

HAZARD RANKING SYSTEM (HRS) DOCUMENTATION RECORD COVER SHEET

Name of Site: Sporlan Valve Plant #1

EPA ID No.: MON000703541

Contact Persons

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Pathways, Components, or Threats Not Scored

The surface water migration pathway, air migration pathway, and soil exposure component of the soil exposure and subsurface intrusion pathway were not evaluated as part of this Hazard Ranking System (HRS) documentation record because those pathways would not change the listing decision. Additionally, the subsurface intrusion component of the soil exposure pathway and ground water pathway were sufficient to qualify the site for the National Priorities List (NPL). The surface water and air migration pathways, and the soil exposure component of the soil exposure and subsurface intrusion pathway, are of concern to the U.S. Environmental Protection Agency (EPA) and may be considered during future evaluation. Currently, the site score is sufficient for listing without the pathways and component mentioned above.

Surface Water Migration Pathway: This migration pathway was not evaluated during HRS scoring. Few targets associated with the nearest surface water feature (Missouri River) have been documented and because of the high flow rate of the Missouri River, it is unlikely that a release based on increases of contaminant concentrations could be documented (Refs. 10, pp. 18-19; 22, pp. 26-27).

Soil Exposure Component, Soil Exposure and Subsurface Intrusion Pathway: Volatile organic compounds (VOC) were detected in subsurface soil samples collected from the former Sporlan Valve property (Ref. 22, pp. 22-23, 28, 32-33). However, likelihood of exposure via the soil exposure component could not be established based on this data, as all detections of VOCs were in subsurface soils. Therefore, the soil exposure component was not scored in this HRS documentation record.

Air Migration Pathway: The listing of this site would not be changed by evaluating this pathway. Additional investigation of this pathway, if warranted, will be performed during a Remedial Investigation.

HAZARD RANKING SYSTEM (HRS) DOCUMENTATION RECORD

Name of Site: Sporlan Valve Plant #1
EPA Region: 7
Date Prepared: September 2018
Street Address of Site*: 611 East 7th Street
City, County, State, Zip: Washington, Franklin County, Missouri 63090
General Location in the State: East-central portion of state
Topographic Maps: Washington West, Missouri 1973 and 2015
Latitude: 38.551900° North
Longitude: 91.006680° West

The coordinates above for Sporlan Valve Plant #1 were measured at the southwest corner of the main plant building (Ref. 4).

* The street address, coordinates, and contaminant locations presented in this HRS documentation record identify the general area of the site. They represent one or more locations EPA considers to be part of the site based on screening information EPA used to evaluate the site for NPL listing. EPA lists national priorities among known “releases or threatened releases” of hazardous substances; thus, focus is on the release, and not precisely delineated boundaries. A site is defined as where a hazardous substance has been “deposited, stored, disposed or placed, or has otherwise come to be located.” Generally, HRS scoring and the subsequent listing of a release merely represent initial determination that a site may need to be further addressed under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Accordingly, preliminary description of site boundaries at the time of scoring may be refined as more information is available regarding where contamination has come to be located.

Pathway	Pathway Score
Ground Water Migration ¹	37.75
Surface Water Migration	Not Scored
Soil Exposure and Subsurface Intrusion	59.30
Air Migration	Not Scored
HRS SITE SCORE	35.15

¹ “Ground water” and “groundwater” are synonymous: the spelling is different due to “ground water” being codified as part of the HRS, while “groundwater” is the modern spelling.

WORKSHEET FOR COMPUTING HRS SITE SCORE

	S Pathway	S ² Pathway
1. Ground Water Migration Pathway Score (S _{gw})	37.75	1,425.06
2. Surface Water Migration Pathway Score (S _{sw})	NS	NS
3. Soil Exposure and Subsurface Intrusion Pathway Score (S _{sessi})	59.30	3,517.49
4. Air Migration Pathway Score (S _a)	NS	NS
5. $S_{gw}^2 + S_{sw}^2 + S_{sessi}^2 + S_a^2$		4942.73
HRS Site Score Divide the value on line 5 by 4 and take the square root		35.15

Note:

NS = Not scored

TABLE 3-1 --GROUND WATER MIGRATION PATHWAY SCORESHEET

Factor categories and factors	Maximum Value	Value Assigned
Aquifer Evaluated: Ozark		
Likelihood of Release to an Aquifer:		
1. Observed Release	550	550.0
2. Potential to Release:		
2a. Containment	10	NS
2b. Net Precipitation	10	NS
2c. Depth to Aquifer	5	NS
2d. Travel Time	35	NS
2e. Potential to Release [lines 2a(2b + 2c + 2d)]	500	NS
3. Likelihood of Release (higher of lines 1 and 2e)	550	550.0
Waste Characteristics:		
4. Toxicity/Mobility	(a)	10000.0
5. Hazardous Waste Quantity	(a)	10.0
6. Waste Characteristics	100	18.0
Targets:		
7. Nearest Well	(b)	18.0
8. Population:		
8a. Level I Concentrations	(b)	NS
8b. Level II Concentrations	(b)	NS
8c. Potential Contamination	(b)	276.6
8d. Population (lines 8a + 8b + 8c)	(b)	276.6
9. Resources	5	NS
10. Wellhead Protection Area	20	20.0
11. Targets (lines 7 + 8d + 9 + 10)	(b)	314.6
Ground Water Migration Score for an Aquifer:		
12. Aquifer Score [(lines 3 x 6 x 11)/82,5000] ^c	100	37.75
Ground Water Migration Pathway Score:		
13. Pathway Score (S_{gw}), (highest value from line 12 for all aquifers evaluated) ^c	100	37.75

^a Maximum value applies to waste characteristics category

^b Maximum value not applicable

^c Do not round to nearest integer

NS Not scored

TABLE 5-11 –SUBSURFACE INTRUSION COMPONENT SCORESHEET

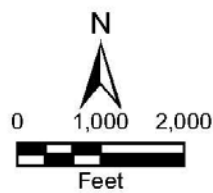
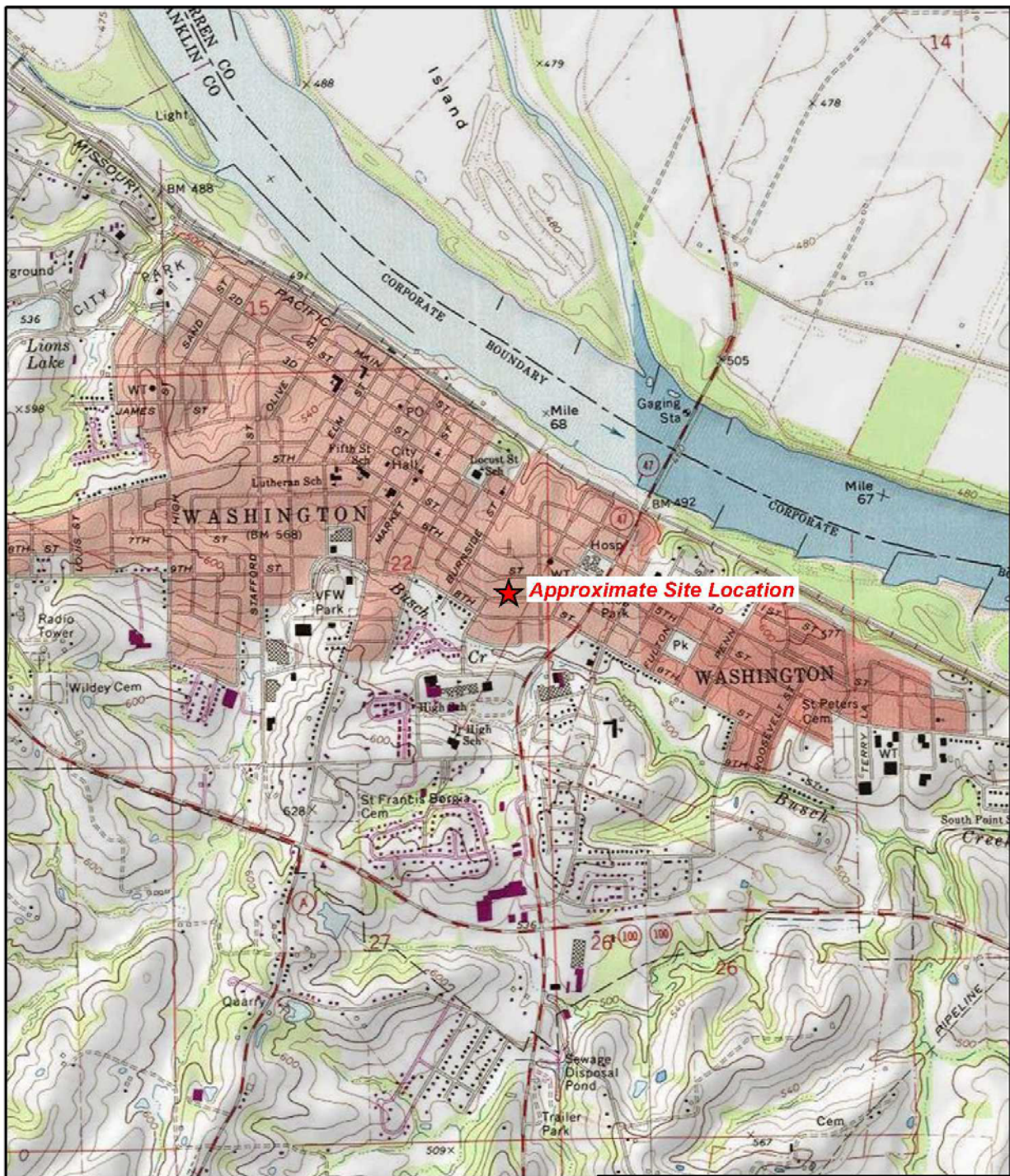
Factor categories and factors	Maximum Value	Value Assigned	
Subsurface Intrusion Component: AOE 1			
Likelihood of Exposure:			
1. Likelihood of Exposure	550	550.0	
2. Potential for Exposure			
2a. Structure Containment	10	NS	
2b. Depth to Contamination	10	NS	
2c. Vertical Migration	15	NS	
2d. Vapor Migration Potential	25	NS	
3. Potential for Exposure (lines 2a * (2b + 2c + 2d), subject to a maximum of 500)	500	NS	
4. Likelihood of Exposure (higher of lines 1 or 3)	550		550
Waste Characteristics:			
5. Toxicity/Degradation	(a)	10,000.0	
6. Hazardous Waste Quantity	(a)	100.0	
7. Waste Characteristics (subject to a maximum of 100)	100		32.0
Targets:			
8. Exposed Individual	50	50.0	
9. Population:			
9a. Level I Concentrations	(b)	160.8	
9b. Level II Concentrations	(b)	60.72	
9c. Population within an area of subsurface Contamination	(b)	6.49	
9d. Population (lines 9a + 9b + 9c)	(b)	228.01	
10. Resources	5	0.0	
11. Targets (lines 8 + 9d + 10)	(b)	278.01	278.01
Subsurface Intrusion Component Score:			
12. Subsurface intrusion Component (lines 4 × 7 × 11)/82,500 ^c (subject to a maximum of 100)	100		59.30
Soil Exposure and Subsurface Intrusion Pathway Score:			
13. Soil Exposure + Subsurface Intrusion Component (subject to a maximum of 100)	100		59.30

^a Maximum value applies to waste characteristics category.

^b Maximum value not applicable.

^c Do not round to nearest integer.

NS Not scored



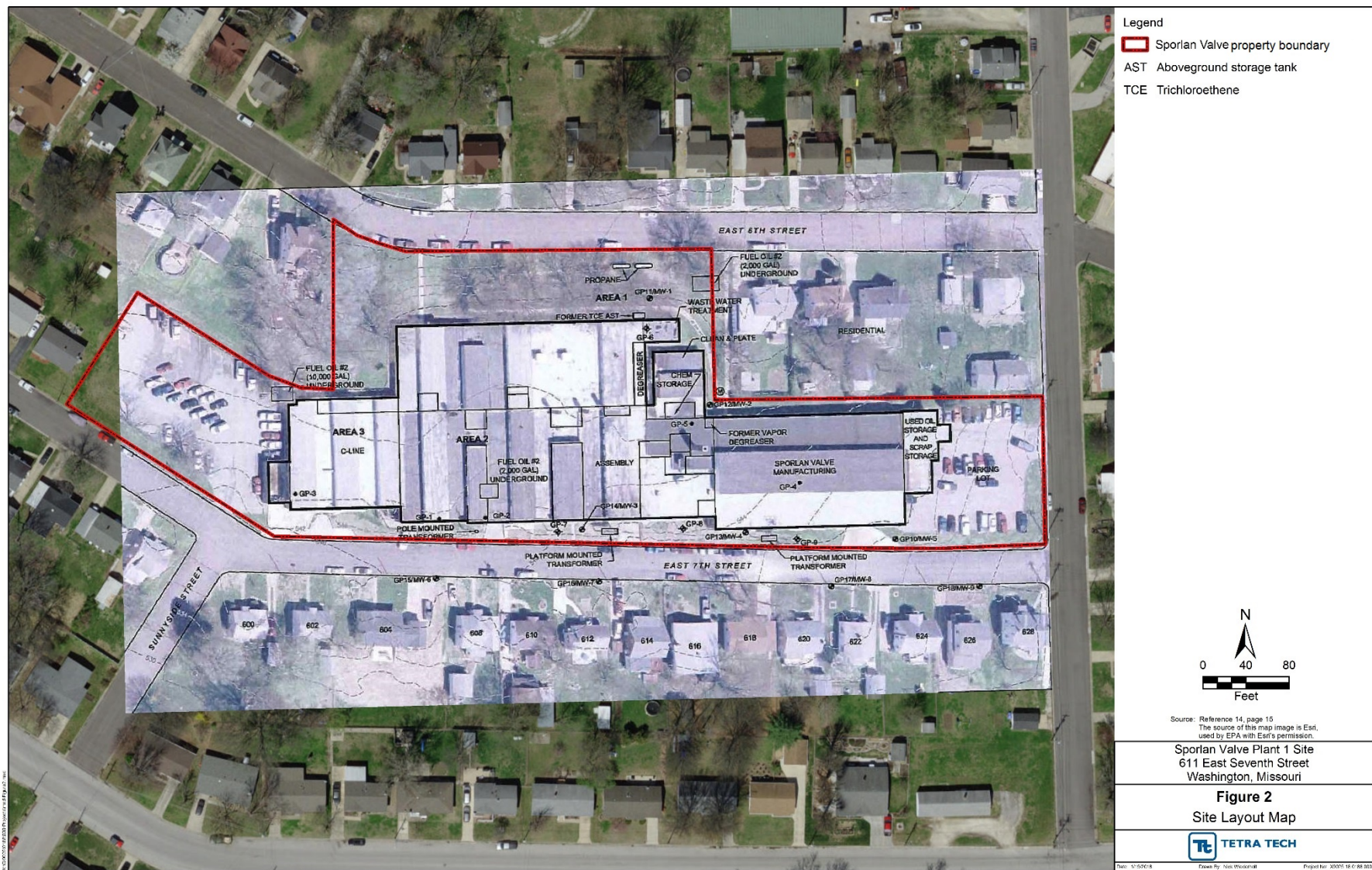
Sporlan Valve Plant #1 Site
611 East Seventh Street
Washington, Missouri

Figure 1
Site Location Map



Source: USGS 7.5 Minute Topo Quad: Washington East, MO, 1972; Washington West, MO, 1973

Date: 02/02/17 Drawn By: Nick Wadsworth Project No: 33025.10.0105.000



REFERENCES

1. U.S. Environmental Protection Agency (EPA). Hazard Ranking System, Title 40 *Code of Federal Regulations* (CFR) Part 300, 55 Federal Register 51532. December 14, 1990. A complete copy is available at: <https://semspub.epa.gov/work/HQ/174028.pdf>. 138 pages.
- 1a. EPA. Addition of a Subsurface Intrusion Component to the Hazard Ranking System, 40 Code of Federal Regulations Part 300, 82 Federal Register 2760. January 9, 2017. Available on-line at <https://www.regulations.gov/document?D=EPA-HQ-SFUND-2010-1086-0104>. 48 pages.
2. U.S. Department of the Interior, U.S. Geological Survey (USGS). Washington West Quadrangle, Missouri. 7.5 Minute Series (Topographic). Scale, 1:24,000. 1985 and Washington East Quadrangle, Missouri. 7.5 Minute Series (Topographic). Scale, 1:24,000. 1972.1 Map. Note: Modified by Tetra Tech, Inc. (Tetra Tech), to add the location of Sporlan Valve Plant #1, source 1 the four mile target distance limit and city of Washington municipal wells. 1 sheet.
3. EPA. Superfund Chemical Data Matrix. Online query of SCDM. Query accessed on August 14, 2018. 13 Pages. The online Superfund Chemical Data Matrix is available at <https://www.epa.gov/superfund/superfund-chemical-data-matrix-scdm-query>
4. Tetra Tech, Inc. (Tetra Tech). Project Note to File with Attachment. Subject: Coordinates for Sporlan Valve Plant 1 in Washington, Missouri. Attachment: Google Earth Map. September 27, 2017. 1 page.
5. Environ International, Corp. (Environ). Annual Groundwater and Sub-Slab Vapor Monitoring Report, Former Sporlan Valve Company Plant No. 1. April 22, 2014. 156 pages.
6. Secor International, Inc. (Secor). Phase II Limited Soil Investigation, Sporlan Valve Company Plant 1. Prepared for Parker Hannifin Corporation. May 24, 2004. 49 pages.
7. Environ. Supplemental Investigation Letter Report, Former Sporlan Valve Company Plant No. 1. August 14, 2007. 65 pages.
8. Reference Reserved
9. Secor. Phase I Environmental Site Assessment, Sporlan Valley Company Plant 1. Prepared for Parker Hannifin Corporation. August 15, 2003. 17 pages.
10. Missouri Department of Natural Resources (MDNR). Site Inspection/Removal Site Evaluation Report, Sporlan Valve Plant 1. March 31, 2016. 920 pages.
11. Superfund Enterprise Management System (SEMS). Facility Registry Service (FRS) Facility Detail Report, Parker Hannifin Corp Sporlan Valve Div. Plant 1. Accessed on September 27, 2017. 5 pages.
12. Tetra Tech. Vapor Intrusion Assessment, First Quarterly Sampling Event, Sporlan Valve Plant #1 Site. Prepared for EPA. March 22, 2017. 141 pages.
13. W. L. Gore & Associates, Inc. (Gore). Gore Surveys Final Report, Sporlan Valve, Washington, Missouri. Prepared for Environ. May 16, 2006. 31 pages.

14. Environ. Offsite Investigation Letter Report, Former Sporlan Valve Company Plant No. 1. Prepared for Brownfields/Voluntary Cleanup Section, Hazardous Waste Program, MDNR. February 20, 2009. 23 pages.
15. Environ. Letter Report for Supplemental Offsite Investigation, Former Sporlan Valve Company Plant No. 1. Prepared for Brownfields/Voluntary Cleanup Section, Hazardous Waste Program, MDNR. December 1, 2009. 24 pages.
16. Environ. Annual Groundwater and Sub-Slab Vapor Monitoring Report, Former Sporlan Valve Company Plant No. 1. Prepared for Brownfields/Voluntary Cleanup Section, Hazardous Waste Program, MDNR. April 15, 2015. 183 pages.
17. Environ. Letter Report for Phase III Supplemental Investigation, Former Sporlan Valve Company Plant No. 1. Prepared for Brownfields/Voluntary Cleanup Section, Hazardous Waste Program, MDNR. June 12, 2012. 33 pages.
18. EPA. Request for a Time-Critical Removal Action at the Sporlan Valve Plant 1 Site. July 28, 2016. 13 pages.
19. Ramboll Environ US Corporation (Ramboll Environ). Monthly Progress Report No. 5. Prepared for EPA. January 4, 2017. 7 pages.
20. EPA Office of Solid Waste and Emergency Response (OSWER). OSWER Technical Guide for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Vapor Sources to Indoor Air. June 2015. 267 pages.
21. Tetra Tech. Vapor Intrusion Assessment, Second Quarterly Sampling Event, November/December 2016 and Third Quarterly Sampling Event, Sporlan Valve Plant #1 Site. Prepared for EPA. September 14, 2017. 86 pages.
22. Tetra Tech. Integrated Site Assessment Report, Sporlan Valve Plant #1 Site, Washington, Missouri. Prepared for EPA. April 24, 2017. 151 pages.
23. Ramboll Environ. Monthly Progress Report No. 9. Prepared for EPA. May 3, 2017. 7 pages.
24. Ramboll Environ. Summary Report, Former Sporlan Valve Facility. Prepared for EPA. June 2017. 262 pages.
25. EPA. HRS Analysis Results Supplement, ASR 7257. September 22, 2017. 19 pages.
26. EPA. HRS Analysis Results Supplement, ASR 7522. September 22, 2017. 15 pages.
27. Tetra Tech. Quality Assurance Project Plan for an Integrated Site Assessment and Removal Site Evaluation, Sporlan Valve Plant #1 Site, Washington, Missouri. Prepared for EPA. September 13, 2016. 27 pages.
28. EPA. Sample Collection Field Sheets & Chain of Custody, ASR 7522. July 31-August 1, 2017. 40 pages.

