from open burning of land clearing debris are zero in these counties. In addition, the State of Colorado implemented a state-wide ban on open burning. Emissions from open burning of land clearing debris in all Colorado counties were assumed to be zero.

d. Emission Factors

Emission factors are reported in the table below. Emission factors for CAPs were developed by the U.S. Environmental Protection Agency (EPA) in consultation with the Eastern Regional Technical Advisory Committee and based primarily on the AP-42 report.[10,11] The $PM_{2.5}$ to PM_{10} emission factor ratio for brush burning (0.7709) was multiplied by the PM_{10} emission factors for land clearing debris burning to develop $PM_{2.5}$ emission factors. Emission factors for HAPs are from an EPA Control Technology Center report[12] and emission factors for 17 dioxin congeners were obtained from an EPA dioxin report.[13] The dioxin emission factors were multiplied by 0.002 to convert from mg/kg to lb/ton.

Emission Factors for Open Burning of Land Clearing Debris (SCC 2610000500)

Pollutant	Pollutant Code	Emission Factor (lb/ton)	Emission Factor Reference
VOC	VOC	11.6	Reference 10
NO_X	NO_X	5	Reference 10
CO	CO	169	Reference 10
PM_{10}-FIL	PM_{10}-FIL	17	Reference 10

$PM_{2.5}$-FIL	$PM_{2.5}$-FIL	13.1	PM_{10}-FIL multiplied by 0.7709
PM_{10}-PRI	PM_{10}-PRI	17	Reference 10
$PM_{2.5}$-PRI	$PM_{2.5}$-PRI	13.1	PM_{10}-PRI multiplied by 0.7709
1,2,3,4,6,7,8-HpCDD	35822469	3.33E-07	Reference 13
1,2,3,4,6,7,8-HpCDF	67562394	5.08E-08	Reference 13
1,2,3,4,7,8,9-HpCDF	55673897	6.12E-09	Reference 13
1,2,3,4,7,8-HxCDD	39227286	1.14E-08	Reference 13
1,2,3,4,7,8-HxCDF	70648269	3.34E-08	Reference 13
1,2,3,6,7,8-HxCDD	57653857	2.14E-08	Reference 13
1,2,3,6,7,8-HxCDF	57117449	1.43E-08	Reference 13
1,2,3,7,8,9-HxCDD	19408743	3.47E-08	Reference 13
1,2,3,7,8,9-HxCDF	72918219	2.23E-09	Reference 13
1,2,3,7,8-PeCDD	40321764	7.66E-09	Reference 13
1,2,3,7,8-PeCDF	57117416	1.27E-08	Reference 13
2,3,4,6,7,8-HxCDF	60851345	1.96E-08	Reference 13
2,3,4,7,8-PeCDF	57117314	2.02E-08	Reference 13
2,3,7,8-TCDD	1746016	2.30E-09	Reference 13
2,3,7,8-TCDF	51207319	1.40E-08	Reference 13
Cumene	98828	1.33E-02	Reference 12
Dibenzofuran	132649	6.75E-03	Reference 12
Ethyl Benzene	100414	4.80E-02	Reference 12
OCDD	3268879	1.33E-06	Reference 13
OCDF	39001020	2.05E-08	Reference 13
Phenol	108952	1.15E-01	Reference 12
Styrene	100425	1.02E-01	Reference 12

e. Emissions

County-level criteria pollutant and HAP emissions were calculated by multiplying the total mass of land clearing debris burned per year by an emission factor.

f. Example Calculations

VOC emissions in Autauga County, Alabama from open burning of land clearing debris:

Rural fraction of Autauga County population = 0.42, so no emission controls

Acres disturbed by residential, non-residential, and road construction in Autauga County = 84.83
Weighted average fuel loading factor for Autauga County = 65.48 tons/acre

Mass of land clearing debris burned = 84.83 acres * 65.48 tons/acre = 5,555 tons

VOC emission factor = 11.6 lbs/ton
Factor to convert from lbs to tons = 1/2000

VOC emissions = tons of land clearing debris burned * VOC emission factor

VOC emissions from land clearing debris burning = 5,555 tons * 11.6 lbs/ton * 1 ton/2000 lbs

VOC emissions from land clearing debris burning in Autauga County in 2010 = 32 tons

g. QA/QC

1. Surrogate methods seem reasonable for determining activity level for land clearing for residential, non-residential, and road construction.
2. Reference 10, "state_comparison ERTAC SS_version7_3 Oct 20 2009" cannot be found. The closest document that can be found is "state_comparison_ERTAC_SS_version7.2_23nov2009." The values in the two documents for emissions from open burning of land-clearing debris appear to be the same.
3. The values for the non-residential category in "Value of Private Construction Put in Place - Not Seasonally Adjusted" do not match the values shown in the reference at http://www.census.gov/const/C30/priv2011.pdf. This same discrepancy was found in the non-residential construction- fugitive dust category. The corrected values are used to update the calculation of the number of acres cleared and affected by open burning for land clearing.
4. The estimate of acres disturbed from non-residential construction uses an assumed value from 1999 of 2 acres/$\$10^6$, which is adjusted to 2011. The source of the 2 acres/$\$10^6$ is not given and cannot be verified.

h. References

1. U.S. Census Bureau, "New Privately Owned Housing Units Started for 2010 (Not seasonally adjusted)," available at http://www.census.gov/const/startsua.pdf

2. U.S. Census Bureau, "Table 2au. New Privately Owned Housing Units Authorized Unadjusted Units for Regions, Divisions, and States, Annual 2010" available at http://www.census.gov/const/C40/Table2/tb2u2010.txt

3. Annual Housing Units Authorized by Building Permits CO2010A, purchased from US Department of Census

4. U.S. Census Bureau, "Annual Value of Construction Put in Place," available at http://www.census.gov/const/www/ototpage.html

5. U.S. Census Bureau, "County Business Patterns," available at http://www.census.gov/econ/cbp/index.html

6. Bureau of Labor Statistics, Producer Price Index, Table BMNR, available at http://www.bls.gov/data/

7. Federal Highway Administration, 2008 Highway Spending, available at http://www.fhwa.dot.gov/policyinformation/statistics/2008/sf12a.cfm
8. 2008 Building Permits data from US Census "BPS01", http://www.census.gov/support/USACdataDownloads.html

9. Ward, D.E., C.C. Hardy, D.V. Sandberg, and T.E. Reinhardt. "Mitigation of Prescribed Fire Atmospheric Pollution through Increased Utilization of Hardwoods, Piled Residues, and Long-Needled Conifers." Final Report. USDA Forest Service, Pacific Northwest Research Station, Fire and Air Resource Management. 1989.

10. Huntley, Roy, U.S. Environmental Protection Agency, "state_comparison ERTAC SS_version7_3 Oct 20 2009 [electronic file]," November 5, 2009.

11. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. *Compilation of Air Pollutant Emission Factors, AP-42, Fifth Edition, Volume I: Stationary Point and Area Sources, Section 2.5 Open Burning*. Research Triangle Park, NC. October 1992.

12. U.S. Environmental Protection Agency, "Evaluation of Emissions from the Open Burning of Household Waste in Barrels, EPA-600/R-97-134a," Control Technology Center. November 1997.

13. Gullet, B.K. and T. Abderrahmne, "PCDD/F Emissions from Forest Fire Simulations," *Atmospheric Environment*, Vol. 37, No. 6, pp. 803-813. February 2003.

Emission Factors for Open Burning of Land Clearing Debris (SCC 2610000500)

Pollutant	Pollutant Code	Emission Factor (lb/ton)	Emission Factor Reference
VOC	VOC	11.6	Reference 10
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CO	CO	169	Reference 10
PM_{10}-FIL	PM_{10}-FIL	17	Reference 10
$PM_{2.5}$-FIL	$PM_{2.5}$-FIL	13.1	PM_{10}-FIL multiplied by 0.7709
PM_{10}-PRI	PM_{10}-PRI	17	Reference 10
$PM_{2.5}$-PRI	$PM_{2.5}$-PRI	13.1	PM_{10}-PRI multiplied by 0.7709
1,2,3,4,6,7,8-HpCDD	35822469	3.33E-07	Reference 13
1,2,3,4,6,7,8-HpCDF	67562394	5.08E-08	Reference 13
1,2,3,4,7,8,9-HpCDF	55673897	6.12E-09	Reference 13
1,2,3,4,7,8-HxCDD	39227286	1.14E-08	Reference 13
1,2,3,4,7,8-HxCDF	70648269	3.34E-08	Reference 13
1,2,3,6,7,8-HxCDD	57653857	2.14E-08	Reference 13
1,2,3,6,7,8-HxCDF	57117449	1.43E-08	Reference 13
1,2,3,7,8,9-HxCDD	19408743	3.47E-08	Reference 13
1,2,3,7,8,9-HxCDF	72918219	2.23E-09	Reference 13
1,2,3,7,8-PeCDD	40321764	7.66E-09	Reference 13
1,2,3,7,8-PeCDF	57117416	1.27E-08	Reference 13
2,3,4,6,7,8-HxCDF	60851345	1.96E-08	Reference 13
2,3,4,7,8-PeCDF	57117314	2.02E-08	Reference 13
2,3,7,8-TCDD	1746016	2.30E-09	Reference 13
2,3,7,8-TCDF	51207319	1.40E-08	Reference 13
Cumene	98828	1.33E-02	Reference 12
Dibenzofuran	132649	6.75E-03	Reference 12
Ethyl Benzene	100414	4.80E-02	Reference 12
OCDD	3268879	1.33E-06	Reference 13
OCDF	39001020	2.05E-08	Reference 13
Phenol	108952	1.15E-01	Reference 12
Styrene	100425	1.02E-01	Reference 12

8.21 Open Burning: Yard Waste

The Missouri DNR accepted EPA's estimates of emissions for this source category. The documentation below was developed by EPA.

a. Source Category Description

Open burning of yard waste is the purposeful burning of leaf and brush species in outdoor areas. Criteria air pollutant (CAP) and hazardous air pollutant (HAP) emission estimates for leaf and brush waste burning are a function of the amount of waste burned per year.

For this source category, the following SCCs were assigned:

SCC	SCC Level 1	SCC Level 2	SCC Level 3	SCC Level 4
2610000100	Waste Disposal, Treatment, and Recovery	Open Burning	All Categories	Yard Waste – Leaf Species Unspecified
2610000400	Waste Disposal, Treatment, and Recovery	Open Burning	All Categories	Yard Waste – Brush Species Unspecified

b. Activity Data

The amount of leaf and brush waste burned was estimated using data from EPA's report *Municipal Solid Waste Generation, Recycling, and Disposal in the United States: Facts and Figures for 2010.*[1,2] The report presents the total mass of waste generated from the residential and commercial sectors, including yard waste, in the United States by type of waste for the calendar year 2010. According to the EPA report, residential waste generation accounts for 55-65 percent of the total waste from the residential and commercial sectors.[3] For the calculation of per capita yard waste subject to burning, the median value of 60 percent was assumed. This information was used to calculate a daily estimate of the per capita yard waste of 0.36 lbs/person/day. Of the total amount of yard waste generated, the yard waste composition was assumed to be 25 percent leaves, 25 percent brush, and 50 percent grass by weight.[4]

Open burning of grass clippings is not typically practiced by homeowners, and as such only estimates for leaf burning and brush burning were developed. Approximately 25 to 32 percent of all waste that is subject to open burning is actually burned.[4] A median value of 28 percent is assumed to be burned in all counties in the United States.

The per capita estimate was then multiplied by the 2010 population in each county that is expected to burn waste. Since open burning is generally not practiced in urban areas, only the rural population of each county was assumed to practice open burning. The ratio of urban to rural population was obtained from 2010 U.S. Census data.[5] This ratio was then multiplied by the 2010 U.S. Census Bureau estimate of the population in each county to obtain the county-level rural population for 2010.[6]

The percentage of forested acres from Version 2 of BELD2 within BEIS was used to adjust for variations in vegetation. The percentage of forested acres per county (including rural forest and urban forest) was then determined. To better account for the native vegetation that would likely be occurring in the residential yards of farming States, agricultural land acreage was subtracted before calculating the percentage of forested acres. The table below presents the ranges that were used to make adjustments to the amount of yard waste that is assumed to be generated per county. All municipios in Puerto Rico and counties in the U.S. Virgin Islands, Hawaii, and Alaska were assumed to have greater than 50 percent forested acres.

Adjustment for Percentage of Forested Acres

Percent Forested Acres per County	Adjustment for Yard Waste Generated
< 10%	0% generated
>= 10%, and < 50%	50% generated
>= 50%	100% generated

c. Controls

Controls for yard waste burning are generally in the form of a ban on open burning of waste in a given municipality or county. Counties that were more than 80% urban were assumed not to practice any open burning. Therefore, criteria pollutant and HAP emissions from residential yard waste burning are zero in these counties. In addition, the State of Colorado implemented a state-wide ban on open burning. Emissions from open burning of residential yard waste in all Colorado counties were assumed to be zero.

d. Emission Factors

Emission factors are specific to yard waste type and are reported in the corresponding tables below. Emission factors for CAPs were developed by the U.S. Environmental Protection Agency (EPA) in consultation with the Eastern Regional Technical Advisory Committee.[7] For leaf burning, emission factors for $PM_{2.5}$ were calculated by multiplying the PM_{10} leaf burning emission factors by the $PM_{2.5}$ to PM_{10} emission factor ratio for brush burning (0.7709). Emission factors for HAPs are from an EPA Control Technology Center report.[8] Forest fire simulation emission factors were used to estimate emissions for 17 dioxin congeners.[9]

e. Emissions

County-level criteria pollutant and HAP emissions were calculated by multiplying the total amount of yard waste (either leaf or brush) burned per year by an emission factor. Emissions for leaves and residential brush were calculated separately, since emission factors vary by yard waste type.

f. Example Calculations

VOC emissions in Autauga County, Alabama from open burning of leaf waste:

Population of Autauga County in 2010 = 54,571

Rural fraction of Autauga County population = 0.42

Per capita waste yard waste generated (lb/person/day) = 0.3557

Leaf fraction of waste = 0.25

Fraction of rural population that burns yard waste = 0.28

Adjustment factor based on % forested acres = 1

Number of days in a year = 365

Factor to convert from lbs to tons = 1/2000

2010 leaf burning activity in Autauga County = 54,571 * 0.42 * 0.3557 * 0.25 * 0.28 * 1 * 365 * 1/2000

2010 leaf burning activity in Autauga County = 104.15 tons

VOC emissions = tons of leaves burned * VOC emission factor

VOC emission factor = 28 lb/ton

VOC emissions from leaf burning in Autauga County in 2010 = 104.15 tons * 28 lbs/ton * 1 ton/2000 lbs

VOC emissions from leaf burning in Autauga County in 2010 = 1.46 tons

g. QA/QC

1. Methodology: Appears to be adequate and accurate.
    a. Paragraph b. 1 - all of the referenced material confirmed and matches, except for the last sentence about the composition of yard waste consisting of 25% leaves, 25% brush, and 50% grass – this info is referenced in a book, which cannot be obtained electronically(same as 2008). One change from 2008 is the addition of sentences 3 and 4, which assumes 60% of all residential and commercial waste is yard waste subject to burning. Still seems high, but this was not factored at all in 2008. This additional factor results in reducing the total VOC emissions by approximately 40%.
    b. Paragraph b. 2 - Removed grass clipping burning factor since no one burns their grass clippings (same as 2008).

c. Paragraph b. 3 – Removed urban population factor since urban areas generally do not allow open burning. Paragraph c. - Counties that are more than 80% urban are assumed to have NO residential open burning.
d. Paragraph b. 4 – Agricultural/non-forested acres was removed from equation – some places just don't have many trees.
e. Paragraph d. – $PM_{2.5}$ emission factor change is explained. The 2008 emission factor was 22. It is now 16.96.
f. References – a little different than in 2008 – nothing significant.
g. Tables of emission factors for pollutants – everything here is the same as 2008 except:
    i. Methyl Ethyl Ketone was removed from the current list/table
    ii. The emission factor for $PM_{2.5}$ FIL and PRI changed from 22 in 2008 to 16.96 in 2011.

2. Data and Calcs: I checked the math for the counties of Adair, Franklin, Gasconade, Jefferson, Lincoln, and Montgomery for the pollutants of PM_{10} primary, NO_x, and VOC. I didn't find any mistakes – only discrepancies from inconsistent use of significant figures (EPA uses 2-4 sig figs – I always used 2 and the end result always came out very close – only varied by a hundredth or thousandth).
3. Overall: Appears everything is accurate in this document and the associated data. I compared this 2011 document to DNR's 2008 version and everything matches except for the items added, which are in red above. I have a marked up hard copy of this document compared to the 2008 version in case you would like to visually see the differences.

h. References

1. U.S. Environmental Protection Agency, *Municipal Solid Waste Generation, Recycling, and Disposal in the United States: Facts and Figures for 2010*, "Table 1. Materials Generated in the Municipal Waste Stream, 1960 to 2010," December 2011, available at http://www.epa.gov/epawaste/nonhaz/municipal/pubs/2010_MSW_Tables_and_Figures_508.pdf (accessed April 2012).

2. U.S. Environmental Protection Agency, *Municipal Solid Waste Generation, Recycling, and Disposal in the United States: Facts and Figures for 2010*, "Table 2. Materials Recovered in the Municipal Waste Stream, 1960 to 2010," December 2011, available at http://www.epa.gov/epawaste/nonhaz/municipal/pubs/2010_MSW_Tables_and_Figures_508.pdf (accessed April 2012).

3. U.S. Environmental Protection Agency, *Municipal Solid Waste Generation, Recycling, and Disposal in the United States: Facts and Figures for 2010—Fact Sheet*," p. 4,December 2011, available at http://www.epa.gov/epawaste/nonhaz/municipal/pubs/msw_2010_rev_factsheet.pdf (accessed April 2012).

4. Two Rivers Regional Council of Public Officials and Patrick Engineering, Inc. "Emission Characteristics of Burn Barrels," prepared for the U.S. Environmental Protection Agency, Region V. June 1994.

5. U.S. Census Bureau, Decennial Censuses, 2010 Census: SF1, Table P2

6. U.S. Census Bureau. *Annual Estimates of the Resident Population for the United States, Regions, States, and Puerto Rico: April 1, 2010 to July 1, 2011 (NST-EST2011-01),* available at http://www.census.gov/popest/data/national/totals/2011/index.html (accessed April 2012).

7. Huntley, Roy, U.S. Environmental Protection Agency, "state_comparison ERTAC SS_version7_3 Oct 20 2009 [electronic file]," November 5, 2009.

8. U.S. Environmental Protection Agency, *Evaluation of Emissions from the Open Burning of Household Waste in Barrels*, EPA-600/R-97-134a, Control Technology Center. November 1997.

9. Gullet, B.K. and T. Abderrahmne, "PCDD/F Emissions from Forest Fire Simulations," *Atmospheric Environment*, Vol. 37, No. 6, pp. 803-813. February 2003.

Emission Factors for Open Burning of Leaf Species (SCC 2610000100)

Pollutant	Pollutant Code	Emission Factor (lb/ton)	Emission Factor Reference
1,2,3,4,6,7,8-heptachlorodibenzofuran	67562394	5.08E-08	Reference 9
1,2,3,4,6,7,8-heptachlorodibenzo-p-dioxin	35822469	3.32E-07	Reference 9
1,2,3,4,7,8,9-heptachlorodibenzofuran	55673897	6.12E-09	Reference 9
1,2,3,4,7,8-hexachlorodibenzofuran	70648269	3.34E-08	Reference 9
1,2,3,4,7,8-hexachlorodibenzo-p-dioxin	39227286	1.136E-08	Reference 9
1,2,3,6,7,8-hexachlorodibenzofuran	57117449	1.428E-08	Reference 9
1,2,3,6,7,8-hexachlorodibenzo-p-dioxin	57653857	2.14E-08	Reference 9
1,2,3,7,8,9-hexachlorodibenzofuran	72918219	2.22E-09	Reference 9
1,2,3,7,8,9-hexachlorodibenzo-p-dioxin	19408743	3.46E-08	Reference 9
1,2,3,7,8-pentachlorodibenzofuran	57117416	1.268E-06	Reference 9
1,2,3,7,8-pentachlorodibenzo-p-dioxin	40321764	7.66E-09	Reference 9
2,3,4,6,7,8-hexachlorodibenzofuran	60851345	1.962E-08	Reference 9
2,3,4,7,8-pentachlorodibenzofuran	57117314	2.02E-08	Reference 9
2,3,7,8-tetrachlorodibenzofuran	51207319	1.396E-08	Reference 9
2,3,7,8-tetrachlorodibenzo-p-dioxin	1746016	2.3E-09	Reference 9
CO	CO	112	Reference 7
Cumene	98828	0.01325	Reference 8
Ethyl Benzene	100414	0.048	Reference 8
Nitrogen Oxides	NO_X	6.2	Reference 7
Octachlorodibenzofuran	39001020	2.06E-08	Reference 9
Octachlorodibenzo-p-dioxin	3268879	1.328E-06	Reference 9
Phenol	108952	0.115	Reference 8
PM_{10}-FIL	PM_{10}-FIL	22	Reference 7
PM_{10}-PRI	PM_{10}-PRI	22	Reference 7
$PM_{2.5}$-FIL	$PM_{2.5}$-FIL	16.96	0.7709 * PM_{10}
$PM_{2.5}$-PRI	$PM_{2.5}$-PRI	16.96	0.7709 * PM_{10}
Styrene	100425	0.1015	Reference 8
Sulfur Dioxide	SO_2	0.76	Reference 7
VOC	VOC	28	Reference 7

Emission Factors for Open Burning of Brush Species (SCC 2610000400)

Pollutant	Pollutant Code	Emission Factor (lb/ton)	Emission Factor Reference
CO	CO	140	Reference 7
Nitrogen Oxides	NOX	5	Reference 7
PM_{10}-PRI	PM_{10}-PRI	19.73	Reference 7
PM_{10}-FIL	PM_{10}-FIL	19.73	Reference 7
$PM_{2.5}$-PRI	$PM_{2.5}$-PRI	15.21	Reference 7
$PM_{2.5}$-FIL	$PM_{2.5}$-FIL	15.21	Reference 7
Sulfur Dioxide	SO_2	1.66	Reference 7
VOC	VOC	19	Reference 7
1,2,3,4,6,7,8-heptachlorodibenzofuran	35822469	3.32E-07	Reference 9
1,2,3,4,6,7,8-heptachlorodibenzo-p-dioxin	67562394	5.08E-08	Reference 9
1,2,3,4,7,8,9-heptachlorodibenzofuran	55673897	6.12E-09	Reference 9
1,2,3,4,7,8-hexachlorodibenzofuran	70648269	3.34E-08	Reference 9
1,2,3,4,7,8-hexachlorodibenzo-p-dioxin	39227286	1.136E-08	Reference 9
1,2,3,6,7,8-hexachlorodibenzofuran	57117449	1.428E-08	Reference 9
1,2,3,6,7,8-hexachlorodibenzo-p-dioxin	57653857	2.14E-08	Reference 9
1,2,3,7,8,9-hexachlorodibenzofuran	72918219	2.22E-09	Reference 9
1,2,3,7,8,9-hexachlorodibenzo-p-dioxin	19408743	3.46E-08	Reference 9
1,2,3,7,8-pentachlorodibenzofuran	57117416	1.268E-06	Reference 9
1,2,3,7,8-pentachlorodibenzo-p-dioxin	40321764	7.66E-09	Reference 9
2,3,4,6,7,8-hexachlorodibenzofuran	60851345	1.962E-08	Reference 9
2,3,4,7,8-pentachlorodibenzofuran	57117314	2.02E-08	Reference 9
2,3,7,8-tetrachlorodibenzofuran	51207319	1.396E-08	Reference 9
2,3,7,8-tetrachlorodibenzo-p-dioxin	1746016	2.3E-09	Reference 9
Cumene	98828	0.01325	Reference 8
Ethyl Benzene	100414	0.048	Reference 8
Octachlorodibenzofuran	39001020	2.06E-08	Reference 9
Octachlorodibenzo-p-dioxin	3268879	1.328E-06	Reference 9
Phenol	108952	0.115	Reference 8
Styrene	100425	0.1015	Reference 8

8.22 Portable Fuel Containers, Residential and Commercial

The Missouri DNR accepted EPA's estimates of emissions for this source category. The documentation below was developed by EPA.

8.22.1 Portable Fuel Containers (PFC) emission inventories

As part of the MSAT rule, emissions for portable fuel containers (PFC) would be processed in EMS-HAP, ASPEN, and subsequent HAPEM exposure modeling. In order to create the emissions inventories for the MSAT HAPs, two main steps were taken. First, state level VOC PFC emissions were allocated to counties and to several SCC codes. Secondly, after allocation of the VOC emissions, HAP specific emissions were developed. This section describes the processes in both steps.

8.22.1.1 VOC allocation

VOC total PFC reference (uncontrolled) emissions were available for 1990, 2005, 2010, 2015, 2020, and 2030 by state. In addition to the reference inventories, there were control emissions for 2010, 2015, 2020, and 2030. In addition to the years listed, a 1999 reference inventory was needed. The 1999 inventory would be created based on linear interpolation between the 1990 and 2005 inventories.

For both the reference and control inventories, the state VOC emissions needed to be allocated to counties and to SCC codes related to PFC emissions. The following steps were used to allocate the VOC emissions:

- For each year, the reference inventories were read into SAS®. For 2010, 2015, 2020, and 2030, the control inventories were read into SAS®.
- The state level VOC emissions for each year and emissions scenario, reference or control, were allocated to residential and commercial components for six categories: 1) vapor displacement while refilling containers at the pump, 2) spillage while refilling at the pump, 3) spillage during transport, 4) vapor displacement while refueling equipment, 5) spillage while refueling equipment, and 6) permeation and evaporation. Total state level PFC emissions were allocated

to the categories by using national level residential and commercial emissions for each of the categories using the following equations:

$$E_{residential,XXXX,YY} = E \times \left(\frac{\mathrm{Re}\,s}{\mathrm{Re}\,s + Com} \right) \tag{9}$$

$$E_{commercial,XXXX,YY} = E \times \left(\frac{Com}{\mathrm{Re}\,s + Com} \right) \tag{10}$$

where E was the emissions of the category being split, XXXX was year, YY was state, and Res and Com were the emissions shown in the corresponding table below.

- After allocating the VOC emissions to the six categories, the commercial and residential permeation and evaporation categories were split into commercial permeation, commercial evaporation, residential permeation, and residential evaporation by

$$E_{AAA,XXXX,YY,perm} = E_{AAA,XXXX,YY,perm\&evap} \times 0.3387 \tag{11}$$

$$E_{AAA,XXXX,YY,evap} = E_{AAA,XXXX,YY,perm\&evap} \times (1 - 0.3387) \tag{12}$$

The fraction 0.3387 represents the fraction of combined permeation and evaporative emissions attributable to permeation, based on data from the California Air Resources Board.

- Once the state VOC emissions were allocated to the residential and commercial components of the categories, they were assigned SCC codes for later processing in EMS-HAP. These codes are shown in the corresponding table below.

  .

- After creating the SCC level state emissions for the years and emission scenarios, a 1999 reference inventory was created by interpolating from the 1990 to 2005 emissions. The interpolation was done for each state and SCC combination and the equation was:

$$E_{1999,YY,SCC} = E_{1990,YY,SCC} + \left(9 \times \left(\frac{E_{2005,YY,SCC} - E_{1990,YY,SCC}}{15}\right)\right) \quad (13)$$

where $E_{1999,YY,SCC}$, $E_{1990,YYY,SCC}$, and $E_{2005,YY,SCC}$ were the 1999, 1990, and 2005 emissions for state YY and SCC shown in the corresponding table below.

- After creating the 1999 state VOC inventory, the state emissions were allocated to the counties by using the ratio of county to state fuel consumption. State emissions were multiplied by the county specific ratio to yield a county specific VOC emissions number for each SCC. This equation is shown as Equation 14.

$$E_{XXXX,YYYYY,AAA,SCC} = E_{XXXX,YY,AAA,SCC} \times \left(\frac{Consumption_{YYYYY}}{Consumption_{YY}}\right) \quad (14)$$

where $E_{XXXX,YYYYY,AAA,SCC}$ were the emissions for year XXXX, county with FIPS code YYYYY, emission scenario AAA (reference or control) and SCC shown in the corresponding table below, $E_{XXXX,YY,AAA,SCC}$ were the state level emissions for year XXXX, state YY, emission scenario AAA, and SCC in the corresponding table below, $Consumption_{YYYY}$ was the county fuel consumption and $Consumption_{YY}$ was the state fuel consumption.