29. Missouri Department of Natural Resources, Division of Geology and Land Survey. The Stratigraphic Succession in Missouri (revised – 1995) by Thomas L. Thompson. Volume 40 (2nd Series) Revised). Excerpt. Original preparation 1961. 12 pages.
30. MDNR, Division of Geology and Land Survey (GLS). Groundwater Resources of Missouri. 1997. 28 pages.
31. MDNR, Missouri Geological Survey (MGS). Geohydrologic Summary of Sporlan Valve Site. September 19, 2014. 17 pages.
32. EPA. HRS Analysis Results Supplement, ASR 7280. October 2, 2017. 17 pages.
33. EPA. HRS Analysis Results Supplement, ASR 7368. September 29, 2017. 7 pages.
34. EPA. HRS Analysis Results Supplement, ASR 7520. October 2, 2017. 16 pages.
35. Tetra Tech. Supplemental Field Sampling Report with Data Summary, Integrated Site Assessment Support, Sporlan Valve Plant #1 Site, Washington, Missouri. Prepared for EPA. May 8, 2018. 48 pages.
36. Environ. Heating Oil Underground Storage Tank Removal Report, Former Sporlan Valve Facility. Prepared for Brownfields/Voluntary Cleanup Section, Hazardous Waste Program, MDNR. June 12, 2012. 54 pages.
37. MDNR. Water Supply System Search for Water System Number MO6010838. Accessed October 3, 2017. Available on-line at: <https://www.dnr.mo.gov/DWW/indexSearchDNR.jsp>. 3 pages.
38. MDNR. Source Water Assessment Plan – Washington Public Water Supply System No. 6010838. Updated January 22, 2016. Accessed October 2, 2017. Available on-line at: <http://drinkingwater.missouri.edu/swap>. 17 pages.
39. U.S. Census Bureau. Quick Facts, Franklin County, Missouri. July 1, 2017 Household size Estimate. Generated on August 17, 2017. Available on-line at: <https://www.census.gov/quickfacts/fact/table/franklincountymissouri/PST045217>. 2 pages.
40. MDNR. Water Supply System Search for Water System Number MO6010838. Reference includes Water System Facilities reports for all active and inactive city wells and a Microsoft Excel table showing pump capacity and yields for each well. Accessed September 27, 2017. Available on-line at: <https://www.dnr.mo.gov/DWW/indexSearchDNR.jsp>. 21 pages.
41. MDNR. Drinking Source Water Assessment Plan – State of Missouri. Revised December 28, 2000. Accessed September 25, 2017. Available on-line at: <http://drinkingwater.missouri.edu/swap>. 21 pages.
42. MDNR, MGS. Response to MDNR’s Comment Letter Dated June 20, 2013, for the Sporlan Valve Site. September 19, 2014. 2 pages.
43. Eurofins Air Toxics Laboratory. Electronic Comprehensive Validation Package Work Order #1507380A. August 14, 2015. 28 pages.

44. Agency for Toxic Substances and Disease Registry (ATSDR). ToxFAQs for Tetrachloroethylene, Trichloroethylene and Vinyl Chloride. Accessed on-line at: <https://www.atsdr.cdc.gov/toxfaqs/tfacts18.pdf>, <https://www.atsdr.cdc.gov/toxfaqs/tfacts19.pdf>, and <https://www.atsdr.cdc.gov/toxfaqs/tfacts20.pdf> 6 pages.
45. Delaware Health and Social Services, Division of Public Health. Frequently Asked Questions for Perchloroethylene and Trichloroethylene. Accessed on-line at: <http://dhss.delaware.gov/dph/hsp/suscarc.html>. September 2013. 4 pages.
46. U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS). 2018. Web Soil Survey of Washington, Missouri. Accessed February 2018. Accessed on-line at: <http://websoilsurvey.nrcs.usda.gov/app/>. 5 pages.
47. USDA Soil Conservation Service in Cooperation with Missouri Agricultural Experiment Station. Soil Survey of Franklin County, Missouri. April 1989. 172 pages.
48. Tetra Tech. Vapor Intrusion Resident Questionnaire Forms. August 2016. 60 pages.
49. Tetra Tech. Vapor Intrusion Assessment, Fourth Quarterly Sampling Event - August/September 2017 and Fifth Quarterly Sampling Event – January/February 2018, Sporlan Valve Plant #1 Site, Washington, Missouri. Prepared for EPA. July 18, 2018. 106 pages.
50. Reference Reserved.
51. EPA. HRS Analysis Results Supplement, ASR 7705. March 29, 2018. 9 pages.
52. EPA. HRS Analysis Results Supplement, ASR 7706. March 29, 2018. 6 pages.
53. EPA. Sample Collection Field Sheets & Chain of Custody, ASR 7705. January 23-25, 2018. 31 pages.
54. EPA. Sample Collection Field Sheets & Chain of Custody, ASR 7706. February 19-20, 2018. 21 pages.
55. USGS. Hydrogeology and Hydrologic Conditions of the Ozark Plateaus Aquifer System. Scientific Investigations report 2016-5137. 2016. 73 pages.
56. MDNR. An Explanation of the Columns, Colors, & Symbols for Well Logs and Strip Logs for Washington, Missouri, Wells 4, 5, and 6 (Log numbers 10841, 24271, and 27809). Accessed on-line at: <https://dnr.mo.gov/geology/wrc/logmain/index.html?env/wrc/logmain/index.html>. 10 pages.

SITE DESCRIPTION

The Sporlan Valve Plant #1 (Sporlan Valve) site includes the release of hazardous substances from this Sporlan Valve facility's operations that has resulted in the contaminated soil, groundwater, and soil gas that originates at a former industrial site and has migrated to surrounding residential properties near the former industrial facility. Volatile organic compounds (VOC), including trichloroethene (TCE), tetrachloroethene (PCE), *cis*-1,2-dichloroethene (DCE), and vinyl chloride, were detected in soils at the former facility, as well as in indoor air and sub-slab vapor samples collected at nearby residences, indicating that a release of hazardous substances has occurred (Refs. 5, pp. 2-4, 16-19, 22-23; 10, pp. 12-13; 22, pp. 14-16, 39, 121; 8, pp. 3, 8; 26, p. 5; 28, pp. 1, 14). Additionally, groundwater data from the former facility and surrounding areas indicate migration of a VOC-dominant plume from an on-site source area (identified during soil sampling) (Refs. 6, pp. 5-7, 10-11, 14; 7, pp. 6-8, 21-22, 28; 8, pp. 6-16; 28; 35, p. 21). The weight of evidence indicates that contaminants migrated to indoor air through the subsurface (subsurface intrusion) and that the groundwater plume possesses potential to impact nearby municipal and private drinking water wells. The groundwater migration pathway and the subsurface intrusion component of the soil exposure and subsurface intrusion pathway were evaluated, as documented in Sections 3.0, 5.0 and 5.2 of this Hazard Ranking System (HRS) documentation record.

The Sporlan Valve property is an unoccupied 4-acre parcel of land at 611 East 7th Street, near downtown Washington, Franklin County, Missouri (Ref. 12, p. 5) (see Figures 1 and 2 of this HRS documentation record). The site is south of a topographic high (Ref. 2). North of the topographic high, surface water runoff generally flows north toward the Missouri River. At the former facility, surface water runoff follows topography to the south and east toward an intermittent surface water feature called Busch Creek (Refs. 2; 10, pp. 8, 18; 24, p. 19). Busch Creek flows east for about 3.3 miles where it enters the Missouri River (Ref. 10, p. 18). The site includes the aforementioned groundwater contamination plume that has migrated beyond the facility property boundaries. The full extent of this plume has not been delineated; however, based on groundwater monitoring results, it is known to extend to the south toward 8th Street and to the east toward MacArthur Street, beneath residential structures (Ref. 10, p. 7).

The geographic location of the Sporlan Valve site is within the NE ¼, NE ¼, SE ¼, Section 22, Township 44 North, Range 1 West, Washington West 7.5-Minute Quadrangle, Franklin County, Missouri (Ref. 2, p. 1). The U.S. Environmental Protection Agency (EPA) identification number, as recorded in the Superfund Enterprise Management System (SEMS) database, is MON000703541 (Refs. 11, p. 3).

From 1939 to 2005, the Sporlan Valve Plant #1 building occupied approximately 4 acres of the parcel and housed a refrigeration valve manufacturing facility. During operation, the plant contained manufacturing and assembly areas, cleaning and plating areas (with associated degreasing and chemical storage areas), a waste water treatment plant (with five associated aboveground storage tanks [AST]), a used oil and scrap storage area, three TCE ASTs, two propane ASTs, and three heating oil underground storage tanks (UST) (Refs. 6, p. 14; 9, p. 10; 12, p. 5).

The former Sporlan Valve property is bordered to the north by residential properties and East 8th Street beyond; to the east by MacArthur Street and residential properties; to the south by East 7th Street and residential properties; and to the west by residential properties and Burnside Street beyond (Ref. 9, p. 6) (see Figure 1 of this HRS documentation record).

OPERATIONAL HISTORY

The Sporlan Valve Plant #1 property was first developed as a refrigeration valve manufacturing facility in 1939. Continuous additions were constructed until 1968 when the final addition was added, bringing the total area of the factory to 80,000 square feet. Operations included plating, degreasing, brazing, assembling, and testing (Ref. 9, p. 6). Over the course of the facility's history, three ASTs, ranging in size from 200 to 2,000 gallons, were used to store TCE for the plant's degreasing processes. A 2,000-gallon AST was located outside and just north of the former manufacturing building, and was positioned on a concrete pad with no secondary containment. Three USTs for storing fuel oil were also present at the property. The fuel oil USTs ranged in size from 2,000 to 10,000 gallons (Ref. 9, p. 10). It is believed that the use and storage of TCE at this property led to the aforementioned contamination. The plant operated until 2003 to 2005; the exact date operations ceased is unknown (Ref. 10, p. 7).

In October 2004, Parker Hannifin Corporation (Parker Hannifin) purchased the Sporlan Valve Company via an asset sale, which excluded the real property of the Sporlan Valve plant. SV Land, LLC, purchased the real property associated with the plant in December 2004. In 2011, the brick building and concrete slab were demolished and the property was cleared (Ref. 10, p. 9).

PREVIOUS INVESTIGATIONS

Numerous environmental investigations have been conducted at the Sporlan Valve Plant #1 site. Table 1 lists all relevant investigations and includes hazardous substances detected in samples collected. Further discussion of these investigations is included in pathway sections to follow.

Table 1: Summary of Previous Investigations					
Company/Agency	Investigation	Date	Sample Types	CVOCs Detected	Reference No.
SECOR	Phase I ESA	8/15/2003	None	None	9
SECOR	Limited Phase II ESA	5/24/2004	Soil Groundwater	TCE	6
Gore	Soil Gas Survey	5/16/2006	Soil Gas	TCE PCE <i>cis</i> -1,2-DCE <i>trans</i> -1,2-DCE	13
Environ	Supplemental Investigation	8/14/2007	Soil Groundwater	1,1-DCE <i>cis</i> -1,2-DCE TCE VC	7
Environ	Offsite Investigation	2/20/2009	Soil Groundwater Sub-slab Soil Gas	1,1-DCE <i>cis</i> -1,2-DCE TCE VC	14
Environ	Supplemental Offsite Investigation	12/1/2009	Soil Groundwater	1,1-DCE <i>cis</i> -1,2-DCE TCE VC	15
Environ	Phase III Supplemental Investigation	6/12/2012	Soil Groundwater	1,1-DCE <i>cis</i> -1,2-DCE Methylene chloride PCE TCE	17
Environ	Annual Groundwater and Sub-slab Vapor Monitoring Report	4/15/2015	Groundwater Sub-slab Soil Gas	PCE TCE VC	16
MDNR	Site Inspection/Removal Site Evaluation	3/31/2016	Sump water Indoor Air Sub-slab Soil Gas	TCE <i>cis</i> -1,2-DCE <i>trans</i> -1,2-DCE VC	10
Tetra Tech	Vapor Intrusion Assessment – 1 st Quarterly Sampling	3/22/2017	Indoor Air Sub-slab soil gas Outdoor Ambient Air	TCE PCE 1,1-DCE <i>cis</i> -1,2-DCE <i>trans</i> -1,2-DCE VC	12
Ramboll Environ	Summary Report	6/2017	Indoor Air Sub-slab Soil Gas	1,1-DCE <i>cis</i> -1,2-DCE <i>trans</i> -1,2-DCE TCE VC	24

Table 1: Summary of Previous Investigations					
Company/Agency	Investigation	Date	Sample Types	CVOCs Detected	Reference No.
Tetra Tech	Integrated Site Assessment Report	4/24/2017	Soil Soil Gas Groundwater Sump Water	TCE PCE 1,1-DCE <i>cis</i> -1,2-DCE <i>trans</i> -1,2-DCE VC	22
Tetra Tech	Supplemental Field Sampling	July and August 2017	Soil Sump Water Groundwater	TCE PCE 1,1-DCE <i>cis</i> -1,2-DCE <i>trans</i> -1,2-DCE VC	35
Tetra Tech	Vapor Intrusion Assessment – 2 nd and 3 rd Quarterly Sampling	9/14/2017	Indoor Air Sub-slab Soil Gas Outdoor Ambient Air	TCE PCE 1,1-DCE <i>cis</i> -1,2-DCE <i>trans</i> -1,2-DCE VC	21
Tetra Tech	Vapor Intrusion Assessment – 4 th and 5 th Quarterly Sampling	August/September 2017 - January/February 2018	Indoor Air Sub-slab Soil Gas Outdoor Ambient Air	TCE PCE <i>cis</i> -1,2-DCE <i>trans</i> -1,2-DCE	49, pp. 11- 16, 67-85, 86- 106

Notes:

ASR	U.S. EPA Region 7 Laboratory Analytical Services Request
CVOC	Chlorinated Volatile Organic Compound
DCE	Dichloroethene
Environ	Environ Corporation International, Inc.
EPA	U.S. Environmental Protection Agency
ESA	Environmental Site Assessment
Gore	W.L. Gore & Associates
MDNR	Missouri Department of Natural Resources
PCE	Tetrachloroethene
Ramboll Environ	Ramboll Environ US Corporation
SECOR	SECOR International, Inc.
TCE	Trichloroethene
Tetra Tech	Tetra Tech, Inc.
VC	Vinyl chloride

2.2 SOURCE CHARACTERIZATION

2.2.1 SOURCE IDENTIFICATION

Name of source: **Contaminated Soils**

Number of source: 1

Source Type: Contaminated soil

Description and Location of Source (with reference to a map of the site): Figure 3

The mass of contaminated soil documented in this section is primarily at the south eastern portion of the former Sporlan Valve Plant #1 at 611 E. 7th Street. The source is composed of soils contaminated with chlorinated volatile organic compounds (CVOC) including but not limited to TCE. CVOC impacted soil has been identified in the vicinity of: (1) a former exterior TCE AST north of the former building, (2) a former interior vapor degreaser, (3) a former waste water treatment area, and (4) a chemical storage area (Refs. 7, p. 1, 10, pp. 9, 10, 12, 14). These former features were absent when EPA began assessing the site as the building was demolished in 2011 and EPA investigations were initiated in 2016 (Refs. 10, p. 9; 27, pp. 1, 15). It is postulated that the soil came to be contaminated from spill or leaks from these former site features at some time over the operational history of the facility (Refs. 10, p.14; 6, p. 7; 18, p. 3).

From 1939 to 2005, the Sporlan Valve Plant #1 building occupied approximately 4 acres of the parcel and housed a refrigeration valve manufacturing facility (Ref. 9, p. 6). Over the course of the facility's history, three ASTs, ranging in size from 200 to 2,000 gallons, were used to store TCE for the plant's degreasing processes (Ref. 9, p. 10). A 2,000-gallon AST was outside and just north of the former manufacturing building and was positioned on a concrete pad with no secondary containment (Refs. 9, p. 10; 6, pp. 7, 10, 14). Spent mineral spirits, and TCE were stored in 55-gallon drums at a hazardous waste storage area at the southeast corner of the facility until disposal was arranged (Refs. 9, p. 10; 14, p. 15).

Contaminated soils that were first reported in 2004 as part of a Phase II limited soil investigation that included sampling nine soil borings along the perimeter of the Sporlan Valve building (Ref. 6, pp. 2, 13). The results of the investigation revealed a detection of TCE in soil (739 micrograms per kilogram [$\mu\text{g/kg}$]) from a boring (SB-3) near the former 2,000-gallon TCE AST at the northern portion of the site, indicating impact from historical site activities (Ref. 6, pp. 7, 10, 14, 18).

In 2006, five soil borings (GP-1 through GP-5) were installed and sampled (Ref. 7, pp. 2, 5, 13, 14, 24). At locations GP-4 and GP-5, chlorinated solvents were identified (Ref. 7, pp. 13, 14, 24). Location GP-5 was near the former chemical storage area and vapor degreaser, and location GP-4 was southeast of the former vapor degreaser (Ref. 7, p. 24). TCE was reported at 4.55 milligrams per kilogram (mg/kg) in a sample collected at 11.5 feet below ground surface (bgs) from GP-5, and at 2.55 mg/kg in a sample

collected at 18 feet bgs from GP-4 (Ref. 7, pp. 13, 14). The sample from GP-4 at 18 feet bgs also contained vinyl chloride at 0.23 mg/kg (Ref 7, p. 13). These two samples also contained 1,1-dichloroethene (DCE) and *cis*-1,2-DCE (Ref. 7, pp. 13, 14). The presence of *cis*-1,2-DCE and vinyl chloride indicate that TCE is attenuating via anaerobic reductive dichlorination (Ref 7, p. 8). In March 2007, samples collected from GP-6 at 2.5 and 4.5 feet below grade contained TCE at 5.46 mg/kg and 3.71 mg/kg, respectively (Ref. 7, p. 14). GP-6 was located southeast of the former TCE AST (Ref. 7, p. 24).

On March 24, 2006, 40 sorbent tubes made by W.L. Gore & Associates were buried across the middle portion of the former facility to assess concentrations of CVOCs in soil gas (Ref. 13, pp. 2, 28). These sorbent tubes were retrieved on April 10, 2006, and sent to the W.L. Gore and Associates Screening Module Laboratory for thermal desorption and gas chromatography/mass selective detection (Ref. 13, pp. 2, 3). Following analysis, contour maps of *cis*- and *trans*-1,2-DCE, PCE, TCE, and total petroleum hydrocarbons were generated (Ref. 13, pp. 4, 28-31). In general, PCE, TCE, and *cis*- and *trans*-1,2-DCE were detected at highest concentrations near the former TCE AST (Ref. 13, pp. 29, 30, 31). These sorbent tubes provide a soil gas mass level that compare favorably with concentrations reported in the soil or groundwater (Ref. 13, p. 4).

The valve manufacturing building and foundation slab were demolished and cleared in 2011 (Ref. 10, p. 9). In 2012, a Phase III Supplemental Investigation commissioned by the Sporlan Valve Company to investigate potential source areas via soil sampling along a test trench north of the plant and from 13 test pits within the north-central portion of the former building (Ref. 17, pp 2, 3, 20). TCE was detected in all four surface soil samples at concentrations ranging from 66.4 to 2,710 µg/kg (Ref, 17, pp. 3, 10), and all 15 subsurface soil samples at concentrations ranging from 36.8 to 9,390 µg/kg (Ref. 17, pp. 4, 11, 12, 20). Results of this investigation led to conclusion that a TCE source was not upgradient (i.e., north) of the former facility (Ref. 17, p. 6).

On October 25-27, 2016, EPA used direct push technology (DPT) equipment and a membrane interface probe (MIP) to survey 37 locations at the site (Ref. 22, pp. 12-14, 38). The MIP served as a screening tool to better delineate the extent of CVOC contamination in subsurface soils (Ref. 22, p. 12). The screening logs provided by the MIP assessment were used to assist with selection of locations and depths for subsurface soil sampling for laboratory analysis for TCE and related CVOCs, as well as benzene, toluene, ethylbenzene, and total xylenes (BTEX) (Ref. 22, p. 13). Following the MIP assessment, EPA returned to selected MIP survey locations for collection of soil samples for laboratory analysis. On October 31 and November 1, 2016, subsurface soil samples were collected at 13 MIP survey locations by use of DPT soil samplers at discrete depth intervals (Ref. 22, p. 14). In addition, one subsurface soil sample (background) was collected upgradient of the site near Municipal Well #5 (Ref. 22, p. 14). See

Figure 3 in the Integrated Site Assessment (ISA) report for subsurface soil sampling locations (Ref. 22, pp. 45). Samples were submitted for laboratory analyses via EPA Region 7 laboratory method 3230.16E (gas chromatography/mass spectrometry [GC/MS] closed system purge and trap) for selected VOCs, which included TCE, PCE, 1,1-DCE, *trans*-1,2-DCE, *cis*-1,2-DCE, and vinyl chloride (VC), along with BTEX (Ref. 22, pp. 14, 38, 131, 132, 134).

In July and August of 2017, EPA and the Superfund Technical Assessment and Response Team (START) collected additional subsurface soil samples using EPA DPT equipment to further delineate the horizontal extent of contaminated soil (Ref. 35, p. 7). This sampling occurred on the south and east portions of the property (Ref. 35, p. 19). Nineteen additional borings (numbered SB-38 through SB-56) were advanced, and two samples were collected from each boring (Ref. 35, pp. 7, -98, p. 3; 28). CVOCs were reported in 35 of the 38 soil samples (Ref. 35, pp. 29, 30, 35, 38-47). TCE concentrations ranged from 13 µg/kg to 27,000 J µg/kg (Ref. 35, pp. 29, 30, 42, 47). The “J” qualifier indicates the reported value is an estimate, but does not impact the identification of the substance present in the sample (Ref. 35, p. 34). Other CVOCs positively identified in the soil samples included PCE, 1,1-DCE, *trans*-1,2-DCE, *cis*-1,2-DCE, and VC (Ref. 35, pp. 29, 30, 35, 38-47).

Sampling during the 2016 and 2017 events was conducted in general accordance with the project-specific quality assurance project plan (QAPP) dated September 13, 2016 (Refs. 22, p. 12; 27; 35, p. 7).

In defining the extent of contaminated soil and associating hazardous substances to the source, only samples collected and analyzed by EPA in 2016 and 2017 will be used for this HRS evaluation. Although past soil sampling by SECOR in 2004 (Ref. 6) and Environ in 2007 and 2012 (Refs. 7 and 17) also reported CVOC contamination in soils as discussed above, those data are not used due to uncertainty in sampling and analytical methods.

2.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE

Hazardous substances associated with this source are documented by showing increases of hazardous substances in the contaminated soil source. All Source 1 samples were collected at the former Sporlan Valve Plant #1 property (see Figure 3 of this HRS documentation record). Locations of the samples collected in 2016 are from Reference 22, page 38. Locations of the samples collected in 2017 were downloaded from a handheld global positioning system device (a geodatabase [*.gdb]) file and are presented in Reference 35, page 19. Based on analytical results, chlorinated solvents were documented in Source 1 soil samples (see Tables 2 and 3 of this HRS documentation record).

Background Samples

As part of the 2016 ISA, one sample was designated to represent background subsurface soil conditions. This subsurface soil sample was collected upgradient of the site near Municipal Well #5, as shown on

Figures 10 and 11 of the ISA report (Ref. 22, pp. 14, 45, 46, 86). In addition, three other soil borings collected at the former Sporlan Valve property (MIP 2, MIP 12, and MIP 24) in 2016 are considered background locations. These locations were at the southeast, southwest, and northeast corners of the sampling grid; no impact by site-related contamination was identified at those locations (Ref. 22, pp. 38-44). As part of the supplemental sampling in 2017, boring location SB-54 was selected as representative of background conditions. This location was at the east-central portion of the former facility property (see Figure 3 of the HRS documentation record). To ensure the increase in contaminant concentrations between the release and background samples is due to a release, and not differences in sampling and analysis procedures, these locations were sampled during the same time period, by the same technique, and at about the same depths, and were analyzed using the same methods as those employed for the source samples (Ref. 22, pp. 7, 8, 12, 13, 120-123).



Table 2: Fixed Laboratory Analytical Results of Background Samples							
Sample Location	Sample Number	Date	Sample Depth (ft. bgs)	Hazardous Substance	Concentration (µg/kg)	Reporting Limit (µg/kg)	References
Background Soil	7257-119	11/01/2016	8-10	1,1-DCE <i>cis</i> -1,2-DCE <i>trans</i> -1,2-DCE TCE VC	6.6 U 6.6 U 6.6 U 6.6 U 6.6 U	6.6 6.6 6.6 6.6 6.6	22, pp. 67, 86, 132, 144; 25, p. 10
MIP2	7257-101	10/31/2016	4-8	1,1-DCE <i>cis</i> -1,2-DCE <i>trans</i> -1,2-DCE TCE VC	6.1 U 6.1 U 6.1 U 6.1 U 6.1 U	6.1 6.1 6.1 6.1 6.1	22, pp. 38, 67, 68, 121, 132, 139; 25, p. 4
MIP12	7257-112	11/01/2016	4-8	1,1-DCE <i>cis</i> -1,2-DCE <i>trans</i> -1,2-DCE TCE VC	5.1 U 5.1 U 5.1 U 5.1 U 5.1 U	5.1 5.1 5.1 5.1 5.1	22, pp. 38, 67, 79, 121, 132, 142; 25, pp. 7, 8
	7257-113		24	1,1-DCE <i>cis</i> -1,2-DCE <i>trans</i> -1,2-DCE TCE VC	5.2 U 5.2 U 5.2 U 5.2 U 5.2 U	5.2 5.2 5.2 5.2 5.2	22, pp. 38, 67, 80, 121, 132, 142; 25, p. 8
MIP24	7257-117	11/01/2016	20	1,1-DCE <i>cis</i> -1,2-DCE <i>trans</i> -1,2-DCE TCE VC	5.8 U 5.8 U 5.8 U 5.8 U 5.8 U	5.8 5.8 5.8 5.8 5.8	22, pp. 38, 67, 84, 121, 132, 143; 25, p. 9
SB-54	7522-33	08/01/2017	13.5	1,1-DCE <i>cis</i> -1,2-DCE <i>trans</i> -1,2-DCE PCE TCE VC	5.0 U 5.0 U 5.0 U 5.0 U 5.0 U 5.0 U	5.0 5.0 5.0 5.0 5.0 5.0	35, pp. 19, 35, 46; 26, p. 12; 28, pp. 2, 35
	7522-34		19	1,1-DCE <i>cis</i> -1,2-DCE <i>trans</i> -1,2-DCE PCE TCE VC	5.4 U 5.4 U 5.4 U 5.4 U 5.4 U 5.4 U	5.4 5.4 5.4 5.4 5.4 5.4	35, pp. 19, 35, 46; 26, p. 12; 28, pp. 2, 36

Notes:

The reporting limit in this table takes into account any dilution factor, volume adjustment, and percent solids for the sample and is sometimes called the sample quantitation limit or SQL (Refs. 25, p. 1; 26, p. 1).

µg/kg	Micrograms per kilogram
ft.	Feet
bgs	Below ground surface
SB	Soil boring
DCE	Dichloroethene
MIP	Membrane interface probe
TCE	Trichloroethene
PCE	Tetrachloroethene
U	Not detected at or above the reportable level shown (Refs. 35, p. 34; 22, pp. 131).
VC	Vinyl chloride

Contaminated Samples

The source hazardous substances are PCE, TCE, 1,1-DCE, *cis*-1,2-DCE, *trans*-1,2-DCE, and VC. As discussed in Section 2.2.1 and listed in Table 2 of this documentation record, CVOCs were detected in multiple soil samples collected at Source 1. On October 31 and November 1, 2016, subsurface soil samples were collected at 13 MIP survey locations by use of DPT soil samplers at discrete depth intervals corresponding to a range of MIP readings. At several MIP locations, (MIP8, MIP10, MIP12, MIP19, and MIP23), two samples were collected at different depths (Ref. 22, pp. 15, 121). CVOCs were identified in 10 different samples from seven MIP locations (Ref. 22, p. 121). In July and August of 2017, 38 soil samples were collected from 19 soil borings (Ref. 35, pp. 7-9, 35). CVOCs were detected in 35 of the 38 samples collected (Ref. 35, pp. 29, 30, 35, 38-47). These samples were submitted to the U.S. EPA Region 7 laboratory for analysis under Analytical Services Request (ASR) # 7257 and #7522 (Refs. 22, p 130; 35, p. 33). The laboratory analyzed for VOCs in soil at low levels by GC/MS Closed-System Purge-and-Trap (Ref. 22, p. 134; 35, p. 36). Associated chain-of-custody (COC) for ASR 7257 is included on page 67 of Ref. 22. Associated chain-of-custody (COC) for ASR 7522 is included on pages 1 and 2 of Ref. 28.

Table 3: Laboratory Analytical Results of Source 1 Samples							
Sample Location	Sample Number	Date	Sample Depth (ft bgs)	Hazardous Substance	Concentration (µg/kg)	Reporting Limit * (µg/kg)	References
MIP5	7257-103	10/31/2016	20	TCE	23	5.9	22, pp. 38, 67, 70, 121, 132, 140; 25, p. 4
MIP16	7257-104	10/31/2016	9.5	TCE	29	6.1	22, pp. 38, 67, 71, 121, 132, 140; 25, p. 5
MIP17	7257-105	10/31/2016	8.5-9.5	TCE <i>cis</i> -1,2-DCE	690 37	53 5.0	22, pp. 38, 67, 72, 121, 132, 140; 25, p. 5
MIP8	7257-106	10/31/2016	8-12	TCE	7.7	5.9	22, pp. 38, 67, 73, 121, 132, 140; 25, p. 5
	7257-107		20	TCE <i>cis</i> -1,2-DCE VC	1,400 J ¹ 32 17	5.5 5.5 5.5	22, pp. 38, 67, 74, 121, 132, 134, 141; 25, p. 6
MIP19	7257-110	10/31/2016	10-12	1,1-DCE <i>cis</i> -1,2-DCE <i>trans</i> -1,2-DCE TCE VC	38 1,500 71 430 580 J ¹	5.3 54 5.3 54 5.3	22, pp. 38, 67, 77, 121, 132, 134, 141; 25, p. 7
	7257-111		13-14	1,1-DCE <i>cis</i> -1,2-DCE <i>trans</i> -1,2-DCE TCE VC	94 2,500 210 2,100 150	56 56 56 56 56	22, pp. 38, 67, 78, 121, 132, 142; 25, p. 7
MIP23	7257-114	11/01/2016	4	<i>cis</i> -1,2-DCE VC	150 44	5.9 5.9	22, pp. 38, 67, 81, 121, 132, 142; 25, p. 8
	7257-115		19-20	1,1-DCE <i>cis</i> -1,2-DCE <i>trans</i> -1,2-DCE	15 3,900 5.9	5.5 54 5.5	22, pp. 38, 67, 82, 121, 132, 134, 143; 25, pp. 8, 9

Table 3: Laboratory Analytical Results of Source 1 Samples							
Sample Location	Sample Number	Date	Sample Depth (ft bgs)	Hazardous Substance	Concentration (µg/kg)	Reporting Limit * (µg/kg)	References
				TCE VC	890 740 J ¹	54 5.5	
MIP33	7257-118	11/01/2016	19	<i>cis</i> -1,2-DCE TCE	6.4 53	6.0 6.0	22, pp. 38, 67, 85, 121, 132, 143; 25, p. 9
SB-38	7522-1	07/31/2017	21	<i>cis</i> -1,2-DCE TCE	34 660	5.4 350	35, pp. 35, 38; 26, p. 1; 28, pp. 1, 3
	7522-2		24-25	<i>cis</i> -1,2-DCE TCE	15 2,500	8.0 400	35, pp. 35, 38; 26, p. 1; 28, pp. 1, 4
SB-39	7522-3	07/31/2017	20-21	<i>cis</i> -1,2-DCE TCE	13 580	9.3 24	35, pp. 35, 38; 26, p. 2; 28, pp. 1, 5
SB-40	7522-5	07/31/2017	15-15	<i>cis</i> -1,2-DCE TCE	64 3,900	18 410	35, pp. 35, 39; 26, p. 2; 28, pp. 1, 7
	7522-6		20	<i>cis</i> -1,2-DCE TCE	22 830	6.4 290	35, pp. 35, 39; 26, p. 3; 28, pp. 1, 8
SB-41	7522-7	07/31/2017	15	<i>cis</i> -1,2-DCE TCE	47 2,000	6.5 600	35, pp. 35, 39; 26, p. 3; 28, pp. 1, 9
	7522-8		18	<i>cis</i> -1,2-DCE TCE	36 4,400	8.6 360	35, pp. 35, 39; 26, p. 3; 28, pp. 1, 10
SB-42	7522-9	07/31/2017	14	<i>cis</i> -1,2-DCE TCE	44 5,400	7.0 900	35, pp. 35, 40; 26, p. 4; 28, pp. 1, 11
	7522-10		15	<i>cis</i> -1,2-DCE TCE	24 2,100	7.1 530	35, pp. 35, 40; 26, p. 4; 28, pp. 1, 12
SB-43	7522-11	07/31/2017	9	<i>cis</i> -1,2-DCE PCE TCE VC	140 24 150 19	5.2 5.5 5.2 5.2	35, pp. 35, 40; 26, p. 4; 28, pp. 1, 13
	7522-12		15	<i>cis</i> -1,2-DCE PCE TCE VC	240 35 580 16	8.2 8.2 8.2 8.2	35, pp. 35, 40; 26, p. 5; 28, pp. 1, 14
SB-44	7522-13	07/31/2017	9	<i>cis</i> -1,2-DCE TCE	28 430	5.5 5.5	35, pp. 35, 41; 26, p. 5; 28, pp. 1, 15
	7522-14		13	<i>cis</i> -1,2-DCE TCE	27 210	7.6 7.6	35, pp. 35, 41; 26, p. 5; 28, pp. 1, 16
SB-45	7522-15	07/31/2017	6	1,1-DCE <i>cis</i> -1,2-DCE <i>trans</i> -1,2-DCE TCE VC	92 520 21 13,000 58	5.4 270 5.4 270 5.4	35, pp. 35, 41; 26, p. 6; 28, pp. 1, 17
	7522-16		9	1,1-DCE <i>cis</i> -1,2-DCE TCE VC	16 250 1,400 40	6.2 6.2 330 6.2	35, pp. 35, 41; 26, p. 6; 28, pp. 1, 18
SB-46	7522-17	07/31/2017	8	<i>cis</i> -1,2-DCE PCE TCE VC	470 J ¹ 10 480 J ¹ 9.4	5.2 5.2 5.2 5.2	35, pp. 35, 42; 26, p. 6; 28, pp. 1, 19
	7522-18		15-16	<i>cis</i> -1,2-DCE TCE VC	190 1,300 21	5.0 300 5.0	35, pp. 35, 42; 26, p. 7; 28, pp. 1, 20

Table 3: Laboratory Analytical Results of Source 1 Samples							
Sample Location	Sample Number	Date	Sample Depth (ft bgs)	Hazardous Substance	Concentration (µg/kg)	Reporting Limit * (µg/kg)	References
SB-47	7522-19	07/31/2017	4.5	1,1-DCE <i>cis</i> -1,2-DCE <i>trans</i> -1,2-DCE TCE VC	400 J ¹ 5,400 J ¹ 49 10,000 J ¹ 1,100 J ¹	5.0 5.0 5.0 5.0 5.0	35, pp. 35, 42; 26, p. 7; 28, pp. 1, 21
	7522-20		13	1,1-DCE <i>cis</i> -1,2-DCE <i>trans</i> -1,2-DCE TCE VC	410 J ¹ 11,000 74 27,000 J ¹ 410 J ¹	5.0 250 5.0 250 5.0	35, pp. 35, 42; 26, p. 7; 28, pp. 1, 22
SB-48	7522-21	07/31/2017	14	<i>cis</i> -1,2-DCE TCE VC	270 480 21	6.0 6.8 6.0	35, pp. 35, 43; 26, p. 8; 28, pp. 1, 23
	7522-22		19	1,1-DCE <i>cis</i> -1,2-DCE TCE VC	25 430 1,900 140	5.0 240 490 5.0	35, pp. 35, 43; 26, p. 8; 28, pp. 1, 24
SB-49	7522-23	07/31/2017	13	<i>cis</i> -1,2-DCE TCE	110 64	6.2 6.2	35, pp. 35, 43; 26, p. 8; 28, pp. 1, 25
	7522-24		20	<i>cis</i> -1,2-DCE TCE VC	120 3,500 63	4.8 320 4.8	35, pp. 35, 43; 26, p. 9; 28, pp. 1, 26
SB-50	7522-25	07/31/2017	18.5	1,1-DCE <i>cis</i> -1,2-DCE TCE VC	9.1 140 740 70	4.9 4.9 280 4.9	35, pp. 35, 144; 26, p. 9; 28, pp. 2, 27
	7522-26		20.5	1,1-DCE <i>cis</i> -1,2-DCE <i>trans</i> -1,2-DCE PCE TCE VC	66 560 7.7 7.8 4,300 370 J ¹	6.6 380 6.6 6.6 760 6.6	35, pp. 35, 44; 26, p. 9; 28, pp. 2, 28
SB-51	7522-27	08/01/2017	16	<i>cis</i> -1,2-DCE TCE VC	19 1,400 16	5.0 280 5.0	35, pp. 35, 44; 26, p. 10; 28, pp. 2, 29
	7522-28		21	1,1-DCE <i>cis</i> -1,2-DCE <i>trans</i> -1,2-DCE TCE VC	75 1,400 18 3,100 660 J ¹	7.2 920 7.2 920 7.2	35, pp. 35, 44; 26, p. 10; 28, pp. 2, 30
SB-52	7522-29	08/01/2017	16	TCE	29	4.9	35, pp. 35, 45; 26, p. 10; 28, pp. 2, 31
	7522-30		21	1,1-DCE <i>cis</i> -1,2-DCE TCE VC	25 270 3,700 140	6.0 6.0 330 6.0	35, pp. 35, 45; 26, p. 11; 28, pp. 2, 32
SB-53	7522-31	08/01/2017	16	<i>cis</i> -1,2-DCE TCE	18 220	5.4 5.4	35, pp. 35, 45; 26, p. 11; 28, pp. 2, 33
	7522-32		25	1,1-DCE <i>cis</i> -1,2-DCE TCE VC	8.8 140 3,600 58 J ²	6.6 6.6 600 6.6	35, pp. 35, 45; 26, p. 11; 28, pp. 2, 34

Table 3: Laboratory Analytical Results of Source 1 Samples							
Sample Location	Sample Number	Date	Sample Depth (ft bgs)	Hazardous Substance	Concentration (µg/kg)	Reporting Limit * (µg/kg)	References
SB-55	7522-35	08/01/2017	10	<i>cis</i> -1,2-DCE VC	330 780 J ²	5.2 300	35, pp. 35, 46; 26, p. 12; 28, pp. 2, 37
	7522-36		13	1,1-DCE <i>cis</i> -1,2-DCE <i>trans</i> -1,2-DCE VC	6.7 1,800 J ¹ 8.5 2,100 J ¹	5.4 5.4 5.4 5.4	35, pp. 35, 46; 26, p. 13; 28, pp. 2, 38
SB-56	7522-37	08/01/2017	15	<i>cis</i> -1,2-DCE TCE VC	1,500 J ¹ 15 790 J ¹	5.2 5.2 5.2	35, pp. 35, 47; 26, p. 13; 28, pp. 2, 39
	7522-38		18	<i>cis</i> -1,2-DCE TCE VC	1,300 J ¹ 13 620 J ¹	5.0 5.0 5.0	35, pp. 35, 47; 26, p. 13; 28, pp. 2, 40

Notes

*The reporting limit in this table takes into account any dilution factor, volume adjustment, and percent solids for the sample and is sometimes called the sample quantitation limit or SQL (Refs. 17, p. 1; 18, p. 1).

µg/kg Micrograms per kilogram

ft Feet

bgs Below ground surface

MIP Membrane interface probe

SB Soil boring

DCE Dichloroethene

J¹ The identification of the analyte is acceptable; the reported value is an estimate. The value was estimated because the concentrations were above the calibration range (Refs. 35, pp. 34, 36; 22, p. 134).

J² The identification of the analyte is acceptable; the reported value is an estimate. The quantitation is an estimate due to the continuing calibration check not meeting accuracy specifications. The actual concentration for this analyte may be lower than the reported value (Ref. 35, pp. 34, 37).

TCE Trichloroethene

PCE Tetrachloroethene

VC Vinyl chloride

2.2.3 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY

Table 4: Containment Factors for Source 1		
Containment Description	Containment Factor Value	References
Gas release to air	Not Scored	N/A
Particulate release to air	Not Scored	N/A
Release to ground water: As described in Section 3.1.1 of this documentation record, there is evidence of hazardous substance migration from the source area. Therefore, based on available evidence, the highest ground water migration pathway containment factor value of 10 was assigned to Source 1 as specified in Table 3-2 of the HRS (Ref. 1, Section 3.1.2.1).	10	1, Table 3-2, Section 3.1.2.1
Release via overland migration and/or flood.	Not scored	N/A

Notes:

N/A Not applicable

2.4.2 HAZARDOUS WASTE QUANTITY

2.4.2.1.1 Hazardous Constituent Quantity - Tier A

The total Hazardous Constituent Quantity for Source 1 could not be adequately determined according to HRS requirements; that is, the total mass of all Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) hazardous substances in the source is not known and cannot be estimated with reasonable confidence [Ref. 1a, pp. Section 2.4.2.1.1]. Insufficient historical and current data (manifests, potentially responsible party [PRP] records, State records, permits, waste concentration data, etc.) are available to adequately calculate the total or partial mass of all CERCLA hazardous substances in the source and including associated releases from the source. Therefore, there is insufficient information to calculate a total or partial Hazardous Constituent Quantity estimate for Source 1 with reasonable confidence.

Hazardous Constituent Quantity Assigned Value: Not scored

2.4.2.1.2 Hazardous Wastestream Quantity – Tier B

The total Hazardous Wastestream Quantity for Source 1 could not be adequately determined according to HRS requirements; that is, the total mass of all hazardous wastestreams and CERCLA pollutants and contaminants for the source is not known and cannot be estimated with reasonable confidence [Ref. 1a, Section 2.4.2.1.2]. Insufficient historical and current data (manifests, PRP records, State records, permits, waste concentration data, annual reports, etc.) are available to adequately calculate the total or partial mass of all hazardous wastestreams and CERCLA pollutants and contaminants for the source and associated releases from the source. Therefore, there is insufficient information to adequately calculate or extrapolate a total or partial Hazardous Wastestream Quantity for Source 1 with reasonable confidence.

Hazardous Wastestream Quantity Assigned Value: Not scored

2.4.2.1.3 Volume – Tier C

Horizontal and vertical extent of the source cannot be accurately determined based on available sampling data; a sufficient number of samples is not available to statistically represent the depth and extent of contamination throughout the source (Ref. 1a, Section 2.4.2.1.3). During the ISA, an estimated volume of soil was calculated using a 3-D interactive computer model, based on results from the MIP investigation and subsequent analytical data from soil samples (Ref. 22, pp. 24, 38 - 44). This modeled visualization of the data suggested a volume of 18,500 cubic yards of impacted soil (Ref. 22, p. 24). However, this information is not used for HRS scoring due to the uncertainty of concentrations based on MIP data as the units it generates (μV) are in terms of relative response (Ref. 22, p. 12).

Volume Assigned Value: 0

2.4.2.1.4 Area – Tier D

Soil samples were collected from Source 1, as presented in Tables 2 and 3 of this documentation record and shown in Figure 3 of the HRS documentation record. These samples were collected from multiple soil boring locations. In addition to samples included in Tables 2 and 3, historical data have shown the presence of Source 1-related contaminants to the north of the designated source area in the vicinity of the former TCE storage tanks on the Sporlan Valve property. The area of contaminated soil based on data presented in Table 3 is the area encompassing locations SB-38, MIP16, SB-42, SB-44, MIP19, SB-46, MIP23, SB-56, SB-55, SB-53, SB-52, SB-51, and SB-39. The area within this polygon was determined by use of mapping applications to be 34,747 square feet, as shown on Figure 3 of this HRS documentation package. Because only EPA collected data were used in the determination of area, the value presented below is less than the actual area of contaminated soil.

Sum (ft^2): 34,747

Equation for Assigning Value (Ref. 1a, Table 2-5): $\text{Area (A)}/34,000$

Area Assigned Value: 1.02

2.4.2.1.5 Source Hazardous Waste Quantity Value

Highest assigned value assigned from HRS Table 2-5 (Ref. 1a, Section 2.4.2.1.5):

Table 5: Summary of Sources Descriptions							
Source No.	Source Hazardous Waste Quantity Value	Source Hazardous Constituent Quantity Complete? (Y/N)	Containment Factor Value by Pathway				
			Ground Water (GW) (Ref. 1, Table 3-2)	Surface Water (SW)		Air	
				Overland/flood (Ref. 1, Table 4-2)	GW to SW (Ref. 1, Table 3-2)	Gas (Ref. 1, Table 6-3)	Particulate (Ref. 1, Table 6-9)
1	1.02	No	10	Not Scored	Not Scored	Not Scored	Not Scored

3.0 GROUND WATER MIGRATION PATHWAY

3.0.1 GENERAL CONSIDERATIONS

The Sporlan Valve Plant #1 site is south of a drainage divide and topography slopes to the southeast (Ref. 2). The site is in the Salem Plateau groundwater province (Ref. 30, pp. 5, 6) of the Ozark Plateau Physiographic province (Refs. 31, p. 1; 55, p. 13). The Salem Plateau contains two major regional aquifer systems—the shallower Ozark aquifer system and the deeper St. Francois aquifer (Ref. 30, p. 7). The St. Francois aquifer is not known to be used within the 4-mile target distance limit (Ref. 31, pp. 8-15) and will not be further discussed. The Ozark aquifer system is generally unconfined on the Salem Plateau (Refs. 55, p. 21; 30, p. 21). The Salem Plateau is an important regional groundwater recharge area (Ref. 30, p. 19). The Ozark aquifer system in the Salem Plateau is predominately recharged by precipitation (also known as meteoric water) (Refs. 30, 19; 55, p. 28).