- As for the nonroad emissions, Broomfield County emissions were allocated to surrounding counties.

Figure 9 shows the flow of steps for allocation of VOC emissions.

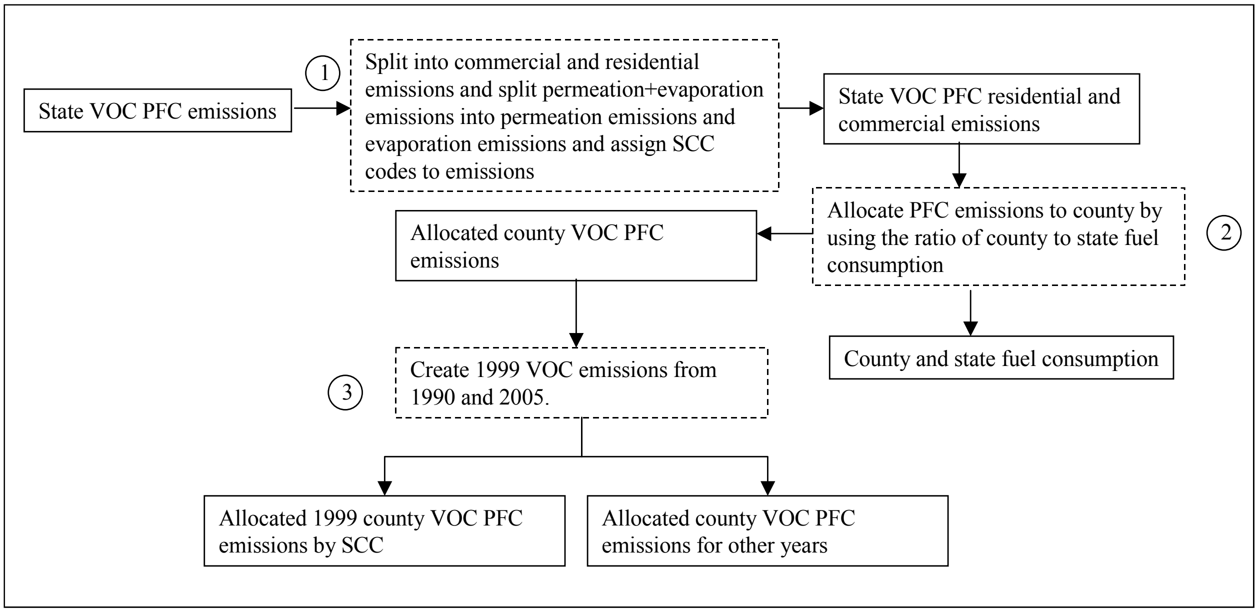


Figure: Steps in allocation of state VOC PFC emissions to counties.

PFC categories with national level residential and commercial emissions

Category	Residential Emissions	Commercial Emissions
Vapor displacement while refilling at the pump	4,328	8,341
Spillage displacement while refilling at the pump	382	735
Spillage during transport	13,519	18,442
Vapor displacement while refueling equipment	4,328	8,341
Spillage while refueling equipment	21,340	41,747
Permeation and evaporation	187,757	5,997

SCC codes of PFC categories

SCC code	Description
2501011011	Storage and Transport; Petroleum and Petroleum Product Storage; Residential Portable Gas Cans; Permeation
2501011012	Storage and Transport; Petroleum and Petroleum Product Storage; Residential Portable Gas Cans; Evaporation
2501011013	Storage and Transport; Petroleum and Petroleum Product Storage; Residential Portable Gas Cans; Spillage During Transport
2501011014	Storage and Transport; Petroleum and Petroleum Product Storage; Residential Portable Gas Cans; Refilling at the Pump - Vapor Displacement
2501011015	Storage and Transport; Petroleum and Petroleum Product Storage; Residential Portable Gas Cans; Refilling at the Pump - Spillage

2501011016	Storage and Transport; Petroleum and Petroleum Product Storage; Residential Portable Gas Cans; Refueling Equipment - Vapor Displacement
2501011017	Storage and Transport; Petroleum and Petroleum Product Storage; Residential Portable Gas Cans; Refueling Equipment - Spillage
2501012011	Storage and Transport; Petroleum and Petroleum Product Storage; Commercial Portable Gas Cans; Permeation
2501012012	Storage and Transport; Petroleum and Petroleum Product Storage; Commercial Portable Gas Cans; Evaporation
2501012013	Storage and Transport; Petroleum and Petroleum Product Storage; Commercial Portable Gas Cans; Spillage During Transport
2501012014	Storage and Transport; Petroleum and Petroleum Product Storage; Commercial Portable Gas Cans; Refilling at the Pump - Vapor Displacement
2501012015	Storage and Transport; Petroleum and Petroleum Product Storage; Commercial Portable Gas Cans; Refilling at the Pump - Spillage
2501012016	Storage and Transport; Petroleum and Petroleum Product Storage; Commercial Portable Gas Cans; Refueling Equipment - Vapor Displacement
2501012017	Storage and Transport; Petroleum and Petroleum Product Storage; Commercial Portable Gas Cans; Refueling Equipment - Spillage

8.22.1.2 Creation of HAP PFC inventories

Once the state VOC PFC emissions were allocated to counties and SCC codes, PFC emissions for MSAT HAPs could be developed. Two methods were used to create the emissions, one for benzene, and the second for other HAPs. For benzene, the county level light duty gasoline vehicle (LDGV) refueling emissions for benzene and VOC were used to create the PFC emissions. At the county level, the benzene refueling emissions were divided by the VOC refueling emissions, to yield a ratio that would be multiplied with the PFC VOC emissions. Benzene fuel control refueling emissions would be used for refueling control emissions while no fuel controls would be used for 1999 and all the future year reference inventories. Several combinations of PFC and benzene fuel control refueling ratios would be used. These combinations were composed of the PFC emissions with no controls, and with controls, and with benzene refueling emissions with and without controls. The corresponding table below lists the combinations and years for which they were used.

PFC and benzene fuel control inventory scenarios

PFC emissions	Benzene refueling emissions	Years
No controls	No controls	1999, 2010, 2015, 2020, 2030
Controls	Controls	2015, 2020, 2030
No controls	Controls	2015, 2020, 2030
Controls	No controls	2010, 2015, 2020, 2030

To calculate the benzene emissions for each PFC SCC in each county the following formulas were used. For all SCC emissions except for permeation (residential and commercial) the benzene emissions were calculated as:

$$Benzene_{AAA,XXXX,YYYYY,SCC} = VOC_{AAA,XXXX,YYYYY,SCC} \times \left(\frac{Benzene_{refuel,XXXX,YYYYY,BBB}}{VOC_{refuel,XXXX,YYYYY,BBB}} \right) \times 0.36 \qquad (15)$$

For permeation emissions, the equation was

$$Benzene_{AAA,XXXX,YYYYY,SCC} = VOC_{AAA,XXXX,YYYYY,SCC} \times \left(\frac{Benzene_{refuel,XXXX,YYYYY,BBB}}{VOC_{refuel,XXXX,YYYYY,BBB}} \right) \times 0.36 \times 1.77 \qquad (16)$$

where XXXX was the year, YYYYY was the FIPS code of the county, and SCC was an SCC code shown in the corresponding table. AAA represents no controls or controls for PFC emissions, and BBB represents whether refueling emissions are control or uncontrolled. Note that 1999 and 2010 uncontrolled benzene refueling emissions were calculated from 2015 as done in the onroad emissions processing.

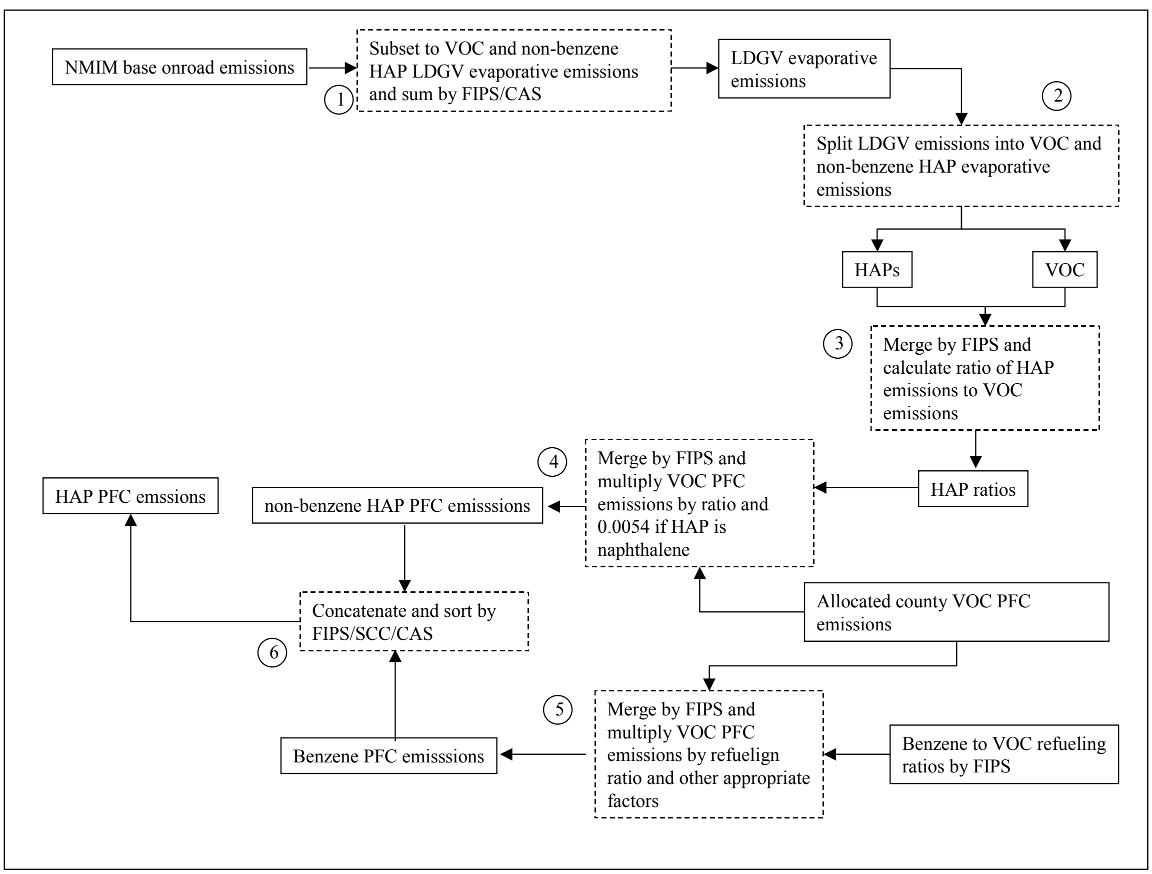
In the equations the factor 0.36 represents an adjustment based on the nationwide percentage of benzene in gasoline vapor from gasoline distribution with an RVP of 10 psi at 60˚F (Hester, 2006). The percentage is 0.27%, in contrast to 0.74% benzene in vehicle refueling emissions from highway vehicles. The ratio or factor of 0.36 was applied to the refueling emissions. A second ratio was used for permeation emissions since recent research suggests that the ratio of benzene from permeation is higher than for evaporation, vapor displacement or spillage. A recent study (Haskew et al., 2004) suggests that the ratio of benzene from permeation to total VOC from permeation is about 1.7727 times higher than the ratio associated with evaporation.

For all other HAPs, the PFC emissions were created by multiplying the PFC VOC emissions by the county level ratio of HAP LDGV evaporative emissions by the VOC LDGV evaporative emissions for the county or:

$$HAP_{AAA,XXXX,YYYYY,SCC} = VOC_{AAA,XXXX,YYYYY,SCC} \times \left(\frac{HAP_{LDGV,XXXX,YYYYY}}{VOC_{LDGV,XXXX,YYYYY}} \right) \quad (17)$$

where the subscripts are as denoted previously. Using the LDGV evaporative emissions means only HAPs in the onroad inventory with LDGV evaporative emissions would have PFC emissions. For all other HAPs, the same formula was used for all SCC codes. Naphthalene was also multiplied by a factor of 0.0054 to reduce the emissions. The corresponding tables below list the emissions summaries for the no controls inventories the emissions summaries for the controlled inventories, respectively. Steps used in creating the HAP inventories are shown in the figure below.

Figure: Steps in creating HAP PFC emissions



PFC emissions with and without controls for units without benzene fuel controls

PFC type	HAP	Year								
		1999	2010		2015		2020		2030	
		PFC: no controls	PFC: no controls	PFC: with controls	PFC: no controls	PFC: with controls	PFC: no controls	PFC: with controls	PFC: no controls	PFC: with controls
Commercial PFC: Evaporation	Benzene	$9.30x10^{0}$	$9.03x10^{0}$	$8.62x10^{0}$	$9.55x10^{0}$	$7.72x10^{-1}$	$1.02x10^{1}$	$8.24x10^{-1}$	$1.15x10^{1}$	$9.33x10^{-1}$
	All HAPs	$4.61x10^{2}$	$3.92x10^{2}$	$3.71x10^{2}$	$4.13x10^{2}$	$3.93x10^{1}$	$4.37x10^{2}$	$4.14x10^{1}$	$4.92x10^{2}$	$4.65x10^{1}$
Commercial PFC: Permeation	Benzene	$8.43x10^{0}$	$8.18x10^{0}$	$7.82x10^{0}$	$8.66x10^{0}$	$7.00x10^{-1}$	$9.25x10^{0}$	$7.47x10^{-1}$	$1.05x10^{1}$	$8.46x10^{-1}$
	All HAPs	$2.40x10^{2}$	$2.04x10^{2}$	$1.94x10^{2}$	$2.15x10^{2}$	$2.04x10^{1}$	$2.28x10^{2}$	$2.15x10^{1}$	$2.57x10^{2}$	$2.42x10^{1}$
Commercial PFC: Refilling at the Pump: Spillage	Benzene	$1.61x10^{0}$	$1.80x10^{0}$	$1.80x10^{0}$	$1.96x10^{0}$	$1.96x10^{0}$	$2.12x10^{0}$	$2.12x10^{0}$	$2.45x10^{0}$	$2.45x10^{0}$
	All HAPs	$8.42x10^{1}$	$8.73x10^{1}$	$8.73x10^{1}$	$9.44x10^{1}$	$9.44x10^{1}$	$1.01x10^{2}$	$1.01x10^{2}$	$1.16x10^{2}$	$1.16x10^{2}$
Commercial PFC: Refilling at the Pump: Vapor Displacement	Benzene	$1.83x10^{1}$	$2.05x10^{1}$	$2.05x10^{1}$	$2.23x10^{1}$	$2.23x10^{1}$	$2.41x10^{1}$	$2.41x10^{1}$	$2.79x10^{1}$	$2.79x10^{1}$
	All HAPs	$9.57x10^{2}$	$9.90x10^{2}$	$9.90x10^{2}$	$1.07x10^{3}$	$1.07x10^{3}$	$1.14x10^{3}$	$1.14x10^{3}$	$1.31x10^{3}$	$1.31x10^{3}$
Commercial PFC: Refueling Equipment: Spillage	Benzene	$1.00x10^{2}$	$8.95x10^{1}$	$5.30x10^{1}$	$9.66x10^{1}$	$5.72x10^{1}$	$1.05x10^{2}$	$6.20x10^{1}$	$1.21x10^{2}$	$7.16x10^{1}$
	All HAPs	$5.17x10^{3}$	$4.09x10^{3}$	$2.58x10^{3}$	$4.40x10^{3}$	$2.78x10^{3}$	$4.72x10^{3}$	$2.97x10^{3}$	$5.41x10^{3}$	$3.41x10^{3}$
Commercial PFC: Refueling Equipment: Vapor Displacement	Benzene	$1.83x10^{1}$	$2.05x10^{1}$	$2.05x10^{1}$	$2.23x10^{1}$	$2.23x10^{1}$	$2.41x10^{1}$	$2.41x10^{1}$	$2.79x10^{1}$	$2.79x10^{1}$
	All HAPs	$9.57x10^{2}$	$9.90x10^{2}$	$9.90x10^{2}$	$1.07x10^{3}$	$1.07x10^{3}$	$1.14x10^{3}$	$1.14x10^{3}$	$1.31x10^{3}$	$1.31x10^{3}$
Commercial PFC: Spillage During Transport	Benzene	$4.10x10^{1}$	$4.44x10^{1}$	$4.35x10^{1}$	$4.81x10^{1}$	$4.29x10^{1}$	$5.20x10^{1}$	$4.64x10^{1}$	$5.99x10^{1}$	$5.34x10^{1}$
	All HAPs	$2.12x10^{3}$	$2.11x10^{3}$	$2.07x10^{3}$	$2.28x10^{3}$	$2.06x10^{3}$	$2.43x10^{3}$	$2.20x10^{3}$	$2.78x10^{3}$	$2.52x10^{3}$
Residential PFC: Evaporation	Benzene	$2.91x10^{2}$	$2.83x10^{2}$	$2.70x10^{2}$	$2.99x10^{2}$	$2.42x10^{1}$	$3.19x10^{2}$	$2.58x10^{1}$	$3.62x10^{2}$	$2.92x10^{1}$
	All HAPs	$1.44x10^{4}$	$1.23x10^{4}$	$1.16x10^{4}$	$1.29x10^{4}$	$1.23x10^{3}$	$1.37x10^{4}$	$1.30x10^{3}$	$1.54x10^{4}$	$1.46x10^{3}$
Residential PFC:	Benzene	$2.64x10^{2}$	$2.56x10^{2}$	$2.45x10^{2}$	$2.71x10^{2}$	$2.19x10^{1}$	$2.90x10^{2}$	$2.34x10^{1}$	$3.28x10^{2}$	$2.65x10^{1}$

PFC type	HAP	Year								
		1999	2010		2015		2020		2030	
		PFC: no controls	PFC: no controls	PFC: with controls	PFC: no controls	PFC: with controls	PFC: no controls	PFC: with controls	PFC: no controls	PFC: with controls
Permeation	All HAPs	$7.50x10^{3}$	$6.39x10^{3}$	$6.06x10^{3}$	$6.75x10^{3}$	$6.40x10^{2}$	$7.14x10^{3}$	$6.75x10^{2}$	$8.04x10^{3}$	$7.58x10^{2}$
Residential PFC: Refilling at the Pump: Spillage	Benzene	$8.37x10^{-1}$	$9.37x10^{-1}$	$9.37x10^{-1}$	$1.02x10^{0}$	$1.02x10^{0}$	$1.10x10^{0}$	$1.10x10^{0}$	$1.27x10^{0}$	$1.27x10^{0}$
	All HAPs	$4.38x10^{1}$	$4.54x10^{1}$	$4.54x10^{1}$	$4.91x10^{1}$	$4.91x10^{1}$	$5.25x10^{1}$	$5.25x10^{1}$	$6.02x10^{1}$	$6.02x10^{1}$
Residential PFC: Refilling at the Pump: Vapor Displacement	Benzene	$9.51x10^{0}$	$1.07x10^{1}$	$1.07x10^{1}$	$1.16x10^{1}$	$1.16x10^{1}$	$1.25x10^{1}$	$1.25x10^{1}$	$1.45x10^{1}$	$1.45x10^{1}$
	All HAPs	$4.97x10^{2}$	$5.14x10^{2}$	$5.14x10^{2}$	$5.55x10^{2}$	$5.55x10^{2}$	$5.94x10^{2}$	$5.94x10^{2}$	$6.82x10^{2}$	$6.82x10^{2}$
Residential PFC: Refueling Equipment: Spillage	Benzene	$5.11x10^{1}$	$4.57x10^{1}$	$2.71x10^{1}$	$4.94x10^{1}$	$2.93x10^{1}$	$5.35x10^{1}$	$3.17x10^{1}$	$6.18x10^{1}$	$3.66x10^{1}$
	All HAPs	$2.64x10^{3}$	$2.09x10^{3}$	$1.32x10^{3}$	$2.25x10^{3}$	$1.42x10^{3}$	$2.41x10^{3}$	$1.52x10^{3}$	$2.77x10^{3}$	$1.74x10^{3}$
Residential PFC: Refueling Equipment: Vapor Displacement	Benzene	$9.51x10^{0}$	$1.07x10^{1}$	$1.07x10^{1}$	$1.16x10^{1}$	$1.16x10^{1}$	$1.25x10^{1}$	$1.25x10^{1}$	$1.45x10^{1}$	$1.45x10^{1}$
	All HAPs	$4.97x10^{2}$	$5.14x10^{2}$	$5.14x10^{2}$	$5.55x10^{2}$	$5.55x10^{2}$	$5.94x10^{2}$	$5.94x10^{2}$	$6.82x10^{2}$	$6.82x10^{2}$
Residential PFC: Spillage During Transport	Benzene	$3.00x10^{1}$	$3.26x10^{1}$	$3.19x10^{1}$	$3.53x10^{1}$	$3.15x10^{1}$	$3.81x10^{1}$	$3.40x10^{1}$	$4.39x10^{1}$	$3.92x10^{1}$
	All HAPs	$1.56x10^{3}$	$1.55x10^{3}$	$1.52x10^{3}$	$1.67x10^{3}$	$1.51x10^{3}$	$1.78x10^{3}$	$1.62x10^{3}$	$2.04x10^{3}$	$1.85x10^{3}$

PFC emissions with and without controls for units with benzene fuel controls

PFC type	HAP	Year					
		2015		2020		2030	
		PFC: no controls	PFC: with controls	PFC: no controls	PFC: with controls	PFC: no controls	PFC: with controls
Commercial PFC: Evaporation	Benzene	5.79×10^{0}	5.05×10^{-1}	6.19×10^{0}	5.39×10^{-1}	7.00×10^{0}	6.10×10^{-1}
	All HAPs	4.10×10^{2}	3.91×10^{1}	4.33×10^{2}	4.12×10^{1}	4.88×10^{2}	4.62×10^{1}
Commercial PFC: Permeation	Benzene	5.25×10^{0}	4.58×10^{-1}	5.61×10^{0}	4.89×10^{-1}	6.35×10^{0}	5.53×10^{-1}
	All HAPs	2.12×10^{2}	2.02×10^{1}	2.24×10^{2}	2.13×10^{1}	2.53×10^{2}	2.39×10^{1}
Commercial PFC: Refilling at the Pump: Spillage	Benzene	1.25×10^{0}	1.25×10^{0}	1.35×10^{0}	1.35×10^{0}	1.56×10^{0}	1.56×10^{0}
	All HAPs	9.37×10^{1}	9.37×10^{1}	1.00×10^{2}	1.00×10^{2}	1.15×10^{2}	1.15×10^{2}
Commercial PFC: Refilling at the Pump: Vapor Displacement	Benzene	1.42×10^{1}	1.42×10^{1}	1.54×10^{1}	1.54×10^{1}	1.77×10^{1}	1.77×10^{1}
	All HAPs	1.06×10^{3}	1.06×10^{3}	1.14×10^{3}	1.14×10^{3}	1.30×10^{3}	1.30×10^{3}
Commercial PFC: Refueling Equipment: Spillage	Benzene	6.02×10^{1}	3.66×10^{1}	6.52×10^{1}	3.97×10^{1}	7.53×10^{1}	4.58×10^{1}
	All HAPs	4.36×10^{3}	2.76×10^{3}	4.68×10^{3}	2.95×10^{3}	5.37×10^{3}	3.38×10^{3}
Commercial PFC: Refueling Equipment: Vapor Displacement	Benzene	1.42×10^{1}	1.42×10^{1}	1.54×10^{1}	1.54×10^{1}	1.77×10^{1}	1.77×10^{1}
	All HAPs	1.06×10^{3}	1.06×10^{3}	1.14×10^{3}	1.14×10^{3}	1.30×10^{3}	1.30×10^{3}
Commercial PFC: Spillage During Transport	Benzene	3.05×10^{1}	2.74×10^{1}	3.30×10^{1}	2.96×10^{1}	3.80×10^{1}	3.41×10^{1}
	All HAPs	2.26×10^{3}	2.05×10^{3}	2.41×10^{3}	2.19×10^{3}	2.76×10^{3}	2.50×10^{3}
Residential PFC: Evaporation	Benzene	1.81×10^{2}	1.58×10^{1}	1.94×10^{2}	1.69×10^{1}	2.19×10^{2}	1.91×10^{1}
	All HAPs	1.28×10^{4}	1.22×10^{3}	1.36×10^{4}	1.29×10^{3}	1.53×10^{4}	1.45×10^{3}
Residential PFC: Permeation	Benzene	1.64×10^{2}	1.43×10^{1}	1.76×10^{2}	1.53×10^{1}	1.99×10^{2}	1.73×10^{1}
	All HAPs	6.64×10^{3}	6.33×10^{2}	7.02×10^{3}	6.67×10^{2}	7.91×10^{3}	7.49×10^{2}
Residential PFC: Refilling at the Pump: Spillage	Benzene	6.50×10^{-1}	6.50×10^{-1}	7.03×10^{-1}	7.03×10^{-1}	8.13×10^{-1}	8.13×10^{-1}
	All HAPs	4.87×10^{1}	4.87×10^{1}	5.21×10^{1}	5.21×10^{1}	5.97×10^{1}	5.97×10^{1}
Residential PFC: Refilling at the Pump: Vapor Displacement	Benzene	7.36×10^{0}	7.36×10^{0}	7.97×10^{0}	7.97×10^{0}	9.20×10^{0}	9.20×10^{0}
	All HAPs	5.51×10^{2}	5.51×10^{2}	5.90×10^{2}	5.90×10^{2}	6.76×10^{2}	6.76×10^{2}
Residential PFC: Refueling Equipment: Spillage	Benzene	3.08×10^{1}	1.87×10^{1}	3.33×10^{1}	2.03×10^{1}	3.85×10^{1}	2.34×10^{1}
	All HAPs	2.23×10^{3}	1.41×10^{3}	2.39×10^{3}	1.51×10^{3}	2.74×10^{3}	1.73×10^{3}
Residential PFC: Refueling Equipment: Vapor Displacement	Benzene	7.36×10^{0}	7.36×10^{0}	7.97×10^{0}	7.97×10^{0}	9.20×10^{0}	9.20×10^{0}
	All HAPs	5.51×10^{2}	5.51×10^{2}	5.90×10^{2}	5.90×10^{2}	6.76×10^{2}	6.76×10^{2}
Residential PFC: Spillage During Transport	Benzene	2.24×10^{1}	2.01×10^{1}	2.42×10^{1}	2.17×10^{1}	2.78×10^{1}	2.50×10^{1}
	All HAPs	1.66×10^{3}	1.50×10^{3}	1.77×10^{3}	1.60×10^{3}	2.02×10^{3}	1.83×10^{3}

8.23 Residential wood combustion

The Missouri DNR accepted EPA's estimates of emissions for this source category. The documentation below was developed by EPA. Subsection d contains Missouri's audit of EPA's estimate.

a. Source Category Description

Residential wood combustion includes the burning of wood and wax firelogs in home heating appliances. Specifically excluded from this category are residential leaf and brush burning from yard or land clearing activities (see 2610000100 and 2610000400). Appliances are broken down by type (fireplaces, woodstoves, furnaces, and outdoor hydronic heaters), and estimates are based on typical usage profile (main heat, supplemental, pleasure burning).

The following source classification code (SCCs) are used for this category:

List of nonpoint SCC codes

SCC	SCC Level 1	SCC Level 2	SCC Level 3	SCC Level 4
2104008100	Stationary Source Fuel Combustion	Residential	Wood	Fireplace: general
2104008210	Stationary Source Fuel Combustion	Residential	Wood	Woodstove: fireplace inserts; non-EPA certified
2104008220	Stationary Source Fuel Combustion	Residential	Wood	Woodstove: fireplace inserts; EPA certified; non-catalytic
2104008230	Stationary Source Fuel Combustion	Residential	Wood	Woodstove: fireplace inserts; EPA certified; catalytic
2104008310	Stationary Source Fuel Combustion	Residential	Wood	Woodstove: freestanding, non-EPA certified
2104008320	Stationary Source Fuel Combustion	Residential	Wood	Woodstove: freestanding, EPA certified, non-catalytic
2104008330	Stationary Source Fuel Combustion	Residential	Wood	Woodstove: freestanding, EPA certified, catalytic
2104008400	Stationary Source Fuel Combustion	Residential	Wood	Woodstove: pellet-fired, general
2104008510	Stationary Source Fuel Combustion	Residential	Wood	Furnace: Indoor, cordwood-fired, non-EPA certified
2104008610	Stationary Source Fuel Combustion	Residential	Wood	Hydronic heater: outdoor
2104008700	Stationary Source Fuel Combustion	Residential	Wood	Outdoor wood burning device, NEC
2104009000	Stationary Source Fuel Combustion	Residential	Firelog	Total: All Combustor Types

b. Estimation Method

EPA has created a tool for states to use to estimate residential wood combustion emissions called the Residential Wood Tool (RWC). It is a Microsoft Access database containing the tables and queries needed by states to update emission estimates. The estimation method is based on the following equation:

(Number of appliances) * (Emission factor) * (Cords of wood burned per appliance) * (Wood Density) = Emissions

c. Activity Data

The activity data in the estimation equation includes the number of appliances, and cords of wood burned.

The number of appliances is estimated from US Census American Housing Survey Metropolitan Survey data estimating the number of occupied households in each county, the type of heating appliances, and their usage. These surveys were mainly done in the late 1990s to mid 2000s, with some state-specific survey data from the late 2000s to update their appliance types. The “appliance profile” table in the tool summarizes the percentage of housing units with that appliance type that burn wood. Missouri’s appliance profiles are 2, 26, and 51.

Burn profiles are used to estimate the amount of wood burned per appliance type. Much of this data are national averages by climate region, with a few geographic specific surveys as well. West Virginia, Wisconsin, Vermont, and Minnesota have done surveys to update their burn profiles. For national defaults, the source of data is cited as “Burn rates are an average of what was discovered in the literature regarding burn rates. For more detail, see file entitled "Burn rate data.xls". Report years are from 1992 to 2002”. This excel file is not made available with the RWC tool, and it has not been reviewed by Missouri.

Emission factors are discussed in section c.

Density of wood is estimated for each county based on the 2005 Timber Products Output (TPO) Fuel wood consumption. The reference within the tool states, “Density by county computed by taking volume of wood reported by species in the TPO, then multiplying by a species density factor provided by the US Forest service. Total mass for a county is then divided by total volume for a county to get average density for a county.
Counties not reporting to the TPO were filled in using regional averages.” Missouri densities are between 1ton/cord and 1.5 ton/cord, with a statewide average of 1.39 ton/cord which is the highest in the country (tied with Connecticut). The University of Missouri Extension publication “Wood Fuel For Heating”[1] cites a dry, seasoned weight of hardwood of 3,600 lb/cord, which is 1.8 ton/cord. Their estimate would be for ideal wood types, so the more typical 1.39 ton/cord average is acceptable.

c. Emission Factors

Criteria air pollutant (CAP) emission factors used in the tool are listed by SCC below with a brief reference to their origin. Hazardous air pollutant (HAP) emissions are included in the RWC tool, but are not included here due to length. The tool also estimates the greenhouse gases (GHG) carbon dioxide and methane, but these emission factors are not included here. Final Missouri calculated emissions for CAP, HAP, and GHG are summarized in section e.

SCC	Pollutant Code	SCC Level 4	pollutant	Emission Factor	numerator	denominator	data_source
2104008100	NH_3	Fireplace: general	Ammonia	1.8	lb	ton	MARAMA
2104008210	NH_3	Woodstove: fireplace inserts; non-EPA certified	Ammonia	1.7	lb	ton	MARAMA
2104008220	NH_3	Woodstove: fireplace inserts; EPA certified; non-catalytic	Ammonia	0.9	lb	ton	MARAMA
2104008230	NH_3	Woodstove: fireplace inserts; EPA certified; catalytic	Ammonia	0.9	lb	ton	MARAMA
2104008310	NH_3	Woodstove: freestanding, non-EPA certified	Ammonia	1.7	lb	ton	MARAMA
2104008320	NH_3	Woodstove: freestanding, EPA certified, non-catalytic	Ammonia	0.9	lb	ton	MARAMA
2104008330	NH_3	Woodstove: freestanding, EPA certified, catalytic	Ammonia	0.9	lb	ton	MARAMA
2104008400	NH_3	Woodstove: pellet-fired, general	Ammonia	0.3	lb	ton	MARAMA
2104008510	NH_3	Furnace: Indoor, cordwood-fired, non-EPA certified	Ammonia	1.8	lb	ton	MARAMA

SCC	Pollutant Code	SCC Level 4	pollutant	Emission Factor	numerator	denominator	data_source
2104008610	NH_3	Hydronic heater: outdoor	Ammonia	1.8	lb	ton	From Woodstoves.
2104008700	NH_3	Outdoor wood burning device, NEC	Ammonia	1.8	lb	ton	MARAMA
2104008100	CO	Fireplace: general	Carbon Monoxide	149	lb	ton	MARAMA
2104008210	CO	Woodstove: fireplace inserts; non-EPA certified	Carbon Monoxide	230.8	lb	ton	2002 NEI
2104008220	CO	Woodstove: fireplace inserts; EPA certified; non-catalytic	Carbon Monoxide	140.8	lb	ton	2002 NEI
2104008230	CO	Woodstove: fireplace inserts; EPA certified; catalytic	Carbon Monoxide	104.4	lb	ton	2002 NEI
2104008310	CO	Woodstove: freestanding, non-EPA certified	Carbon Monoxide	230.8	lb	ton	2002 NEI
2104008320	CO	Woodstove: freestanding, EPA certified, non-catalytic	Carbon Monoxide	140.8	lb	ton	2002 NEI
2104008330	CO	Woodstove: freestanding, EPA certified, catalytic	Carbon Monoxide	104.4	lb	ton	2002 NEI
2104008400	CO	Woodstove: pellet-fired, general	Carbon Monoxide	15.9	lb	ton	MARAMA
2104008510	CO	Furnace: Indoor, cordwood-fired, non-EPA certified	Carbon Monoxide	184	lb	ton	MARAMA
2104008610	CO	Hydronic heater: outdoor	Carbon Monoxide	360	lb	ton	From EPA report , 2012, Gullet et al.
2104008700	CO	Outdoor wood burning device, NEC	Carbon Monoxide	149	lb	ton	MARAMA
2104009000	CO	Residential Firelog Total: All Combustor Types	Carbon Monoxide	125.08	lb	ton	Content and emission characteristics of Artificial Wax Firelogs, Environment Canada
2104008100	NO_X	Fireplace: general	Nitrogen Oxides	2.6	lb	ton	2002 NEI
2104008210	NO_X	Woodstove: fireplace inserts; non-EPA certified	Nitrogen Oxides	2.8	lb	ton	2002 NEI
2104008220	NO_X	Woodstove: fireplace inserts; EPA certified; non-catalytic	Nitrogen Oxides	2.28	lb	ton	MARAMA
2104008230	NO_X	Woodstove: fireplace inserts; EPA certified; catalytic	Nitrogen Oxides	2	lb	ton	2002 NEI
2104008310	NO_X	Woodstove: freestanding, non-EPA certified	Nitrogen Oxides	2.8	lb	ton	2002 NEI
2104008320	NO_X	Woodstove: freestanding, EPA certified, non-catalytic	Nitrogen Oxides	2.28	lb	ton	MARAMA
2104008330	NO_X	Woodstove: freestanding, EPA certified, catalytic	Nitrogen Oxides	2	lb	ton	2002 NEI
2104008400	NO_X	Woodstove: pellet-fired, general	Nitrogen Oxides	3.8	lb	ton	MARAMA
2104008510	NO_X	Furnace: Indoor, cordwood-fired, non-EPA certified	Nitrogen Oxides	1.8	lb	ton	MARAMA
2104008610	NO_X	Hydronic heater: outdoor	Nitrogen Oxides	1.8	lb	ton	From Woodstoves.

SCC	Pollutant Code	SCC Level 4	pollutant	Emission Factor	numerator	denominator	data_source
2104008700	NO_X	Outdoor wood burning device, NEC	Nitrogen Oxides	2.6	lb	ton	2002 NEI
2104009000	NO_X	Residential Firelog Total: All Combustor Types	Nitrogen Oxides	7.684	lb	ton	Content and emission characteristics of Artificial Wax Firelogs, Environment Canada
2104008100	PM_{10}-PRI	Fireplace: general	Primary PM_{10}	23.6	lb	ton	2002 NEI
2104008210	PM_{10}-PRI	Woodstove: fireplace inserts; non-EPA certified	Primary PM_{10}	30.6	lb	ton	2002 NEI
2104008220	PM_{10}-PRI	Woodstove: fireplace inserts; EPA certified; non-catalytic	Primary PM_{10}	19.6	lb	ton	2002 NEI
2104008230	PM_{10}-PRI	Woodstove: fireplace inserts; EPA certified; catalytic	Primary PM_{10}	20.4	lb	ton	2002 NEI
2104008310	PM_{10}-PRI	Woodstove: freestanding, non-EPA certified	Primary PM_{10}	30.6	lb	ton	2002 NEI
2104008320	PM_{10}-PRI	Woodstove: freestanding, EPA certified, non-catalytic	Primary PM_{10}	19.6	lb	ton	2002 NEI
2104008330	PM_{10}-PRI	Woodstove: freestanding, EPA certified, catalytic	Primary PM_{10}	20.4	lb	ton	2002 NEI
2104008400	PM_{10}-PRI	Woodstove: pellet-fired, general	Primary PM_{10}	3.06	lb	ton	MARAMA
2104008510	PM_{10}-PRI	Furnace: Indoor, cordwood-fired, non-EPA certified	Primary PM_{10}	27.6	lb	ton	MARAMA
2104008610	PM_{10}-PRI	Hydronic heater: outdoor	Primary PM_{10}	64	lb	ton	From EPA report , 2012, Gullet et al.
2104008700	PM_{10}-PRI	Outdoor wood burning device, NEC	Primary PM_{10}	23.6	lb	ton	2002 NEI
2104009000	PM_{10}-PRI	Residential Firelog Total: All Combustor Types	Primary PM_{10}	29.32	lb	ton	Content and emission characteristics of Artificial Wax Firelogs, Environment Canada
2104008100	$PM_{2.5}$-PRI	Fireplace: general	Primary $PM_{2.5}$	23.6	lb	ton	2002 NEI
2104008210	$PM_{2.5}$-PRI	Woodstove: fireplace inserts; non-EPA certified	Primary $PM_{2.5}$	30.6	lb	ton	2002 NEI
2104008220	$PM_{2.5}$-PRI	Woodstove: fireplace inserts; EPA certified; non-catalytic	Primary $PM_{2.5}$	19.6	lb	ton	2002 NEI
2104008230	$PM_{2.5}$-PRI	Woodstove: fireplace inserts; EPA certified; catalytic	Primary $PM_{2.5}$	20.4	lb	ton	2002 NEI
2104008310	$PM_{2.5}$-PRI	Woodstove: freestanding, non-EPA certified	Primary $PM_{2.5}$	30.6	lb	ton	2002 NEI
2104008320	$PM_{2.5}$-PRI	Woodstove: freestanding, EPA certified, non-catalytic	Primary $PM_{2.5}$	19.6	lb	ton	2002 NEI
2104008330	$PM_{2.5}$-PRI	Woodstove: freestanding, EPA certified, catalytic	Primary $PM_{2.5}$	20.4	lb	ton	2002 NEI
2104008400	$PM_{2.5}$-PRI	Woodstove: pellet-fired, general	Primary $PM_{2.5}$	3.06	lb	ton	MARAMA
2104008510	$PM_{2.5}$-PRI	Furnace: Indoor, cordwood-fired, non-EPA certified	Primary $PM_{2.5}$	27.6	lb	ton	MARAMA
2104008610	$PM_{2.5}$-PRI	Hydronic heater: outdoor	Primary $PM_{2.5}$	64	lb	ton	From EPA report , 2012, Gullet et al.

SCC	Pollutant Code	SCC Level 4	pollutant	Emission Factor	numerator	denominator	data_source
2104008700	$PM_{2.5}$-PRI	Outdoor wood burning device, NEC	Primary $PM_{2.5}$	23.6	lb	ton	2002 NEI
2104009000	$PM_{2.5}$-PRI	Residential Firelog Total: All Combustor Types	Primary $PM_{2.5}$	28.4	lb	ton	Content and emission characteristics of Artificial Wax Firelogs, Environment Canada
2104008100	SO_2	Fireplace: general	Sulfur Dioxide	0.4	lb	ton	2002 NEI
2104008210	SO_2	Woodstove: fireplace inserts; non-EPA certified	Sulfur Dioxide	0.4	lb	ton	2002 NEI
2104008220	SO_2	Woodstove: fireplace inserts; EPA certified; non-catalytic	Sulfur Dioxide	0.4	lb	ton	2002 NEI
2104008230	SO_2	Woodstove: fireplace inserts; EPA certified; catalytic	Sulfur Dioxide	0.4	lb	ton	2002 NEI
2104008310	SO_2	Woodstove: freestanding, non-EPA certified	Sulfur Dioxide	0.4	lb	ton	2002 NEI
2104008320	SO_2	Woodstove: freestanding, EPA certified, non-catalytic	Sulfur Dioxide	0.4	lb	ton	2002 NEI
2104008330	SO_2	Woodstove: freestanding, EPA certified, catalytic	Sulfur Dioxide	0.4	lb	ton	2002 NEI
2104008400	SO_2	Woodstove: pellet-fired, general	Sulfur Dioxide	0.32	lb	ton	MARAMA
2104008510	SO_2	Furnace: Indoor, cordwood-fired, non-EPA certified	Sulfur Dioxide	2.03	lb	ton	MARAMA
2104008610	SO_2	Hydronic heater: outdoor	Sulfur Dioxide	2.03	lb	ton	From Woodstoves.
2104008700	SO_2	Outdoor wood burning device, NEC	Sulfur Dioxide	0.4	lb	ton	2002 NEI
2104008100	VOC	Fireplace: general	Volatile Organic Compounds	18.9	lb	ton	MARAMA
2104008210	VOC	Woodstove: fireplace inserts; non-EPA certified	Volatile Organic Compounds	53	lb	ton	2002 NEI
2104008220	VOC	Woodstove: fireplace inserts; EPA certified; non-catalytic	Volatile Organic Compounds	12	lb	ton	2002 NEI
2104008230	VOC	Woodstove: fireplace inserts; EPA certified; catalytic	Volatile Organic Compounds	15	lb	ton	2002 NEI
2104008310	VOC	Woodstove: freestanding, non-EPA certified	Volatile Organic Compounds	53	lb	ton	2002 NEI
2104008320	VOC	Woodstove: freestanding, EPA certified, non-catalytic	Volatile Organic Compounds	12	lb	ton	2002 NEI
2104008330	VOC	Woodstove: freestanding, EPA certified, catalytic	Volatile Organic Compounds	15	lb	ton	2002 NEI
2104008400	VOC	Woodstove: pellet-fired, general	Volatile Organic Compounds	0.041	lb	ton	MARAMA
2104008510	VOC	Furnace: Indoor, cordwood-fired, non-EPA certified	Volatile Organic Compounds	11.7	lb	ton	MARAMA
2104008610	VOC	Hydronic heater: outdoor	Volatile Organic Compounds	67.4	lb	ton	From EPA report , 2012, Gullet et al.
2104008700	VOC	Outdoor wood burning device, NEC	Volatile Organic Compounds	18.9	lb	ton	MARAMA

SCC	Pollutant Code	SCC Level 4	pollutant	Emission Factor	numerator	denominator	data_source
2104009000	VOC	Residential Firelog Total: All Combustor Types	Volatile Organic Compounds	39.56	lb	ton	Content and emission characteristics of Artificial Wax Firelogs, Environment Canada

d. Quality Assurance

The first review was of the number of occupied housing units file EPA used by default. The file contained one extra county for Missouri that is a duplicate – Ste. Genevieve county is listed twice with FIPS 29186 and 29193.The calculated emissions table has values for both counties, but they are not identical. The density by county table has two different densities for the duplicate county. Assuming the density is correct for the correct county identifier 29186, the tool is run with the duplicate county 29193 removed from the county population and density by county tables.

Missouri's burn rate profile is listed as "3A". That profile contains all SCCs, the burn type (main, secondary, pleasure burning), and the cords of wood burned per year. The list of all burn rates for profile 3A are below.

SCC	SCC Description	Burn Type	Annual burn rate	Burn Unit
2104008100	Fireplace: general	Main	2	Cords
2104008210	Woodstove: fireplace inserts; non-EPA certified	Main	3	Cords
2104008220	Woodstove: fireplace inserts; EPA certified; non-catalytic	Main	2.37	Cords
2104008230	Woodstove: fireplace inserts; EPA certified; catalytic	Main	2.37	Cords
2104008310	Woodstove: freestanding, non-EPA certified	Main	3	Cords
2104008320	Woodstove: freestanding, EPA certified, non-catalytic	Main	2.37	Cords
2104008330	Woodstove: freestanding, EPA certified, catalytic	Main	2.37	Cords
2104008400	Woodstove: pellet-fired, general	main	3	Ton
2104008510	Furnace: Indoor, cordwood-fired, non-EPA certified	Main	4	Cords
2104008610	Hydronic heater: outdoor	Main	5	Cords
2104009000	Residential Firelog Total: All Combustor Types	Main	0	Ton
2104008100	Fireplace: general	Secondary	0.8	Cords
2104008210	Woodstove: fireplace inserts; non-EPA certified	Secondary	1.5	Cords
2104008220	Woodstove: fireplace inserts; EPA certified; non-catalytic	Secondary	1.185	Cords
2104008230	Woodstove: fireplace inserts; EPA certified; catalytic	Secondary	1.185	Cords
2104008310	Woodstove: freestanding, non-EPA certified	Secondary	1.5	Cords
2104008320	Woodstove: freestanding, EPA certified, non-catalytic	Secondary	1.185	Cords
2104008330	Woodstove: freestanding, EPA certified, catalytic	Secondary	1.185	Cords

SCC	SCC Description	Burn Type	Annual burn rate	Burn Unit
2104008400	Woodstove: pellet-fired, general	secondary	1	Ton
2104009000	Residential Firelog Total: All Combustor Types	Secondary	0.32	Ton
2104008100	Fireplace: general	Pleasure	0.3	Cords
2104008210	Woodstove: fireplace inserts; non-EPA certified	Pleasure	0.5	Cords
2104008220	Woodstove: fireplace inserts; EPA certified; non-catalytic	Pleasure	0.395	Cords
2104008230	Woodstove: fireplace inserts; EPA certified; catalytic	Pleasure	0.395	Cords
2104008310	Woodstove: freestanding, non-EPA certified	Pleasure	0.5	Cords
2104008320	Woodstove: freestanding, EPA certified, non-catalytic	Pleasure	0.395	Cords
2104008330	Woodstove: freestanding, EPA certified, catalytic	Pleasure	0.395	Cords
2104008400	Woodstove: pellet-fired, general	pleasure	0.3	Ton
2104008610	Hydronic heater: outdoor	Pleasure	0	Cords
2104008700	Outdoor wood burning device, NEC	Pleasure	0.213	Cords
2104009000	Residential Firelog Total: All Combustor Types	Pleasure	0.14	Ton

For main heating sources, the estimate is that between 2 and 5 cords of wood per year could be used to heat a home. While this quantity of wood seems very low, and anecdotal evidence would show 5+ cords of wood per year for main heating for any appliance type, there is no vetted data source at this time to base a revised burn rate on. Future improvements to the estimate of emissions will include a Missouri-specific residential wood survey to update the burn rates, appliance population, and wood density.

The emission factor table was examined to look for outlier or unreasonable factors. The factor that stands out for closer examination is the SO_2 emission factor for indoor furnaces and outdoor wood boilers (hydronic heaters). The factor for these two appliance types is 2.03 lb/ton, while all other appliance types except pellet stoves have a factor of 0.4 lb/ton. Since SO_2 is a product of the fuel being burned, the factor should be the same across appliance types when using the same fuel type. The data source cited for the 2.03 lb/ton factor was unable to be located based on the non-specific reference of “MARAMA”, so the factor is changed to match all other wood burning appliances. The list of SO_2 emission factors (in lbs/ton) are provided below.

SCC	Pollutant Code	SCC Level 4	Emission Factor	Data Source
2104008100	SO_2	Fireplace: general	0.4	2002 NEI
2104008210	SO_2	Woodstove: fireplace inserts; non-EPA certified	0.4	2002 NEI
2104008220	SO_2	Woodstove: fireplace inserts; EPA certified; non-catalytic	0.4	2002 NEI
2104008230	SO_2	Woodstove: fireplace inserts; EPA certified; catalytic	0.4	2002 NEI
2104008310	SO_2	Woodstove: freestanding, non-EPA certified	0.4	2002 NEI
2104008320	SO_2	Woodstove: freestanding, EPA certified, non-catalytic	0.4	2002 NEI

2104008330	SO_2	Woodstove: freestanding, EPA certified, catalytic	0.4	2002 NEI
2104008400	SO_2	Woodstove: pellet-fired, general	0.32	MARAMA
2104008510	SO_2	Furnace: Indoor, cordwood-fired, non-EPA certified	~~2.03~~	MARAMA
2104008610	SO_2	Hydronic heater: outdoor	~~2.03~~	From Woodstoves.

e. Emissions

Criteria pollutant emissions are listed by SCC below.

SCC	SCC Description	CO	NH_3	NO_X	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_2	VOC
2104008100	Fireplace: general	27,656.78	334.11	482.60	4,380.54	4,380.54	74.25	3,508.14
2104008210	Woodstove: fireplace inserts; non-EPA certified	20,347.31	149.87	246.85	2,697.69	2,697.69	35.26	4,672.48
2104008220	Woodstove: fireplace inserts; EPA certified; non-catalytic	3,958.89	25.31	64.11	551.10	551.10	11.25	337.41
2104008230	Woodstove: fireplace inserts; EPA certified; catalytic	978.55	8.44	18.75	191.21	191.21	3.75	140.60
2104008310	Woodstove: freestanding, non-EPA certified	18,632.92	137.24	226.05	2,470.40	2,470.40	32.29	4,278.79
2104008320	Woodstove: freestanding, EPA certified, non-catalytic	3,627.03	23.18	58.73	504.90	504.90	10.30	309.12
2104008330	Woodstove: freestanding, EPA certified, catalytic	896.23	7.73	17.17	175.13	175.13	3.43	128.77
2104008400	Woodstove: pellet-fired, general	222.16	4.19	53.10	42.76	42.76	4.47	0.57
2104008510	Furnace: Indoor, cordwood-fired, non-EPA certified	2,445.49	23.98	24.53	367.62	367.62	27.04	157.17
2104008610	Hydronic heater: outdoor	6,061.87	30.31	31.01	1,077.67	1,077.67	34.18	1,134.92
2104008700	Outdoor wood burning device, NEC	88.31	1.07	1.54	13.99	13.99	0.24	11.20
2104009000	Total: All Combustor	595.64		36.59	139.62	135.24		188.39

	Types							
Statewide Total		85,511.19	745.42	1,261.01	12,612.61	12,608.23	236.47	14,867.55

The statewide GHG and HAP total for all residential wood SCCs is provided below for reference. The table is not broken into the separate SCCs due to length. Emissions are reported in tons per year.

Pollutant	Missouri Total (tons per year)
Carbon Dioxide	48,949.62
Methane	16,281.10
Formaldehyde	740.97
Benzene	622.34
Acetaldehyde	368.75
Phenol	178.90
Toluene	132.63
Cresols (Includes o, m, & p)/Cresylic Acids	132.10
1,3-Butadiene	108.92
Naphthalene	95.28
Acrolein	42.48
o-Xylene	37.46
Acenaphthylene	23.65
Phenanthrene	11.27
Fluorene	2.98
Pyrene	2.80
Fluoranthene	2.40
Benz[a]Anthracene	2.32
Anthracene	1.75
Chrysene	1.58
Benzo[e]Pyrene	1.34
Acenaphthene	1.33
Benzo[a]Pyrene	0.954
Benzo[g,h,i,]Perylene	0.876
Benzo[b]Fluoranthene	0.759
Benzo(g,h,i)Fluoranthene	0.664
Biphenyl	0.479
Indeno[1,2,3-c,d]Pyrene	0.475
Nitrous Oxide	0.317
Benzo[k]Fluoranthene	0.231

Pollutant	Missouri Total (tons per year)
Dibenzo[a,h]Anthracene	0.109
7,12-Dimethylbenz[a]Anthracene	0.087
Perylene	0.044
Manganese	0.036
Cadmium	0.005
Nickel	0.003
Mercury	0.002
Dioxins/Furans as 2,3,7,8-TCDD TEQs - WHO2005	1.09E-06
2,3,7,8-Tetrachlorodibenzofuran	5.34E-07
Octachlorodibenzo-p-Dioxin	2.84E-07
2,3,4,7,8-Pentachlorodibenzofuran	2.75E-07
1,2,3,7,8-Pentachlorodibenzofuran	1.95E-07
1,2,3,4,7,8-Hexachlorodibenzofuran	1.52E-07
1,2,3,4,6,7,8-Heptachlorodibenzo-p-Dioxin	1.35E-07
1,2,3,4,6,7,8-Heptachlorodibenzofuran	1.28E-07
1,2,3,7,8-Pentachlorodibenzo-p-Dioxin	1.10E-07
1,2,3,4,7,8-Hexachlorodibenzo-p-Dioxin	1.07E-07
1,2,3,6,7,8-Hexachlorodibenzo-p-Dioxin	1.07E-07
1,2,3,7,8,9-Hexachlorodibenzo-p-Dioxin	1.07E-07
1,2,3,4,7,8,9-Heptachlorodibenzofuran	9.99E-08
2,3,7,8-Tetrachlorodibenzo-p-Dioxin	9.73E-08
1,2,3,6,7,8-Hexachlorodibenzofuran	9.39E-08
1,2,3,7,8,9-Hexachlorodibenzofuran	8.47E-08
Octachlorodibenzofuran	7.11E-08
2,3,4,6,7,8-Hexachlorodibenzofuran	7.04E-08

e. References

1. University of Missouri Extension “Wood Fuel for Heating”
   http://extension.missouri.edu/explorepdf/agguides/forestry/g05450.pdf

8.24 Solvent: Architectural Coatings

The Missouri DNR accepted EPA's estimates of emissions for this source category. No documentation was provided by EPA.

8.25 Solvent: Auto Refinishing/Auto Aftermarket

The Missouri DNR accepted EPA's estimates of emissions for this source category. No documentation was provided by EPA.

8.26 Solvent: Consumer and Commercial Household Products

The Missouri DNR accepted EPA's estimates of emissions for this source category. No documentation was provided by EPA.

8.27 Solvent: Consumer and Commercial Personal Care, Cosmetic, and Toiletries

The Missouri DNR accepted EPA's estimates of emissions for this source category. No documentation was provided by EPA.

8.28 Solvent: Consumer and Commercial Miscellaneous Products

The Missouri DNR accepted EPA's estimates of emissions for this source category. No documentation was provided by EPA.

8.29 Solvent: Consumer and Commercial Adhesives and Sealants

The Missouri DNR accepted EPA's estimates of emissions for this source category. No documentation was provided by EPA.

8.30 Solvent: Consumer and Commercial Auto Aftermarket

The Missouri DNR accepted EPA's estimates of emissions for this source category. No documentation was provided by EPA.

8.31 Solvent: Consumer and Commercial Coatings and Related Products

The Missouri DNR accepted EPA's estimates of emissions for this source category. No documentation was provided by EPA.

8.32 Solvent: Consumer and Commercial FIFRA Regulated Products

The Missouri DNR accepted EPA's estimates of emissions for this source category. No documentation was provided by EPA.

8.33 Solvent: Degreasing

The Missouri DNR accepted EPA's estimates of emissions for this source category. No documentation was provided by EPA.

8.34 Solvent: Dry Cleaning

The Missouri DNR accepted EPA's estimates of emissions for this source category. No documentation was provided by EPA.