At the site, dolomite bedrock is overlain by unconsolidated silt, clay, chert, and sand that varies in thickness from about 10 to 11 feet along the northern Sporlan property boundary (Refs. 17, p. 2; 31, pp. 2, 16) to 49 feet at monitoring well MW-12 at the northeast corner of 8th Street and MacArthur Street (Ref. 15, pp. 10, 11, 14, 16, 17, 18). Depth to groundwater ranges from 7.86 to 15.15 feet below ground surface (Ref. 16, p. 6). The top of bedrock slopes to the southeast, presumably toward Busch Creek, which is at an approximate elevation of 500 feet above mean sea level (amsl) (Refs. 2; 15, pp. 10, 11; 38, p. 3). None of the 12 monitoring wells installed in past investigations penetrate bedrock and are screened in the sand, silt, and clay overburden that directly overlie the bedrock (Refs. 7, pp. 35-39; 14, pp. 19-22; 15, pp. 10-12, 14-18). Groundwater in the overburden flows in a southerly direction mimicking surface topography and top of bedrock slope (Ref. 16, pp. 6, 29). Saturated thickness of the overburden increases to the south (Ref. 15, pp. 10, 11). Since 2007, the northernmost well, (MW-1), completed to a depth of 6.5 feet bgs (Ref. 7, pp. 27, 36), has only contained enough water to sample three times (Ref. 16, p. 8). Investigations in 2012 suggest that there is no shallow groundwater north of MW-1 (Ref. 17, pp. 6, 7, 19). To the south and east, saturated thickness of groundwater in the overburden increases to 37 feet at MW-12 (Ref. 15, pp. 10, 11).

The Missouri Geosciences Technical Resource Assessment Tool (GeoSTRAT) maps a number of karstic features such as sinkholes, losing streams, and springs in the southern parts of Franklin County; however, very few sinkholes have been mapped around the town of Washington. Geology at the site was evaluated as non-karst. However, a geologist with the Missouri Geological Survey indicates that there is potential for karst development in the vicinity of the site (Ref. 31, p. 3).

The information that follows describes properties of the geological materials (from shallowest to deepest) that underlie the site.

Soil and Residuum:

Soil in the vicinity of the site is Menfro silt loam, which consists of 22 to 29 percent clay and has a hydraulic conductivity of 3×10^{-4} to 9×10^{-4} centimeters per second (cm/sec) (Refs. 22, p. 7; 31, p. 2). Beneath the developed soil layer is residuum, which is a geologic term referring to soil and subsoil that forms as the result of long weathering over carbonate rocks (limestone and dolomite). Slug test data collected from monitoring wells at the site in 2007 show a range of hydraulic conductivities between 1.02×10^{-5} and 4.89×10^{-5} cm/sec (Ref. 7, pp. 4, 46, 50). Soil thickness varies between 11 feet along the northern Sporlan property boundary (Ref. 17, p. 2) to 49 feet at monitoring well MW-12 at the northeast corner of 8th Street and MacArthur Street (Refs. 15, pp. 10, 11, 16, 17; 17, pp. 2, 19, 22). The residuum consists of clay, chert, and sand derived from weathered sedimentary bedrock (Ref. 31, p. 2). Hydraulic conductivity would be expected to be higher in residuum along the bedrock surface than in overlying deposits (Ref. 10, p. 14).

Bedrock Units:

A series of Ordovician and Cambrian-age dolomite formations underlie residuum at the site and together form the approximately 1,000-foot-thick Ozark aquifer system (Refs. 10, p. 14; 30 pp. 19, 20). Units or strata that form the Ozark aquifer system are described in the paragraphs that follow.

Strip logs for Washington City Municipal wells (Wells 4, 5, and 6, with log numbers 10841, 24271, and 27809 respectively) identify that the uppermost bedrock under the site consists of either the Cotter Dolomite or the Jefferson City Dolomite (Ref. 56, pp. 8 - 10). The Cotter Dolomite occurs in Well 5 located 1.2 miles west of the site and is absent in Well 4 (0.46 mile east southeast) and Well 6 (1.1 miles southeast) where the first bedrock is the Jefferson City Dolomite (Refs. 2; 56, pp. 8-10). Cotter and Jefferson City Dolomites are light brownish-gray cherty dolomites, medium fine to crystalline (Refs. 30, pp. 11, 12; 56, pp. 3, 8, 9, 10). Locations of these wells are shown on Figure 11 of the ISA report (Ref. 22, p. 46) and are also shown in the City of Washington's source water assessment plan (Ref. 38, pp. 1, 3-5). In 2016, USGS further divided the Ozark aquifer into upper, middle, and lower sections for an updated hydrogeologic framework to better represent the hydraulic properties of the aquifer (Ref. 55, p. 27). The Cotter and Jefferson City Dolomites encompass the middle Ozark aquifer section (Ref. 55, pp. 28, 29, 31). The middle Ozark aquifer does not serve as a regionally important aquifer but does provide for minor domestic water supply (Ref. 55, p. 31). Reported mean horizontal hydraulic conductivity of the middle Ozark aquifer is approximately 0.3 feet per day and the lower Ozark aquifer is reported as 1.5 feet

per day (Ref. 55, p. 33). The Cotter Formation is present west of the site at Washington Well 5, and absent at Washington Wells 4 and 6 east of the site (Ref. 56, pp. 8, 9, 10). The Cotter Formation is 200 feet thick at Washington Well 5 (Ref. 56, p. 9). The underlying Jefferson City formation is approximately 165 feet thick at Washington Well 5, 270 feet thick at Washington Well 4, and 110 feet thick at Washington Well 6 (Ref. 56, pp. 8, 9, 10). According to the Strip Logs for these three City wells, the middle Ozark aquifer system ranges in thickness from 110 feet at Washington Well 6 to 365 feet at Washington Well 5 (Ref. 56, pp 8, 9, 10). Washington Well 6 is at an elevation of 492 feet and Well 5 is at an elevation of 604 feet (Refs. 56, p. 8; 38, pp. 1, 5).

Underlying the Jefferson City Formation is the Roubidoux Formation, which consists of medium to coarsely crystalline dolomite, cherty dolomite, sandy dolomite, dolomitic sandstone, and sandstone (Refs. 30, p. 11; 31, p. 16). At Washington Wells 5, 4, and 6, the Roubidoux Formation is 120 to 140 feet thick (Ref. 56, pp. 8, 9, 10).

The Upper Gasconade formation, which underlies the Roubidoux Formation, is medium crystalline dolomite with relatively little chert. The Lower Gasconade is generally coarsely crystalline dolomite and may contain more than 50 percent chert. A sandstone unit (formerly recognized as the Gunter Sandstone member) is typically present in the lowermost Gasconade (Refs. 30, pp. 10, 11; 31, p. 16). The Gunter Sandstone is apparent at the three Washington Well locations (Ref. 56, pp. 8, 9, 10). The Gunter Sandstone is composed of varying amounts of sandstone or sandy dolomite (Ref. 30, p 10). In Washington the Gunter is mostly dolomitic and ranges in thickness from 15 to 35 feet (Ref. 56, pp. 3, 8, 9, 10). Within two miles, the Gasconade ranges in thickness from 250 to 280 feet (Ref. 31, pp. 2, 3, 16). According to the City's strip logs, the Upper and Lower Gasconade units range in thickness between 215 to 255 feet (Ref. 56, pp. 8, 9, 10).

Underlying the Gunter is the Cambrian-aged Eminence Dolomite. The Eminence Dolomite consists of medium to coarsely crystalline, dolomite with minor nodular chert (Ref. 30, pp. 9, 10; 31, p. 16). The lower part of the formation contains scattered quartz druse that resembles druse found throughout the underlying Potosi Dolomite. The Eminence varies from about 90 to 185 feet thick near Washington and has a gradational contact with the underlying Potosi Dolomite (Ref. 31, p. 16). In Washington, the Eminence ranges in thickness from 145 to 165 feet at Washington Wells 4 and 5 and is reported to be 325 feet thick at Washington Well 6 (Ref. 56, pp. 3, 8, 9, 10).

The Potosi Dolomite consists of dark brown, gray, or tan (at bottom) medium to finely crystalline dolomite (Ref. 30, p. 9). The formation usually contains small cavities that are commonly filled with quartz druse (Ref. 30, p. 9). This formation is frequently very porous due to interconnected dissolution cavities (karst) (Ref. 55, p. 36). The Potosi Dolomite is approximately 185 to 235 feet thick in the area

around Washington (Ref. 31, pp. 3, 16). In Washington, the Potosi Dolomite ranges in thickness from 235 to 285 feet at Washington Wells 4 and 5 and is reported to be 130 feet thick at Washington Well 6 (Ref. 56, pp. 3, 8, 9, 10).

Underlying the Potosi are the Derby-Doerun Dolomite and Davis Formation (Ref. 31, pp. 3, 16). These two units are grouped together and referred to as the Elvins Group (Ref. 29, pp. 5, 6). These two formations encompass the St. Francois Confining Unit which is about 310 feet thick and consists of shales, siltstones, and dolomites (Ref. 31, p. 16). The Derby-Doerun is an argillaceous dolomite, and the upper part may be difficult to distinguish from the overlying Potosi. The underlying Davis Formation consists of about 200 feet of shale, siltstone, fine-grained sandstone, dolomite, and limestone conglomerate (Ref. 31, p. 16). These formations are described in the Table 6 below.

Table 6: Stratigraphy and Hydrology of the Sporlan Valve Site						
System	Formation	Thickness (Feet)	Lithology	Nature of Porosity and Permeability	Hydraulic Conductivity (cm/sec)	Hydrogeologic Unit
Post - Ordovician	Soil and Residuum	10-40	Silt loam, clay, sand, chert cobbles	Intergranular space throughout matrix; Moderate permeability	3×10^{-4} - 9×10^{-4}	None
Ordovician	Cotter/Jefferson City Dolomite	267 - 315	Medium to finely crystalline argillaceous to cherty dolomite with thin shale & sandstone beds	Bedding separations, fractures, and dissolution features; Moderate permeability	1×10^{-4} - 1×10^{-3}	Ozark Aquifer
	Roubidoux Formation	85 – 140	Dolomite, cherty dolomite, sandstone, dolomitic sandstone, and minor shale			
	Gasconade Dolomite	250 – 280	Medium crystalline dolomite with sandstone beds			
Cambrian	Eminence Dolomite	90-185	Medium crystalline dolomite with chert	Bedding separations and fractures; Low permeability	9×10^{-13} - 3×10^{-11}	St. Francois Confining Unit
	Potosi Dolomite	185-235	Medium to finely crystalline dolomite with quartz druse and chert			
	Derby-Doerun Dolomite	~ 110	Medium to finely crystalline dolomite with alternating beds of silt and shale			
	Davis Formation	~ 200	Shale, siltstone, fine grained sandstone, dolomite, and limestone conglomerate			

Source: Reference 31, p. 16

Aquifer/Stratum Name: Residuum Groundwater

None of the 12 monitoring wells installed in past investigations penetrate into bedrock (i.e., the Ozark Aquifer system) and are screened in the clay, silt and sand overburden that directly overlie the bedrock (Refs. 7, pp. 35-39; 14, pp. 19-22; 15, pp. 10-12, 14-18). Groundwater in the overburden flows in a southerly direction, mimicking surface topography and top of bedrock slope (Ref. 16, pp. 6, 29). Depth to groundwater ranges from 7.86 to 15.15 feet below ground surface (Ref. 16, p. 6). Saturated thickness of the overburden increases to the south (Ref. 15, pp. 10, 11). Since 2007, the northernmost well (MW-1), completed to a depth of 6.5 feet bgs (Ref. 7, pp. 27, 36), has only contained enough water to sample three times (Ref. 16, p. 8). Investigations in 2012 suggest that there is no shallow groundwater north of MW-1 (Ref. 17, pp. 6, 7, 19). To the south and east, saturated thickness of groundwater in the overburden increases to 38 feet at MW-12 (Ref. 15, pp. 10, 11, 16, 17). The total depth of MW-12 is reported to be 49 feet with a 5-foot screen at the bottom of the well (Ref. 15, pp. 16, 17). Static water level was measured at 10.95 feet bgs on September 23, 2009 (Ref. 15, p. 16).

In July 2007, in-situ hydraulic conductivity tests (slug tests) were performed at shallow monitoring wells MW-3, MW-4 and MW-5 (Ref. 7, pp. 1, 3). Hydraulic conductivities were calculated between 1.50^{-5} to 5.86^{-5} cm/sec (Ref. 7, pp. 4, 12). Calculations were made to assess whether that water-bearing zone met the definition of an “exploitable aquifer” as defined by the Missouri Risk-based Technical Guidance Document (Ref. 7, p. 4). According to the calculations, the required saturated aquifer thickness needed for the water-bearing zone to be considered a potentially exploitable aquifer is 31.7 feet (Ref. 7, p. 4). Although thickness of saturated deposits at the slug tested wells (MW-3, MW-4, and MW-5) did not meet the definition of an exploitable aquifer, subsequently installed wells to the south (MW-11, MW-12) were determined to be located in deposits with more than 31.7 feet of saturated thickness (Refs. 7, pp. 4, 5, 24; 15, pp. 12, 15, 16); therefore, the water bearing zone would meet the State’s definition of a potentially exploitable aquifer.

Aquifer/Stratum Name: Ozark Aquifer—Cotter/Jefferson City Dolomite through Potosi Dolomite

Groundwater from the Ozark aquifer is the principal source of public and private water supplies within four miles of the former facility area (Ref. 31, pp. 8-15). All Washington Public Water supply wells draw from the Ozark aquifer (Ref. 31, pp. 8, 9, 12). None of the city wells have screens, rather they are open hole construction with an upper steel casing (ranging in diameters from 6 inches to 16 inches) installed to varying depths, with an open borehole below the casings (Ref. 38, pp. 11, 12). Reference 30, pages 25-27 describe and illustrate the open hole completions for municipal and private wells. Table 7 below summarized information from references 38 and 40 on the completion details of the Washington wells.

Table 7: City of Washington Public Water Supply Wells									
Well Number	W3	W4	W5	W6	W7	W8	W9	W10	W11
Well ID #	14274	14282	14324	14363	14375	14415	14326	16640	16641
Date Drilled	1937	1949	1966	1975	1983	1987	1967	2002	2002
Ground Elevation	470	519	604	492	480	590	534	640	620
Static Water Level (ft.)	90	72	139	50	40	52	31	160	115
Static Water Level Elevation ¹	380	447	465	442	440	538	503	480	505
Casing Size (in.)	16	16	16	16	16	16	6	12	12
Casing Depth (ft)	348	460	350	230	400	415	402	420	485
Base of Casing Elevation ²	122	59	254	262	80	175	132	220	135
Base of Casing Formation	Roub.	Gasc.	Jeff. C.	Roub.	Roub.	Gasc.	Gasc.	Roub.	Gasc.
Pump Depth (ft.)	420	500	360	400	400	400	360	504	504
Pump Elevation ³	50	19	244	92	80	190	174	136	116
Well Depth (ft.)	1,000	1,149	1,180	1,080	1,100	1,043	725	1,100	1,150
Well Depth Elevation ⁴	-530	-630	-576	-588	-620	-453	-191	-460	-530
Well Depth Formation	Potosi	Elvins	Potosi	Elvins	Potosi	Elvins	Emin.	Potosi	Elvins
Feet of Well Open to Formation ⁵	652	689	830	850	700	628	323	680	665

Notes: Data for this table was obtained from References 38, pages 11 and 12; and 40, pages 1-18.

- ¹ Equals reported ground elevation minus static water level
- ² Equals reported ground elevation minus casing depth
- ³ Equals reported ground elevation minus pump depth
- ⁴ Equals reported ground elevation minus well depth
- ⁵ Equals reported well depth minus casing depth
- Emin. Eminence formation
- Gasc. Gasconade formation
- ID # Identification number
- In. Inches
- Jeff. C. Jefferson City formation
- Ft. Feet
- Roub. Roubidoux formation

Ordovician rocks, along with the Cambrian Eminence and Potosi dolomites form the Ozark aquifer (Ref. 31, p. 16). The Ozark aquifer is regionally considered to be unconfined; however, deeper units can be locally confined or semiconfined in some areas because of local rock characteristics (Ref. 30, p. 21). The Ozark aquifer consists of relatively permeable horizontal zones separated by less permeable zones (Ref. 30, p. 21). Permeable residuum coupled with karst features produce complex groundwater conditions, with rapid percolation of waters to the bedrock aquifers (Ref. 30, p. 19). The Ozark aquifer is the most important aquifer in the Salem Plateau (Ref. 30, p. 19). Of the Ozark aquifer formations, the Potosi Dolomite is the most prolific and reliable aquifer. Also, the upper part of the Eminence yields 50 to 75 gallons per minute (gpm), principally due to secondary porosity developed along fractures (Ref. 30, p. 20).

Hydraulic conductivity of the Ozark aquifer ranges from 1×10^{-4} to 1×10^{-3} cm/sec or 0.283 to 2.83 feet/day (Ref. 31, p. 16). Reported mean horizontal hydraulic conductivity of the middle Ozark aquifer is approximately 0.3 feet per day (1.06×10^{-4} cm/sec) and the lower Ozark aquifer is reported as 1.5 feet per day (5.29×10^{-4} cm/sec) (Ref. 55, p. 33). Of the wells on record within 4 miles of the site, all 301 are

reportedly completed in the Ozark aquifer (Ref. 31, pp. 8-15). Total depths of these wells range from 60 to 1,180 feet (Ref. 31, pp. 8-15), but most of the domestic wells are completed to depths of 200 to 500 feet (Ref. 31, pp. 8 – 14). The Ozark aquifer is underlain by the St. Francois Confining Unit, a series of alternating shale and dolomite formations that form an effective barrier to downward groundwater movement (Ref. 31, p. 3). The direction of shallow groundwater is usually controlled by topography (Ref. 30, p. 21). Deeper circulation of groundwater is generally dependent on regional dip of the rocks, which is away from the St. Francois Mountains (Ref. 30, pp. 6, 21). USGS indicates that throughout most of the Ozarks flow in the Ozark aquifer system is outward from the St. Francois Mountains to discharge areas in the Missouri River Basin (Ref. 55, pp. 13, 23). The Missouri Geological Survey reports that regional estimates of groundwater flow direction based upon well data indicate that groundwater in the Ozark aquifer in the vicinity of the site may flow to the northwest, north, or northeast (Ref. 31, p. 3). The Missouri River Valley is a hydraulic boundary and discharge zone for the Ozark aquifer near the site (Refs 31, p. 3; 55, p. 23). Groundwater flow direction within this aquifer is likely influenced locally by pumping wells and proximity to the Missouri River (Ref. 31, pp 3, 6, 7).

Although primary permeability accounts for some groundwater flow, secondary porosity provided by faulting, jointing, fracturing, and dissolution of carbonate rock has a greater influence on current hydrogeologic conditions in the Salem Plateau (Ref. 30, pp. 13, 21). There are two bedrock faults near the site: the Washington Fault 0.7 mile west, and the St. Johns Fault 1.6 miles northwest (Ref. 31, pp. 4, 7). Presence of these faults and their orientation indicates likelihood that fractured bedrock is present beneath the Sporlan Valve site (Ref. 31, p. 4). This faulting may increase secondary porosity of the units described above and enhance recharge to the aquifer (Ref. 55, pp. 25, 35, 38). Because the local bedrock is likely fractured, there are no known aquitards between the unconsolidated zone and the bedrock Ozark aquifer. Site contaminants are dense non-aqueous phase liquids; therefore, chlorinated solvent contamination from the site may pose a future threat to public and private wells (Refs. 10, pp. 13, 14; 42).

Aquifer Interconnections/Distance from Source

Description:

Groundwater within residuum at the site is believed to be in direct contact with the Ozark aquifer and is therefore considered interconnected with the Ozark aquifer for HRS purposes. The Ozark aquifer is reported to be generally unconfined on the Salem Plateau (Refs. 55, p. 21; 30, p. 21). The Salem Plateau is an important regional groundwater recharge area (Ref. 30, p. 19). The Ozark aquifer in the Salem Plateau is predominately recharged by precipitation (also known as meteoric water) (Refs. 30, 19; 55, p. 38). Monitoring wells MW-2 through MW-12, installed to characterize groundwater at the site, are installed to bedrock and are screened with 5-foot long screens in the clay, silt, and sand, overburden that

directly overlie the bedrock (Refs. 7, pp. 3, 35, 37-39; 14, pp. 2, 19-22; 15, pp. 2, 10-12, 14-18). In July 2007, in-situ hydraulic conductivity tests (slug tests) were performed at shallow monitoring wells MW-3, MW-4 and MW-5 (Ref. 7, pp. 1, 3). Hydraulic conductivities for the shallow water bearing zone were calculated between 1.50×10^{-5} to 5.86×10^{-5} cm/sec (Ref. 7, pp 4, 12). Reported hydraulic conductivities of the rock formations under the residuum that encompass the Ozark aquifer are greater than the hydraulic conductivity reported for the monitoring wells. Hydraulic conductivity of the Ozark aquifer ranges from 1×10^{-4} to 1×10^{-3} cm/sec or 0.283 to 2.83 feet/day (Ref. 31, p. 16). Reported mean horizontal hydraulic conductivity of the middle Ozark aquifer is approximately 0.3 feet per day (1.06×10^{-4} cm/sec) and the lower Ozark aquifer is reported as 1.5 feet per day (5.29×10^{-4} cm/sec) (Ref. 55, p. 33). No intervening materials or formations with significantly lower hydraulic conductivities between the clayey residuum where contamination has been identified and the underlying dolomites that encompass the middle Ozark aquifer are known to exist.

The strip log for Washington Well 6 shows the first bedrock unit encountered is the Jefferson City Dolomite that is part of the Ozark aquifer (Ref. 56, p. 8). In 1975, static water level in the well was reported to be 18 to 21.5 feet bgs, which would be in the residuum (Ref. 56, p. 8). The strip log indicates the well is cased to 230 feet which, according to the strip log, would be in the Roubidoux Formation (Refs. 56, p. 8; 38, p. 11). The well is completed to a depth of 1080 feet bgs. The well has no screen, rather it is open to the formation from 230 to 1,080 feet bgs or for 850 feet and is open to the Roubidoux, Gasconade, Gunter, Eminence and Potosi formations (Refs. 38, p 11; 56, p. 8).

Aquifer Discontinuities within the Target Distance Limit

Description:

No aquifer discontinuities are known to exist within the four-mile target distance limit. The Missouri River has been described as a hydraulic boundary and discharge zone for the Ozark aquifer near the site (Ref. 31, p. 3). The river valley likely does not fully dissect all formations encompassing the Ozark aquifer.

Table 8: Summary of Water Bearing Units (WBU) Being Evaluated				
WBU No.	WBU Name	Is WBU Interconnected with Upper WBU within 2 miles? (Y/N/NA)	Is WBU Continuous Within 4-mile TDL? (Y/N)	Is WBU Karst? (Y/N)
1	Residuum	Not Applicable	No	No
2	Ozark aquifer	Yes	Yes	No

3.1 LIKELIHOOD OF RELEASE

3.1.1 OBSERVED RELEASE

Aquifer Being Evaluated: Ozark aquifer

An observed release occurred to the groundwater migration pathway associated with contaminated soils (Source 1) at the Sporlan Valve #1 site. All monitoring wells and DPT wells that were sampled and shown to contain chlorinated solvents were drilled to a depth directly above bedrock. In addition, soil samples from Source 1 collected at depths below the static water level contained CVOCs. Observed releases by direct observation and chemical analysis are discussed below.

Direct Observation

- Basis for Direct Observation:

Soil samples collected in October and November 2016, and July and August 2017 from depths below the static water level of on-site monitoring wells have been shown by chemical analysis to be contaminated with hazardous substances as described below. Section 2.2.2 of this documentation record presents these samples as well as samples above the static water level that define the vertical extent of soil contamination. The discussion that follows focusses on those samples collected below the static water level. These samples contained elevated concentrations of hazardous substances attributable to the site. In October and November 2016, subsurface soil samples were collected at 13 MIP survey locations by use of DPT soil samplers at discrete depth intervals corresponding to a range of MIP readings. At several MIP locations (MIP8, MIP10, MIP12, MIP19, and MIP23), two samples were collected at different depths (Ref. 22, pp. 15, 121). CVOCs were identified in 10 samples from seven MIP locations (Ref. 22, p. 121). In July and August of 2017, 38 soil samples were collected from 19 soil borings (Ref. 35, p. 35). CVOCs were detected in 35 of the 38 samples collected (Ref. 35, pp. 38-47). These samples were submitted to the EPA Region 7 laboratory for analysis under ASR 7257 and 7522 (Refs. 22, p 130; 35, p. 35). The laboratory analyzed the soil samples for VOCs at low levels by GC/MS Closed-System Purge-and-Trap (Ref. 22, p. 134; 35, p. 36). The chain-of-custody (COC) record for ASR 7257 is included on page 67 of Ref. 22. The COC record for ASR 7522 is included on pages 1 and 2 of Ref. 28.

Depth to groundwater at the site has been measured many times; data from 2014, 2015, and 2016 are presented in Table 9 below. Locations of the monitoring wells are included in Reference 16, page 29.

Table 9: Depth to Groundwater					
Monitoring Well	Top of Casing Elevation (amsl)	Date	Depth to Water (FBTOC)	Elevation of Water Table (amsl)	Reference
MW-1	548.98	January 2014	Dry		7, p. 36; 16, pp. 3, 4
		February 2015	Dry		
MW-2	547.22	January 2014	14.21	533.01	5, p. 24; 7, p. 37; 16, p. 29; 22, p. 108
		February 2015	9.04	538.18	
		11/16/2016	10.05	537.17	
MW-3	543.86	January 2014	16.6	527.7	5, p. 24; 7, p. 39; 16, p. 29; 22, p. 109
		February 2015	10.71	533.15	
		11/16/2016	11.98	531.88	
MW-4	542.03	January 2014	13.31	528.72	5, p. 24; 7, p. 38; 16, p. 29; 22, p. 110
		February 2015	10.11	532.92	
		11/16/2016	10.35	531.68	
MW-5	535.12	January 2014	11.81	523.31	5, p. 24; 7, p. 35; 16, p. 29; 22, p. 111
		February 2015	9.6	525.52	
		11/16/2016	10.75	524.37	
MW-6	540.09	January 2014	19.64	520.45	5, p. 24; 14, p. 19; 16, p. 29; 22, p. 112
		February 2015	15.15	524.94	
		11/16/2016	15.95	524.14	
MW-7	538.61	January 2014	13.8	524.81	5, p. 24; 14, p. 20; 16, p. 29; 22, p. 113
		February 2015	10.11	528.50	
		11/16/2016	11.5	527.11	
MW-8	536.31	January 2014	12.71	523.6	5, p. 24; 14, p. 21; 16, p. 29; 22, p. 114
		February 2015	10.4	525.91	
		11/16/2016	10.58	525.73	
MW-9	530.83	January 2014	8.97	521.86	5, p. 24; 14, p. 22; 16, p. 29; 22, p. 115
		February 2015	7.86	522.97	
		11/17/2016	7.9	522.93	

Notes:

amsl Above mean sea level

FBTOC Feet below top of casing

As shown on Figures 3 and 4 of this documentation record, most of the soil samples collected were from borings situated between monitoring wells MW-2, MW-3, MW-4, and MW-5. Within this area, depth to the water table ranged from 9.6 feet to 16.6 feet below the top of casing. Contaminated soil samples are documented in Table 3 of this documentation record. Contaminated soil samples collected at depths deeper than 16.6 feet include MIP-5 at 20 feet bgs, MIP-8 at 20 feet bgs, MIP-23 at 19-20 feet bgs, MIP-33 at 19 feet bgs, SB-38 at 21 and 24-25 feet bgs, SB-39 at 20-21 feet bgs, SB-40 at 20 feet bgs, SB-41 at 18 feet bgs, SB-48 at 19 feet bgs, SB-49 at 20 feet bgs, SB-50 at 18.5 and 20.5 feet bgs, SB-52 at 21 feet bgs, SB-53 at 25 feet bgs, and SB-56 at 18 feet bgs (Refs. 22, p 15, 70, 74, 82, 85; 35, pp. 8, 9; 28, pp. 3-5, 8, 10, 24, 26-28, 32, 34, 40).

- Hazardous Substances in Release:

The following hazardous substances have been detected in one or more soil samples collected from depths below the static water level.

Table 10: Hazardous Substances in Soil		
Hazardous Substance	Evidence	References
Tetrachloroethene (PCE) Trichloroethene (TCE) <i>cis</i> -1,2-Dichloroethene (DCE) <i>trans</i> -1,2-DCE 1,1-DCE Vinyl chloride (VC)	Soil sample numbers 7257-103, 7257-107, 7257-115, 7522-1, 7222-2, 7522-3, 7522-6, 7522-8, 7522-22, 7522-24, 7522-25, 7522-26, 7522-30, 7522-32 and 7522-38, all collected below water table.	22, pp. 38, 67, 70, 74, 82, 121, 132, 134, 140, 141, 143; 8, pp. 3, 6, 7, 11-13, 15; 28, pp. 1-5, 8, 10, 24, 26-28, 31, 32, 34, 40

Chemical Analysis

In April 2014, ENVIRON, on behalf of the Sporlan Valve Company, submitted an Annual Groundwater and Sub-Slab Vapor monitoring report (Ref. 5, p. 1). The report summarized groundwater sample results from a January 2014 sampling event (Ref. 5, p. 1). The report also summarized all sample results from monitoring wells since May 2007 (Ref. 5, pp. 5 – 7, 17, 18). In January 2014, groundwater samples were not collected from MW-1 and MW-2 due to lack of water (Ref. 5, pp. 1, 2). Since 2007, MW-1 was sampled three times and contained TCE each time at concentrations ranging from 839 to 7,490 µg/L (Ref. 5, p. 17). Since 2007, MW-2 was sampled 10 times and TCE was detected eight times at concentrations ranging from 4.9 (estimated) to 231 µg/L (Ref. 5, p. 17). Since 2007, MW-3 was sampled 11 times and TCE was detected 11 times at concentrations ranging from 2,960 to 12,100 µg/L (Ref. 5, p. 17). Since 2007, MW-4 was sampled 11 times and TCE was detected 11 times at concentrations ranging from 372 to 1,430 µg/L (Ref. 5, p. 17). Since 2007, MW-5 was sampled 12 times (including one duplicate sample) and TCE was detected 12 times at concentrations ranging from 4,080 to 6,310 µg/L (Ref. 5, p. 17). Since 2008, MW-6 was sampled 13 times (including three duplicate samples) and TCE was detected 13 times at concentrations ranging from 1.9 to 291 µg/L (Ref. 5, p. 17). Since 2008, MW-7 was sampled 10 times and TCE was detected 10 times at concentrations ranging from 1,560 to 4,560 µg/L (Ref. 5, p. 18). Since 2008, MW-8 was sampled 13 times (including three duplicate samples) and TCE was detected 13 times at concentrations ranging from 5,970 to 8,440 µg/L (Ref. 5, p. 18). Since 2008, MW-9 was sampled 13 times (including three duplicate samples) and TCE was detected 13 times at concentrations ranging from 2,010 to 4,500 µg/L (Ref. 5, p. 18). Since 2009, MW-10 was sampled eight times and TCE was detected eight times at concentrations ranging from 194 to 289 µg/L (Ref. 5, p. 18). Since 2009, MW-11 was sampled nine times (including one duplicate sample) and TCE was detected nine times at concentrations ranging from 74.7 to 205 µg/L (Ref. 5, p. 18). Since 2009, MW-12 was sampled eight times and TCE

was detected eight times at concentrations ranging from 15.4 to 25.2 µg/L (Ref. 5, p. 18). Other CVOCs detected in groundwater including 1,1-DCE as high as 153 µg/L in MW-8, *cis*-1,2-DCE as high as 1,510 µg/L in MW-8, *trans*-1,2-DCE as high as 50 µg/L in MW-4, PCE as high as 8 µg/L in MW-5, and vinyl chloride as high as 817 µg/L in MW-8 (Ref. 5, pp. 17, 18). The highest concentrations of CVOCs were typically found in wells MW-1 (near the former TCE AST), MW-3, MW-5, MW-7, MW-8, and MW-9 (placed along the southern boundary of the former facility) (Ref. 5, pp. 17, 18, 25). These results are presented to document the long history of release to groundwater, but are not used to establish an observed release to groundwater because not all laboratory-provided analytical data packages are available, and for those that do exist, third-party data validation does not appear to have been conducted. As discussed below, samples used in establishing an observed release to groundwater were collected by EPA and EPA's START contractor during the 2016 ISA (Ref. 22).

As part of the 2016 ISA, groundwater samples were collected from permanent monitoring wells and DPT temporary wells. All monitoring wells were installed previous to ISA activities. Nine temporary DPT groundwater wells were installed at the site and sampled by START. Depths of the DPT wells ranged from 9 to 40 feet bgs (Ref. 22, pp. 16, 17, 45). Groundwater samples were collected from the DPT wells by use of a Geoprobe Screen Point 16 sampling apparatus containing a 4-foot-long, reusable, stainless steel screen driven directly below the water table or to the maximum depth possible. Groundwater samples were collected through disposable polyethylene tubing inserted into the Geoprobe rods and sampling apparatus by use of a peristaltic pump (Ref. 22, p. 16).

Samples were submitted to the EPA Region 7 laboratory and were analyzed for a select list of VOCs in groundwater by GC/MS for low detection limits (Ref. 22, pp. 132, 133, 135, 136).

Background Concentrations

Background wells were selected based on the following criteria. Permanent monitoring wells were selected that were located hydrologically upgradient (north) or cross gradient (east and west) of the former Sporlan Valve facility (Refs. 5, p. 24; 7, pp. 24 - 27). Wells were chosen that were topographically higher at the surface than nearby possible source areas and were completed at a variety of depths. The most northern monitoring well (MW-1) did not produce enough water for sampling during the ISA, so MW-2 was used as a background well. When MW-1 was sampled in May 2007, it did contain TCE at 839 µg/L (Ref. 7, p. 21). This well was installed close to the former TCE AST (Ref. 7, p. 24) and is not considered representative of background conditions. In March and April 2012, an investigation was conducted on behalf of Sporlan Valve Company to investigate the presence of groundwater and potential contamination sources upgradient (north) of MW-1 (Ref. 17, p. 1). On March 13, 2012, a 25-foot-long test trench was installed 30 feet north of MW-1 (Ref. 17, pp. 2, 19). The

completed trench was 2 feet wide and extended to bedrock, encountered at 11 feet bgs (Ref. 17, p. 2). During excavation, soils were screened with a PID and no VOCs were detected (Ref. 17, pp. 2, 20). Also, no VOCs were detected in a soil sample collected from the base of the test trench at 11 feet bgs (Ref. 17, p. 2). The test trench was allowed to remain open for 24 hours, and no water accumulated in the trench (Ref. 17, pp. 2, 22, 24). The consultant for the Sporlan Valve Company concluded that a source of TCE in soil or groundwater is not present upgradient (north) of MW-1 (Ref. 17, pp. 2, 6).

Selected background DPT wells were located northeast (Geoprobe well [GPW]1), southwest GPW6, and west (DPT background) of the former Sporlan Valve property (Ref. 22, p. 45). Samples were collected from the same environmental media (groundwater), and were collected and analyzed using the same procedures employed for the release samples. These wells also contained no or low concentrations of CVOCs. The locations of the background wells are shown on Figure 4 of this HRS documentation record.

Sample Similarity

All 12 permanent monitoring wells installed at the site are 2-inch diameter polyvinyl chloride (PVC) wells installed using a direct push technology rig (DPT) equipped with augers that were advanced to refusal (Ref. 7, pp. 2, 3, 24; 14, pp. 2, 16; 15, pp. 2, 10). All monitoring wells except for MW-1 were completed with 5-foot-long PVC screens placed at the bottom of the boreholes (Ref. 7, pp. 2, 3, 24; 14, pp. 2, 16; 15, pp. 2, 10). Because all wells were installed with a DPT rig, none were advanced into bedrock (Refs. 7, pp. 35-38; 14, pp. 19-22; 15, pp. 2, 10). Because only samples collected by START and analyzed by the EPA laboratory were used in establishing the observed release, sampling and analytical methods were the same for all samples collected from these wells. In addition, background and release samples were collected at the same time period, analyzed by the same method, and at the same laboratory.

The following table presents the well depth in both feet bgs and amsl for each background well sampled. It also presents the date that the well was sampled. The samples presented below were collected during EPA's ISA in 2016 (Ref. 22).

Table 11: Background Well Sample Summary					
Well ID	Well Depth (feet bgs)	Elevations (feet amsl)		Date	References
		Surface	Well Depth		
GPW-1	29.8	528*	498.2	11/02/2016	22, pp. 45, 92, 93, 132
GPW-Background	9	Not Measured	Not determined	11/05/2016	22, pp. 45, 100, 103, 132
GPW-6	19	534*	514	11/07/2016	22, pp. 45, 100, 104, 133
MW-2	15	547.22	532.22	11/16/2016	7, pp. 3, 24, 25, 37; 22, pp. 45, 107, 108, 132

Notes:

* Elevations were not measured, rather approximated based on a topographic figure in Reference 16, page 29 and the approximate location.
 amsl Above mean sea level
 bgs Below ground surface
 ID Identification

The following table presents concentrations of VOCs measured in the background wells and the sample quantitation limits provided by the EPA Region 7 laboratory. All samples collected during the ISA were submitted to the EPA regional laboratory for analysis under analytical services request (ASR) 7257 (Ref. 22, pp. 130-133). Data validation comments are provided in Reference 22, pages 134 to 136. Sample quantitation limits are presented in Reference 25.

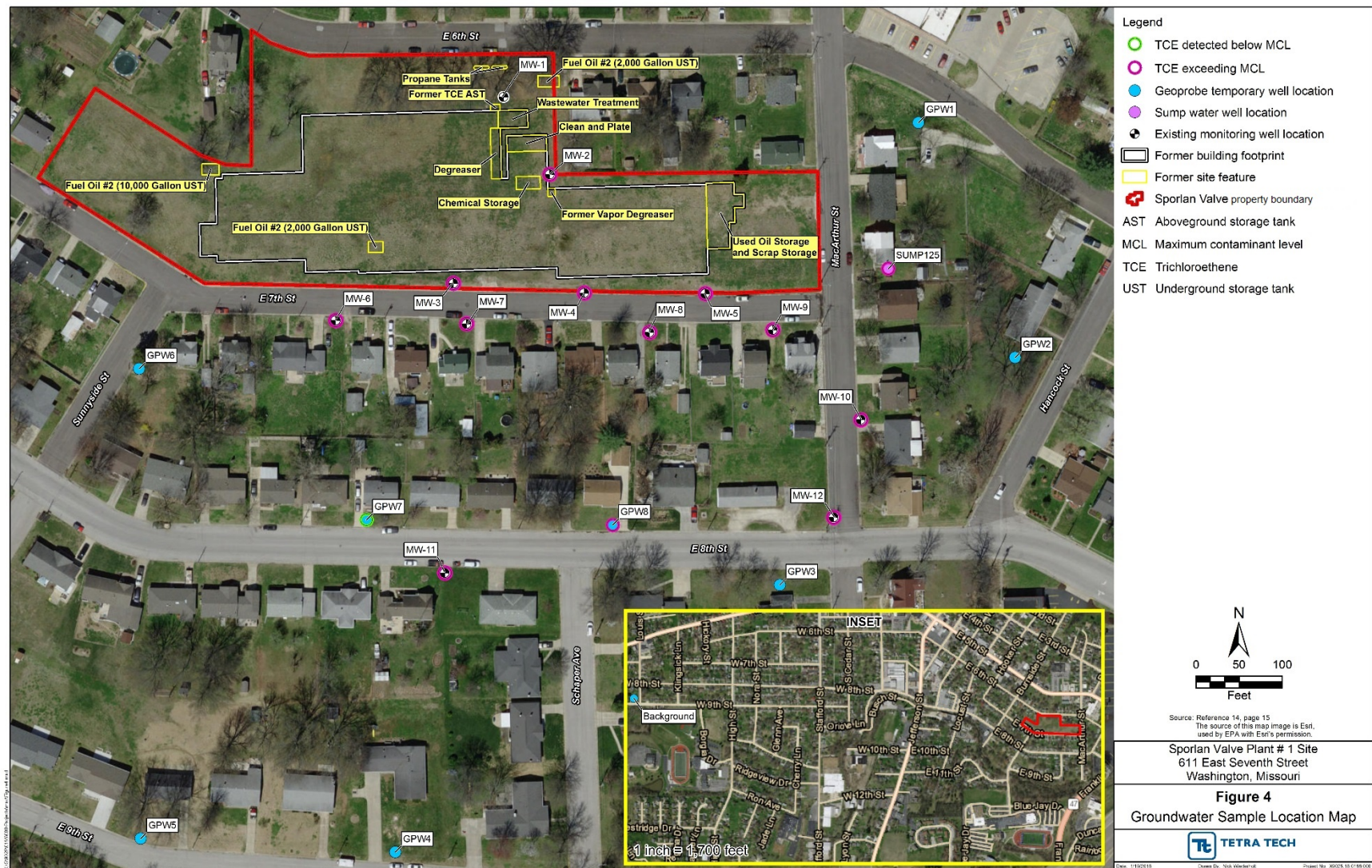
Table 12: Background Sample Concentrations					
Well ID	Sample Number	Hazardous Substance	Concentration (µg/L)	Sample Quantitation Limit* (µg/L)	References
GPW-1	7257-301	Trichloroethene	0.50 U	0.50	22, pp. 45, 132, 145; 25, p. 11
		1,1-Dichloroethene	0.50 U	0.50	
		<i>cis</i> -1,2-Dichloroethene	0.50 U	0.50	
		Vinyl chloride	0.50 U	0.50	
GPW-Background	7257-309	Trichloroethene	0.50 U	0.50	22, pp. 45, 132, 147; 25, p. 13
		1,1-Dichloroethene	0.50 U	0.50	
		<i>cis</i> -1,2-Dichloroethene	0.50 U	0.50	
		Vinyl chloride	0.50 U	0.50	
GPW-6	7257-307	Trichloroethene	0.50 U	0.50	22, pp. 45, 132, 146; 25, p. 13
		1,1-Dichloroethene	0.50 U	0.50	
		<i>cis</i> -1,2-Dichloroethene	0.50 U	0.50	
		Vinyl chloride	0.50 U	0.50	
MW-2	7257-313	Trichloroethene	11	0.50	22, pp. 45, 133, 148; 25, p. 15
		1,1-Dichloroethene	0.50 U	0.50	
		<i>cis</i> -1,2-Dichloroethene	3.0	0.50	
		Vinyl chloride	0.50 U	0.50	

Notes:

µg/L Micrograms per liter
 ID Identification
 U The analyte was not detected at or above the sample quantitation limit (SQL) (Ref. 22, p. 131)
 * The SQLs provided in this table are referred to as reporting limits in Reference 25, page 1.

TCE, 1,1-DCE, *cis*-1,2-DCE, and vinyl chloride were not detected in cross-gradient DPT wells GPW-1 or GPW-6, nor were they detected in the other background DPT temporary well (GPW-Background in Table 11). Detection limits of 0.5 µg/L were reported for those CVOCs in the background samples. In MW-2, north and northeast of the former vapor degreaser and chemical storage areas, respectively, and southeast of the former TCE storage tank (see Figure 4 of this documentation record), TCE was detected at 11 µg/L, and *cis*-1,2-DCE was detected at 3.0 µg/L. 1,1-DCE and vinyl chloride were not detected. These detected concentrations will be used as background levels for this evaluation, although, these

concentrations may represent past releases from the nearby former vapor degreaser or upgradient TCE AST. No other upgradient nearby well to the north that is screened above bedrock and contains water is known to exist. A test trench excavated 30 feet north of MW-1 to the top of bedrock showed no evidence of groundwater after being left open for 24 hours (Ref. 17, pp. 2, 21, 22, 24).