8.35 Solvent: Graphic Arts

The Missouri DNR accepted EPA's estimates of emissions for this source category. No documentation was provided by EPA.

8.36 Solvent: Industrial Maintenance Coatings

The Missouri DNR accepted EPA's estimates of emissions for this source category. No documentation was provided by EPA.

8.37 Solvent: Other Special Purpose Coatings

The Missouri DNR accepted EPA's estimates of emissions for this source category. No documentation was provided by EPA.

8.38 Surface Coating: Aircraft

The Missouri DNR accepted EPA's estimates of emissions for this source category. No documentation was provided by EPA.

8.39 Surface Coating: Electronic and other Electric Coatings

The Missouri DNR accepted EPA's estimates of emissions for this source category. No documentation was provided by EPA.

8.40 Surface Coating: Factory Finished Wood

The Missouri DNR accepted EPA's estimates of emissions for this source category. No documentation was provided by EPA.

8.41 Surface Coating: Large Appliances

The Missouri DNR accepted EPA's estimates of emissions for this source category. No documentation was provided by EPA.

Missouri DNR compared the NAICS 3352* (Household Appliances) against the list of ~500 point sources to be submitted to the EIS. No point source facilities were identified using the NAICS code.

County Business Patterns only identifies three facilities in three counties in Missouri with under 10 employees each. EPA's estimation method assigns 3 employees to each county and uses the VOC and HAP emission factors to estimate emissions.

County	Number of Employees Assigned
057- Dade	3
095- Jackson	3
099- Jefferson	3

Searching the wider universe of facilities who have ever submitted an EIQ to Missouri (regardless of PTE or point facility status) reveals no air permitted sources. Three facilities have been added to the facility list with NAICS of 3352*, but none of them have permits or are required to complete an emissions report. The largest employer, Tacony Manufacturing, assembles vacuums, but does not produce emissions. This larger search provides no indication that EPA's estimation method is incorrect.

8.42 Surface Coating: Machinery and Equipment

The Missouri DNR accepted EPA's estimates of emissions for this source category. No documentation was provided by EPA.

8.43 Surface Coating: Marine

The Missouri DNR accepted EPA's estimates of emissions for this source category but subtracted point source emissions from EPA's totals. No documentation was provided by EPA.

The NAICS 3366* and 488390* were compared against the list of ~500 point sources to be submitted to the EIS. Three point source facilities were identified using these NAICS codes. The following point sources with their number of employees are listed below:

County	Plant ID	Plant Name	NAICS	Product Description	Number of Employees
HENRY	0031	TRACKER MARINE	336612	FIBERGLASS BOATS	195
LACLEDE	0006	BRUNSWICK FRESHWATER GROUP	336612	BOATS, ALUMINUM	322
LACLEDE	0046	TRACKER MARINE	336612	ALUMINUM BOATS	497
LACLEDE	0038	G3 BOATS	336612	BOAT MFG	230
PEMISCOT	0030	TRINITY MARINE PRODUCTS INC	336611	BARGES	630

The following number of employees was subtracted from those counties:

County FIPS	County Name	EPA Estimate of all Point and Nonpoint Employees	Point Source Employees Subtracted	Employees Remaining in Nonpoint Estimate	Missouri Adjusted Final Number of Nonpoint Employees
083	HENRY	278	195	83	0
105	LACLEDE	1,081	1,049	32	0
155	PEMISCOT	556	630	0	0

Where there were remaining employees in the county, the County Business Patterns data was reviewed to see if the assumptions EPA used to "adjust" the number of withheld employees are reasonable, or if they inflate the number of employees higher than what the facility reports to the state.

For Henry County, 2010 CBP reports only one employer in the county with between 250 and 499 employees. The specific number of employees reported to Missouri for the single point source facility is 195 in 2011. It is reasonable to assume that EPA's method of assigning a specific value to the number of employees is inflating the employment tally in this county, and there should be no remaining nonpoint employees in Henry County, so the remaining nonpoint employees are removed.

For Laclede County, the 2010 CBP releases an actual number of employees of 1,081, with an undetermined number of facilities. Missouri point sources account for 1,049 of these employees based on their 2011 report. It is reasonable to assume that the difference in years could account for the fewer than 5% discrepancy in the number of employees. The remaining 32 nonpoint employees are zeroed out for this county and category.

After subtraction, the remaining counties where county business patterns identifies large numbers of employees that are not in the point source category are examined.

FIPS	County Name	EPA Estimated Number of Employees	Missouri Estimated Number of Employees
167	Polk	278	0
510	St. Louis City	149	149

In Polk County, there was a point source facility named “Tracker Marine – Bolivar Plant”. The facility reported over 200 employees before they shut down in July of 2009 per an air inspection. This facility should not have appeared in the 2010 County Business Patterns, where the report states that only one employer with between 250 and 499 employees existed. As there are no other employers in this NAICS in the county, EPA’s estimated number of employees (the adjusted county employee number), the county is zeroed out.

In St. Louis City, there are no other facilities Missouri is aware of in the NAICS of 3366* and 488390*. Missouri permits sources above certain de minimis thresholds as described in 10 CSR 10-6.060 and 10 CSR 10-6.065, therefore it is possible for facilities with smaller PTE to be unpermitted and unknown by the state. County business patterns state that there are three employer with NAICS 336611 (Ship building and repair) with between 100 and 249 employees total. CBP also cites that 3 employers in NAICS 488390 (Other support activities for water transportation) have total employment of 20 to 99 employees. The EPA method to adjust estimated ranges of employees to a specific number returns 149 employees in St. Louis City for marine surface coating. Since Missouri has no more specific information on permitted facilities engaged in marine operations in the county, Missouri will accept EPA’s estimate of 149 employees engaged in these activities in the county.

One county with a smaller remaining number of nonpoint employees is Camden County, 29029. EPA estimates 44 nonpoint employees in the county, and with the given emission factors, estimates 5 tons of VOC in this county. Missouri has a source in NAICS 3366*with a Basic operating permit in the county, Charger Inc. They provide periodic full EIQs, and have certified that for 2011, their emissions are within the range of 5 to 15 tons VOC. In the case of Camden County, EPA’s nonpoint estimate and Missouri-specific data are reasonably close.

This larger search provides no indication that EPA’s estimation method is incorrect, so point source subtraction is the only adjustment needed.

8.44 Surface Coating – Metal Can Coating

EPA provided an Access database with national metal can coating nonpoint emissions, and the Missouri DNR reviewed the file before making necessary adjustments.

EPA estimates emissions for VOC and three HAPs.

Pollutant Code	Pollutant Name	Emission Factor	Emission Factor Numerator	Emission Factor Denominator
VOC	Volatile Organic Compounds	3035	LB	EACH
67561	Methanol	406.69	LB	EACH
108883	Toluene	813.38	LB	EACH
107211	Ethylene Glycol	886.22	LB	EACH

EPA's estimation method relies on a count of the number of employees in each county in the industry. The US Census County Business Patterns gives this information by NAICS, but withholds certain employment numbers when a county only has one employer to avoid releasing confidential data. EPA has a methodology to take withheld county employment, given as a range of employees, to estimate a specific number of employees. Many other surface coating categories have an associated excel spreadsheet from EPA that demonstrates how the allocation of withheld employees is completed, but this work is not shown for this category. Missouri took the Access database and extracted Missouri's employment estimate by county.

State And County FIPS Code	County Name	SCC	Number of Employees
29021	Buchanan	2401040000	135.77
29031	Cape Girardeau	2401040000	7.75
29037	Cass	2401040000	7.75
29077	Greene	2401040000	46.55
29095	Jackson	2401040000	135.77
29099	Jefferson	2401040000	135.77
29107	Lafayette	2401040000	46.55
29109	Lawrence	2401040000	46.55
29155	Pemiscot	2401040000	7.75
29157	Perry	2401040000	46.55
29159	Pettis	2401040000	581.88
29189	St. Louis	2401040000	46.55

29205	Shelby	2401040000	7.75

The point sources being submitted to EPA were checked for NAICS 33243*.

County FIPS	County Name	Plant ID	Plant Name	NAICS	NAICS Description	Product Description	Number of Employees
29021	BUCHANAN	0064	SILGAN CONTAINERS CORP	332431	Metal Can Manufacturing	CANS MTL	205
29077	GREENE	0008	BRISTOL MANUFACTURING CORP	332439	Other Metal Container Manufacturing	STEEL DRUM CLEANING & REFURBISHMENT	120
29099	JEFFERSON	0044	METAL CONTAINER CORPORATION	332431	Metal Can Manufacturing	CANS BEER	174
29159	PETTIS	0012	WATERLOO INDUSTRIES INC	332439	Other Metal Container Manufacturing	METAL BOXES	650
29189	ST. LOUIS CO.	0226	GREIF-FENTON	332439	Other Metal Container Manufacturing	55 GALLON BARRELS	43

Removing the reported number of employees for point sources from Buchanan, Greene, Jefferson, Pettis and St. Louis Counties leaves the following numbers of employees:

State And County FIPS Code	County Name	SCC	Number of Employees
29021	Buchanan	2401040000	0
29031	Cape Girardeau	2401040000	7.75851393188855
29037	Cass	2401040000	7.75851393188855
29077	Greene	2401040000	0
29095	Jackson	2401040000	135.77399380805
29099	Jefferson	2401040000	0
29107	Lafayette	2401040000	46.5510835913313
29109	Lawrence	2401040000	46.5510835913313
29155	Pemiscot	2401040000	7.75851393188855
29157	Perry	2401040000	46.5510835913313
29159	Pettis	2401040000	0
29189	St. Louis	2401040000	0
29205	Shelby	2401040000	7.75851393188855

The county with the largest number of nonpoint employees is Jackson (29095) at 135 employees. Review of the US Census website (since EPA didn't provide how the final number was estimated) shows that there is one employer with between 100 and 249 employees in the county. Missouri has a previous point source facility named Ball Metal Beverage Container Company in Jackson County (EIS Facility ID 7356411), with 147 employees, but the facility closed in September of 2009. The CBP should not continue to show this county with this number of employees, so the county nonpoint number of employees is being zeroed out.

Lawrence County shows 46 nonpoint employees, and CBP shows one employer with 20 to 99 employees. Missouri has a nonpoint facility named Silgan Container Company in Lawrence County, which reported 70 employees in 2011. They were a point source in 2008 (EIS Facility ID 7281811), but have since amended their permits and as of 2009, their potential emissions do not meet the AERR requirements to be a point source. As this facility is now included in the nonpoint category, its Missouri-submitted emissions are compared to EPA's nonpoint estimate for the county. EPA estimates at 3,035 pounds VOC per employee, the single Lawrence County facility emits over 70 tons of VOC per year. Silgan has reported to Missouri emissions of 4.23 tons VOC. Missouri will be replacing EPA's estimate with higher quality, bottom-up directly reported emission data from the facility. For VOC, emissions will be the facility total as reported. The facility was below the reporting threshold for HAP data, and as such, no HAP data will be submitted for this 4 ton VOC source.

Perry County shows 46 nonpoint employees, and CBP shows one employer with 20 to 99 employees. Missouri has a nonpoint facility named H and G Marine Service in Perry County (EIS Facility ID 7285511) which reports 12 employees as of 2010. It currently has the NAICS of 332313, Plate Work Manufacturing, and has permit limits that keep it under the AERR definition of point source, but until 2010 it's NAICS was 332439, Other Metal Container Manufacturing, and its emissions were large enough to be submitted as a point source under AERR's Type B threshold. As the facility is now included in the nonpoint category, its Missouri-submitted emissions are compared to EPA's nonpoint estimate for the county. EPA estimates, at 3,035 pounds VOC per employee, the single Perry County facility emits over 70 tons of VOC per year. H and G Marine have reported to Missouri for 2010 that their VOC emissions are 20.9 tons, and that their 2011 emissions are 5 tons plus or minus that value. To provide higher-quality, bottom-up inventory data for Perry County, Missouri will replace EPA's estimate with facility-reported emissions for both VOC and HAPs.

Cape Girardeau County has 7 nonpoint employees based on the EPA and CBP estimation method. CBP shows one facility with between 0 and 19 employees in the county, and that facility corresponds to the point source facility named Mid-South Products, Inc with 13 employees in 2011 (the NAICS is listed as 332322 according to Missouri). Since all emissions for this county will appear in the point source inventory, the nonpoint number of employees will be zeroed out.

Lafayette, Cass, Pemiscot, and Shelby counties were investigated to see if a very similar NAICS code point or nonpoint facility could be determined through Missouri records, but no such facilities were identified. These counties will have emission estimates identical to EPA's estimates.

The final emission estimates being reported to EPA for nonpoint surface coating of metal cans are:

County FIPS	County Name	Number of Employees	Pollutant Code	Total Emissions	Emissions Unit of Measure
29021	Buchanan	0	VOC	0	LB
29021	Buchanan	0	107211	0	LB
29021	Buchanan	0	67561	0	LB
29021	Buchanan	0	108883	0	LB
29031	Cape Girardeau	0	VOC	0	LB
29031	Cape Girardeau	0	107211	0	LB
29031	Cape Girardeau	0	67561	0	LB
29031	Cape Girardeau	0	108883	0	LB
29037	Cass	7.75	VOC	23547.08978	LB
29037	Cass	7.75	107211	6875.750217	LB
29037	Cass	7.75	67561	3155.310031	LB
29037	Cass	7.75	108883	6310.620062	LB
29077	Greene	0	VOC	0	LB
29077	Greene	0	107211	0	LB
29077	Greene	0	67561	0	LB
29077	Greene	0	108883	0	LB
29095	Jackson	0	VOC	0	LB
29095	Jackson	0	107211	0	LB
29095	Jackson	0	67561	0	LB
29095	Jackson	0	108883	0	LB
29099	Jefferson	0	VOC	0	LB
29099	Jefferson	0	107211	0	LB
29099	Jefferson	0	67561	0	LB
29099	Jefferson	0	108883	0	LB
29107	Lafayette	46.55	VOC	141282.5387	LB
29107	Lafayette	46.55	107211	41254.5013	LB
29107	Lafayette	46.55	67561	18931.86019	LB
29107	Lafayette	46.55	108883	37863.72037	LB
29109	Lawrence	0	VOC	4.23	TON
29155	Pemiscot	7.75	VOC	23547.08978	LB
29155	Pemiscot	7.75	107211	6875.750217	LB
29155	Pemiscot	7.75	67561	3155.310031	LB
29155	Pemiscot	7.75	108883	6310.620062	LB
29157	Perry	0	VOC	20.09	TON
29157	Perry	0	100414	569.11	LB
29157	Perry	0	1330207	4344.89	LB
29157	Perry	0	108101	15467.25	LB
29157	Perry	0	108883	9766.5	LB

County FIPS	County Name	Number of Employees	Pollutant Code	Total Emissions	Emissions Unit of Measure
29159	Pettis	0	VOC	0	LB
29159	Pettis	0	107211	0	LB
29159	Pettis	0	67561	0	LB
29159	Pettis	0	108883	0	LB
29189	St. Louis	0	VOC	0	LB
29189	St. Louis	0	107211	0	LB
29189	St. Louis	0	67561	0	LB
29189	St. Louis	0	108883	0	LB
29205	Shelby	7.75	VOC	23547.08978	LB
29205	Shelby	7.75	107211	6875.750217	LB
29205	Shelby	7.75	67561	3155.310031	LB
29205	Shelby	7.75	108883	6310.620062	LB

8.45 Surface Coating: Metal Furniture

The Missouri DNR accepted EPA's estimates of emissions for this source category. No documentation was provided by EPA.

8.46 Surface Coating: Miscellaneous Manufacturing

The Missouri DNR developed the following estimate of emissions and documentation for this source category.

1. Category Description:

The category of miscellaneous manufacturing is covered by the SCC 2401090000.

SCC	**SCC Level One**	**SCC Level Two**	**SCC Level Three**	**SCC Level Four**
2401090000	Solvent Utilization	Surface Coating	Miscellaneous Manufacturing	Total: All Solvent Types

2. Estimation Method:

EPA's estimate is based on the US Census County Business Patterns database for 2010 that reports the number of employees by NAICS in each county. Some county employment data is withheld where release could be considered confidential data (especially where there is only one or two employers in the county). EPA uses an estimation method to take a range of employees and assign a specific number to each county with withheld data.

For Miscellaneous Manufacturing, EPA assigns employees in NAICS 339** and 3369* to this category. For Missouri, the adjusted employment in these NAICS is 9,108 employees.

3. Emission Factors

EPA proposes emission factors based on the number of employees in each county (pounds of pollutant released per employee per year). The only CAP with an emission factor is VOC, and nine HAPs are estimated. There is no documentation provided on the source of data for these emission factors.

CAS#	Chemical Name	Emission Factor
95476	o-Xylene	0.531418
100414	Ethyl Benzene	0.583173
108383	m-Xylene	1.20886
108101	Methyl Isobutyl Ketone	3.661701
106423	p-Xylene	0.538812
540885	Tert-butyl Acetate	2.308664
108883	Toluene	11.55441
110543	Hexane	21.84266
121448	Triethylamine	0.043438
VOC	VOC	92.42051

4. Controls

No controls are assumed for this category.

5. Emissions

EPA provides an estimate of statewide emissions for this SCC, and leaves it to the state to subtract out point source employees that overlap this NAICS. Missouri's point sources are listed below:

County FIPS	County Name	Plant ID	Plant Name	NAICS	NAICS Description	Product Description	Number of Employees
165	PLATTE	2415	HARLEY DAVIDSON MOTOR COMPANY	336991	Motorcycle, Bicycle, and Parts Manufacturing	MOTORCYCLES	900
510	ST. LOUIS CITY	1460	ALLIED HEALTH CARE PRODUCTS	339112	Surgical and Medical Instrument Manufacturing	MEDICAL GAS SYSTEMS/ MEDICAL PRODUCTS	520

The remaining categories with high assumed nonpoint employment are:

County FIPS	County name	Number of Employees Remaining
189	St. Louis	2611.46
095	Jackson	956.4601
183	St. Charles	588.7716
009	Barry	290.6557
187	St. Francois	290.6557
077	Greene	282
099	Jefferson	258
047	Clay	221
071	Franklin	170
021	Buchanan	164
097	Jasper	135.6393
181	Ripley	135.6393

St. Louis County has the highest number of nonpoint employees after considering point source subtraction. CBP states that over 2,600 employees work in NAICS 339** at over 120 employers. There are several facilities in Missouri's database of permitted emission sources with this NAICS in St. Louis County, but it is impossible to account for the sheer number of facilities and so any meaningful accounting association with nonpoint direct facility-reported emissions is not possible. The same can be said of all other counties that were examined – a large number of miscellaneous manufacturers make up the total, and individual facility contribution cannot be removed or itemized.

Total statewide emissions after point source subtraction for the miscellaneous manufacturing category are listed below.

Pollutant	Pollutant Code	Emissions (tons per year)
Volatile Organic Compounds	VOC	420.9
Hexane	110543	99.48
Toluene	108883	52.62
Methyl Isobutyl Ketone	108101	16.68
Tert-butyl Acetate	540885	10.51
m-Xylene	108383	5.51
Ethyl Benzene	100414	2.66
p-Xylene	106423	2.45
o-Xylene	95476	2.42
Triethylamine	121448	0.2

8.47 Surface Coating: Motor Vehicle

The Missouri DNR accepted EPA's estimates of emissions for this source category. No documentation was provided by EPA.

8.48 Surface Coating: Paper, foil, and film

The Missouri DNR developed the following estimate of emissions and documentation for this source category.

Description:

Paper, foil and film surface coating emissions are covered by the following nonpoint SCC:

SCC	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four
2401030000	Solvent Utilization	Surface Coating	Paper: SIC 26	Total: All Solvent Types

Activity:

EPA estimates activity by the number of reported employees in the US Census County Business Patterns database for NAICS 322221*, 322222*, 322223*, 322225* and 322226*. The employment table for Missouri counties is below:

FIPS State and County Code	fipstate	fipscty	naics	empflag	emp	Ranges	Midpoint
29047	29	047	322221	B	0	20-99	60
29047	29	047	322222	B	0	20-99	60
29077	29	077	322222	A	0	0-19	10
29077	29	077	322223	A	0	0-19	10
29139	29	139	322226	A	0	0-19	10
29165	29	165	322222	B	0	20-99	60
29183	29	183	322222	C	0	100-249	175
29189	29	189	322221		17	0	0
29189	29	189	322222		38	0	0
29510	29	510	322223	C	0	100-249	175
29510	29	510	322226	A	0	0-19	10

Emission Factors:

EPA's spreadsheet that calculates activity and emissions for VOC contains a list of HAP emission factors that is different in values and number of HAPs compared to the Access database with national emissions of CAP and HAP already completed.

	Spreadsheet	Database
Pollutant Code	EF	EF
107211	3.3075	
171	10.1577	
78933	26.46	
1330207	16.17	
71556	5.88	
108883	19.11	76.13718
108101	61.005	24.12858
100414		3.84279
106423		3.55047
108383		7.96572
110543		143.93106
121448		0.28623
540885		15.21282
95476		3.50175
VOC	609.3887738	609

Missouri will use the HAP emission factors from the database when doing point source adjustments as these are the emissions EPA intends to use for gap filling where states submit no data.

Point Source Subtraction

Point source employment in NAICS 322221*, 322222*, 322223*, 322225* and 322226* returns a single source:

Count FIPS	County Name	Plant ID	Plant Name	NAICS	Number of Employees
29510	ST. LOUIS CITY	0118	JW ALUMINUM	322225	250

County Business Patterns identifies two employers in the 249-499 number of employee range. One of the employers is in the range of 100-249 (JW Aluminum fits this category and is a point source), and another facility is within the range of 0-19 employees. A nonpoint facility with air permits is National Graphics (aka IJ Technologies) with NAICS 322222. They've reported 10 employees as of 2006, and CBP agrees they're still in this range. Their reported VOC emissions as a nonpoint source directly reporting to the state are 0.24 tons VOC in 2011. Subtracting the number of point source employees from EPA's estimated total for the county leaves (333-250) 83 employees as nonpoint. This estimate is not reasonable given the single nonpoint source direct report, so Missouri will substitute the bottom-up data from National Graphics as higher quality data compared to EPA's estimate. This county will not have HAP data as they are below the HAP reporting threshold.

Nonpoint comparisons:

The remaining counties with EPA-estimated nonpoint employees and emissions are compared to the emissions database for Missouri containing other permitted sources that do not meet EPA's AERR definition of Type A or B point source.

County FIPS	County Name	Number of Remaining Nonpoint Employees
29183	St. Charles	118
29047	Clay	78
29189	St. Louis	55
29165	Platte	41
29139	Montgomery	29
29077	Greene	24

In St. Charles County, two facilities show up on the list: EHV Weidmann Industries has a rotogravure printer for sheet printing of electrically conductive papers, and RX Systems prints paper materials for the pharmaceutical industry. Both facilities do not meet the AERR definition of point source, and have reported emissions to Missouri of less than 5 tons VOC. Neither of these facilities have reported their number of employees to Missouri, and CBP shows seven facilities comprise the total nonpoint employment in this county. Without complete employer and facility data, there is no justification to change EPA's emission estimate for this county.

In Clay County, CBP lists one employer with between 20 and 99 employees in NAICS 32221. Missouri's data shows one nonpoint facility, Pioneer Container Corporation with 74 employees. Their last reported emissions for 1996 were 3.91 tons of VOC. EPA's estimate puts them at 23 tons of VOC, which seems unreasonable given their current permit type. Missouri will use the bottom-up facility reported VOC emissions in place of EPA's estimate for this nonpoint county estimate. This county does not have HAP emissions as they are below the HAP reporting threshold.

In St. Louis County, there are no sources with this NAICS according to Missouri's data. EPA's estimate is accepted.

In Platte County, there are no sources with this NAICS according to Missouri's data. EPA's estimate is accepted.

In Montgomery County, there are no sources with this NAICS according to Missouri's data. EPA's estimate is accepted.

In Greene County, there are multiple employers according to CBP, and only one out of business facility in Missouri's data. There is not enough Missouri-specific information to verify EPA's estimate, and it is accepted as-is.

Emissions

Emissions of VOC and HAPs are summarized by county below in pounds per year. All counties not listed have zero emissions for this SCC.

County FIPS	County Name	Ethyl Benzene	p-Xylene	Methyl Isobutyl Ketone	m-Xylene	Toluene	Hexane	Triethylamine	Tert-butyl Acetate	o-Xylene	VOC
29047	Clay										7,820.00
29077	Greene	92.23	85.21	579.09	191.18	1,827.29	3,454.35	6.87	365.11	84.04	14,707.00
29139	Montgomery	111.44	102.96	699.73	231.01	2,207.98	4,174.00	8.30	441.17	101.55	17,529.00
29165	Platte	157.55	145.57	989.27	326.59	3,121.62	5,901.17	11.74	623.73	143.57	24,695.00
29183	St. Charles	453.45	418.96	2,847.17	939.95	8,984.19	16,983.87	33.78	1,795.11	413.21	72,028.00
29189	St. Louis	211.35	195.28	1,327.07	438.11	4,187.54	7,916.21	15.74	836.71	192.60	33,516.00
29510	St. Louis City										480.00

8.49 Surface Coating: Railroad

The Missouri DNR developed the following estimate of emissions and documentation for this source category.

1. Category Description

Surface coating of railroad equipment and rolling stock is covered by the following nonpoint SCC

SCC	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four
2401085000	Solvent Utilization	Surface Coating	Railroad: SIC 374	Total: All Solvent Types

2. Emission Factors

EPA's spreadsheet and the Access database contain differing numbers of HAP pollutants and different emission factors.

	Access DB	Spreadsheet
Pollutant Code	Emission Factor	Emission Factor
100414	3.12832	None
108883	41.44816	5.772
110543	73.8608	None
1330207	12.03488	4.884
VOC	208	208
74556	none	1.776
78933	none	7.992
171	none	3.068
107211	none	0.999

The Access database emission factors are used for Missouri's estimate as EPA intends to submit this data to the EIS as a national default.

3. Point Source Subtraction

For point sources with NAICS 3365*, the following point source in Jefferson County has more reported employees than the EPA CDB estimation method for the single employer in the county. For Jefferson County, there are no nonpoint emissions for railroad surface coating.

County	County Name	Plant Number	Plant Name	Site Name	NAICS	NAICS Description	Product Description	Number of Employees
095	JACKSON	2035	WABTEC KANSAS CITY SERVICE CENTER	WABTEC KANSAS CITY SERVICE CENTER	336510	RAILROAD ROLLING STOCK MANUFACTURING	RAILCAR PARTS RMFGF	228
099	JEFFERSON	0011	UNION PACIFIC RAILROAD CO	DESOTO CAR SHOP	336510	RAILROAD ROLLING STOCK MANUFACTURING	RAILCARS	316

For Jackson County, a nonpoint permitted facility named Wabtec Kansas City Service Center has reported 228 employees to Missouri, with 3.4 tons of VOC emissions. The CBP database shows only one employer in the county with a range from 100-249 employees. Since there are no unaccounted for employees in the county, and the nonpoint estimation method is significantly higher than this (12 tons VOC), the more accurate, bottom-up reported emissions are used in place of EPA's estimate.

The final emissions submitted for this category (all other Missouri counties are submitted with zero emissions):

State And County FIPS Code	County Name	Emissions Unit of Measure Code	Ethyl Benzene	Hexane	Toluene	Volatile Organic Compounds	Xylenes (Mixed Isomers)
29031	Cape Girardeau	LB	188	4432	2487	12498	722
29043	Christian	LB	188	4432	2487	12498	722
29069	Dunklin	LB	188	4432	2487	12498	722
29095	Jackson	LB	0	0	0	6800	0
29099	Jefferson	LB	0	0	0	0	0

8.50 Surface Coating: Traffic Markings

The Missouri DNR accepted EPA's estimates of emissions for this source category. No documentation was provided by EPA.

8.51 Surface Coating: Wood Furniture

The Missouri DNR accepted EPA's estimates of emissions for this source category. No documentation was provided by EPA.

8.52 Landfills

a. Source Category Description

Emissions from landfills include criteria and HAP pollutants, along with GHG pollutants not covered by this inventory. Landfills with large capacity and methane generation potential are subject to Part 70 operating permit requirements, and are therefore included in the point source part of the inventory. The list of point source landfills is in the table below.

County Name	County Code	Plant Identifier	Plant Name	Site Name	Operating Permit Type	SIC	NAICS
BOONE	019	0091	COLUMBIA SANITARY LANDFILL	COLUMBIA	P70	4953	562212
BUCHANAN	021	0105	ST. JOSEPH LANDFILL	50TH ROAD SE	P70	4953	562212
BUTLER	023	0058	BUTLER COUNTY LANDFILL	BUTLER COUNTY SANITARY LANDFILL	P70	4953	562212
COLE	051	0058	JEFFERSON CITY LANDFILL LLC	JEFFERSON CITY	P70	4953	562212
GREENE	077	0161	SPRINGFIELD SANITARY LANDFILL	WILLARD	P70	4953	562212
JACKSON	095	0267	COURTNEY RIDGE LANDFILL, LLC	COURTNEY RIDGE LANDFILL	P70	4953	562212
JACKSON	095	0273	RUMBLE RECYCLING AND DISPOSAL SERVICES	SANITARY LANDFILL RUMBLE 1 & 2	P70	4953	562212
JACKSON	095	2101	SOUTHEAST LANDFILL, LLC	KANSAS CITY LANDFILL	P70	4953	562212
JACKSON	095	0272	LEE'S SUMMIT SANITARY LANDFILL	LEE'S SUMMIT SANITARY LANDFILL	P70	4953	562212
BARTON	011	0039	PRAIRIE VIEW REGIONAL WASTE FACILITY	LAMAR	P70	4953	562212
LEWIS	111	0025	BFI BACKRIDGE LANDFILL	LAGRANGE	P70	4953	562212
WRIGHT	229	0022	BLACK OAK RECYCLING & DISPOSAL FACILITY	DIV WASTE CORPORATION OF MISSOURI INC	P70	4953	562212
MACON	121	0027	VEOLIA ES MAPLE HILL LANDFILL, INC	MACON	P70	4953	562212
PETTIS	159	0055	CENTRAL MISSOURI SANITARY LANDFILL	CENTRAL MISSOURI SANITARY LANDFILL	P70	4953	562212
PIKE	163	0040	EAGLE RIDGE LANDFILL	BOWLING GREEN	P70	4953	562212
ST. LOUIS CO.	189	0281	BFI MISSOURI PASS	MARYLAND	P70	4953	562212

County Name	County Code	Plant Identifier	Plant Name	Site Name	Operating Permit Type	SIC	NAICS
			LANDFILL	HEIGHTS			
ST. LOUIS CO.	189	0308	IESI MO CHAMP LANDFILL	ST. LOUIS COUNTY	P70	4953	562212
ST. LOUIS CO.	189	0310	ADVANCED DISPOSAL SERVICES	OAK RIDGE LANDFILL	P70	4953	562212
ST. LOUIS CO.	189	0312	BRIDGETON LANDFILL, LLC	BRIDGETON	P70	4953	562212
STODDARD	207	0062	LEMONS SANITARY LANDFILL	DEXTER	P70	4953	562212
WASHINGTON	221	0031	IESI CORPORATION	TIMBER RIDGE LANDFILL	P70	4953	562212
JOHNSON	101	0046	SHOW-ME REGIONAL LANDFILL	SHOW-ME REGIONAL LANDFILL	P70	4953	562212

For this source category, the following SCC was assigned:

Source Classification Code	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four
2320000000	Waste Disposal, Treatment, and Recovery	Landfills	All Categories	Total

b. Activity Data

The small landfills in Missouri are not permitted, and therefore aren't subject to reporting requirements that would allow bottom-up inventory development with state-specific data. EPA has not provided a nonpoint estimate starting point for states for 2011. EPA's 2008 NEI v2 documentation states on page 7:

"Landfills have not been estimated by EPA for the 2008 NEI, as had been done in earlier NEI years. Some States do report some pollutants for some of their larger landfills, and these have been included in the 2008 NEI. This is expected to be largely an issue for some toxics. The scope of the underestimate is uncertain, due to an expectation that many landfills have been adding gas collection systems as a result of various control programs and the value of the collected gas as a fuel. "

As such, Missouri is choosing not to provide a nonpoint emission estimate for landfills and will let the point source landfills stand on their own.

f. References

1. 2008 NEI Version 2 Technical Support Documentation (draft), updated 6/2012. Accessed 10-25-2012 at http://www.epa.gov/ttn/chief/net/2008neiv2/2008_neiv2_tsd_draft.pdf

8.53 Publically Owned Treatment Works

The Missouri DNR accepted EPA's estimates of emissions for this source category. EPA is pulling this emission estimate forward as-is from 2008 to 2011 with no updates. Missouri sees no problems with this method, and has no point source subtraction to complete for this category. The documentation below was developed by EPA.

Source Category Description

Publicly Owned Treatment Works (POTW) means a treatment works that is owned by a state, municipality, city, town, special sewer district, or other publicly owned and financed entity as opposed to a privately (industrial) owned treatment facility. The definition includes intercepting sewers, outfall sewers, sewage collection systems, pumping, power, and other equipment. The wastewater treated by these POTWs is generated by industrial, commercial, and domestic sources.[1]

The general approach to calculating emissions for POTWs is to estimate the 2008 national POTW flow rate using methods described below and then multiply the estimated flow rate by the emission factors for VOCs, ammonia, and 53 HAPs. The emissions are allocated to the county level using methods described below.

Activity Data

A nationwide projected flow rate in 2010 of 39,780 million gallons per day (MMGD) was available from an EPA report.[2] Of this, POTWs account for 98.5 percent of the flow rate or 39,180 MMGD, with privately owned treatment works accounting for the rest. The EPA Clean Watersheds Needs Survey reports the existing flow rate in 2004 for POTWs as 34,370 MMGD.[3] The interpolated 2008 nationwide flow rate (using a linear regression) was calculated at 37,580 MMGD, or 13,754,280 million gallons annually. The nationwide flow rate includes Puerto Rico and the U.S. Virgin Islands.

Emission Factors

The ammonia emission factor was obtained from a report to EPA[4], while the VOC emission factor was based on a TriTAC study.[5] Emission factors for the 53 HAPs were derived using 1996 area source emissions estimates that were provided by ESD[6] and the 1996 nationwide flow rate.[7] These HAP emission factors were then multiplied by the 2008 to 2002 VOC emission factor ratio (0.85/9.9) to obtain the final HAP emission factors applied in the 2008 inventory. The emission factors, pollutant codes, and pollutant descriptions are reported in the table below.

Criteria and HAP Emission Factors for Publicly Owned Treatment Works (SCC 2630020000): Not Adjusted for Point Source Emissions

Pollutant Description	NIF 3.0 Pollutant Codes	Emission Factor (lb/MMGAL)	Emission Factor Reference(s)
1,1,2,2-TETRACHLOROETHANE	79345	1.75E-06	6, 7
1,1,2-TRICHLOROETHANE	79005	1.17E-06	6, 7
1,2,4-TRICHLOROBENZENE	120821	8.67E-05	6, 7
1,3-BUTADIENE	106990	2.51E-05	6, 7
1,4-DICHLOROBENZENE	106467	2.16E-04	6, 7
1-CHLORO-2,3-EPOXYPROPANE	106898	4.52E-06	6, 7
2,4-DINITROTOLUENE	121142	4.81E-05	6, 7
2-NITROPROPANE	79469	2.92E-07	6, 7
ACETALDEHYDE	75070	3.10E-04	6, 7
ACETONITRILE	75058	3.45E-04	6, 7
ACROLEIN	107028	3.84E-04	6, 7
ACRYLONITRILE	107131	3.86E-04	6, 7
ALLYL CHLORIDE	107051	1.94E-05	6, 7
AMMONIA	NH_3	1.69E-01	4
BENZENE	71432	6.73E-03	6, 7
BENZYL CHLORIDE	100447	8.17E-06	6, 7
BIPHENYL	92524	7.52E-05	6, 7
CARBON DISULFIDE	75150	4.32E-03	6, 7
CARBON TETRACHLORIDE	56235	1.12E-03	6, 7
CHLOROBENZENE	108907	4.83E-04	6, 7
CHLOROFORM	67663	6.44E-03	6, 7
CHLOROPRENE	126998	2.38E-05	6, 7
CRESOLS (INCLUDES O, M, & P)/CRESYLIC ACIDS	331	1.61E-06	6, 7
DIMETHYL SULFATE	77781	1.31E-06	6, 7
ETHYL ACRYLATE	140885	1.75E-06	6, 7
ETHYL BENZENE	100414	7.66E-03	6, 7
ETHYLENE OXIDE	75218	2.22E-04	6, 7
FORMALDEHYDE	50000	1.97E-05	6, 7
GLYCOL ETHERS	171	1.15E-02	6, 7
HEXACHLOROBUTADIENE	87683	7.29E-07	6, 7
HEXACHLOROCYCLOPENTADIENE	77474	5.83E-07	6, 7
METHANOL	67561	1.14E-02	6, 7
METHYL CHLOROFORM	71556	5.63E-04	6, 7
METHYL ETHYL KETONE	78933	2.84E-03	6, 7
METHYL ISOBUTYL KETONE	108101	2.69E-03	6, 7
METHYL METHACRYLATE	80626	3.11E-04	6, 7
METHYL TERT-BUTYL ETHER	1634044	6.37E-05	6, 7
METHYLENE CHLORIDE	75092	9.10E-03	6, 7
N,N-DIMETHYLANILINE	121697	3.22E-04	6, 7
NAPHTHALENE	91203	1.31E-03	6, 7

Pollutant Description	NIF 3.0 Pollutant Codes	Emission Factor (lb/MMGAL)	Emission Factor Reference(s)
NITROBENZENE	98953	6.56E-06	6, 7
O-TOLUIDINE	95534	1.75E-06	6, 7
P-DIOXANE	123911	1.79E-05	6, 7
PROPIONALDEHYDE	123386	3.50E-06	6, 7
PROPYLENE DICHLORIDE	78875	1.15E-05	6, 7
PROPYLENE OXIDE	75569	7.32E-04	6, 7
STYRENE	100425	2.73E-03	6, 7
TETRACHLOROETHYLENE	127184	4.27E-03	6, 7
TOLUENE	108883	1.23E-02	6, 7
TRICHLOROETHYLENE	79016	3.06E-04	6, 7
VINYL ACETATE	108054	7.66E-05	6, 7
VINYL CHLORIDE	75014	6.71E-06	6, 7
VINYLIDENE CHLORIDE	75354	4.23E-04	6, 7
VOLATILE ORGANIC COMPOUNDS	VOC	8.50E-01	5
XYLENES (MIXTURE OF O, M, AND P ISOMERS)	1330207	5.98E-02	6, 7

lb/MMGAL = pounds per million gallons

Emissions

Emissions were allocated to the county-level by the county proportion of the U.S. population.[8]

It is important to note that the emission estimates for this category represent total emissions. It may be necessary to determine whether there are point source emissions in SCCs 50100701 through 50100781 and 50100791 through 50182599 that need to be subtracted to yield the nonpoint source emission estimates for this category.

Sample Calculations:

The 1996 flow rate per day was 32,175 MMGD. (1996 was a leap year.) Annually, this computes to:

32,175 MMGD treated * 366 days = 11,776,050 million gallons treated

Benzene emissions in 1996 for area source POTWs were estimated to be 461.44 tons per year. The derived benzene emission factor is calculated as follows:

Benzene emission factor = ((461.44 tons * 2000 lb/ton) / (11,776,050 million gallons treated)) * (0.85/9.9)

Benzene emission factor = 0.0067287 lb/million gallons treated

Benzene emissions for 2008 for area source POTWs are calculated as follows:

2008 Benzene emissions = (37,580 MMGD * 366 days) * (0.0067287 lb/million gallons treated)

2008 Benzene emissions = 92,548 pounds / 2,000 pounds = 46.27 tons/year

Total national 2008 benzene emissions from area source POTWs are allocated to county-level by the county proportion of the U.S. population. The total U.S. population in 2008 is 308,123,578. Benzene emissions for Autauga County, Alabama (2008 population of 50,364) are calculated as follows:

2008 emissions = 46.27 tons/year * 50,364/308,123,578 = 0.0076 tons/year

References

1. U.S. Environmental Protection Agency, 64FR57572, National Emission Standards for Publicly Owned Treatment Works, Final Rule, 40 CFR Part 63, 26 October 1999.
2. U.S. Environmental Protection Agency, "Wastewater Flow Projections for POTWs and Privately and Federally Owned Treatment Works in 2000, 2005, and 2010," Table A-8 in *Biosolids Generation, Use, and Disposal in the United States*, EPA530-R-99-009, September 1999.
3. U.S. Environmental Protection Agency, Clean Watersheds Needs Survey, Ask WATERS Online Database Query Tool, at http://iaspub.epa.gov/waters10/query_tool.criteria?srept_no=165&branding=15, accessed 19 May 2009.
4. Stephen M. Roe, Melissa D. Spivey, Holly C. Lindquist, Kirstin B. Thesing, and Randy P. Strait, E.H. Pechan & Associates, Inc., *Estimating Ammonia Emissions from Anthropogenic Nonagricultural Sources – Draft Final Report*, prepared for U.S. Environmental Protection Agency, Emission Inventory Improvement Program, April 2004.
5. Prakasam Tata, Jay Witherspoon, Cecil Lue-Hing (eds.), VOC Emissions from Wastewater Treatment Plants: Characterization, Control, and Compliance, Lewis Publishers, 2003, p. 261.
6. Memorandum from Bob Lucas, U.S Environmental Protection Agency to Greg Nizich, U.S. Environmental Protection Agency, "Review of Baseline Emissions Inventory," 16 October 1998.
7. U.S. Environmental Protection Agency, "Facilities Database (Needs Survey) - Frequently Asked Questions," at http://www.epa.gov/owm/mtb/cwns/1996rtc/faqwfd.htm, accessed 22 May 2009.

8. U.S. Census Bureau, "Population Estimates," at http://www.census.gov/popest/estimates.html, released 14 May 2009 with population estimates as of 1 July 2008. Note: The U.S. Census Bureau estimate does not include the U.S. Virgin Islands, so the Census Bureau estimate was supplemented with Virgin Island population data from U.S. Department of Commerce, National Oceanic and Atmospheric Administration, *Demographic Baseline Report of U.S. Territories and Counties Adjacent to Coral Reef Habitats*, June 2008, at http://coris.noaa.gov/activities/coral_demographics, accessed 9 June 2009.

8.54 Cremation: Human and Animal

The Missouri DNR developed the following estimate of emissions and documentation for this source category.

a. Source Category Description

Human and animal cremation is the process of disposing of carcasses in a high temperature incineration chamber. Criteria air pollutant (CAP) and hazardous air pollutant (HAP) emission estimates for cremation are reported as the mass of material incinerated combined with an emission factor for each pollutant.

For this source category, the following SCC was assigned:

SCC	SCC Level 1	SCC Level 2	SCC Level 3	SCC Level 4
2810060100	Miscellaneous Area Sources	Other Combustion	Cremation	Humans
2810060200	Miscellaneous Area Sources	Other Combustion	Cremation	Animals

b. Activity Data

Missouri chose between two methods to develop emissions for this category: use emission inventory data collected from specific, stationary crematory sites, or use surrogate activity data with emission assumptions.

The Emission Inventory Improvement Program[4] (EIIP) Volume 3, Chapter 1 describes area source (now known as nonpoint source) emission estimation methods states can choose from. To obtain the most accurate inventory, the most specific data collected and quality assured is preferable to surrogate activity data that is allocated to the geographic region of interest. For the human or animal crematory category, these facilities have reported emissions directly to the state of Missouri as described in section c. Using quality assured facility-reported data ensures that the inventory is developed in a bottom-up fashion, as opposed to a top-down method where activity data from a much larger geographic region is used to estimate emissions and allocated down to the county level.

The bottom-up approach for Missouri relies on facility submitted emission reports required by 10 CSR 10-6.110. Crematory facilities are not required to submit detailed emission reports annually due to their permit type and potential to emit – they can roll forward a representative year's emissions as long as the total emissions change less than 5 tons and they have no new permitted equipment operating in the year. For the majority of these facilities, emissions vary less than 2 tons per year due to their steady nature of operation and consistent emission rates. It is reasonable to assume a past emission report is representative of the 2011 year for this category.

c. Controls

Emissions from crematory operations may include a very small amount of several chemicals. Controls are seldom used for this process. Afterburners are the most frequently used for the sites which have controlled emissions. Of the 90 crematory sites in Missouri, 14 use control equipment.

d. Emission Factors

The statewide average for the emission factor of the criteria pollutants are listed in the following table:

Pollutant	Emission Factor (lbs/ton cremated)
PM_{10}	3.152
SO_x	2.296
NO_x	4.296
VOC	3.482
CO	2.783
$PM_{2.5}$	1.973

An examination of the range of values for the emission factors was done to determine the effect of changing the high and low end values of the emission factor. The webFIRE factor was used for the sites which used factors significantly different than the webFIRE factor. The emissions would change minimally (about 0.02 tons or 40 pounds per pollutant), so the emission factors have a negligible effect on the total emissions.

Criteria pollutants are included in Missouri's data as not all facilities reported HAP data due to the reporting threshold of 20 or 200 lbs per year, depending on the HAP pollutant. EPA has provided estimates of HAPs for this category, and they may choose to use them where Missouri does not provide data.

e. Crematory Sites

When the list was initially pulled from the Missouri Emission Inventory database the sites were queried by SIC/NAICS. Incinerators which were in grocery stores that burned cardboard boxes were on the initial list. Currently, all those incinerators are shut down but the grocery stores are still active and exist in the database. To eliminate facilities which do not cremate the second criteria was added to the query – SCCs which are specific to cremation. Hospitals which cremate remains would not be included on the list because of the SIC/NAICS they have even though they use the SCCs which are specific to cremation. The list which was generated is 90 active facilities.

The sites in Missouri were selected based on a combination of the NAICS/SIC and the SCC used on the emission inventory questionnaires. The following tables show which codes were selected and their descriptions.

Crematory NAICS			
NAICS	**NAICS description**	**SIC**	**SIC description**
562213	Solid Waste Combustors and Incinerators	4953	Refuse Systems (solid waste combustors and incinerators)
812210	FUNERAL HOMES AND FUNERAL SERVICES	7261	FUNERAL SERVICES AND CREMATORIES (FUNERAL HOMES AND SERVICES)
812220	CEMETERIES AND CREMATORIES	7261	FUNERAL SERVICES AND CREMATORIES (CREMATORIES)
812910	PET CARE (EXCEPT VETERINARY) SERVICES	0752	ANIMAL SPECIALTY SERVICES, EXCEPT VETERINARY (PET CARE SERVICES, EXCEPT VETERINARY)

Crematory SCC				
SCC code	**Level 1 Description**	**Level 2 Description**	**Level 3 Description**	**Level 4 Description**
31502101	Industrial Processes	Photographic Equipment/Health Care/Laboratories	Health Care - Crematoriums	Crematory Stack

Crematory SCC				
SCC code	Level 1 Description	Level 2 Description	Level 3 Description	Level 4 Description
31502102	Industrial Processes	Photographic Equipment/Health Care/Laboratories	Health Care - Crematoriums	Crematory Stack - Human and Animal Crematories
50100505	Waste Disposal	Solid Waste Disposal - Government	Other Incineration	Medical Waste Incinerator, unspecified type, Infectious wastes only
50200101	Waste Disposal	Solid Waste Disposal - Commercial/Institutional	Incineration	Multiple Chamber
50200501	Waste Disposal	Solid Waste Disposal - Commercial/Institutional	Incineration: Special Purpose	Med Waste Controlled Air Incin-aka Starved air, 2-stg, or Modular comb
50200504	Waste Disposal	Solid Waste Disposal - Commercial/Institutional	Incineration: Special Purpose	Medical Waste Incinerator, unspecified type (use 502005-01, -02, -03)
50200505	Waste Disposal	Solid Waste Disposal - Commercial/Institutional	Incineration: Special Purpose	Medical Waste Incinerator, unspecified type, Infectious wastes only

The table below shows which counties have these sites as well the count of each. One site on the list (in Pettis County) had a facility which processed both human and animal remains at their location.

County	County Name	Number of sites	Animal Crematories	Human Crematories
29001	ADAIR	1	0	1
29003	ANDREW	0	0	0
29005	ATCHISON	0	0	0
29007	AUDRAIN	0	0	0
29009	BARRY	1	0	1
29011	BARTON	0	0	0
29013	BATES	0	0	0
29015	BENTON	2	0	2
29017	BOLLINGER	0	0	0
29019	BOONE	6	2	4
29021	BUCHANAN	2	0	2
29023	BUTLER	1	0	1
29025	CALDWELL	0	0	0
29027	CALLAWAY	1	0	1
29029	CAMDEN	1	0	1
29031	CAPE GIRARDEAU	3	2	1
29033	CARROLL	0	0	0
29035	CARTER	0	0	0
29037	CASS	0	0	0
29039	CEDAR	0	0	0
29041	CHARITON	0	0	0

County	County Name	Number of sites	Animal Crematories	Human Crematories
29043	CHRISTIAN	0	0	0
29045	CLARK	0	0	0
29047	CLAY	2	2	0
29049	CLINTON	1	1	0
29051	COLE	2	2	0
29053	COOPER	1	1	0
29055	CRAWFORD	0	0	0
29057	DADE	0	0	0
29059	DALLAS	0	0	0
29061	DAVIESS	0	0	0
29063	DE KALB	0	0	0
29065	DENT	0	0	0
29067	DOUGLAS	0	0	0
29069	DUNKLIN	0	0	0
29071	FRANKLIN	1	0	1
29073	GASCONADE	0	0	0
29075	GENTRY	0	0	0
29077	GREENE	3	0	3
29079	GRUNDY	0	0	0
29081	HARRISON	0	0	0
29083	HENRY	0	0	0
29085	HICKORY	0	0	0
29087	HOLT	0	0	0
29089	HOWARD	0	0	0
29091	HOWELL	1	0	1
29093	IRON	0	0	0
29095	JACKSON	10	4	6
29097	JASPER	7	3	4
29099	JEFFERSON	2	1	1
29101	JOHNSON	2	1	1
29103	KNOX	0	0	0
29105	LACLEDE	1	1	0
29107	LAFAYETTE	0	0	0
29109	LAWRENCE	0	0	0
29111	LEWIS	0	0	0
29113	LINCOLN	0	0	0
29115	LINN	0	0	0
29117	LIVINGSTON	1	1	0
29119	MCDONALD	0	0	0

County	County Name	Number of sites	Animal Crematories	Human Crematories
29121	MACON	0	0	0
29123	MADISON	0	0	0
29125	MARIES	1	1	0
29127	MARION	0	0	0
29129	MERCER	0	0	0
29131	MILLER	0	0	0
29133	MISSISSIPPI	0	0	0
29135	MONITEAU	0	0	0
29137	MONROE	0	0	0
29139	MONTGOMERY	0	0	0
29141	MORGAN	0	0	0
29143	NEW MADRID	0	0	0
29145	NEWTON	0	0	0
29147	NODAWAY	0	0	0
29149	OREGON	1	1	0
29151	OSAGE	0	0	0
29153	OZARK	0	0	0
29155	PEMISCOT	1	1	0
29157	PERRY	0	0	0
29159	PETTIS	1	1	1
29161	PHELPS	4	3	1
29163	PIKE	0	0	0
29165	PLATTE	2	1	1
29167	POLK	1	1	0
29169	PULASKI	2	1	1
29171	PUTNAM	0	0	0
29173	RALLS	0	0	0
29175	RANDOLPH	0	0	0
29177	RAY	0	0	0
29179	REYNOLDS	0	0	0
29181	RIPLEY	0	0	0
29183	ST. CHARLES	6	2	4
29185	ST. CLAIR	0	0	0
29186	STE. GENEVIEVE	0	0	0
29187	ST. FRANCOIS	3	0	3
29189	ST. LOUIS CO.	10	1	9
29195	SALINE	0	0	0
29197	SCHUYLER	0	0	0
29199	SCOTLAND	0	0	0

County	County Name	Number of sites	Animal Crematories	Human Crematories
29201	SCOTT	0	0	0
29203	SHANNON	0	0	0
29205	SHELBY	0	0	0
29207	STODDARD	1	0	1
29209	STONE	1	0	1
29211	SULLIVAN	0	0	0
29213	TANEY	0	0	0
29215	TEXAS	0	0	0
29217	VERNON	0	0	0
29219	WARREN	0	0	0
29221	WASHINGTON	0	0	0
29223	WAYNE	0	0	0
29225	WEBSTER	1	1	0
29227	WORTH	0	0	0
29229	WRIGHT	0	0	0
29510	ST. LOUIS CITY	3	2	1
Total Statewide		**90**	**37**	**54**

f. Emissions from Human Cremation

The following table lists county-total emissions by pollutant. Emissions are listed in tons per year. Counties without human crematories are not included in this table.

County	County Name	Number of Human Crematory Facilities	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_x	VOC
29001	ADAIR	1	0.0008	0.0056	0	0	0	0.0002
29009	BARRY	1	0.0052	0.0063	0.0054	0.0036	0.0038	0.0005
29015	BENTON	2	0.0171	1.7375	0.1141	0	0.265	0.0146
29019	BOONE	4	0.1516	0.1376	0.1176	0.0868	0.0872	0.0252
29021	BUCHANAN	2	0.3336	0.1575	0.2541	0.108	0.1212	0.2999
29023	BUTLER	1	0	0	0	0	0	0
29027	CALLAWAY	1	0	0	0.0123	0	0	0
29029	CAMDEN	1	0	0	0	0	0	0
29031	CAPE GIRARDEAU	1	0.0002	0	0.0003	0	0.0007	0
29071	FRANKLIN	1	0.0001	0.0123	0.0002	0	0.0012	0.0001
29077	GREENE	3	0.0057	0.1767	0.0617	0.0348	0.0513	0.0024
29091	HOWELL	1	0	0.0003	0.03	0	0.0001	0
29095	JACKSON	6	0.1152	0.457	0.9048	0.6919	0.5172	0.6599
29097	JASPER	4	0.0417	0.2651	0.0817	0.006	0.06	0.1914
29099	JEFFERSON	1	0.0199	0.024	0.0205	0	0.0146	0.002
29101	JOHNSON	1	0.0017	0.0374	0.0622	0.0212	0.0778	0.0059

County	County Name	Number of Human Crematory Facilities	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_x	VOC
29159	PETTIS	1	0.0583	0.0175	0.0151	0	0.0151	0.0175
29161	PHELPS	1	0.0148	0.0178	0.0152	0	0.0109	0.0015
29165	PLATTE	1	0.1008	0.1217	0.2024	0	0.0855	0.3488
29169	PULASKI	1	0.0116	0.0447	0.0771	0	0.0027	0.0671
29183	ST. CHARLES	4	0.2025	0.2446	0.2389	0.0001	0.1485	0.2066
29187	ST. FRANCOIS	3	0.0162	0.0268	0.033	0	0.0148	0.0563
29189	ST. LOUIS CO.	9	0.173	0.2089	0.178	0	0.127	0.0171
29207	STODDARD	1	0	0	0.0006	0	0	0
29209	STONE	1	0	0	0	0	0	0
29510	ST. LOUIS CITY	1	0.1062	0.1281	0.1682	0	0.0781	0.0107
Statewide Total Human Cremation			1.3762	3.8274	2.5934	0.9524	1.6827	1.9277

g. Emissions from Animal Cremation

The following table lists county-total emissions by pollutant. Counties without animal crematories are not included in this table. Emissions are in tons per year.