Contaminated Samples

Presented below are permanent monitoring well and DPT temporary well data that are used to establish an observed release by chemical analysis. Permanent wells are designated MW and temporary wells are designated GPW. The locations of these wells are shown on Figure 10 of the ISA report (Ref. 22, p. 45). All are south (hydrogeologically downgradient) of the permanent monitoring wells from the former Sporlan Valve facility (Ref. 5, p. 24). In establishing an observed release, results for permanent monitoring wells were compared to concentrations found in background monitoring well MW-2. Results from DPT wells (GPW-7 and GPW-8) were compared to background DPT well data (GPW1, GPW6, and GPW-Background) (Ref. 22, p. 45). In the three background DPT temporary wells, no contaminants were reported. In MW-2, TCE was reported at 11 µg/L, and *cis*-1,2-DCE was reported at 3 µg/L. All well locations are shown on Figure 4 of this HRS documentation record.

The following table presents the well depth in both feet bgs and feet amsl for each release well sampled. It also presents the date that the well was sampled. The samples presented below were collected during EPA's 2016 ISA investigation (Ref. 22).

Table 13: Contaminated Well Sample Summary					
Well ID (Sample #)	Well Depth (feet bgs)	Elevations (feet amsl)		Date	References
		Surface	Well Depth		
MW-3 (7257-314)	23.5	543.86	520.36	11/16/2016	22, pp. 107, 109, 133; 7, p. 39
MW-4 (7257-315)	24	542.03	518.03	11/16/2016	22, pp. 107, 110, 133; 7, p. 38
MW-5 (7257-316)	22.5	535.12	512.62	11/16/2016	22, pp. 107, 111, 133; 7, p. 35
MW-6 (7257-317)	32.8	540.4	507.6	11/16/2016	22, pp. 107, 112, 133; 14, pp. 16, 19
MW-7 (7257-318)	24.5	539.17	514.67	11/16/2016	22, pp. 107, 113, 133; 14, pp. 16, 20
MW-8 (7257-319)	24.5	536.86	512.36	11/16/2016	22, pp. 107, 114, 133; 14, pp. 16, 21
MW-9 (7257-320)	27.6	531.08	503.48	11/17/2017	22, pp. 107, 115, 133; 14, pp. 16, 22
MW-10 (7257-321)	35.5	525.68	490.18	11/17/2017	22, pp. 107, 116, 133; 15, p. 14
MW-11 (7257-322)	49	524.58	475.58	11/17/2017	22, pp. 107, 117, 133; 15, p. 15
MW-12 (7257-323)	49	523.47	474.47	11/17/2017	22, pp. 107, 118, 133; 15, p. 16
GPW-7 (7257-311)	19	Not measured	Not determined	11/07/2016	22, pp. 99, 105, 133
GPW-8 (7257-312)	34.6	Not measured	Not determined	11/07/2016	22, pp. 99, 106, 133

Notes:

Number
 amsl Above mean sea level
 bgs Below ground surface
 ID Identification

The following table presents concentrations of CVOCs detected in the release wells and sample quantitation limits provided by the EPA Region 7 laboratory. All groundwater sample analyses conducted during the ISA were outsourced to an EPA contract laboratory (Ref. 22, pp. 130 - 135). Sample quantitation limits were provided as a separate reference (Ref. 25).

Table 14: Contaminated Groundwater Sample Summary					
Well ID	Sample Number	Hazardous Substance	Concentration (µg/L)	SQL* (µg/L)	References
MW-3	7257-314	Trichloroethene	3,100	100	22, pp. 45, 133, 148; 25, p. 15
		cis-1,2-Dichloroethene	30	25	
MW-4	7257-315	Trichloroethene	720	50	22, pp. 45, 133, 148; 25, pp. 15, 16
		cis-1,2-Dichloroethene	920	50	
		Vinyl chloride	51	10	
MW-5	7257-316	Trichloroethene	3,900	25	22, pp. 44, 133, 149; 25, p. 16
		cis-1,2-Dichloroethene	410	25	
		Vinyl chloride	63	25	
MW-6	7257-317	Trichloroethene	53	5.0	22, pp. 44, 133, 149; 25, p. 16
MW-7	7257-318	Trichloroethene	1,400	50	22, pp. 44, 133, 149; 25, pp. 16, 17
		cis-1,2-Dichloroethene	28	13	
MW-8	7257-319	Trichloroethene	5,900	250	22, pp. 44, 133, 149; 25, p. 17
		1,1-Dichloroethene	150	50	
		cis-1,2-Dichloroethene	1,700	250	
		Vinyl chloride	1,100	50	
MW-9	7257-320	Trichloroethene	5,000	250	22, pp. 44, 133, 150; 25, p. 17
		cis-1,2-Dichloroethene	290	50	
MW-10	7257-321	Trichloroethene	120	5.0	22, pp. 44, 133, 150; 25, p. 18
MW-11	7257-322	Trichloroethene	190	5.0	22, pp. 44, 133, 150; 25, p. 18
MW-12	7257-323	Trichloroethene	37	1.0	22, pp. 44, 133, 150; 25, p. 19
GPW7	7257-311	Trichloroethene	2.1	0.5	22, pp. 44, 133, 147; 25, p. 14
GPW8	7257-312	Trichloroethene	7.3	0.5	22, pp. 44, 133, 148; 25, p. 14

Notes:

GPW Direct push technology temporary well

µg/L Micrograms per liter

MW Monitoring well

SQL Sample quantitation limit

* The SQLs provided in this table are referred to as reporting limits in Reference 25., page1

Attribution

The Phase I ESA conducted in 2003 of the Sporlan Valve Company Plant #1 property identified three ASTs ranging in size from 200 to 2,000 gallons used to contain TCE for the degreasing operations at the

facility (Ref. 9, p. 10), as well as 55-gallon drums of TCE (Ref. 9, p. 10). Operations at the plant included plating, degreasing, machining, brazing, assembling, and testing (Ref. 9, p. 6). The 2,000-gallon TCE AST was noted as having no secondary containment (Ref. 9, p. 10). Phase II ESA sampling indicated TCE contamination in soils near the TCE AST (Ref. 6, pp. 7, 10, 14, 18). Test pit and trench investigations in 2012 concluded that a source of TCE in soil or groundwater is not present upgradient (north) of MW-1 (Ref. 17, pp. 2, 6).

The former facility lies within a primarily residential neighborhood, with single-family homes surrounding the facility in every direction. No environmental concerns regarding these residential properties were found during the Phase I Environmental Site Assessment, and a radius search did not identify any facilities that might pose environmental concern to the facility (Ref. 9, pp. 6, 11, 12).

As documented in Section 2 of this HRS documentation record, contaminants found in downgradient monitoring wells are the same contaminants found in on-site soils. Numerous sampling events have identified TCE in subsurface soil at the identified source area (see Figure 3 of the HRS documentation record) (Refs. 8, 22, 25, 26, and 28). TCE detections ranged from 13 µg/kg to 27,000 µg/kg in those soils (Ref. 26, pp. 7, 15). Other CVOCs positively identified in the soil samples included PCE, 1,1-DCE, *trans*-1,2-DCE, *cis*-1,2-DCE, and VC (Ref. 8, pp. 8, 9, 10, 12; 25, pp. 4-9; 26, pp. 4-13; 28, pp. 1-40).

Existing groundwater data indicate migration of TCE-contaminated shallow groundwater to the south and east, downgradient of the former facility; upgradient background samples have revealed no such contamination (Ref. 16, pp. 10-11, 19, 22, 30-31, 34).

Groundwater Observed Release Factor Value: 550

3.2 WASTE CHARACTERISTICS

3.2.1 TOXICITY/MOBILITY

The substances in the table below are associated with Source 1 or have been documented in one or more monitoring wells at the site as discussed above.

Table 15: Toxicity/Mobility of Hazardous Substances in Groundwater						
Hazardous Substance	Source Number	Toxicity Factor Value	Mobility Factor Value*	Does Hazardous Substance Meet Observed Release? (Y/N)	Toxicity/Mobility (Table 3-9)	Reference
Trichloroethene	1	1,000	1	Yes	1,000	1, section 3.2.1.2; 3, p. 10
1,1-Dichloroethene	1	10	1	Yes	10	1, section 3.2.1.2; 3, p. 1
<i>cis</i> -1,2-Dichloroethene	1	1,000	1	Yes	1,000	1, section 3.2.1.2; 3, p. 4
<i>trans</i> -1,2-Dichloroethene	1	100	1	Yes**	100	1, section 3.2.1.2; 3, p. 6
Tetrachloroethene	1	100	1	Yes**	100	1, section 3.2.1.2; 3, p. 8
Vinyl chloride	1	10,000	1	Yes	10,000	1, section 3.2.1.2; 3, p. 12

Notes:

* Liquid, non-karst mobility factor value used, or if substance was found in an observed release to groundwater, then a mobility factor value of 1 is assigned (Ref. 1, Sec. 3.2.1.2).

** Meets observed release by direct observation as documented in Section 3.1.1 above.

Vinyl chloride has the greatest toxicity/mobility factor value of the hazardous substances evaluated.

/Mobility Factor Value: 10,000
(Ref. 1, Table 3-9)

3.2.2 HAZARDOUS WASTE QUANTITY

Table 16: Hazardous Waste Quantity for Groundwater		
Source No.	Source Type	Source Hazardous Waste Quantity
1	Contaminated soil	1.02

Sum of Values: 1.02

The hazardous constituent quantity for Source 1 is not adequately determined. The source Hazardous Waste Quantity (HWQ) is 1.02 based on the area of documented soil contamination (see Section 2.4.2 of this HRS documentation record). As specified in Reference 1a, Section 2.4.2.2, a minimum HWQ factor

value of 10 was assigned because there have been no removal actions associated with the CVOC-contaminated soil source (Ref. 1a, Section 2.4.2.2).

Hazardous Waste Quantity Factor Value: 10
(Ref. 1a, Table 2-6)

3.2.3 WASTE CHARACTERISTICS FACTOR CATEGORY VALUE

Toxicity/Mobility Factor Value: 10,000
Hazardous Waste Quantity Factor Value: 10

Toxicity/Mobility Factor Value X
Hazardous Waste Quantity Factor Value: 100,000 or 1×10^5

In accordance with the HRS Table 2-7, the waste characteristics factor category value is assigned a value of 18 (Ref. 1, section 3.2.3; 1a, Table 2-7).

Waste Characteristics Factor Category Value: 18
(Ref. 1a, Table 2-7)

3.3 TARGETS

The Washington, Missouri public water supply (water system number: MO6010838) consists of 10 water supply wells, of which nine are active. These public water supply wells as well as numerous registered domestic wells are all within the four-mile target distance limit and draw from a formation (the Ozark aquifer) that is hydrologically connected to the residuum where the contamination was observed. The Washington public water supply system serves a population of 13,892 (Ref. 37, pp 1, 2).

3.3.1 NEAREST WELL

Well ID: Washington Municipal Well # 4

Level of Contamination (I, II, or potential): Potential

If potential contamination, distance from source in miles: Washington Municipal Well #4 is located about 2,435 feet (0.46 mile) southeast of the former Sporlan Valve # 1 facility property (Refs. 2; 38, pp. 1, 3, 13).

In accordance with Reference 1, Section 3.3.1, Table 3-11, a nearest well factor value of 18 is assigned to the site.

Nearest Well Factor Value: 18
(Ref. 1, Table 3-11)

3.3.2 POPULATION

Population served by individual wells listed in State databases (Ref. 31, pp. 2, 8-15) was estimated based on the average household size of 2.52 persons per household in Franklin County, Missouri (Ref. 39). Databases included the MDNR Public Drinking Water Program (PDWP) database, MDNR's certified Well Information Management System (WIMS) database, and the MDNR/Missouri Geologic Survey sample well log library (Logmain) database (Ref. 31, p. 6).

The WIMS database can be accessed from the link below; according to the website, the database includes only wells drilled after 1987 and may not account for all wells and therefore underestimate the number of well users:

<https://dnr.mo.gov/mowells/wimsSearchLanding.do>

Older wells in the Logmain database can be accessed by the public at the following address:

<https://dnr.mo.gov/geology/wrc/logmain/index.html?env/wrc/logmain/index.html>. These wells must be searched by well ID from Table 1 of Reference 31. Where well IDs are less than six numbers long, zeros must be added before the well ID to produce a six-digit number.

The MDNR Public Drinking Water Program database is not available to the general public, but only public wells used by the City of Washington were used in scoring potential population. Locations of the Washington, Missouri public supply wells are shown in Reference 38.

The population served by the City of Washington's public water supply is provided in Reference 37.

3.3.2.1 Level of Contamination

No Level I or Level II concentrations attributable to the site have been documented at this time.

3.3.2.2 Level I Concentrations

Not scored.

3.3.2.3 Level II Concentrations

Not Scored.

3.3.2.4 Potential Contamination

The public water supply system for the City of Washington includes nine active permanent municipal wells that draw from the Ozark Aquifer (Refs. 37; 38). These wells are reported to range in depth from 725 to 1,180 feet bgs (Refs. 31, pp. 8, 9, 12 – 14; 38, pp.11, 12). The public water supply serves a population of 13,892 (Ref. 37, p. 2). These wells are all within 4 miles of the former Sporlan Valve Plant #1 property (Refs. 2; 31, p. 6; 38, p. 1). The water system has a design capacity of 6,365,000 gallons per day (Ref. 37, p. 3). Individual well capacities and yields are presented in Reference 40. The Microsoft Excel table on the last page of the reference shows that no single well provides more than 40 percent of system total (Ref. 40, pp. 2, 4, 6, 8, 10, 12, 14, 16, 18, 21). Therefore, the total population served by the system (13,892) (Ref. 37, p. 2) is apportioned equally amongst the nine production wells for an assigned population of 1,543 persons per Washington City well.

Also included as potential targets were registered domestic wells within four miles of the facility. Data was obtained from the Geological Survey Program of the Missouri Geological Survey (Ref. 31, pp. 1, 2, 6, 8 – 15). All 286 registered wells within 4 miles draw from the Ozark Aquifer (Ref. 31, pp. 2, 8 – 15). In assigning population to each registered well, the average population per household in Franklin County of 2.52 persons per home was used (Ref. 39). The municipal and private wells described above are included in the table below.

Table 17: Populations Served by Groundwater										
Distance Category (miles)	Well (Well ID)	Population	Reference	Distance Weighted Population Value (Ref. 1, Table 3-12)						
0 – ¼	None Known	-		0						
¼ – ½	Washington Municipal Wells Well #4 (104381) 4 Private Wells	1,543 10.08	1, Section 3.3.2.4; 31, pp. 6, 8	1,013						
	Total ¼ – ½	1,553.08								
½ - 1	6 Private Wells	15.12	1, Section 3.3.2.4; 31, pp. 6, 8	5						
	Total ½ - 1	15.12								
1 – 2	Washington Municipal Wells Well #3 (104378) Well #5 (104380) Well #6 (104382) Well #8 (104383) Well #9 (104384) 39 private wells	1,543 1,543 1,543 1,543 1,543 98.28	1, Section 3.3.2.4; 31, pp. 6, 8, 9	939						
	Total 1 - 2	7,813.28								
	2 - 3	Washington Municipal Wells Well #10 (104977) Well #7 (104377) 93 private wells			1,543 1,543 234.36	1, Section 3.3.2.4; 31, pp. 6, 9, 10, 11	678			
		Total 2 - 3			3,320.36					
		3 - 4			Washington Municipal Wells Well #11 (104978) 144 private wells			1,543 362.88	1, Section 3.3.2.4; 31, pp. 6, 12, 13, 14, 15	131
					Total 3 - 4			1,905.88		
Sum of the Distance-Weighted Population Values:				2,766						

Sum of Distance-Weighted Population Values: 2,766
Sum of Distance-Weighted Population Values/10: 276.6
(Ref. 1, Section 3.3.2.4)

Potential Contamination Factor Value: 276.6

3.3.3 RESOURCES

This factor was not scored.

3.3.4 WELLHEAD PROTECTION AREA

A designated Wellhead Protection Area for the Washington public water supply system has been mapped within the 4-mile target distance limit (Ref. 38, p. 1). The maps provided in Reference 38 are based on the Missouri Source Water Assessment Plan (SWAP) which was developed to implement requirements of the Safe Drinking Water Act Amendments of 1996 for state Source Water Assessment Programs [Sections 1453 and 1428(b)] (Ref. 41, p. 1). The former Sporlan Valve property (identified on the SWAP

as facility C20) is located within the ½-mile buffer of Washington Well # 4 (Ref. 38, pp. 1, 3, 13). In accordance with Section 3.3.4 of Reference 1, a wellhead protection value of 20 is assigned for the site.

Wellhead Protection Area Factor Value: 20

(Ref. 1, Section 3.3.4)

5.0 SOIL EXPOSURE AND SUBSURFACE INTRUSION PATHWAY

5.2 SUBSURFACE INTRUSION COMPONENT

As a result of a release of PCE and TCE to soil and groundwater at the former Sporlan Valve #1 Plant, a CVOC-dominant groundwater plume has migrated off the Sporlan Valve property beneath nearby residences (Refs. 5, pp. 2-4, 10, 12-13, 25; 35, pp. 19, 27, 29-30, 35, 40). Groundwater, and VI data indicate this plume emanates from contaminated soils on the Sporlan Valve property and migrates downgradient (south-southeast) (Ref. 10, p. 7) (see Source Characterization and Ground Water Migration Pathway, Likelihood of Release above in Sections 2.2 and 3.1.1 above). As presented in Table 9 of this documentation record and shown on pages 10 and 11 of reference 15, the depth to groundwater ranges from about 10 to 20 feet below ground surface. As documented in Section 2.2, the vapor origin (contaminated soil source 1) is located in the vadose zone (the soil zone between land surface and the groundwater table within which the moisture content is less than saturation) and has also been reported in samples collected from below the groundwater table. Vapors have the potential to migrate radially in all directions from the origin via diffusion (i.e., upward toward the atmosphere, laterally outward, and downward toward the water table. If the subsurface vapor source is in the upper-most groundwater, the vapors have the potential to migrate upwards toward the atmosphere via diffusion (Ref. 20, pp. 42, 46). Soil gas concentrations emanating from a subsurface vapor source generally attenuate, or decrease, as the volatile chemicals move from the source through the soil and into indoor air (Ref. 20, p. 46).

The subsurface intrusion component of the soil exposure and subsurface intrusion pathway evaluation is based on a release of PCE, TCE, and their degradation product vinyl chloride to sub surface media that has resulted in one Area of Observed Exposure (AOE), designated AOE 1, and one Area of Subsurface Contamination (ASC), designated ASC A. Residential properties along East 6th Street, MacArthur Street, East 7th Street, and East 8th Street assessed during VI sampling were adjacent to or near the former Sporlan Valve Plant #1 property. Generally, these single-family residential structures within the ASC and AOE are ranch-style with one story, a basement, and no subunits. Likely preferential pathways for subsurface intrusion into these structures include cracks, crevices, holes, pits, sumps, and floor drains in the unsealed concrete floors and walls of the basements (Ref. 20, pp. 48-50).

5.2.0 GENERAL CONSIDERATIONS

The subsurface intrusion component of the soil exposure and subsurface intrusion pathway evaluation for this site is based on one AOE and one ASC. These are presented on Figures 5 and 6 of this HRS documentation record.

The AOE consists of 32 regularly occupied residential structures. Significant increases of hazardous substances (i.e., CVOCs) in indoor air samples have been identified within these structures as documented in Tables 22 and 23 in this section. Indoor air within these regularly occupied structures have been found to, or have been inferred to, be contaminated with TCE, PCE, or vinyl chloride.

The ASC is currently defined as an 8.41-acre area that underlies 5 regularly occupied structures (see Figure 6 of this HRS documentation record). The ASC was delineated based on analytical results of sub-slab soil gas samples collected beneath regularly occupied structures near the site during the MDNR SI/RSE, Tetra Tech START ISA, and associated quarterly VI sampling events from July 2015 to February 2018 (Refs. 10, pp. 20-34; 12, pp. 40-141; 21, pp. 53-86; 49, pp. 72-85, 90-97, 100-106).

Table 18 below presents the structures within AOE and ASC.

Table 18: Structures within AOE and ASC					
Type of Structure	Location ID	Number(s) of Specific Type of Structure	VMS System Installed?	Observed Exposure or Inferred	References
Area of Observed Exposure					
Residential	117	Single Family	Yes	Observed Exposure	24, p. 17; 48, pp. 1-4
Residential	118	Single Family	Yes	Observed Exposure	24, p. 17; 48, pp. 5-8
Residential	124	Single Family	Yes	Observed Exposure	24, p. 17; 48, pp. 9-12
Residential	125	Single Family	Yes	Observed Exposure	10, pp. 20, 21, 94-156
Residential	130	Single Family	No	Observed Exposure	48, pp. 13-16
Residential	131	Single Family	No	Observed Exposure	48, pp. 17-20
Residential	143	Single Family	No	Inferred	10, pp. 20, 21, 94-156
Residential	144	Single Family	Yes	Inferred	24, p. 17; 48, pp. 21-24
Residential	145	Single Family	Yes	Inferred	10, pp. 20, 21, 94-156; 24, p. 17
Residential	146	Single Family	Yes	Inferred	24, p. 17; 10, pp. 183-186
Residential	147	Single Family	Yes	Inferred	10, pp. 20, 21, 94-156; 24, p. 17
Residential	148	Single Family	Yes	Inferred	10, pp. 20, 21, 94-156; 24, p. 17
Residential	149	Single Family	Yes	Inferred	24, p. 17; 10, pp. 190-193
Residential	150	Single Family	Yes	Inferred	24, p. 17; 10, pp. 197-200

Table 18: Structures within AOE and ASC					
Type of Structure	Location ID	Number(s) of Specific Type of Structure	VMS System Installed?	Observed Exposure or Inferred	References
Residential	151	Single Family	Yes	Observed Exposure	24, p. 17; 10, pp. 204-207
Residential	152	Single Family	Yes	Inferred	24, p. 17; 10, pp. 211-214
Residential	153	Single Family	Yes	Observed Exposure	24, p. 17; 10, pp. 218-221
Residential	165	Single Family	No	Inferred	49, pp. 12-15, 36
Residential	176	Single Family	Yes	Observed Exposure	24, p. 17; 10, pp. 225-228
Residential	177	Single Family	No	Observed Exposure	10, pp. 232-235; 48, pp. 29-32
Residential	178	Single Family	No	Inferred	48, pp. 33-36
Residential	179	Single Family	Yes	Observed Exposure	10, pp. 20, 21, 94-156; 24, p. 17
Residential	180	Single Family	No	Observed Exposure	10, pp. 20, 21, 94-156
Residential	181	Single Family	Yes	Observed Exposure	10, pp. 20, 21, 94-156; 24, p. 17
Residential	182	Single Family	No	Inferred	10, pp. 239-242; 48, pp. 37-40
Residential	186	Single Family	No	Observed Exposure	48, pp. 41-43
Residential	191	Single Family	No	Observed Exposure	52, p. 1
Residential	192	Single Family	No	Observed Exposure	48, pp. 45-48
Residential	193	Single Family	No	Observed Exposure	10, pp. 246-249; 48, pp. 49-52
Residential	194	Single Family	No	Inferred	48, pp. 53-56
Residential	195	Single Family	No	Observed Exposure	48, pp. 57-60
Residential	213	Single Family	No	Observed Exposure	49, pp. 12, 14, 36
Area of Subsurface Contamination					
Residential	154	Single Family	Yes	N/A	10, pp. 20, 21, 94-156; 24, p. 17
Residential	155	Single Family	No	N/A	10, pp. 20, 21, 94-156
Residential	156	Single Family	No	N/A	10, pp. 20, 21, 94-156
Residential	175	Single Family	No	N/A	48, pp. 25-28
Residential	185	Single Family	No	N/A	49, pp. 14, 15, 36

Notes:

ID Identification
VMS Vapor mitigation system
N/A Not applicable

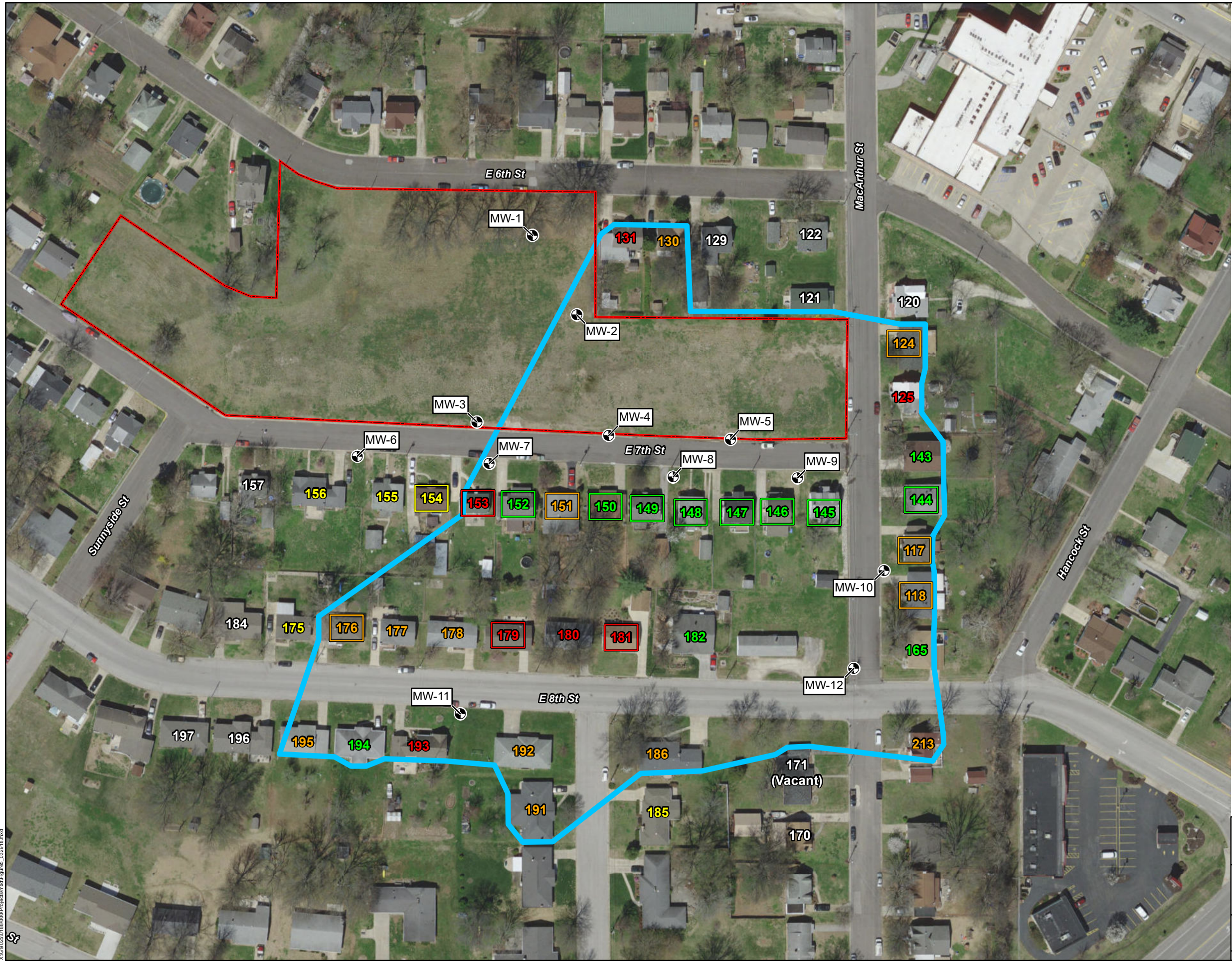
As a result of the MDNR SI/RSE, and review of other available data, sub-slab depressurization vapor mitigation systems (VMS) were installed at two residences in September 2015 (Property IDs 153 and 176) (Ref. 24, p. 5). In August 2016 EPA issued a Unilateral Administrative Order for Removal Action (UAO, or Order) to SV Land LLC (Ref. 24, pp. 3, 6). Under this Order, SV Land, LLC was required to

either conduct quarterly sampling at residences to determine concentrations of TCE vapors, or preemptively install mitigation systems at residences in lieu of sampling (Ref. 12, p. 10). Due to limited financial resources, SV Land LLC advocated for preemptive mitigation verses additional investigation (Ref. 24, p. 6). Sub-slab VMSs were installed in homes prioritized by EPA (Ref. 24, p. 6). SV Land LLC retained the services of an environmental consulting contractor, to oversee installation of the VMSs (Refs 12, p. 10; 24, p. 6). Initially, this activity was planned to focus on the 11 properties nearest the south perimeter of the former facility along East Seventh Street due to their proximity to the known groundwater plume. Performance sampling of indoor air to determine the effectiveness of the systems at these properties 30 days after the VMSs had been installed was also required (Ref. 24, pp. 6, 7). These activities began in fall 2016 (Refs. 12, p. 10; 24, p. 7). All systems installed were active mitigation systems which use an exhaust fan to draw vapors from beneath the buildings and vent it to the atmosphere through a pipe (Ref. 24, pp. 7, 8). Table 19 below provides a summary of VMS installation activities associated with the SV Land LLC UAO (also see Figures 5 and 6 of this HRS documentation record).

Table 19: Summary of Vapor Mitigation System Installation				
Property ID	Date Installed	Post-installation IA TCE detections (maximum)	References	Notes:
117	10/20/2016	ND	24, pp. 16-17; 48, p. 1	
118	11/16/2016	ND	24, pp. 16-17; 48, p. 5	
120	3/15/2017	NA	24, p. 17; 21, p. 37	VMS not operable due to water intrusion issues
124	10/18/2016	ND	24, pp. 16-17; 48, p. 9	
125	11/3/2016	22 µg/m ³	24, p. 17; 49, p. 8	VMS not operable due to water intrusion issues
144	11/2/2016	ND	24, pp. 16-17; 48, p. 21	
145	10/19/2016	ND	24, pp. 16-17	
146	11/4/2016	ND	24, pp. 16-17; 10, p. 183	
147	11/11/2016	NA	24, p. 17	
148	10/27/2016	NA	24, p. 17	
149	10/21/2016	ND	24, pp. 16-17; 10, p. 190	
150	10/24/2016	ND	24, pp. 16-17; 10, p. 197	
151	4/2012	NA	24, pp. 16-17; 10, p. 204	
152	10/26/2016	0.35 µg/m ³	24, pp. 16-17; 10, p. 211	
153	9/10/2015	8.1 µg/m ³	24, pp. 8, 16-17; 10, p. 211	
	3/9/2017	ND		
154	10/28/2017	ND	24, pp. 16-17, 76	
176	9/16/2015	ND	24, pp. 16-17; 10, p. 225	
179	2/16/2017	ND	24, pp. 16-17, 88	
181	2/15/2017	0.52 µg/m ³	24, pp. 16-17, 88; 21, p. 23	

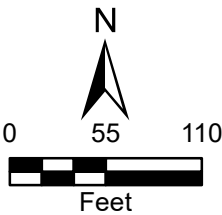
Notes:

µg/m³ Micrograms per cubic meter
 IA Indoor air
 ID Identification
 NA Not analyzed
 ND Analyte not detected
 VMS Vapor mitigation system
 TCE Trichloroethene



- Legend
- Existing monitoring well location
 - Area of observed exposure
 - Sporlan Valve property boundary
 - Property ID - No samples collected
 - Property ID - Area of subsurface contamination
 - Property ID - Level I concentration
 - Property ID - Level II concentration
 - Property ID - Level II inferred
 - Boxed Property ID indicates presence of vapor mitigation system

Notes: Property location identification numbers were derived from references 10, 12, and 21, 29, 49, and 50.



Source: Reference 14, page 15
The source of this map image is Esri,
used by EPA with Esri's permission.

Sporlan Valve Plant #1 Site
611 East Seventh Street
Washington, Missouri

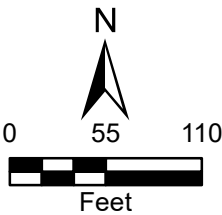
Figure 5
Area of Observed Exposure Map





- Legend
- Existing monitoring well location
 - Area of subsurface contamination
 - Sporlan Valve property boundary
 - Property ID - No samples collected
 - Property ID - Area of subsurface contamination
 - Property ID - Level I concentration
 - Property ID - Level II concentration
 - Property ID - Level II inferred
 - Boxed Property ID indicates presence of vapor mitigation system

Notes: Property location identification numbers were derived from references 10,12, and 21, 29, 49, and 50.



Source: Reference 14, page 15
The source of this map image is Esri, used by EPA with Esri's permission.

Sporlan Valve Plant #1 Site
611 East Seventh Street
Washington, Missouri

Figure 6
Area of Subsurface Contamination Map



Area of Observed Exposure

Name of AOE: AOE 1

Location, description and delineation of AOE (see Figure 5 of this HRS documentation record):

AOE 1 consists of 32 regularly occupied residential structures in which indoor air is contaminated or inferred to be contaminated with TCE, PCE, and vinyl chloride (see Figure 5 of this HRS documentation record). As shown in Table 18 of this documentation record, all residences within AOE 1 are regularly occupied structures with no subunits. Regularly occupied structures with indoor air samples that met observed exposure criteria were used to delineate AOE 1 (see Tables 20 and 22 of this HRS documentation record). Regularly occupied structures without a documented observed exposure, but are located between structures with a documented observed exposure, are also inferred to be within the AOE (Ref. 1a, Section 5.2.0). Structures where contamination is inferred are located near Source 1 south of East. 7th Street, where a vapor mitigation system was installed preemptively (before indoor air samples were collected, between structures with documented contamination, or may have had CVOC concentrations in sub-slab soil gas or indoor air in the past, but results were inconclusive. Preferential pathways for subsurface intrusion into these residences include cracks, crevices, holes, pits, and floor drains in unsealed concrete floors and walls of the basements (Refs. 10, pp. 169-252; 24, pp. 23-97).

Observed Exposure by Chemical Analysis

In July 2015, MDNR conducted a combined SI/RSE that included sampling focused on the VI pathway (Ref. 10, p. 20). Samples of indoor air were collected by MDNR during the SI/RSE. Outdoor ambient air was also collected to establish background concentrations of CVOCs (Ref 10, pp. 20, 25-27).

Beginning in August 2016, EPA initiated quarterly VI monitoring at 26 residences near the Sporlan Valve site. To date, 146 indoor air, and 13 outdoor ambient air samples have been collected during five Tetra Tech VI sampling events (Refs. 12, pp. 11-13; 21, pp. 11-15; 49, pp. 11-16). Indoor air contaminated with TCE was found to range in concentrations from 0.18 to 7.9 µg/m³. PCE, 1,1-DCE, *cis*-1,2-DCE, *trans*-1,2-DCE, and vinyl chloride were also detected in indoor air samples at concentration ranging from 0.18 to 31 µg/m³ (Refs. 12, pp. 11-13, 40-141; 21, pp. 11-16, 53-86; 49 pp. 72-85, 90-97, 102-106). These VI sampling events also established observed exposures at residential properties surrounding the site. Table 20 below provides a summary of properties sampled, along with other pertinent information.

Background Samples

Outdoor ambient air samples listed in Table 20 were collected by MDNR and the EPA during each VI sampling event (Refs. 10, pp. 20-22; 12, pp. 35, 38; 21, pp. 48, 50, 52; 49, pp. 13, 15, 16). These samples were collected from locations throughout the AOE in yards of regularly occupied structures. Table 20 also summarizes indoor air samples collected from three properties (120, 121 and 129) located to the north and east of the former facility (see Figure 5 of this documentation record). Although near the former facility, these two residences are upgradient with respect to groundwater flow of the former facility (Ref. 16, p. 29). Samples from property 120 were collected one time by EPA in December 2016. Samples from property 121 were collected four time by MDNR or EPA in July 2015, November 2016, March 2017, and August 2017. Samples from property 129 were collected once by MDNR in July 2015.

Table 20: Background Sample Descriptions – July 2015 through February 2018						
Property ID	Laboratory/ Sample ID	Sample Location	Volume of Air	Start Date and Time	End Date and Time	References
Indoor Air						
120	7280-54/ 120-1	Cellar Area	6 liters	12/05/2016 @08:12	12/06/2016 @07:52	21, pp. 12, 19, 34, 37, 57
	7280-55/ 120-2	Laundry Room		12/05/2016 @08:03	12/06/2016 @07:52	21, pp. 12, 19, 34, 37, 57
	7280-56/ 120-3	Living Room		12/05/2016 @08:08	12/06/2016 @07:51	21, pp. 12, 19, 34, 37, 57
121	AC57031/ 153107	Basement	6 liters	7/14/2015 @16:11	7/15/2015 ¹ @14:54	10, pp. 21, 23, 271, 296
	AC57032/ 153108	Living Room	6 liters	7/14/2015 @16:09	7/15/2015 ¹ @14:52	10, pp. 21, 23, 271, 296
	7280-30/ 121-3	Basement	6 liters	11/29/2016 @09:26	11/30/2016 @08:57	21, pp. 12, 19, 34, 37, 56, 67

Table 20: Background Sample Descriptions – July 2015 through February 2018						
Property ID	Laboratory/ Sample ID	Sample Location	Volume of Air	Start Date and Time	End Date and Time	References
	7280-31/ 121-4	Dining Room	6 liters	11/29/2016 @09:28	11/30/2016 @09:00	21, pp. 12, 19, 34, 37, 56, 68
	7368-09/ 121-3	Basement	6 liters	3/08/2017 @10:35	3/9/2017 @10:09	21, pp. 14, 15, 46, 77
	7368-10/ 121-4	Dining Room	6 liters	3/08/2017 @10:36	3/9/2017 @10:10	21, pp. 14, 15, 46, 77
	7520-34/ 121-3	Basement	6 liters	8/22/2017 @12:35	8/23/2017 @12:32	49, pp. 13, 17, 36, 69
	7520-35/ 121-4	Dining Room	6 liters	8/22/2017 @12:38	8/23/2017 @12:33	49, pp. 13, 17, 36, 69
129	AC57023/ 153099	Basement	6 liters	7/14/2015 @15:25	7/15/2015 ¹ @14:26	10, pp. 21, 22, 271, 294
	AC57024/ 153100	Kitchen	6 liters	7/14/2015 @15:26	7/15/2015 ¹ @14:27	10, pp. 21, 22, 271, 294
Background Ambient Air						
193	AC57022/ 153112	Backyard AA	6 liters	7/14/2015 @16:38	7/15/2015 ¹ @15:22	10, pp. 21, 22, 271, 293
129	AC57030/ 153106	Backyard AA	6 liters	7/14/2015 @15:27	7/15/2015 @14:23	10, pp. 21, 22, 271, 295
182	P1603935-007/ 182-3	Backyard AA	6 liters	8/02/2016 ²	8/3/2016 @14:50	12, pp. 11, 12, 37, 43
131	P1603935-018/ 131-4	Backyard AA	6 liters	8/03/2016 ²	8/4/2016 @14:02	12, pp. 11, 12, 35, 43
144	P1603961-026/ 144-4	Backyard AA	6 liters	8/5/2016 ²	8/6/2016 @08:24	12, pp. 11, 12, 35, 76
194	P1604058-004/ 194-4	Backyard AA	6 liters	8/12/2016 ²	8/13/2016 @09:54	12, pp. 11, 13, 38, 119
192	7280-12	Backyard AA	6 liters	11/07/2016 @15:59	11/8/2016 @14:37	21, pp. 12, 13, 42, 56
213	7368-14	Backyard AA	6 liters	3/08/2017 @14:10	3/9/2017 @13:30	21, pp. 12, 15, 52, 77
186	7368-27	Backyard AA	6 liters	3/15/2017 @12:35	3/16/2017 @12:49	21, pp. 12, 15, 50, 77
180	7520-19	Backyard AA	6 liters	8/14/2017 @15:34	8/15/2017 @15:20	49, pp. 13, 69
121	7520-36	Backyard AA	6 liters	8/22/2017 @12:42	8/23/2017 @12:34	49, pp. 13, 69
175	7520-49	Backyard AA	6 liters	8/31/2017 @17:00	9/1/2017 @16:28	49, pp. 13, 70
165	7705-4	Backyard AA	6 liters	1/23/2018 @09:18	1/24/2018 @09:13	49, pp. 15, 103
125	7706-10	Backyard AA	6 liters	2/19/2018 @11:02	2/20/2018 @10:26	49, pp. 15, 100
191	7706-4	Backyard AA	6 liters	2/19/2018 @09:13	2/20/2018 @09:00	49, pp. 16, 100

Notes:

- ¹ Reference 10, page 22 has a collection date of 7/14/2015. This is believed to be in error as all other referenced pages show the sample was collected on 7/15/2015.
- ² Only end times were recorded for these samples along with beginning and ending pressures; however, all samples were 24-hours in duration (Ref. 12, pp. 11, 44, 45, 77, 78, 120).
- ~ Approximately

Background Concentrations

Concentrations of the VOCs from these background samples are presented in Table 21 that follows.

Eurofins Air Toxics Ltd. (Eurofins) analyzed the July 2015 air samples for VOCs using EPA Method TO-15 and in accordance with laboratory SOPs VOA-TO15 (Ref. 16, pp. 376, 390, 420). Eurofins utilized an independent validation in accordance with the EPA National Functional Guidelines for Organic Data Review and the analytical method (Ref. 10, pp. 318, 335, 346, 364, 377, 392, 406, 422, 435, 447, 458, 773, 803). ALS Environmental analyzed the August 2016 air samples for TCE, PCE, 1,1-DCE, *cis*-1,2-DCE, *trans*-1,2-DCE, VC and the fuel related VOCs benzene, toluene, ethylbenzene, and xylenes (BTEx) using EPA Method TO-15 and in accordance with laboratory SOPs VOA-TO15 (Ref. 12, pp. 13, 41, 74, 117). These analytical results were validated by Tetra Tech in accordance with the EPA National Functional Guidelines for Organic Data Review and the analytical method (Ref. 12, pp. 133- 141).

The EPA Region 7 laboratory analyzed the November/December 2016, March 2017, August 2017, January 2018, and February 2018 air samples for TCE, PCE, 1,1-DCE, *cis*-1,2-DCE, *trans*-1,2-DCE, VC and fuel related VOCs using EPA Region 7 RLAB Method 3230.4H (VOCs in Air samples in Canisters at Ambient Levels by GC/MS) (Refs. 21, pp. 54-58, 75-78; 49, pp. 67-71, 86-89, 98-101). These analytical results were reviewed and verified in accordance with procedures described in the Quality Manual (Refs. 21, pp. 54, 75; 49, pp. 67, 86, 98). The reporting limits (RL) are listed on the analytical data sheets in References 10, 12, 32, 33, 34, 51, and 52. For data generated by the EPA Region 7 Laboratory, each RL is sample-specific and corresponds to the lowest demonstrated level of acceptable quantitation; it is adjusted for preparation weights and volumes, and any dilutions performed and is sometimes called the sample quantitation limit (SQL) (Refs. 32, p. 1; 33, p. 1; 34, p. 1; 51, p. 1; 52, p. 1). ALS Environmental presents method reporting limits (MRL) which are the minimum quantity of a target analyte that can be confidently determined by the referenced method (Ref. 12, p. 48).