County	County Name	Number of Animal Crematory Facilities	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_x	VOC
29019	BOONE	2	0.2794	0.043	0.0708	0.0555	0.0311	0.1093
29031	CAPE GIRARDEAU	2	0.0532	0.095	0.118	0.023	0.1561	0.1803
29047	CLAY	2	0.1342	0.1619	0.2693	0.22	0.1137	0.4641
29049	CLINTON	1	0.0147	0.0178	0.0296	0.025	0.0125	0.051
29051	COLE	2	0.1369	0.0412	0.0645	0	0.0343	0.041
29053	COOPER	1	0.0002	0.0037	0.0006	0.0006	0.0007	0.0037
29095	JACKSON	4	2.0289	1.157	0.9072	0	0.9641	0.8858
29097	JASPER	3	0.1481	0.1725	0.0781	0	0.1389	0.2393
29099	JEFFERSON	1	0.3726	1.599	0.9173	0	1.3325	1.599
29101	JOHNSON	1	0.0039	0.0048	0.0062	0.0027	0.0029	0
29105	LACLEDE	1	0.0929	0.1121	0.1864	0	0.0787	0.3213
29117	LIVINGSTON	1	0.0029	0.0035	0.0059	0	0.0025	0.0102
29125	MARIES	1	0.0047	0.0056	0.0093	0	0.0039	0.0161
29149	OREGON	1	0.0022	0.0027	0.0023	0.0015	0.0016	0.0002
29155	PEMISCOT	1	0.001	0.0048	0.0015	0	0	0.0048
29159	PETTIS	1	0.0015	0.0189	0.0147	0	0.0147	0.0189
29161	PHELPS	3	0.0277	0.0335	0.0724	0	0.0233	0.0907
29165	PLATTE	1	0.0293	0.4295	0.0796	0	0.2343	0.1063
29167	POLK	1	0.0038	0.0046	0.0076	0	0.0032	0.0132
29169	PULASKI	1	0.0135	0.0163	0.0271	0	0.0099	0.0468
29183	ST. CHARLES	2	0.1841	0.2259	0.3716	0	0.1568	0.6402
29189	ST. LOUIS CO.	1	0.043	0.052	0.0443	0	0.0317	0.0043
29225	WEBSTER	1	0.0214	0.0258	0.0429	0	0.0181	0.074
29510	ST. LOUIS CITY	2	0.049	0.9529	0.4919	0	1.4762	1.941
Statewide Total Animal Cremation			**3.6491**	**5.184**	**3.8191**	**0.3283**	**4.8417**	**6.8615**

h. QA/QC

1. Number of facilities checked –outliers examined

One of the first sites examined was Logan College (29189-1114). The NO_x emissions from this site are over 4 tons. A closer look at the data revealed that natural gas combustion in space heaters contributed virtually all their NO_x emissions. This revelation led to the use of specific SCCs to obtain the cremation emissions in our tables. Site emissions include data which would overstate the cremation emission data. Therefore the process emissions were used via the SCC at specific sites which have the selected NAICS. Once the selection criteria were established, the data was reliable.

The emissions for each site are usually small so the sites which have large numbers stand out. Ten sites with the largest quantity of emissions were selected for a quality check. Emission factors, past years throughput and emission variances were quality checked. They were acceptable.

Further quality checks revealed two facilities used an unusually large throughput for their incinerator. They were submitting in the incorrect units (pounds or hours) of throughput when the questionnaire requires the throughput quantity in tons. They were corrected.

2. Compared to EPA estimate (statewide total table)

In the table below, the animal and human cremation emissions are combined. There are discrepancies between the emissions taken from the EPA website and the data from the Missouri EIQs.

Pollutant	**EPA Estimate Of Cremation** *(Emissions in Tons)*	**Missouri EIQ Cremation Data** *(Emissions in Tons)*
PM_{10}	1.34	6.41
SO_x	3.14	6.52
NO_x	20.38	9.01
VOC	.07	8.79
CO	.1	5.03
$PM_{2.5}$	1.34	1.28

EPA's emission estimate uses top-down information on mortality, population distribution, and emission factors that Missouri has not reviewed. Missouri's estimate comes from a bottom-up method, and uses published and vetted emission factors from AP-42 in most all cases. Missouri chooses to use state-specific inventory data for this category.

8.55 Asphalt Paving: Cutback

The Missouri DNR accepted EPA's estimates of emissions for this source category. The documentation below was developed by EPA.

a. Source Category Description

Asphalt paving is the process of applying asphalt concrete to seal or repair the surface of roads, parking lots, driveways, walkways, or airport runways. Asphalt concrete is a composite material comprised of a binder and a mineral aggregate. The binder, referred to as asphalt cement, is a byproduct of petroleum refining and contains the semi-solid residual material left after the more volatile chemical fractions have been distilled off.[1]

Asphalt cements thinned with petroleum distillates are known as cutback asphalts. The primary uses of cutback asphalt include tack and seal operations, priming roadbeds, and paving operations for pavements up to several inches thick. Cut-back asphalt is produced by thinning the binder in a diluent containing 25 to 45 percent petroleum distillates by volume prior to mixing with the aggregate. This reduces the viscosity of the asphalt making it easier to work with the mixture.

Emissions from cutback asphalt result from the evaporation of VOCs and HAPS after the mixture is laid down. Of all asphalt types, cutback asphalt has the highest diluent content and, as a result, emits the highest levels of VOCs per ton used. The timeframe and quantity of VOC and HAP emissions depend on the type and the quantity of organic solvent used as a diluent.

For this source category, the following SCC was assigned:

SCC	**SCC Level 1**	**SCC Level 2**	**SCC Level 3**	**SCC Level 4**
2461021000	Solvent Utilization	Miscellaneous Non-industrial: Commercial	Cutback Asphalt	Total: All Solvent Types

The general approach to calculating emissions from cutback asphalt paving is to multiply the estimated county-level cutback asphalt usage by emission factors for VOCs and HAPs.

b. Activity Data

State-level cutback asphalt usage in 2008 was obtained from the Asphalt Institute's *2008 Asphalt Usage Survey*.[2] (the EPA used the same activity values for the 2011 as they did for the 2008 NEI due to limited resources.) State-level data were allocated to county-level according to the fraction of paved road vehicle miles traveled (VMT) in each county.

Total annual VMT estimates by State and roadway class were obtained from the Federal Highway Administration's (FHWA) annual Highway Statistics report.[3] Paved road VMT was calculated by subtracting the State/roadway class unpaved road VMT from total State/roadway class VMT. State-level paved road VMT was spatially allocated to counties according to the fraction of total VMT in each county for the specific roadway class as shown by the following equation:

$$VMT_{x,total} = \sum VMT_{ST,y} * VMT_{x,y} / VMT_{ST,y}$$

where: $VMT_{x,total}$ = VMT (million miles) in county x on all paved roadways

$VMT_{ST,y}$ = paved road VMT for the entire State for roadway class y

$VMT_{x,y}$ = total VMT (million miles) in county x and roadway class y

$VMT_{ST,y}$ = total VMT (million miles) in entire State for roadway class y

The county-level total VMT by roadway class used in this calculation was previously developed by E.H. Pechan and Associates, Inc. to support the onroad national emissions inventory.[4]

c. Emission Factors

Emission factors for cutback asphalt usage were obtained from the *Technical Report Series* produced by the U.S. EPA's Emission Inventory Improvement Program and are reported in the corresponding table below.[1]

d. Emissions

Emissions were calculated by multiplying the county-level asphalt usage (barrels) by the emission factors listed in the corresponding table below and then dividing by 2000 to convert pounds to tons.

$$Emissions_{x,y} = (Asphalt\ Usage_x * EF_y) / 2000$$

where: $Emissions_{x,y}$ = emissions (tons) of pollutant y in county x

$Asphalt\ Usage_x$ = cutback asphalt (barrels) used in county x

EF_y = emission factor for pollutant y

To convert tons of asphalt reported in the *2008 Asphalt Usage Survey* to barrels, it was assumed that the density of asphalt is similar to that of water, 8.34 lbs/gal, and that one barrel equals 42 gallons.

$$\text{Barrels of Asphalt} = (\text{tons of asphalt} * 2000 \text{ lbs} / 8.34 \text{ lbs/gal}) / 42 \text{ gal/barrel}$$

Note that one barrel of asphalt weights approximately 350 pounds.

e. Sample Calculation

VOC emissions from cutback asphalt usage in Autauga County, Alabama:

From the *2008 Asphalt Usage Survey*, the state of Alabama used 1,728 tons of cutback asphalt in 2008. The fraction of paved road VMT traveled in Autauga County is 497 million miles divided by 53,633 million miles which equals 0.0093.

$$\text{Asphalt Usage}_{\text{Autauga}} = ((1{,}728 \text{ tons} * 2000 \text{ lbs} / 8.34 \text{ lbs/gal}) / 42 \text{ gal/barrel}) * 0.0093$$

$$\text{Asphalt Usage}_{\text{Autauga}} = 91.41 \text{ barrels}$$

$$\text{VOC Emissions}_{\text{Autauga}} = (91.41 \text{ barrels} * 88 \text{ lbs/barrel}) / 2000 \text{ lbs/ton}$$

$$\text{VOC Emissions}_{\text{Autauga}} = 4.022 \text{ tons}$$

Criteria and HAP Emission Factors for Cutback Asphalt Paving

Pollutant Description	Pollutant Code	Emission Factor (LBS/BARREL)	Emission Factor Reference
VOLATILE ORGANIC COMPOUNDS	VOC	88.00	1
ETHYL BENZENE	100414	2.02	1
TOLUENE	108883	5.63	1
XYLENES (MIXTURE OF O, M, AND P	1330207	10.74	1

f. References

1. U.S. Environmental Protection Agency, Emissions Inventory Improvement Program, *Technical Report Series*, Volume III – Area Sources, Chapter 17, "Asphalt Paving," prepared by Eastern Research Group, Inc. for EPA, Research Triangle Park, NC, 2001. Available at http://www.epa.gov/ttn/chief/eiip/techreport/volume03/index.html.

2. Asphalt Institute, *2008 Asphalt Usage Survey for the United States and Canada*, http://www.asphaltinstitute.org/.

3. U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics 2007,*

Office of Highway Policy Information, Washington, DC, 2008. Available at http://www.fhwa.dot.gov/policyinformation/statistics/2007/.

4. E.H. Pechan & Associates, Inc. “Documentation for the Onroad National Emission Inventory (NEI) for Base Years 1970 - 2002,” report prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC. January 2004.

8.56 Asphalt Paving: Emulsified

The Missouri DNR accepted EPA's estimates of emissions for this source category. The documentation below was developed by EPA.

a. Source Category Description

Asphalt paving is the process of applying asphalt concrete to seal or repair the surface of roads, parking lots, driveways, walkways, or airport runways. Asphalt concrete is a composite material comprised of a binder and a mineral aggregate. The binder, referred to as asphalt cement, is a byproduct of petroleum refining and contains the semi-solid residual material left after the more volatile chemical fractions have been distilled off.[1]

Asphalt cements thinned with water and an emulsifying agent are known as emulsified asphalts. This thinning reduces the viscosity of the asphalt making it easier to work with the mixture. The primary uses of emulsified asphalt include tack and seal operations, priming roadbeds, and paving operations for pavements up to several inches thick.

Emulsified asphalt may contain up to 12 percent organic solvents by volume.[1] Emissions from emulsified asphalt result from the evaporation of VOCs after the mixture is laid down. Compared to cutback asphalt, emulsified asphalt has lower VOCs emissions per ton used.

For this source category, the following SCC was assigned:

SCC	SCC Level 1	SCC Level 2	SCC Level 3	SCC Level 4
2461022000	Solvent Utilization	Miscellaneous Non-industrial: Commercial	Emulsified Asphalt	Total: All Solvent Types

The general approach to calculating emissions from emulsified asphalt paving is to multiply the estimated county-level emulsified asphalt usage by emission factors for VOCs.

b. Activity Data

State-level emulsified asphalt usage in 2008 was obtained from the Asphalt Institute's *2008 Asphalt Usage Survey*.[2] (the EPA used the same activity values for the 2011 as they did for the 2008 NEI due to limited resources.) State-level data were allocated to county-level according to the fraction of paved road vehicle miles traveled (VMT) in each county.

Total annual VMT estimates by State and roadway class were obtained from the Federal Highway Administration's (FHWA) annual Highway Statistics report.[3] Paved road VMT was calculated by subtracting the State/roadway class unpaved road VMT from total State/roadway class VMT. State-level paved road VMT was spatially allocated to counties according to the fraction of total VMT in each county for the specific roadway class as shown by the following equation:

$$VMT_{x,total} = \sum VMT_{ST,y} * VMT_{x,y} / VMT_{ST,y}$$

where: $VMT_{x,total}$ = VMT (million miles) in county x on all paved roadways

$VMT_{ST,y}$ = paved road VMT for the entire State for roadway class y

$VMT_{x,y}$ = total VMT (million miles) in county x and roadway class y

$VMT_{ST,y}$ = total VMT (million miles) in entire State for roadway class y

The county-level total VMT by roadway class used in this calculation was previously developed by E.H. Pechan and Associates, Inc. to support the onroad national emissions inventory.[4]

c. Emission Factors

Emission factors for emulsified asphalt usage were obtained from the *Technical Report Series* produced by the U.S. EPA's Emission Inventory Improvement Program and are reported in the corresponding table below.[1]

d. Emissions

Emissions were calculated by multiplying the county-level asphalt usage (barrels) by the emission factors listed in the corresponding table below and then dividing by 2000 to convert pounds to tons.

$$Emissions_{x,y} = (Asphalt\ Usage_x * EF_y) / 2000$$

where: $Emissions_{x,y}$ = emissions (tons) of pollutant y in county x

$Asphalt\ Usage_x$ = emulsified asphalt (barrels) used in county x

EF_y = emission factor for pollutant y

To convert tons of asphalt reported in the *2008 Asphalt Usage Survey* to barrels, it was assumed that the density of asphalt is similar to that of water, 8.34 lbs/gal, and that one barrel equals 42 gallons.

$$\text{Barrels of Asphalt} = (\text{tons of asphalt} * 2000 \text{ lbs} / 8.34 \text{ lbs/gal}) / 42 \text{ gal/barrel}$$

Note that one barrel of asphalt weights approximately 350 pounds.

e. Sample Calculation

VOC emissions from emulsified asphalt usage in Autauga County, Alabama:

From the *2008 Asphalt Usage Survey*, the state of Alabama used 18,988 tons of emulsified asphalt in 2008. The fraction of paved road VMT traveled in Autauga County is 497 million miles divided by 53,633 million miles which equals 0.0093.

$$\text{Asphalt Usage}_{\text{Autauga}} = ((18{,}988 \text{ tons} * 2000 \text{ lbs} / 8.34 \text{ lbs/gal}) / 42 \text{ gal/barrel}) * 0.0093$$

$$\text{Asphalt Usage}_{\text{Autauga}} = 1{,}004 \text{ barrels}$$

$$\text{VOC Emissions}_{\text{Autauga}} = (1{,}004 \text{ barrels} * 9.2 \text{ lbs/barrel}) / 2000 \text{ lbs/ton}$$

$$\text{VOC Emissions}_{\text{Autauga}} = 4.62 \text{ tons}$$

Criteria Emission Factors for Emulsified Asphalt Paving

Pollutant Description	Pollutant Code	Emission Factor (LBS/BARREL)	Emission Factor Reference
VOLATILE ORGANIC COMPOUNDS	VOC	9.2	1

f. References

5. U.S. Environmental Protection Agency, Emissions Inventory Improvement Program, *Technical Report Series*, Volume III – Area Sources, Chapter 17, "Asphalt Paving," prepared by Eastern Research Group, Inc. for EPA, Research Triangle Park, NC, 2001. Available at http://www.epa.gov/ttn/chief/eiip/techreport/volume03/index.html.

6. Asphalt Institute, *2008 Asphalt Usage Survey for the United States and Canada*, http://www.asphaltinstitute.org/.

7. U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics 2007,*

Office of Highway Policy Information, Washington, DC, 2008. Available at http://www.fhwa.dot.gov/policyinformation/statistics/2007/.

8. E.H. Pechan & Associates, Inc. "Documentation for the Onroad National Emission Inventory (NEI) for Base Years 1970 - 2002," report prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC. January 2004.

8.57 Miscellaneous Mercury: Lamp Breakage, Health, Dental

The Missouri DNR accepted EPA's estimates of emissions for this source category. EPA pulled these estimates forward from previous inventories like the 1999 and 2002 NEI's.

8.58 Oil and Gas Production

CenSARA contracted with Environ to survey oil and gas producers to improve emission estimates for nonpoint oil and gas production. Environ subcontracted with Transsystems to create the emission calculation tool and EIS staging tables for states to use in 2011. The tool is updatable for future years and improved data sources.

The tool is fully described in the Environ report “2011 Oil and Gas Emission Inventory Enhancement Project for CenSARA States”, Dec 21, 2012, attached as Appendix B-4. It roughly covers: sixteen CAP, HAP and GHG pollutants for all 115 Missouri counties for 16 SCCs. Missouri only has oil and gas activity for five counties, and their emissions of CAP are listed below:

State And County FIPS Code	County Name	CO	NO_x	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_2	VOC
29005	Atchison	5.536111	3.922423	0.084068	0.084068	0.000827	9.183114
29037	Cass	10.38051	7.3546	0.157627	0.157627	0.001551	21.04987
29095	Jackson	3.460204	2.45154	0.052542	0.052542	0.000517	7.472651
29177	Ray	0.691992	0.490299	0.010508	0.010508	0.000103	0.867738
29217	Vernon	3.391025	2.488806	0.065422	0.065422	1.565628	18.85303
Statewide Total		23.45984	16.70767	0.370168	0.370168	1.568627	57.42641

Missouri has no point source contribution to this category, and the contractor-provided emissions are accepted.

Missouri did remove values from the “ControlApproach”, “ControlPollutant”, and “ControlMeasure” table as these tables were causing an XML schema problem that could not be corrected. Missouri does not believe that this removal materially affects the emission report.

Table 4 displays the 2011 nonpoint emissions by county for the entire state. Table 5 displays the statewide nonpoint emissions by SCC.

Table 4 Nonpoint Source Emissions by County (tons per year)

FIPS	County Name	Lead	CO	NH_3	NO_X	PM_{10} Primary	$PM_{2.5}$ Primary	SO_2	VOC
29001	Adair	0.00	525	372	57	4,642	693	4	422
29003	Andrew	0.00	336	457	28	4,804	684	2	451
29005	Atchison	0.00	141	896	18	4,588	768	1	474
29007	Audrain	0.00	451	1,590	61	9,225	1,594	4	664
29009	Barry	0.00	980	5,093	127	8,857	1,110	12	614
29011	Barton	0.00	250	1,711	31	5,731	950	2	389
29013	Bates	0.00	395	1,876	37	7,362	1,141	2	506
29015	Benton	0.00	481	1,168	34	5,960	769	3	398
29017	Bollinger	0.00	323	255	22	5,177	710	2	208
29019	Boone	0.00	2,419	537	313	12,053	1,742	15	2,427
29021	Buchanan	0.00	1,278	561	290	5,493	894	21	1,445
29023	Butler	0.00	1,055	1,309	101	9,865	1,437	10	902
29025	Caldwell	0.00	249	547	20	5,228	792	2	241
29027	Callaway	0.00	1,026	1,048	99	10,890	1,483	16	945
29029	Camden	0.00	1,241	285	78	10,874	1,346	6	786
29031	Cape Girardeau	0.00	1,944	916	194	10,724	1,593	11	1,370
29033	Carroll	0.00	186	972	24	7,575	1,361	1	385
29035	Carter	0.00	187	73	13	2,095	259	1	141
29037	Cass	0.00	1,960	1,336	189	13,059	1,840	13	1,563
29039	Cedar	0.00	330	597	29	3,601	450	2	240
29041	Chariton	0.00	195	1,072	17	9,126	1,620	1	374
29043	Christian	0.00	2,310	502	148	12,755	1,669	9	1,268
29045	Clark	0.00	196	542	17	5,741	961	1	270
29047	Clay	0.00	3,418	285	515	8,968	1,581	27	2,725
29049	Clinton	0.00	462	1,214	40	6,151	822	3	457
29051	Cole	0.00	1,871	824	174	8,828	1,257	14	1,130
29053	Cooper	0.00	357	1,336	36	4,474	666	2	527
29055	Crawford	0.00	687	235	68	6,051	752	7	674
29057	Dade	0.00	200	794	17	3,688	530	1	223
29059	Dallas	0.00	382	720	28	4,504	546	2	263
29061	Daviess	0.00	192	1,480	17	4,654	706	2	344
29063	DeKalb	0.00	209	495	19	3,624	519	1	299
29065	Dent	0.00	368	203	31	3,597	453	4	235
29067	Douglas	0.00	316	405	30	3,549	436	3	236
29069	Dunklin	0.00	579	1,629	70	11,681	1,941	3	1,018
29071	Franklin	0.00	2,599	1,265	227	20,294	2,664	37	1,469
29073	Gasconade	0.00	383	516	40	4,348	560	5	427
29075	Gentry	0.00	161	1,497	17	3,513	525	1	212
29077	Greene	0.00	4,172	700	672	17,584	2,515	32	4,064
29079	Grundy	0.00	203	612	28	3,549	597	2	265

FIPS	County Name	Lead	CO	NH_3	NO_X	PM_{10} Primary	$PM_{2.5}$ Primary	SO_2	VOC
29081	Harrison	0.00	189	879	21	4,729	786	1	344
29083	Henry	0.00	504	1,015	59	6,421	1,017	6	644
29085	Hickory	0.00	252	263	17	3,189	388	1	172
29087	Holt	0.00	105	596	12	4,693	806	1	371
29089	Howard	0.00	211	421	22	3,463	532	2	250
29091	Howell	0.00	1,031	759	105	9,658	1,194	13	661
29093	Iron	0.99	267	88	19	2,695	336	1	153
29095	Jackson	0.01	10,472	496	1,811	17,064	3,640	90	9,159
29097	Jasper	0.00	2,230	1,551	334	12,303	1,846	22	1,978
29099	Jefferson	0.00	5,537	175	369	24,220	3,284	35	3,158
29101	Johnson	0.00	976	1,496	100	10,515	1,444	19	893
29103	Knox	0.00	103	653	9	3,264	538	1	243
29105	Laclede	0.00	918	739	103	7,425	950	11	787
29107	Lafayette	0.00	691	1,776	73	8,988	1,327	5	909
29109	Lawrence	0.00	751	2,535	79	7,844	1,003	6	666
29111	Lewis	0.00	248	664	24	5,329	798	2	314
29113	Lincoln	0.00	1,233	863	89	15,713	2,113	16	909
29115	Linn	0.00	271	569	38	4,363	663	3	318
29117	Livingston	0.00	299	556	37	5,979	1,062	2	397
29119	McDonald	0.00	709	2,673	79	7,652	928	10	413
29121	Macon	0.00	345	1,162	35	6,057	945	2	384
29123	Madison	0.00	408	299	26	2,743	351	2	209
29125	Maries	0.00	242	517	17	3,192	399	2	168
29127	Marion	0.00	556	1,561	75	6,171	1,084	4	648
29129	Mercer	0.00	88	364	8	2,223	344	1	121
29131	Miller	0.00	683	2,436	45	6,707	837	4	434
29133	Mississippi	0.00	263	1,636	29	6,916	1,273	1	512
29135	Moniteau	0.00	293	1,996	32	3,544	502	2	392
29137	Monroe	0.00	245	1,163	21	5,320	829	2	319
29139	Montgomery	0.00	324	858	27	4,707	694	2	479
29141	Morgan	0.00	516	2,682	38	6,858	834	3	371
29143	New Madrid	0.00	391	2,936	53	14,357	2,608	4	955
29145	Newton	0.00	1,373	3,906	139	12,812	1,617	11	960
29147	Nodaway	0.00	408	1,466	62	6,438	1,040	6	689
29149	Oregon	0.00	261	353	21	2,905	359	2	200
29151	Osage	0.00	334	1,775	34	4,998	638	7	271
29153	Ozark	0.00	261	415	20	3,182	386	2	380
29155	Pemiscot	0.00	332	1,873	48	9,011	1,578	3	827
29157	Perry	0.00	498	589	71	4,830	700	8	447
29159	Pettis	0.00	869	2,756	133	7,993	1,227	15	827
29161	Phelps	0.00	1,097	263	85	7,190	933	7	878
29163	Pike	0.00	364	2,194	38	6,568	1,067	3	506
29165	Platte	0.00	1,422	639	194	6,528	1,054	10	1,566
29167	Polk	0.00	690	1,802	51	7,287	907	4	521

FIPS	County Name	Lead	CO	NH_3	NO_X	PM_{10} Primary	$PM_{2.5}$ Primary	SO_2	VOC
29169	Pulaski	0.00	1,198	511	72	7,971	1,024	5	693
29171	Putnam	0.00	140	903	13	2,261	322	1	150
29173	Ralls	0.00	249	591	43	5,686	877	7	443
29175	Randolph	0.00	466	507	58	5,500	820	4	485
29177	Ray	0.00	508	625	50	8,992	1,336	3	458
29179	Reynolds	0.58	170	70	13	2,232	271	1	161
29181	Ripley	0.00	374	633	31	5,092	651	3	228
29183	St. Charles	0.00	4,727	900	627	14,500	2,598	34	4,792
29185	St. Clair	0.00	231	478	20	5,056	758	2	296
29186	Ste. Genevieve	0.00	521	829	49	5,078	659	5	404
29187	St. Francois	0.00	1,703	405	127	9,144	1,205	11	941
29189	St. Louis	0.01	14,585	718	2,681	24,594	5,315	142	16,228
29195	Saline	0.00	445	1,912	74	10,246	1,792	5	671
29197	Schuyler	0.00	109	261	8	1,910	265	1	112
29199	Scotland	0.00	119	702	12	3,703	612	1	212
29201	Scott	0.00	727	3,095	96	8,912	1,395	6	864
29203	Shannon	0.00	210	155	18	2,738	329	2	186
29205	Shelby	0.00	193	1,330	17	6,172	1,065	1	336
29207	Stoddard	0.00	746	4,368	93	14,529	2,376	12	1,101
29209	Stone	0.00	1,122	431	62	9,719	1,189	4	548
29211	Sullivan	0.00	176	3,276	31	2,745	376	3	161
29213	Taney	0.00	2,864	113	137	9,701	1,352	10	920
29215	Texas	0.00	667	889	51	8,436	1,016	5	560
29217	Vernon	0.00	438	3,931	54	8,342	1,367	5	589
29219	Warren	0.00	953	648	57	8,485	1,183	5	664
29221	Washington	0.00	571	185	38	6,525	783	4	370
29223	Wayne	0.00	343	147	28	4,596	565	2	257
29225	Webster	0.00	870	1,087	62	9,109	1,136	6	698
29227	Worth	0.00	53	253	5	1,265	194	0	101
29229	Wright	0.00	443	2,031	38	4,860	607	3	353
29510	St. Louis city	0.00	4,955	148	1,062	4,920	1,429	52	5,095

Table 5 Nonpoint Source Emissions by SCC (tons per year)

SCC	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four	Lead	CO	NH_3	NO_X	PM_{10} Primary	$PM_{2.5}$ Primary	SO_2	VOC
2302002200	Industrial Processes	Food and Kindred Products: SIC 20	Commercial Cooking - Charbroiling	Under-fired Charbroiling		404			1,056	1,056		124
2302003100	Industrial Processes	Food and Kindred Products: SIC 20	Commercial Cooking - Frying	Flat Griddle Frying		38			309	309		18
2302002100	Industrial Processes	Food and Kindred Products: SIC 20	Commercial Cooking - Charbroiling	Conveyorized Charbroiling		127			149	149		36
2103008000	Stationary Source Fuel Combustion	Commercial/Institutional	Wood	Total: All Boiler Types		840	7	308	724	626	35	24
2302003200	Industrial Processes	Food and Kindred Products: SIC 20	Commercial Cooking - Frying	Clamshell Griddle Frying					21	21		1
2102008000	Stationary Source Fuel Combustion	Industrial	Wood	Total: All Boiler Types		667	8	244	575	497	28	19
2104006000	Stationary Source Fuel Combustion	Residential	Natural Gas	Total: All Combustor Types		2,148	1,074	5,047	28	23	32	295
2103006000	Stationary Source Fuel Combustion	Commercial/Institutional	Natural Gas	Total: Boilers and IC Engines	0.01	2,185	13	2,601	14	11	16	143
2102006000	Stationary Source Fuel Combustion	Industrial	Natural Gas	Total: Boilers and IC Engines	0.01	994	38	1,183	6	5	7	65
2104007000	Stationary Source Fuel Combustion	Residential	Liquified Petroleum Gas (LPG)	Total: All Combustor Types		389	5	1,370	5	4	6	53
2102004001	Stationary Source Fuel Combustion	Industrial	Distillate Oil	All Boiler Types	0.00	7	1	30	3	2	63	0

SCC	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four	Lead	CO	NH_3	NO_X	PM_{10} Primary	$PM_{2.5}$ Primary	SO_2	VOC
2102004002	Stationary Source Fuel Combustion	Industrial	Distillate Oil	All IC Engine Types	0.00	193	0	896	65	61	59	0
2104004000	Stationary Source Fuel Combustion	Residential	Distillate Oil	Total: All Combustor Types	0.00	3	1	12	2	1	29	0
2104011000	Stationary Source Fuel Combustion	Residential	Kerosene	Total: All Heater Types	0.00	3	1	12	2	1	28	0
2102005000	Stationary Source Fuel Combustion	Industrial	Residual Oil	Total: All Boiler Types	0.00	2	0	25	10	7	160	0
2103004001	Stationary Source Fuel Combustion	Commercial/Institutional	Distillate Oil	Boilers	0.00	1	0	5	1	1	12	0
2103004002	Stationary Source Fuel Combustion	Commercial/Institutional	Distillate Oil	IC Engines	0.01	35	0	164	12	12	11	0
2102011000	Stationary Source Fuel Combustion	Industrial	Kerosene	Total: All Boiler Types	0.00	1	0	3	0	0	6	0
2103011000	Stationary Source Fuel Combustion	Commercial/Institutional	Kerosene	Total: All Combustor Types	0.00	0	0	2	0	0	4	0
2103005000	Stationary Source Fuel Combustion	Commercial/Institutional	Residual Oil	Total: All Boiler Types	0.00	0	0	4	1	1	29	0
2102007000	Stationary Source Fuel Combustion	Industrial	Liquified Petroleum Gas (LPG)	Total: All Boiler Types		31	1	56	0	0	0	2

SCC	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four	Lead	CO	NH_3	NO_X	PM_{10} Primary	$PM_{2.5}$ Primary	SO_2	VOC
2103007000	Stationary Source Fuel Combustion	Commercial/Institutional	Liquified Petroleum Gas (LPG)	Total: All Combustor Types	0.00	17	0	30	0	0	0	1
2102001000	Stationary Source Fuel Combustion	Industrial	Anthracite Coal	Total: All Boiler Types	-	-	-	-	-	-	-	-
2102002000	Stationary Source Fuel Combustion	Industrial	Bituminous/Subbituminous Coal	Total: All Boiler Types	-	-	-	-	-	-	-	-
2103001000	Stationary Source Fuel Combustion	Commercial/Institutional	Anthracite Coal	Total: All Boiler Types	-	-	-	-	-	-	-	-
2103002000	Stationary Source Fuel Combustion	Commercial/Institutional	Bituminous/Subbituminous Coal	Total: All Boiler Types	-	-	-	-	-	-	-	-
2104001000	Stationary Source Fuel Combustion	Residential	Anthracite Coal	Total: All Combustor Types		-	-	-	-	-	-	-
2104002000	Stationary Source Fuel Combustion	Residential	Bituminous/Subbituminous Coal	Total: All Combustor Types		-	-	-	-	-	-	-
2104005000	Stationary Source Fuel Combustion	Residential	Residual Oil	Total: All Combustor Types	-	-	-	-	-	-	-	-
2104008100	Stationary Source Fuel Combustion	Residential	Wood	Fireplace: general		27,657	334	483	4,381	4,381	74	3,508
2104008210	Stationary Source Fuel Combustion	Residential	Wood	Woodstove: fireplace inserts; non-EPA certified		20,347	150	247	2,698	2,698	35	4,672

SCC	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four	Lead	CO	NH_3	NO_X	PM_{10} Primary	$PM_{2.5}$ Primary	SO_2	VOC
2104008220	Stationary Source Fuel Combustion	Residential	Wood	Woodstove: fireplace inserts; EPA certified; non-catalytic		3,959	25	64	551	551	11	337
2104008230	Stationary Source Fuel Combustion	Residential	Wood	Woodstove: fireplace inserts; EPA certified; catalytic		979	8	19	191	191	4	141
2104008310	Stationary Source Fuel Combustion	Residential	Wood	Woodstove: freestanding, non-EPA certified		18,633	137	226	2,470	2,470	32	4,279
2104008320	Stationary Source Fuel Combustion	Residential	Wood	Woodstove: freestanding, EPA certified, non-catalytic		3,627	23	59	505	505	10	309
2104008330	Stationary Source Fuel Combustion	Residential	Wood	Woodstove: freestanding, EPA certified, catalytic		896	8	17	175	175	3	129
2104008400	Stationary Source Fuel Combustion	Residential	Wood	Woodstove: pellet-fired, general (freestanding or FP insert)		222	4	53	43	43	4	1
2104008510	Stationary Source Fuel Combustion	Residential	Wood	Furnace: Indoor, cordwood-fired, non-EPA certified		2,445	24	25	368	368	27	157
2104008610	Stationary Source Fuel Combustion	Residential	Wood	Hydronic heater: outdoor		6,062	30	31	1,078	1,078	34	1,135
2104008700	Stationary Source Fuel Combustion	Residential	Wood	Outdoor wood burning device, NEC (fire-pits, chimeas, etc)		88	1	2	14	14	0	11

SCC	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four	Lead	CO	NH_3	NO_X	PM_{10} Primary	$PM_{2.5}$ Primary	SO_2	VOC
2104009000	Stationary Source Fuel Combustion	Residential	Firelog	Total: All Combustor Types		596		37	140	135		188
2294000000	Mobile Sources	Paved Roads	All Paved Roads	Total: Fugitives					38,189	9,547		
2296000000	Mobile Sources	Unpaved Roads	All Unpaved Roads	Total: Fugitives					539,143	53,741		
2302003000	Industrial Processes	Food and Kindred Products: SIC 20	Commercial Cooking - Frying	Deep Fat Fying								38
2306000000	Industrial Processes	Petroleum Refining: SIC 29	All Processes	Total	0.00	499		214	266	12	139	142
2310000220	Industrial Processes	Oil and Gas Exploration and Production	All Processes	Drill Rigs		-		-	-	-	-	-
2310000330	Industrial Processes	Oil and Gas Exploration and Production	All Processes	Artificial Lift		21		13	0	0	0	0
2310000550	Industrial Processes	Oil and Gas Exploration and Production	All Processes	Produced Water								-
2310000660	Industrial Processes	Oil and Gas Exploration and Production	All Processes	Hydraulic Fracturing Engines		-		-	-	-	-	-
2310010100	Industrial Processes	Oil and Gas Exploration and Production	Crude Petroleum	Oil Well Heaters		3		3	0	0	0	0
2310010200	Industrial Processes	Oil and Gas Exploration and Production	Crude Petroleum	Oil Well Tanks - Flashing & Standing/Working/Breathing		0		0			0	25

SCC	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four	Lead	CO	NH_3	NO_X	PM_{10} Primary	$PM_{2.5}$ Primary	SO_2	VOC
2310010300	Industrial Processes	Oil and Gas Exploration and Production	Crude Petroleum	Oil Well Pneumatic Devices								21
2310011000	Industrial Processes	Oil and Gas Exploration and Production	On-Shore Oil Production	Total: All Processes		0		0			1	3
2310011201	Industrial Processes	Oil and Gas Exploration and Production	On-Shore Oil Production	Tank Truck/Railcar Loading: Crude Oil								0
2310011501	Industrial Processes	Oil and Gas Exploration and Production	On-Shore Oil Production	Fugitives: Connectors								2
2310011502	Industrial Processes	Oil and Gas Exploration and Production	On-Shore Oil Production	Fugitives: Flanges								0
2310011503	Industrial Processes	Oil and Gas Exploration and Production	On-Shore Oil Production	Fugitives: Open Ended Lines								0
2310011505	Industrial Processes	Oil and Gas Exploration and Production	On-Shore Oil Production	Fugitives: Valves								4
2310021010	Industrial Processes	Oil and Gas Exploration and Production	On-Shore Gas Production	Storage Tanks: Condensate		-		-			-	-
2310021030	Industrial Processes	Oil and Gas Exploration and Production	On-Shore Gas Production	Tank Truck/Railcar Loading: Condensate								-
2310021100	Industrial Processes	Oil and Gas Exploration and Production	On-Shore Gas Production	Gas Well Heaters		-		-	-	-	-	-

SCC	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four	Lead	CO	NH_3	NO_X	PM_{10} Primary	$PM_{2.5}$ Primary	SO_2	VOC
2310021202	Industrial Processes	Oil and Gas Exploration and Production	On-Shore Gas Production	Natural Gas Fired 4Cycle Lean Burn Compressor Engines 50 To 499 HP		-		-	-	-	-	-
2310021209	Industrial Processes	Oil and Gas Exploration and Production	On-Shore Gas Production	Total: All Natural Gas Fired 4Cycle Lean Burn Compressor Engines		-		-	-	-	-	-
2310021251	Industrial Processes	Oil and Gas Exploration and Production	On-Shore Gas Production	Lateral Compressors 4 Cycle Lean Burn		-		-	-	-	-	-
2310021300	Industrial Processes	Oil and Gas Exploration and Production	On-Shore Gas Production	Gas Well Pneumatic Devices								-
2310021302	Industrial Processes	Oil and Gas Exploration and Production	On-Shore Gas Production	Natural Gas Fired 4Cycle Rich Burn Compressor Engines 50 To 499 HP		-		-	-	-	-	-
2310021309	Industrial Processes	Oil and Gas Exploration and Production	On-Shore Gas Production	Total: All Natural Gas Fired 4Cycle Rich Burn Compressor Engines		-		-	-	-	-	-
2310021351	Industrial Processes	Oil and Gas Exploration and Production	On-Shore Gas Production	Lateral Compressors 4 Cycle Rich Burn		-		-	-	-	-	-
2310021400	Industrial Processes	Oil and Gas Exploration and Production	On-Shore Gas Production	Gas Well Dehydrators		-		-	-	-	-	-
2310021501	Industrial Processes	Oil and Gas Exploration and Production	On-Shore Gas Production	Fugitives: Connectors								-

SCC	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four	Lead	CO	NH_3	NO_X	PM_{10} Primary	$PM_{2.5}$ Primary	SO_2	VOC
2310021502	Industrial Processes	Oil and Gas Exploration and Production	On-Shore Gas Production	Fugitives: Flanges								-
2310021503	Industrial Processes	Oil and Gas Exploration and Production	On-Shore Gas Production	Fugitives: Open Ended Lines								-
2310021505	Industrial Processes	Oil and Gas Exploration and Production	On-Shore Gas Production	Fugitives: Valves								-
2310021506	Industrial Processes	Oil and Gas Exploration and Production	On-Shore Gas Production	Fugitives: Other								-
2310021603	Industrial Processes	Oil and Gas Exploration and Production	On-Shore Gas Production	Gas Well Venting - Blowdowns		-		-			-	-
2310111100	Industrial Processes	Oil and Gas Exploration and Production	On-Shore Oil Exploration	Mud Degassing								-
2310111401	Industrial Processes	Oil and Gas Exploration and Production	On-Shore Oil Exploration	Oil Well Pneumatic Pumps								2
2310111700	Industrial Processes	Oil and Gas Exploration and Production	On-Shore Oil Exploration	Oil Well Completion: All Processes		-		-			-	-
2310121100	Industrial Processes	Oil and Gas Exploration and Production	On-Shore Gas Exploration	Mud Degassing								-
2310121401	Industrial Processes	Oil and Gas Exploration and Production	On-Shore Gas Exploration	Gas Well Pneumatic Pumps								-

SCC	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four	Lead	CO	NH_3	NO_X	PM_{10} Primary	$PM_{2.5}$ Primary	SO_2	VOC
2310121700	Industrial Processes	Oil and Gas Exploration and Production	On-Shore Gas Exploration	Gas Well Completion: All Processes		-		-			-	-
2311010000	Industrial Processes	Construction: SIC 15 - 17	Residential	Total					618	62		
2311020000	Industrial Processes	Construction: SIC 15 - 17	Industrial/Commercial/Institutional	Total					24,459	2,446		
2311030000	Industrial Processes	Construction: SIC 15 - 17	Road Construction	Total					20,137	2,014		
2325000000	Industrial Processes	Mining and Quarrying: SIC 14	All Processes	Total					1,243	65		
2325060000	Industrial Processes	Mining and Quarrying: SIC 10	Lead Ore Mining and Milling	Total	1.57							
2401001000	Solvent Utilization	Surface Coating	Architectural Coatings	Total: All Solvent Types								7,007
2401005000	Solvent Utilization	Surface Coating	Auto Refinishing: SIC 7532	Total: All Solvent Types								1,459
2401008000	Solvent Utilization	Surface Coating	Traffic Markings	Total: All Solvent Types								19
2401015000	Solvent Utilization	Surface Coating	Factory Finished Wood: SIC 2426 thru 242	Total: All Solvent Types								136
2401020000	Solvent Utilization	Surface Coating	Wood Furniture: SIC 25	Total: All Solvent Types								819
2401025000	Solvent Utilization	Surface Coating	Metal Furniture: SIC 25	Total: All Solvent Types								277
2401030000	Solvent Utilization	Surface Coating	Paper: SIC 26	Total: All Solvent Types								85
2401040000	Solvent Utilization	Surface Coating	Metal Cans: SIC 341	Total: All Solvent Types								130
2401055000	Solvent Utilization	Surface Coating	Machinery and Equipment: SIC 35	Total: All Solvent Types								311

SCC	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four	Lead	CO	NH_3	NO_X	PM_{10} Primary	$PM_{2.5}$ Primary	SO_2	VOC
2401060000	Solvent Utilization	Surface Coating	Large Appliances: SIC 363	Total: All Solvent Types								1
2401065000	Solvent Utilization	Surface Coating	Electronic and Other Electrical: SIC 36 - 363	Total: All Solvent Types								21
2401070000	Solvent Utilization	Surface Coating	Motor Vehicles: SIC 371	Total: All Solvent Types								568
2401075000	Solvent Utilization	Surface Coating	Aircraft: SIC 372	Total: All Solvent Types								4
2401080000	Solvent Utilization	Surface Coating	Marine: SIC 373	Total: All Solvent Types								35
2401085000	Solvent Utilization	Surface Coating	Railroad: SIC 374	Total: All Solvent Types								22
2401090000	Solvent Utilization	Surface Coating	Miscellaneous Manufacturing	Total: All Solvent Types								421
2401100000	Solvent Utilization	Surface Coating	Industrial Maintenance Coatings	Total: All Solvent Types								1,806
2401200000	Solvent Utilization	Surface Coating	Other Special Purpose Coatings	Total: All Solvent Types								192
2415000000	Solvent Utilization	Degreasing	All Processes/All Industries	Total: All Solvent Types								3,263
2420000000	Solvent Utilization	Dry Cleaning	All Processes	Total: All Solvent Types								157
2425000000	Solvent Utilization	Graphic Arts	All Processes	Total: All Solvent Types								1,206
2460100000	Solvent Utilization	Miscellaneous Non-industrial: Consumer and Commercial	All Personal Care Products	Total: All Solvent Types								5,689

SCC	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four	Lead	CO	NH_3	NO_X	PM_{10} Primary	$PM_{2.5}$ Primary	SO_2	VOC
2460200000	Solvent Utilization	Miscellaneous Non-industrial: Consumer and Commercial	All Household Products	Total: All Solvent Types								5,390
2460400000	Solvent Utilization	Miscellaneous Non-industrial: Consumer and Commercial	All Automotive Aftermarket Products	Total: All Solvent Types								4,072
2460500000	Solvent Utilization	Miscellaneous Non-industrial: Consumer and Commercial	All Coatings and Related Products	Total: All Solvent Types								2,845
2460600000	Solvent Utilization	Miscellaneous Non-industrial: Consumer and Commercial	All Adhesives and Sealants	Total: All Solvent Types								1,707
2460800000	Solvent Utilization	Miscellaneous Non-industrial: Consumer and Commercial	All FIFRA Related Products	Total: All Solvent Types								5,330
2460900000	Solvent Utilization	Miscellaneous Non-industrial: Consumer and Commercial	Miscellaneous Products (Not Otherwise Covered)	Total: All Solvent Types								210
2461021000	Solvent Utilization	Miscellaneous Non-industrial: Commercial	Cutback Asphalt	Total: All Solvent Types								1,855
2461022000	Solvent Utilization	Miscellaneous Non-industrial: Commercial	Emulsified Asphalt	Total: All Solvent Types								970

SCC	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four	Lead	CO	NH_3	NO_X	PM_{10} Primary	$PM_{2.5}$ Primary	SO_2	VOC
2461850001	Solvent Utilization	Miscellaneous Non-industrial: Commercial	Pesticide Application: Agricultural	Herbicides, Corn								3,523
2461850002	Solvent Utilization	Miscellaneous Non-industrial: Commercial	Pesticide Application: Agricultural	Herbicides, Apples								1
2461850003	Solvent Utilization	Miscellaneous Non-industrial: Commercial	Pesticide Application: Agricultural	Herbicides, Grapes								0
2461850004	Solvent Utilization	Miscellaneous Non-industrial: Commercial	Pesticide Application: Agricultural	Herbicides, Potatoes								6
2461850005	Solvent Utilization	Miscellaneous Non-industrial: Commercial	Pesticide Application: Agricultural	Herbicides, Soy Beans								5,773
2461850006	Solvent Utilization	Miscellaneous Non-industrial: Commercial	Pesticide Application: Agricultural	Herbicides, Hay & Grains								551
2461850009	Solvent Utilization	Miscellaneous Non-industrial: Commercial	Pesticide Application: Agricultural	Herbicides, Not Elsewhere Classified								743
2461850051	Solvent Utilization	Miscellaneous Non-industrial: Commercial	Pesticide Application: Agricultural	Other Pesticides, Corn								20
2461850052	Solvent Utilization	Miscellaneous Non-industrial: Commercial	Pesticide Application: Agricultural	Other Pesticides, Apples								14
2461850053	Solvent Utilization	Miscellaneous Non-industrial: Commercial	Pesticide Application: Agricultural	Other Pesticides, Grapes								0

SCC	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four	Lead	CO	NH_3	NO_X	PM_{10} Primary	$PM_{2.5}$ Primary	SO_2	VOC
2461850054	Solvent Utilization	Miscellaneous Non-industrial: Commercial	Pesticide Application: Agricultural	Other Pesticides, Potatoes								199
2461850055	Solvent Utilization	Miscellaneous Non-industrial: Commercial	Pesticide Application: Agricultural	Other Pesticides, Soy Beans								10
2461850056	Solvent Utilization	Miscellaneous Non-industrial: Commercial	Pesticide Application: Agricultural	Other Pesticides, Hay & Grains								10
2461850099	Solvent Utilization	Miscellaneous Non-industrial: Commercial	Pesticide Application: Agricultural	Other Pesticides, Not Elsewhere Classified								408
2501011011	Storage and Transport	Petroleum and Petroleum Product Storage	Residential Portable Gas Cans	Permeation								1,261
2501011012	Storage and Transport	Petroleum and Petroleum Product Storage	Residential Portable Gas Cans	Evaporation (includes Diurnal losses)								2,462
2501011013	Storage and Transport	Petroleum and Petroleum Product Storage	Residential Portable Gas Cans	Spillage During Transport								287
2501011014	Storage and Transport	Petroleum and Petroleum Product Storage	Residential Portable Gas Cans	Refilling at the Pump - Vapor Displacement								97
2501011015	Storage and Transport	Petroleum and Petroleum Product Storage	Residential Portable Gas Cans	Refilling at the Pump - Spillage								8
2501012011	Storage and Transport	Petroleum and Petroleum Product Storage	Commercial Portable Gas Cans	Permeation								40

SCC	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four	Lead	CO	NH_3	NO_X	PM_{10} Primary	$PM_{2.5}$ Primary	SO_2	VOC
2501012012	Storage and Transport	Petroleum and Petroleum Product Storage	Commercial Portable Gas Cans	Evaporation (includes Diurnal losses)								79
2501012013	Storage and Transport	Petroleum and Petroleum Product Storage	Commercial Portable Gas Cans	Spillage During Transport								392
2501012014	Storage and Transport	Petroleum and Petroleum Product Storage	Commercial Portable Gas Cans	Refilling at the Pump - Vapor Displacement								188
2501012015	Storage and Transport	Petroleum and Petroleum Product Storage	Commercial Portable Gas Cans	Refilling at the Pump - Spillage								15
2501050120	Storage and Transport	Petroleum and Petroleum Product Storage	Bulk Terminals: All Evaporative Losses	Gasoline								754
2501055120	Storage and Transport	Petroleum and Petroleum Product Storage	Bulk Plants: All Evaporative Losses	Gasoline								879
2501060051	Storage and Transport	Petroleum and Petroleum Product Storage	Gasoline Service Stations	Stage 1: Submerged Filling								53
2501060052	Storage and Transport	Petroleum and Petroleum Product Storage	Gasoline Service Stations	Stage 1: Splash Filling								17,343
2501060053	Storage and Transport	Petroleum and Petroleum Product Storage	Gasoline Service Stations	Stage 1: Balanced Submerged Filling								56
2501060101	Storage and Transport	Petroleum and Petroleum Product Storage	Gasoline Service Stations	Stage 2: Displacement Loss/Uncontrolled								2,391

SCC	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four	Lead	CO	NH_3	NO_X	PM_{10} Primary	$PM_{2.5}$ Primary	SO_2	VOC
2501060102	Storage and Transport	Petroleum and Petroleum Product Storage	Gasoline Service Stations	Stage 2: Displacement Loss/Controlled								36
2501060103	Storage and Transport	Petroleum and Petroleum Product Storage	Gasoline Service Stations	Stage 2: Spillage								928
2501060201	Storage and Transport	Petroleum and Petroleum Product Storage	Gasoline Service Stations	Underground Tank: Breathing and Emptying								1,617
2501070100	Storage and Transport	Petroleum and Petroleum Product Storage	Diesel Service Stations	Stage 2: Total								237
2501080050	Storage and Transport	Petroleum and Petroleum Product Storage	Airports : Aviation Gasoline	Stage 1: Total	0.01							571
2501080100	Storage and Transport	Petroleum and Petroleum Product Storage	Airports : Aviation Gasoline	Stage 2: Total	0.00							30
2505030120	Storage and Transport	Petroleum and Petroleum Product Transport	Truck	Gasoline								97
2505040120	Storage and Transport	Petroleum and Petroleum Product Transport	Pipeline	Gasoline								1,120
2610000100	Waste Disposal, Treatment, and Recovery	Open Burning	All Categories	Yard Waste - Leaf Species Unspecified		327		18	64	50	2	82

SCC	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four	Lead	CO	NH_3	NO_X	PM_{10} Primary	$PM_{2.5}$ Primary	SO_2	VOC
2610000400	Waste Disposal, Treatment, and Recovery	Open Burning	All Categories	Yard Waste - Brush Species Unspecified		409		15	58	44	5	55
2610000500	Waste Disposal, Treatment, and Recovery	Open Burning	All Categories	Land Clearing Debris (use 28-10-005-000 for Logging Debris Burning)		13,555		401	1,364	1,051		931
2610030000	Waste Disposal, Treatment, and Recovery	Open Burning	Residential	Household Waste (use 26-10-000-xxx for Yard Wastes)		6,734		475	3,010	2,757	79	678
2630020000	Waste Disposal, Treatment, and Recovery	Wastewater Treatment	Public Owned	Total Processed			16					83
2801000003	Miscellaneous Area Sources	Agriculture Production - Crops	Agriculture - Crops	Tilling					187,393	37,478		
2801700001	Miscellaneous Area Sources	Agriculture Production - Crops	Fertilizer Application	Anhydrous Ammonia			7,335					
2801700002	Miscellaneous Area Sources	Agriculture Production - Crops	Fertilizer Application	Aqueous Ammonia			-					
2801700003	Miscellaneous Area Sources	Agriculture Production - Crops	Fertilizer Application	Nitrogen Solutions			5,974					
2801700004	Miscellaneous Area Sources	Agriculture Production - Crops	Fertilizer Application	Urea			20,775					

SCC	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four	Lead	CO	NH_3	NO_X	PM_{10} Primary	$PM_{2.5}$ Primary	SO_2	VOC
2801700005	Miscellaneous Area Sources	Agriculture Production - Crops	Fertilizer Application	Ammonium Nitrate			1,208					
2801700006	Miscellaneous Area Sources	Agriculture Production - Crops	Fertilizer Application	Ammonium Sulfate			979					
2801700007	Miscellaneous Area Sources	Agriculture Production - Crops	Fertilizer Application	Ammonium Thiosulfate			38					
2801700010	Miscellaneous Area Sources	Agriculture Production - Crops	Fertilizer Application	N-P-K (multi-grade nutrient fertilizers)			309					
2801700011	Miscellaneous Area Sources	Agriculture Production - Crops	Fertilizer Application	Calcium Ammonium Nitrate			0					
2801700012	Miscellaneous Area Sources	Agriculture Production - Crops	Fertilizer Application	Potassium Nitrate			-					
2801700013	Miscellaneous Area Sources	Agriculture Production - Crops	Fertilizer Application	Diammonium Phosphate			2,362					
2801700014	Miscellaneous Area Sources	Agriculture Production - Crops	Fertilizer Application	Monoammonium Phosphate			658					
2801700015	Miscellaneous Area Sources	Agriculture Production - Crops	Fertilizer Application	Liquid Ammonium Polyphosphate			80					
2801700099	Miscellaneous Area Sources	Agriculture Production - Crops	Fertilizer Application	Miscellaneous Fertilizers			3,353					

SCC	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four	Lead	CO	NH_3	NO_X	PM_{10} Primary	$PM_{2.5}$ Primary	SO_2	VOC
2805001100	Miscellaneous Area Sources	Agriculture Production - Livestock	Beef cattle - finishing operations on feedlots (drylots)	Confinement			1,009					
2805001200	Miscellaneous Area Sources	Agriculture Production - Livestock	Beef cattle - finishing operations on feedlots (drylots)	Manure handling and storage			0					
2805001300	Miscellaneous Area Sources	Agriculture Production - Livestock	Beef cattle - finishing operations on feedlots (drylots)	Land application of manure			767					
2805002000	Miscellaneous Area Sources	Agriculture Production - Livestock	Beef cattle production composite	Not Elsewhere Classified			10,939					
2805003100	Miscellaneous Area Sources	Agriculture Production - Livestock	Beef cattle - finishing operations on pasture/range	Confinement			9,665					
2805007100	Miscellaneous Area Sources	Agriculture Production - Livestock	Poultry production - layers with dry manure management systems	Confinement			3,206					
2805007300	Miscellaneous Area Sources	Agriculture Production - Livestock	Poultry production - layers with dry manure management systems	Land application of manure			74					
2805009100	Miscellaneous Area Sources	Agriculture Production - Livestock	Poultry production - broilers	Confinement			5,110					
2805009200	Miscellaneous Area Sources	Agriculture Production - Livestock	Poultry production - broilers	Manure handling and storage			929					
2805009300	Miscellaneous Area Sources	Agriculture Production - Livestock	Poultry production - broilers	Land application of manure			4,181					

SCC	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four	Lead	CO	NH_3	NO_X	PM_{10} Primary	$PM_{2.5}$ Primary	SO_2	VOC
2805010100	Miscellaneous Area Sources	Agriculture Production - Livestock	Poultry production - turkeys	Confinement			4,286					
2805010200	Miscellaneous Area Sources	Agriculture Production - Livestock	Poultry production - turkeys	Manure handling and storage			771					
2805010300	Miscellaneous Area Sources	Agriculture Production - Livestock	Poultry production - turkeys	Land application of manure			3,854					
2805018000	Miscellaneous Area Sources	Agriculture Production - Livestock	Dairy cattle composite	Not Elsewhere Classified			1,259					
2805019100	Miscellaneous Area Sources	Agriculture Production - Livestock	Dairy cattle - flush dairy	Confinement			26					
2805019200	Miscellaneous Area Sources	Agriculture Production - Livestock	Dairy cattle - flush dairy	Manure handling and storage			74					
2805019300	Miscellaneous Area Sources	Agriculture Production - Livestock	Dairy cattle - flush dairy	Land application of manure			7					
2805021100	Miscellaneous Area Sources	Agriculture Production - Livestock	Dairy cattle - scrape dairy	Confinement			686					
2805021200	Miscellaneous Area Sources	Agriculture Production - Livestock	Dairy cattle - scrape dairy	Manure handling and storage			930					
2805021300	Miscellaneous Area Sources	Agriculture Production - Livestock	Dairy cattle - scrape dairy	Land application of manure			1,154					

SCC	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four	Lead	CO	NH_3	NO_X	PM_{10} Primary	$PM_{2.5}$ Primary	SO_2	VOC
2805022100	Miscellaneous Area Sources	Agriculture Production - Livestock	Dairy cattle - deep pit dairy	Confinement			100					
2805022200	Miscellaneous Area Sources	Agriculture Production - Livestock	Dairy cattle - deep pit dairy	Manure handling and storage			5					
2805022300	Miscellaneous Area Sources	Agriculture Production - Livestock	Dairy cattle - deep pit dairy	Land application of manure			58					
2805023100	Miscellaneous Area Sources	Agriculture Production - Livestock	Dairy cattle - drylot/pasture dairy	Confinement			458					
2805023200	Miscellaneous Area Sources	Agriculture Production - Livestock	Dairy cattle - drylot/pasture dairy	Manure handling and storage			8					
2805023300	Miscellaneous Area Sources	Agriculture Production - Livestock	Dairy cattle - drylot/pasture dairy	Land application of manure			611					
2805030000	Miscellaneous Area Sources	Agriculture Production - Livestock	Poultry Waste Emissions	Not Elsewhere Classified (see also 28-05-007, -008, -009)			710					
2805030007	Miscellaneous Area Sources	Agriculture Production - Livestock	Poultry Waste Emissions	Ducks			20					
2805030008	Miscellaneous Area Sources	Agriculture Production - Livestock	Poultry Waste Emissions	Geese			6					
2805035000	Miscellaneous Area Sources	Agriculture Production - Livestock	Horses and Ponies Waste Emissions	Not Elsewhere Classified			2,005					

SCC	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four	Lead	CO	NH_3	NO_X	PM_{10} Primary	$PM_{2.5}$ Primary	SO_2	VOC
2805039100	Miscellaneous Area Sources	Agriculture Production - Livestock	Swine production - operations with lagoons (unspecified animal age)	Confinement			7,739					
2805039200	Miscellaneous Area Sources	Agriculture Production - Livestock	Swine production - operations with lagoons (unspecified animal age)	Manure handling and storage			14,188					
2805039300	Miscellaneous Area Sources	Agriculture Production - Livestock	Swine production - operations with lagoons (unspecified animal age)	Land application of manure			1,210					
2805040000	Miscellaneous Area Sources	Agriculture Production - Livestock	Sheep and Lambs Waste Emissions	Total			269					
2805045000	Miscellaneous Area Sources	Agriculture Production - Livestock	Goats Waste Emissions	Not Elsewhere Classified			672					
2805047100	Miscellaneous Area Sources	Agriculture Production - Livestock	Swine production - deep-pit house operations (unspecified animal age)	Confinement			1,735					
2805047300	Miscellaneous Area Sources	Agriculture Production - Livestock	Swine production - deep-pit house operations (unspecified animal age)	Land application of manure			726					
2805053100	Miscellaneous Area Sources	Agriculture Production - Livestock	Swine production - outdoor operations (unspecified animal age)	Confinement			35					

SCC	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four	Lead	CO	NH_3	NO_X	PM_{10} Primary	$PM_{2.5}$ Primary	SO_2	VOC
2810060100	Miscellaneous Area Sources	Other Combustion	Cremation	Humans	0.01	1		2	2	1	1	1
2810060200	Miscellaneous Area Sources	Other Combustion	Cremation	Animals		4		5	4	0	5	7

9.0 Mobile Source Inventory

9.1 Onroad Inventory

EPA's MOVES model, version 2010b, was used to estimate total annual onroad emissions by county for Missouri. The 115 Missouri MOVES county input databases were updated with local activity data. These updates more accurately reflect Missouri emissions than the default data in the 2011 County Databases provided by EPA. The Air Program updated the following Input Tables:

- hpmsvtypeyear: this table was updated for all 115 counties. VMT by county for the State of Missouri was provided by MoDOT. Area-specific VMT by county for the St. Louis City region was provided by the East/West Gateway Council of Governments. The VMT was distributed to the Vehicle Source Type using a Statewide VMT-Vehicle distribution provided by MoDOT.

- roadtypedistribution: this table was updated for all 115 counties. VMT distribution by road type for the State of Missouri was provided by MoDOT. Seven MOVES road type distribution tables were created, one for each of the seven MoDOT county districts.

  District CD: Boone, Callaway, Camden, Cole, Cooper, Crawford, Dent, Gasconade, Howard, Laclede, Maries, Miller, Moniteau, Morgan, Osage, Phelps, Pulaski, Washington

  District KC: Cass, Clay, Jackson, Johnson, Lafayette, Pettis, Platte, Ray, Saline

  District NE: Adair, Audrain, Clark, Knox, Lewis, Lincoln, Macon, Marion, Monroe, Montgomery, Pike, Ralls, Randolph, Schuyler, Scotland, Shelby, Warren

  District NW: Andrew, Atchison, Buchanan, Caldwell, Carroll, Chariton, Clinton, Daviess, DeKalb, Gentry, Grundy, Harrison, Holt, Linn, Livingston, Mercer, Nodaway, Putnam, Sullivan, Worth

  District SE: Bollinger, Butler, Cape Girardeau, Carter, Douglas, Dunklin, Howell, Iron, Madison, Mississippi, New Madrid, Oregon, Ozark, Pemiscot, Perry, Reynolds, Ripley, Scott, Shannon, St. Francois, Ste. Genevieve, Stoddard, Texas, Wayne, Wright

  District SL: Franklin, Jefferson, St. Charles, St. Louis, St. Louis City

  District SW: Barry, Barton, Bates, Benton, Cedar, Christian, Dade, Dallas, Greene, Henry, Hickory, Jasper, Lawrence, McDonald, Newton, Polk, St. Clair, Stone, Taney, Vernon, Webster

- sourcetypeagedistribution: this table was updated for all 115 counties. A list of Vehicle Identification Numbers (VINs), by county, was provided by the Missouri Department of Revenue. The VINs were decoded into model year and MOBILE6 vehicle classes by ESP Data Solutions, Inc, a private contractor. Specific age distributions were created for all current and formerly proposed non-attainment areas, as well as four distributions created for the remaining counties of the state. These age distributions were converted to the MOVES format using the EPA provided Mobile6 to MOVES conversion excel workbook.

Northeast Counties in Attainment: Adair, Audrain, Boone, Callaway, Carroll, Chariton, Clark, Cole, Cooper, Grundy, Howard, Knox, Lewis, Linn, Livingston, Macon, Marion, Mercer, Moniteau, Monroe, Montgomery, Osage, Pike, Putnam, Ralls, Randolph, Saline, Schuyler, Scotland, Shelby, Sullivan, Warren

Northwest Counties in Attainment: Andrew, Atchison, Bates, Benton, Buchanan, Caldwell, Daviess, DeKalb, Gentry, Harrison, Henry, Holt, Johnson, Lafayette, Nodaway, Pettis, Ray, Worth

Southwest Counties in Attainment: Barry, Barton, Camden, Cedar, Dade, Dallas, Douglas, Hickory, Jasper, Laclede, Lawrence, McDonald, Miller, Morgan, Newton, Ozark, Polk, St. Clair, Vernon, Webster, Wright

Southeast Counties in Attainment: Bollinger, Butler, Cape Girardeau, Carter, Crawford, Dent, Dunklin, Gasconade, Howell, Iron, Madison, Maries, Mississippi, New Madrid, Oregon, Pemiscot, Phelps, Pulaski, Reynolds, Ripley, St. Francois, Scott, Shannon, Stoddard, Texas, Washington, Wayne

Kansas City formerly proposed Non-Attainment area: Cass, Clay, Clinton, Jackson, Platte

Greene County formerly proposed Non-Attainment area: Christian, Greene, Stone, Taney

St Louis current and formerly proposed Non-Attainment area: Franklin, Jefferson, Lincoln, St Charles, St Louis, St Louis City

Perry and Ste. Genevieve formerly proposed Non-Attainment area: Perry, Ste. Genevieve

- sourcetypeyear: this table was updated for all 115 counties. A list of Vehicle Identification Numbers (VINs), by county, was provided by the Missouri Department of Revenue. The VINs were decoded into model year and MOBILE6 vehicle classes by ESP Data Solutions, Inc, a private contractor. Mobile6 vehicle population counts were created for each county. These county vehicle populations were converted to the MOVES format using the EPA provided Mobile6 to MOVES conversion excel workbook.

- fuelsupply: this table was updated for the 110 counties not in the St Louis NonAttainment Area. In 2008, Missouri's ethanol mandate took effect and required a 10% ethanol blend in all gasoline sold except premium gasoline. The 'fuelsupply' table in the 2011 County Databases provided by EPA estimate gasoline without ethanol comprising 27.4% of gasoline sales in Missouri counties outside of the St Louis NonAttainment Area. According to data on the US Energy Information Administration website (http://www.eia.gov/dnav/pet/PET_CONS_REFMG_D_SMO_VTR_MGALPD_A.htm), premium gasoline sales comprised 2.65% of the total gasoline sales in Missouri in 2009, the most current year of available data. This data seems more accurate than the 27.4% market share currently listed in the 2011 County Databases for Missouri. Using the US EIA data to update the 'fuelsupply' tables, the market share for gasohol (E10) would be 97.35% and the market share for non-ethanol-blend gasoline would be 2.65%.

The ‘fuelsupply’ tables for the five counties in the St Louis NonAttainment Area were already populated with the reformulated gasoline that is required in those counties.

• imcoverage: this table was updated for the five counties in the St Louis Ozone NonAttainment Area. These counties are Franklin County (29071), Jefferson County (29099), St Charles County (29183), St Louis County (29187), and St Louis City (29510). IM data was provided by the Air Program’s IM Program. The Air Program used EPA technical guidance on appropriate input assumptions and sources of data for the use of MOVES 2010 in State Implementation Plan (http://www.epa.gov/otaq/models/moves/420b10023.pdf). Section 3.10 of this guidance document explains the appropriate assumptions and methods to be used when developing the I/M input table for MOVES 2010. This guidance was followed in the development of the I/M input Tables. The following outlines the approach used to develop each parameter of these I/M input tables in MOVES.

Pollutant Process ID

To begin development of the I/M input table, the default data for the I/M input table for St. Louis County was exported from the MOVES county database manager. The default data included four different I/M test types. However, the actual St. Louis area only had two different test types (On-board diagnostics) OBD tests for the exhaust and evaporative systems. In the default I/M input table, these were the only two types of tests that were “turned on” along with the appropriate pollutant process IDs that would be impacted by each test. Therefore, the pollutant process IDs that were included in the default table for the two OBD tests were the same pollutant process IDs used in the I/M input table for the St. Louis nonattainment area. The other two tests included in the default data along with their associated pollutant process IDs were still included in the I/M input table, but they were “turned off”.

Source Type ID

The St. Louis I/M program includes passenger cars and also trucks with a gross vehicle weight rating of 8,500 lbs. or less. Therefore, the three source type IDs included in the I/M input table for the St. Louis nonattainment area are passenger cars, passenger trucks, and light commercial trucks (IDs = 21, 31, and 32).

Inspection Frequency

The St. Louis I/M program requires that emission be tested every two years, so the inspection frequency ID that represents biennial tests (ID = 2) was used in the I/M input table for the OBD tests applicable to the St. Louis nonattainment area.

Test Standards

The St. Louis I/M program is a centralized program with OBD tests for exhaust and evaporative systems on the vehicles. Therefore, the test standard IDs for exhaust OBD check and the evaporative system OBD check (IDs = 43 and 51) were used in the I/M input table for the St. Louis nonattainment area.

I/M Program ID

This is an arbitrary number developed by the MOVES user to define a unique test given for vehicles within a range of model years. Therefore, I/M program IDs were arbitrarily assigned to the various unique tests within the St. Louis I/M program.

Beginning and Ending Model Years

The St. Louis I/M program applies to gasoline vehicles with a model year of 1996 or later and it also applies to diesel vehicles with a model year of 1997 or later. Since the emissions inspection is required biennially, the ending model year would always be two years less than the emissions inventory year that is being developed. Therefore, for the tests for gasoline vehicles, the beginning model year is 1996 and the ending model year is two years earlier than the year for which MOVES is being run, and the for diesel vehicles the beginning model year is 1997 and the ending model year is two years earlier than the year for which MOVES is being run.

Compliance Factor

According to page 39 of the MOVES guidance document the compliance factor is calculated with the following equation:

Compliance Factor = percent compliance rate x (100 – percent waiver rate) x regulatory class coverage adjustment.

Therefore, in order to calculate the compliance factor for each source type included in the I/M program, the compliance rate, waiver rate, and regulatory class coverage adjustment needed to be determined. These three values were determined by the processes described below and then the compliance factors for each source type were calculated with the equation written above.

Compliance Rate

The compliance rate was calculated with the following equation:

Compliance Rate = Number of vehicles that were tested over a two year period (2010 – 2011) / Population of vehicles that is theoretically subject to I/M during the same period.

In order to determine the compliance rate, as it compares to the source type population by model year, the population of vehicles that is theoretically subject to I/M first needed to be determined.

In May 2012, the Missouri Department of Revenue (DOR) Vehicle Registration database was queried and a VIN decoder was used to separate the vehicle counts into Mobile 6.2 vehicle classes by model year. In the St. Louis nonattainment area, the Mobile 6.2 vehicle classes that are subject to I/M include 1996 and newer light duty gasoline vehicles, light duty gasoline trucks Class 1, light duty gasoline trucks Class 2, light duty gasoline trucks Class 3, light duty gasoline trucks Class 4, as well as 1997 and newer light duty diesel vehicles, light duty diesel trucks Class 1, light duty diesel trucks Class 2, light duty diesel trucks Class 3, and light duty diesel trucks Class 4. The table below shows the total combined population of these 10 vehicle classes within the appropriate model years by county in the St. Louis nonattainment area according the May 2012 DOR data.

Vehicles Theoretically Subject to the I/M Program in the St. Louis Nonattainment Area

County	Light Duty Gas (1996 and newer)	Light Duty Diesel (1997 and newer)
Franklin	74,904	398
Jefferson	158,322	553
St Charles	270,453	854
St Louis City	143,503	517
St Louis County	792,960	2,352
Total	1,440,142	4,674
Total Count	**1,444,816**	

The Air Program also queried the I/M report generator to determine the total number of vehicles, which had their emissions tested at least once from January 1, 2010 through December 31, 2011. The query also included the total number of vehicles that received waivers during the same time period. The table below, was generated with data from this query.

Initially Tested Vehicles that Received a Waiver in the St. Louis I/M Program from January 1, 2010 through December 31, 2011

Model Year	Passenger Car			Truck			Total Initially Tested		
	Test Count	Waivers	% Waivers	Test Count	Waivers	% Waivers	Test Count	Waivers	% Waivers
1996	32,015	295	0.92 %	10,024	75	0.75 %	42,039	370	0.88 %
1997	40,698	156	0.38 %	12,314	34	0.28 %	53,012	190	0.36 %
1998	52,841	236	0.45 %	15,709	72	0.46 %	68,550	308	0.45 %
1999	63,520	139	0.22 %	17,052	28	0.16 %	80,572	167	0.21 %
2000	78,614	318	0.40 %	19,769	67	0.34 %	98,383	385	0.39 %
2001	80,007	270	0.34 %	18,769	39	0.21 %	98,776	309	0.31 %
2002	97,599	314	0.32 %	21,911	62	0.28 %	119,510	376	0.31 %
2003	90,007	134	0.15 %	20,853	18	0.09 %	110,860	152	0.14 %
2004	99,537	161	0.16 %	22,613	34	0.15 %	122,150	195	0.16 %
2005	103,390	66	0.06 %	19,223	11	0.06 %	122,613	77	0.06 %
2006	101,753	116	0.11 %	18,218	18	0.10 %	119,971	134	0.11 %
2007	113,181	30	0.03 %	19,128	4	0.02 %	132,309	34	0.03 %
2008	109,592	64	0.06 %	16,640	14	0.08 %	126,232	78	0.06 %
2009	82,184	29	0.04 %	8,984	0	0.00 %	91,168	29	0.03 %
2010	27,720	19	0.07 %	2,918	3	0.10 %	30,638	22	0.07 %
2011	7,060	0	0.00 %	467	0	0.00 %	7,527	0	0.00 %
2012	124	0	0.00 %	2	0	0.00 %	126	0	0.00 %
Total	**1,179,842**	**2,347**	**0.20 %**	**244,594**	**479**	**0.20 %**	**1,424,436**	**2,826**	**0.20 %**

Using the data from the two tables above, the compliance rate is calculated for the St. Louis I/M Program with the following equation:

Compliance Rate: (1,424,436 / 1,444,816) x 100% = 98.59%

Waiver Rate

The waiver rate is the percentage of vehicles that fail an initial I/M test and do not pass a retest, but do receive a certificate of compliance. The waiver rate was determined by dividing the number of vehicles that received waivers from January 1, 2010 through December 31, 2011 by the total number of vehicles that were tested at least once during the same time period. Therefore, the waiver rate was calculated for the St. Louis I/M Program with the following equation:

Waiver Rate: (2,826 / 1,444,816) X 100% = 0.20%

Regulatory Class Coverage Adjustment

The regulatory class coverage adjustment is an adjustment that accounts for the fraction of vehicles within a source type that are covered by the I/M program. Since the I/M program in St. Louis exempts vehicles with a gross vehicle weight rating above 8,500 lbs., the compliance factor needs to reflect the percentage of vehicles in the source types subject to I/M that are exempt because of their GVWR. Table A.3 in the Appendix of the MOVES Technical Guidance Document was used to develop adjustments to the compliance factor to account for this discrepancy. The adjustments are percentages of vehicle miles traveled by the various regulatory weight classes within a source type. The corresponding adjustment factors used for the three source categories are as follow:

Passenger cars: 100%

Passenger Trucks: 94%

Light Commercial Trucks: 88%

Calculating the Compliance Factor

Based on the calculations listed above the compliance factor for each source category impacted by the I/M program in St. Louis is listed below.

Passenger cars: 98.59% x (100% - 0.20%) x 100% = **98.39%**

Passenger Trucks: 98.59% x (100% - 0.20%) x 94% = **92.49%**

Light Commercial Trucks: 98.59% x (100% - 0.20%) x 88% = **86.59%**

9.2 Nonroad Inventory

9.2.1 Nonroad Model

EPA's NONROAD model (http://www.epa.gov/otaq/nonrdmdl.htm) estimates emissions from engines not used on roads. Examples include lawn and garden equipment, construction equipment, recreational equipment engines, and portable industrial, commercial, and agricultural engines. Commercial marine, aircraft, and locomotive engine emissions are not included in the NONROAD model, and their emission estimates are covered in sections 9.2.2 through 9.2.4.

The National Mobile Inventory Model (NMIM) (http://www.epa.gov/otaq/nmim.htm) is EPA's consolidated mobile emissions estimation system that allows EPA to produce nonroad mobile emissions in a consistent and automated way for the entire country. EPA encouraged state and local agencies to submit NMIM inputs to the EIS for the 2011 NEI for inclusion in the National County Database (NCD). The NCD contains all the county-specific information needed to run NONROAD. Although NMIM was also designed to estimate onroad emissions, it is no longer used for that purpose, and the MOVES model is used for onroad emissions (see section 9.1). Eventually, MOVES will be revised to also estimate nonroad emissions and NMIM will be retired.

NMIM estimates emissions for engines with a variety of fuel types, from diesel and gasoline to LPG and CNG. The model estimates monthly emissions for total hydrocarbons (THC), nitrogen oxides, carbon monoxide, particulate matter, and sulfur dioxide, as well as calculates monthly fuel consumption. NMIM uses ratios from some of these emissions to calculate emissions for an additional 33 HAPs and 17 dioxin/furan congeners. All of the input and activity data required to run NMIM are contained within the NCD, which is distributed with the model. State and local agencies are able to update the data within the NCD to create emission estimates that accurately reflect local conditions and equipment usage.

Missouri did not submit updates to the NCD as no state-specific updates to equipment population, distribution, or temporal usage is available. The default NCD was used by EPA to estimate Missouri's emissions using the NONROAD model, and Missouri accepted these emission values. To quality assure the emission totals, Missouri also ran the NONROAD model using the default NCD, and the emission totals matched EPA's results.

9.2.2 Commercial Marine

The Missouri DNR accepted EPA's estimates of emissions for this source category. No documentation was provided by EPA.

9.2.3 Aircraft

The Missouri DNR accepted EPA's estimates of emissions for this source category. Documentation is available in Appendix B-5 – 2011 Aircraft LTO Processing for the National Emission Inventory.

9.2.4 Locomotive

The Missouri DNR accepted EPA's estimates of emissions for this source category. Documentation is available in Appendix B-6- Development of 2011 Railroad Component for National Emissions Inventory.

10.0 Biogenic Inventory

Per the AERR, EPA creates the biogenic inventory with no updates or improvement from state or local agencies. The documentation below is taken from EPA's Draft NEI documentation

Biogenic emission sources are emissions that come from natural sources. They need to be accounted for in photochemical grid models, as most types are widespread and ubiquitous contributors to background air chemistry. In the NEI, only the emissions from vegetation and soils are included, but other relevant sources include volcanic emissions, lightning, and sea salt.

Biogenic emissions from vegetation and soils are computed using a model which utilizes spatial information on vegetation and land use and environmental conditions of temperature and solar radiation. The model inputs are typically horizontally allocated (gridded) data, and the outputs are gridded biogenic emissions which can then be speciated and utilized as input to photochemical grid models.

Sector Description

In the 2011 NEI, biogenic emissions are included in the nonpoint data category, in the EIS sector "Biogenics – Vegetation and Soil." The table below lists the two SCCs used in the 2011 NEI that comprise this sector. These 2 SCCs have distinct pollutants: SCC 2701220000 has only NO_X emissions, and SCC 2701200000 has emissions for CO, VOC and 3 VOC HAPs: formaldehyde, acetaldehyde and methanol.

Source Classification Code	EI Sector	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four	Tier 1 Description	Tier 2 Description	Tier 3 Description
2701200000	Biogenics - Vegetation and Soil	Natural Sources	Biogenic	Vegetation	Total	Natural Resources	Biogenic	Vegetation
2701220000	Biogenics - Vegetation and Soil	Natural Sources	Biogenic	Vegetation/ Agriculture	Total	Natural Resources	Biogenic	Vegetation

The biogenic emissions for the 2011 NEI were computed based on 2011 meteorology data from the Weather Research and Forecasting (WRF) Model using the Biogenic Emission Inventory System, version 3.14 (BEIS3.14) model within SMOKE. The BEIS3.14 model creates gridded, hourly, model-species emissions from vegetation and soils. The 12-kilometer gridded hourly data are summed to monthly and annual level, and are mapped from 12-kilometer grid cells to counties using a standard mapping file. BEIS produces biogenic emissions for a modeling domain which includes the contiguous 48 states in the U.S., parts of Mexico, and Canada. The NEI uses the biogenic emissions from counties from the contiguous 48.

The model-species are those associated with the carbon bond 2005 chemical mechanism (CB05). The NEI pollutants produced are: CO, VOC, NO_X, methanol, formaldehyde and acetaldehyde. VOC is the sum of all other biogenic species except CO, NO, SESQ. Mapping of BEIS pollutants to NEI pollutants is as follows:

- NO maps to NO_X
- FORM maps to formaldehyde;
- ALD2 maps to acetaldehyde;
- MEOH maps to methanol;
- VOC is the sum of all other biogenic species except CO, NO, SESQ.

The BEIS3.14 model is described further in:
http://www.cmascenter.org/conference/2011/slides/pouliot_tale_two_cmas08.ppt

The inputs to BEIS include:

- Temperature data at 2 meters which were obtained from the WRF input files to the air quality model,

- Land-use data from the Biogenic Emissions Land use Database, version 3 (BELD3). BELD3 data provides data on the 230 vegetation classes at 1-km resolution over most of North America. These data are available at http://www.epa.gov/ttnchie1/emch/biogenic/.

Sources of data overview and selection hierarchy

The only source of data for this sector is the EPA-estimated emissions from BEIS3.14. States are neither required nor encouraged to report emissions, and no state has done this. The name of the EPA dataset in EIS is: 2011EPA_biogenics.

Spatial coverage and data sources for the sector

The spatial coverage of the biogenics emissions is governed by the “2011 platform” modeling domain which covers all counties in the lower 48 states. More information on this modeling platform is available at http://www.epa.gov/ttn/chief/emch/index.html#2011.

Biogenic emissions are a very large fraction of the total NEI VOC, methanol, formaldehyde and acetaldehyde emissions but a very small fraction of the CO and NO_x.

More detailed summaries of the BEIS model species at county level and monthly are available as a supporting summary on the 2011 web page
(ftp://ftp.epa.gov/EmisInventory/2011/2011_biogenic_reports.zip).

11.0 Event Inventory

The 2011 inventory included prescribed fires and wild fires, but no other events. Missouri DNR accepted EPA's estimates of emissions for these types of events. Appendix B-7 is the technical memorandum from Sonoma Technology, Inc. (STI) explaining STI's role in developing wild fire emissions for EPA.

12.0 EIS Data Submission

A total of 505 facilities were required to be reported as point sources to the 2011 NEI according to the AERR. Facility information along with relevant emissions data was uploaded to the Emission Inventory System (EIS) Gateway. Several steps were taken to prepare MoEIS data for submission to the NEI. Key steps included:

- All active emission units for previously identified facilities were retrieved from MoEIS and matched to corresponding emission units in EPA's EIS. Attributes such as operating status and descriptions were changed in the EPA database as needed. Also, new units were added to the NEI.
- All facilities with Part 70 or Intermediate Operating Permits during the 2011 emission year were identified. Also, facilities that had a Part 70 or Intermediate Operating Permit for only a portion of the year were found and added to the submission list.
- A table of Emission Release Points for the previously identified Emission Units was compiled, including all relevant stack data. Missing stack data was obtained by contacting facility representatives or reviewing issued permits.
- All active Emission Processes for the previously identified facilities were retrieved from MoEIS and matched to corresponding emission units in EPA's database. Attributes such as the SCC code were changed as needed. Also, new processes were added to the EIS.
- Control device information was searched for missing data such as pollutant codes and percentage controlled. Data was obtained and added as needed. Additionally, a query was written to verify that all active control devices were connected to an emission unit, while others verify that controlled units are marked as such and that controlled emission factors are used when appropriate.
- The data was queried to ensure that emission factors are marked controlled or uncontrolled as appropriate.
- Both MoEIS and EPA's system allow a division of emissions between different release paths. However, MoEIS requires the sum total of emissions to equal 100% at the unit level, while the federal system requires a sum of 100% per emission process. An Access query is used to determine which units have multiple processes so that corrections can be made before submission.
- An Access query was developed to ensure that point source facilities in the 5-county St. Louis ozone nonattainment area are including typical ozone season day emissions for VOC, NO_x, and CO on the Ozone Season worksheet as required.

Data was transferred in steps to lower the total number of errors during each step of the submittal process. Basic facility information was uploaded first, followed by:

- Emission Units – All active emission units in MoEIS for the 505 facilities were uploaded. Operating status was changed for formerly active units.
- Emission Release Points- All active emission release points were uploaded. Operating status was changed for formerly active units.

- Emission Processes- All active emission processes uploaded and any that were no longer reportable were given a "last reporting year" in the EIS gateway.
- Control Approach- All active controls along with control percentage and pollutants controlled were uploaded.
- Emissions- Criteria and HAP annual pollutant emissions were uploaded to the EIS gateway.
- Ozone emissions for facilities in the nonattainment area were uploaded.

After each submittal, accuracy was verified by downloading the inventory from the gateway and comparing it to the data in MoEIS.

Each nonpoint data category was submitted individually to the EIS where Missouri was providing a state-specific update to an EPA-provided number, or where Missouri estimated emissions independently of EPA. Where Missouri accepted the EPA estimate, a support request was sent via the EIS listing the SCCs for which Missouri accepted EPA's estimation.

Missouri submitted the onroad mobile data inputs for the MOVES model, as requested in the AERR. Using those model inputs, EPA is able to run the model and create emission estimates identical to Missouri's model runs.