Table 21: Analytical Results for Background Air Samples					
Property ID	Laboratory Sample ID	Hazardous Substance	Concentration (µg/m ³)	RL (µg/m ³)	Reference
Indoor Air					
120	7280-54/ 120-1	PCE	0.34 U	0.34	32, p. 16; 21, pp. 55, 57, 73
		TCE	0.32 U ²	0.27	
		VC	0.13 UJ ¹	0.13	
	7280-55/ 120-2	PCE	0.34 U	0.34	32, p. 17; 21, pp. 55, 57, 74
		TCE	0.27 U	0.27	
		VC	0.13 UJ ¹	0.13	
	7280-56/ 120-3	PCE	0.34 U	0.34	32, p. 17; 21, pp. 55, 57, 74
		TCE	0.27 U	0.27	
		VC	0.13 UJ ¹	0.13	

Table 21: Analytical Results for Background Air Samples					
Property ID	Laboratory Sample ID	Hazardous Substance	Concentration (µg/m³)	RL (µg/m³)	Reference
121	AC57031/ 153107	TCE VC	Not detected Not detected	0.16 0.051	10, pp. 296, 382, 412
	AC57032/ 153108	TCE VC	Not detected Not detected	0.19 0.045	10, pp. 296, 382, 413
	7280-30/ 121-3	PCE TCE VC	0.34 U 0.35 U ² 0.14	0.34 0.27 0.13	32, p. 10; 21, pp. 55, 56, 59, 67
	7280-31/ 121-4	PCE TCE VC	0.34 U 0.27 U 0.13 U	0.34 0.27 0.13	32, p. 10; 21, pp. 55, 56, 68
	7368-09/ 121-3	PCE TCE VC	0.34 U 0.27 U 0.13 U	0.34 0.27 0.13	33, p. 3
	7368-10/ 121-4	PCE TCE VC	0.34 U 0.27 U 0.13 U	0.34 0.27 0.13	33, p. 3
	7520-34/ 121-3	PCE TCE VC	0.68 U ² 0.27 U 0.13 UJ ¹	0.34 0.27 0.13	34, p. 11; 49, p. 71
	7520-35/ 121-4	PCE TCE VC	0.68 U ² 0.27 U 0.13 UJ ¹	0.34 0.27 0.13	34, p. 11; 49, p. 71
129	AC57023/ 153099	TCE VC	Not detected Not detected	0.15 0.035	10, pp. 271, 294, 383
	AC57024/ 153100	TCE VC	Not detected Not detected	0.21 0.049	10, pp. 271, 294, 384
Background Ambient air					
193	AC57022/ 153112	VC	Not detected	0.037	10, p. 382
		TCE	Not detected	0.11	10, p. 382
129	AC57030/ 153106	VC	Not detected	0.046	10, p. 411
		TCE	Not detected	0.19	10, p. 411
182	P1603935-007/ 182-3	VC	ND	0.16	12, p. 54
		TCE	ND	0.16	12, p. 54
		PCE	ND	0.16	12, p. 54

Table 21: Analytical Results for Background Air Samples					
Property ID	Laboratory Sample ID	Hazardous Substance	Concentration (µg/m³)	RL (µg/m³)	Reference
131	P1603935-018/ 131-4	VC	ND	0.15	12, p. 65
		TCE	ND	0.15	12, p. 65
		PCE	ND	0.15	12, p. 65
144	P1603961-026/ 144-4	VC	ND	0.17	12, p. 106
		TCE	ND	0.17	12, p. 106
		PCE	ND	0.17	12, p. 106
194	P1604058-004/ 194-4	VC	ND	0.16	12, p. 125
		TCE	ND	0.16	12, p. 125
		PCE	0.16	0.16	12, p. 125
192	7280-12	VC	0.13 UJ ¹	0.13	32, p. 4; 21, pp. 55, 58
		TCE	0.27 U	0.27	32, p. 4
		PCE	0.41	0.34	32, p. 4
213	7368-14	VC	0.13 U	0.13	33, p. 4
		TCE	0.27 U	0.27	33, p. 4
		PCE	0.34 U	0.34	33, p. 4
186	7368-27	VC	0.13 U	0.13	33, pp. 6-7
		TCE	0.27 U	0.27	33, pp. 6-7
		PCE	0.34 U	0.34	33, pp. 6-7
180	7520-19	VC	0.13 U	0.13	34, pp. 6-7
		TCE	0.27 U	0.27	34, pp. 6-7
		PCE	0.68 U ²	0.34	34, pp. 6-7; 49, p. 71
121	7520-36	VC	0.13 UJ ¹	0.13	34, p. 12; 49, p. 71
		TCE	0.27 U	0.27	34, p. 12
		PCE	0.68 U ²	0.34	34, p. 12; 49, p. 71
175	7520-49	VC	0.13 UJ ¹	0.13	34, p. 16; 49, p. 71
		TCE	0.27 U	0.27	34, p. 16
		PCE	0.68 U ²	0.34	34, p. 16; 49, p. 71
165	7705-4	VC	0.13 U	0.13	51, p. 2
		TCE	0.27 U	0.27	51, p. 2
		PCE	0.34 U	0.34	51, p. 2
125	7706-10	VC	0.13 U	0.13	52, p. 5
		TCE	0.27 U	0.27	52, p. 5
		PCE	0.34 U	0.34	52, p. 5
191	7706-4	VC	0.13 U	0.13	52, p. 2
		TCE	0.27 U	0.27	52, p. 2
		PCE	0.34 U	0.34	52, p. 2

Notes:

¹ The analyte was not found in the samples at or above the reporting limit however, the reporting limit is an estimate (UJ-coded) due to the low recovery of the analyte in the laboratory control sample. The actual reporting limit for this analyte may be higher than the reported value.

² The reporting limit for Tetrachloroethene was raised to from 0.34 µg/m³ to 0.68 µg/m³ due to concerns of residual canister contamination (Ref. 49, p. 71).

ID Identification number

µg/m³ Micrograms per cubic meter

ND Compound was analyzed for, but not detected above the laboratory reporting limit.

PCE Tetrachloroethene

TCE Trichloroethene

U The analyte was not detected at or above the reporting limit.

UJ The analyte was not detected at or above the reporting limit. The reporting limit is an estimate (Ref. 49, p. 68).

VC Vinyl chloride

As Table 21 shows, no PCE or TCE were detected in the background indoor air samples collected from the 3 properties during the July 2015, November/December 2016, March 2017 or August 2017 sampling events. Of all the indoor air samples collected from the three properties, only one detection of vinyl chloride was reported, and that was in a basement air sample from property 121 collected in late November 2016. In the sample 7280-30, vinyl chloride was reported at 0.14 $\mu\text{g}/\text{m}^3$ s slightly above the reporting limit of 0.13 $\mu\text{g}/\text{m}^3$. In the 15 ambient outdoor air samples collected from within the boundaries of AOE-1, only two contained reportable quantities of PCE. No TCE or vinyl chloride was identified in any sample. The Highest PCE concentration in ambient air was 0.41 $\mu\text{g}/\text{m}^3$ collected in November 2016 from property 192. In August 2017, PCE was reported at 0.16 $\mu\text{g}/\text{m}^3$ in an ambient air sample collected from property 194.

TCE and PCE are solvents that are not naturally occurring substances, and vinyl chloride is a breakdown product of TCE and PCE (Refs. 44, p. 5; 45, pp. 1, 3). Therefore, they should not be present in the environment. Indoor air from three properties, and outdoor air samples collected from locations throughout the AOE were used to represent background airborne concentrations. As shown in Tables 20 and 21 above, only property 121 located east and north of the former facility was indoor air sampled more than one time. A summary of all samples collected from this property is presented in reference 49, page 1. Outdoor air samples were compared to the samples below because each regularly occupied structure is ventilated with ambient air (Refs. 10, pp. 169-252; 24, pp. 23-97). Because background indoor air samples were non-detect for PCE and TCE, observed exposure will be documented by any indoor air sample with PCE and TCE above reporting limits.

Vinyl chloride in indoor air will be considered significantly elevated if the concentration is 3 times the single background indoor air detection of 0.14 $\mu\text{g}/\text{m}^3$, which is 0.42 $\mu\text{g}/\text{m}^3$. Because PCE was reported in ambient air in November 2016 and again in August 2016, exposure samples collected during those periods of time will be considered elevated if the indoor air PCE concentration is three times the outdoor air PCE concentration. For the November/December 2016 sampling, that PCE concentration is 1.23 $\mu\text{g}/\text{m}^3$. For the August 2017 sampling, that PCE concentration is 0.48 $\mu\text{g}/\text{m}^3$.

Exposure Samples – MDNR 2015 and Tetra Tech START 2016-2018 Indoor Air Sampling

The indoor air samples listed in Table 22 were collected by MDNR in July 2015, and by the EPA in August 2016, November/December 2016, March 2017, August 2017, January 2018, and February 2018 (Refs. 10, pp. 20-24; 12, pp. 11-13; 21, pp. 11, 14; 49, pp. 13-16). Sampling activities were conducted in accordance with the approved work plan and QAPP. The indoor air samples were collected at residences, whom granted access near the former facility– from basements and first floor areas (Refs. 10, pp. 20-34;

12, pp. 11-13, 40-141; 21, pp. 11-16, 53-86; 49, pp. 11-16; 43, pp. 10-23) (see also Figure 5 of this HRS documentation record). The chain-of-custody records are provided in References 10, pp. 315, 332, 343, 361, 374, 389, 403, 419, 432, 444, 455, 466; 12, pp. 44-45, 77-78, 120; 43, p. 25; 53 pp. 1, 2; and 54, p. 1.

Table 22: Indoor Air Sample Descriptions – July 2015 through February 2018						
Property ID	Laboratory/ Sample ID	Sample Location	Volume of Air	Start Date and Time	End Date and Time	References
117	P1603961-013/ 117-2	Basement	6 liters	8/05/2016 ¹	8/06/2016 @07:20	12, pp. 12, 16, 76, 93
	P1603961-014/ 117-3	Kitchen		8/05/2016 ¹	8/06/2016 @07:19	12, pp. 12, 16, 76, 94
118	P1603961-020/ 118-2	Basement	6 liters	8/05/2016 ¹	8/06/2016 @08:00	12, pp. 12, 16, 76, 100
	P1603961-021/ 118-3	1 st Floor		8/05/2016 ¹	8/06/2016 @08:03	12, pp. 12, 16, 76, 101
	P1603961-022/ 118-3D	1 st Floor (duplicate)		8/05/2016 ¹	8/06/2016 @08:03	12, pp. 12, 16, 76, 102
124	P1603961-007/ 124-2	Basement	6 liters	8/04/2016 ¹	8/05/2016 @09:11	12, pp. 12, 17, 76, 87
125	7706-8/ 125-1	Basement	6 liters	2/19/2018 @ 10:39	2/20/2018 @ 10:24	49, pp. 15, 100; 54, p. 12
	7706-8-FD/ 125-1	Basement		2/19/2018 @ 10:39	2/20/2018 @ 10:24	49, pp. 15, 100; 54, p. 13
	7706-9/ 125-2	1 st Floor		2/19/2018 @ 10:36	2/20/2018 @ 10:22	49, pp. 15, 100; 54, p. 14
	7706-9-FD/ 125-2	1 st Floor		2/19/2018 @ 10:36	2/20/2018 @ 10:22	49, pp. 15, 100; 54, p. 15
130	7520-38/ 130-2	Basement	6 liters	08/22/2017 @13:13	8/23/2017 @13:14	49, pp. 13, 69
	7520-38-FD/ 130-2	Basement		08/22/2017 @13:13	8/23/2017 @13:14	49, pp. 13, 69
	7520-39/ 130-3	1 st Floor		08/22/2017 @13:13	8/23/2017 @13:14	49, pp. 13, 69
131	7280-43/ 131-2	Basement	6 liters	12/01/2016 @09:24	12/02/2016 @08:27	21, pp. 13, 20, 57, 71
	7280-44/ 131/3	Kitchen		12/01/2016 @09:20	12/02/2016 @08:28	21, pp. 13, 20, 57, 71
	7368-19/ 131-2	Basement		3/15/2017 @08:36	3/16/2017 @07:18	21, pp. 15, 20, 77, 83, 84
	7368-19-FD/ 131-2	Basement		3/15/2017 @08:36	3/16/2017 @07:18	21, pp. 15, 20, 77, 83, 84
	7368-20/ 131-3	Kitchen		3/15/2017 @08:38	3/16/2017 @07:19	21, pp. 15, 20, 77, 83, 84
	7520-44/ 131-2	Basement		8/22/2017 @ 15:27	8/23/2017 @ 15:23	49, pp. 13, 70
	7520-45/ 131-3	1 st Floor		8/22/2017 @ 15:24	8/23/2017 @ 15:26	49, pp. 13, 70
151	AC57013/ 150400	Basement	6 liters	7/13/2015 @11:02	7/14/2015 @09:45	10, pp. 20, 21, 23, 28, 29, 271, 291, 345, 351
	AC57014/ 153089	Living Room		7/13/2015 @10:53	7/14/2015 @09:42	10, pp. 20, 21, 23, 28, 29, 271, 291, 345, 352

Table 22: Indoor Air Sample Descriptions – July 2015 through February 2018						
Property ID	Laboratory/ Sample ID	Sample Location	Volume of Air	Start Date and Time	End Date and Time	References
153	AC57043/ 153123	Basement	6 liters	7/15/2015 @11:30	7/16/2015 @10:07	10, pp. 20, 21, 24, 30, 272, 299; 43, p. 4
	AC57044/ 153124	Living Room		7/15/2015 @11:37	7/16/2015 @10:09	10, pp. 20, 21, 24, 30, 272, 299; 43, p. 4
176	AC57036/ 153113	Basement	6 liters	7/15/2015 @10:18	7/16/2015 @09:16	10, pp. 20, 21, 24, 30, 31, 272, 297; 43, p. 4
	AC57037/ 153114	Living Room		7/15/2015 @10:18	7/16/2015 @09:15	10, pp. 20, 21, 24, 30, 31, 272, 297; 43, p. 4
177	P1603961-009/ 177-2	Basement	6 liters	8/03/2016 ¹	8/04/2016 @07:40	12, pp. 12, 18, 43, 56
	P1603961-010/ 177-3	1 st Floor		8/03/2016 ¹	8/04/2016 @07:39	12, pp. 12, 18, 43, 57
	7280-14/ 177-2	Basement		11/7/2016 @16:22	11/8/2016 @15:11	21, pp. 13, 22, 56, 63
	7280-14D/ 177-2D	Basement		11/7/2016 @16:22	11/8/2016 @15:11	21, pp. 13, 22, 56, 63
	7280-16/ 178-1	1 st Floor		11/7/2016 @16:20	11/8/2016 @15:13	21, pp. 13, 21, 56, 64
	7520-30/ 177-2	Basement		08/22/2017 @12:11	8/23/2017 @ 12:09	49, pp. 13, 69
	7520-31/ 177-3	1 st Floor		08/22/2017 @12:12	8/23/2017 @ 12:13	49, pp. 13, 69
180	7520-17/ 180-2	Basement	6 liters	8/14/2017 @15:31	8/15/2017 @15:20	49, pp. 13, 69
	7520-18/ 180-3	1 st Floor		8/14/2017 @15:33	8/15/2017 @15:20	49, pp. 13, 69
181	7280-2/ 181-2	Basement	6 liters	11/7/2016 @13:49	11/8/2016 @13:00	21, pp. 13, 23, 56, 60
	7280-3/ 181-3	Kitchen/ Living Area		11/7/2016 @13:52	11/8/2016 @13:04	21, pp. 13, 23, 56, 60
186	P1603961-016/ 186-2	Basement	6 liters	8/05/2016 ¹	8/06/2016 @07:43	12, pp. 12, 18, 76, 96
	P1603961-017/ 186-2D	Basement (duplicate)		8/05/2016 ¹	8/06/2016 @07:43	12, pp. 12, 18, 76, 97
	P1603961-018/ 186-3	Kitchen		8/05/2016 ¹	8/06/2016 @07:45	12, pp. 13, 18, 76, 98
	7368-25/ 186-2	Basement		3/15/2017 @12:32	3/16/2017 @12:48	21, pp. 15, 23, 24, 77, 85
	7368-26/ 186-3	Kitchen		3/15/2017 @12:33	3/16/2017 @12:49	21, pp. 15, 23, 24, 77, 86
191	7706-2/ 191-2	Basement	6 liters	2/19/2018 @09:10	2/20/2018 @08:53	49, pp. 16, 100
	7706-2-FD/ 191-2	Basement		2/19/2018 @09:10	2/20/2018 @08:53	49, pp. 16, 100
	7706-3/ 191-3	1 st Floor		2/19/2018 @09:11	2/20/2018 @08:55	49, pp. 16, 100
192	P1604058-006/ 192-2	Basement	6 liters	8/12/2016 ¹	8/13/2016 @10:33	12, pp. 13, 19, 119, 127
	P1604058-007/ 192-3	1 st Floor		8/12/2016 ¹	8/13/2016 @10:33	12, pp. 13, 19, 119, 128

Table 22: Indoor Air Sample Descriptions – July 2015 through February 2018						
Property ID	Laboratory/ Sample ID	Sample Location	Volume of Air	Start Date and Time	End Date and Time	References
	7280-10/ 192-2	Basement		11/7/2016 @15:54	11/8/2016 @14:33	21, pp. 13, 24, 56, 62
	7280-11/ 192-3	1 st Floor		11/7/2016 @15:56	11/8/2016 @14:36	21, pp. 13, 24, 56, 62
	7520-15/ 192-3	1 st Floor		8/14/2017 @14:20	8/15/2017 @14:09	49, pp. 14, 69
193	P1603935-003/ 193-3	Basement	6 liters	8/02/2016 ¹	8/03/2016 @13:51	12, pp. 13, 19, 43, 50
	P1603935-004/ 193-4	Kitchen		8/02/2016 ¹	8/03/2016 @13:51	12, pp. 13, 19, 43, 51
	7520-3/ 193-3	Basement		8/14/2017 @12:05	8/15/2017 @11:07	49, pp. 16, 69
	7520-4/ 193-4	1 st Floor		8/14/2017 @12:07	8/15/2017 @ 11:07	49, pp. 16, 69
	7705-16/ 193-3	Basement		1/24/2018 @11:23	1/25/2018 @11:03	49, pp. 16, 88
	7705-17/ 193-4	1 st Floor		1/24/2018 @11:25	1/25/2018 @11:06	49, pp. 16, 88
195	7520-24/ 195-2	Basement	6 liters	8/16/2017 @09:31	8/17/2017 @09:11	49, pp. 14, 69
213	7520-21/ 213-2	Basement	6 liters	8/14/2017 @16:08	8/15/2017 @ 15:56	49, pp 14, 69
	7520-22/ 213-3	1 st Floor		8/14/2017 @16:09	8/15/2017 @15:56	49, pp. 14, 69

Notes:

¹ Only end times were recorded for these samples along with beginning and ending pressures; however, all samples were 24-hours in duration (Ref. 12, pp. 11, 44, 45, 77, 78, 120).

ID Identification number

All sample results in Table 22 were compared with the highest background concentrations detected for each analyte and meet the criteria for a significant increase in accordance with Reference 1a, Section 5.2.0, General Considerations and HRS Table 2-3.

Eurofins Air Toxics Ltd. (Eurofins) analyzed the July 2015 air samples for VOCs using EPA Method TO-15 and in accordance with laboratory SOPs VOA-TO15 (Ref. 16, pp. 376, 390, 420). Eurofins utilized an independent validation in accordance with the EPA National Functional Guidelines for Organic Data Review and the analytical method (Ref. 10, pp. 318, 335, 346, 364, 377, 392, 406, 422, 435, 447, 458, 773, 803). ALS Environmental analyzed the August 2016 air samples for TCE, PCE, 1,1-DCE, *cis*-1,2-DCE, *trans*-1,2-DCE, VC and the fuel related VOCs benzene, toluene, ethylbenzene, and xylenes (BTEX) using EPA Method TO-15 and in accordance with laboratory SOPs VOA-TO15 (Ref. 12, pp. 13, 41, 74, 117). These analytical results were validated by Tetra Tech in accordance with the EPA National Functional Guidelines for Organic Data Review and the analytical method (Ref. 12, pp. 133- 141).

The EPA Region 7 laboratory analyzed the November/December 2016, March 2017, August 2017, January 2018, and February 2018 air samples for TCE, PCE, 1,1-DCE, *cis*-1,2-DCE, *trans*-1,2-DCE, VC and fuel related VOCs using EPA Region 7 RLAB Method 3230.4H (VOCs in Air samples in Canisters at Ambient Levels by GC/MS) (Refs. 21, pp. 54-58, 75-78; 49, pp. 67-71, 86-89, 98-101). These analytical results were reviewed and verified in accordance with procedures described in the Quality Manual (Refs. 21, pp. 54, 75; 49, pp. 67, 86, 98). The reporting limits (RL) are listed on the analytical data sheets in References 10, 12, 32, 33, 34, 51, and 52. For data generated by the EPA Region 7 Laboratory, each RL is sample-specific and corresponds to the lowest demonstrated level of acceptable quantitation; it is adjusted for preparation weights and volumes, and any dilutions performed and is sometimes called the sample quantitation limit (SQL) (Refs. 32, p. 1; 33, p. 1; 34, p. 1; 51, p. 1; 52, p. 1. ALS Environmental presents method reporting limits (MRL) which are the minimum quantity of a target analyte that can be confidently determined by the referenced method (Ref. 12, p. 48).

Table 23: Analytical Results for AOE 1 – 2015, 2016, 2017, and 2018 Indoor Air Samples					
Property ID	Laboratory/ Sample ID	Hazardous Substance	Concentration ($\mu\text{g}/\text{m}^3$)	RL ($\mu\text{g}/\text{m}^3$)	Reference
117	P1603961-013/ 117-2	PCE	3.4	0.13	12, p. 93
	P1603961-014/ 117-3	PCE	1.4	0.13	12, p. 94
118	P1603961-020/ 118-2	PCE	0.20	0.16	12, p. 100
	P1603961-021/ 118-3	PCE	0.21	0.17	12, p. 101
	P1603961-022/ 118-3D	PCE	0.21	0.15	12, p. 102
124	P1603961-007/ 124-2	TCE	0.18	0.17	12, p. 87
125	7706-8/ 125-1	TCE	7	0.27	52, p. 4
		PCE	7.9	0.34	52, p. 4
	7706-8FD/ 125-1	TCE	6.4	0.27	52, p. 4
		PCE	8	0.34	52, p. 4
	7706-9/ 125-2	TCE	2.3	0.27	52, p. 4
	7706-9-FD/ 125-2	TCE	2.2	0.27	52, p. 4
130	7520-38/ 130-2	TCE	0.29	0.27	49, p. 82; 34, p.12
	7520-38-FD/ 130-2	TCE	0.30	0.27	49, p. 82; 34, p. 13
	7520-39/ 130-3	TCE	0.29	0.27	49, p. 82; 34, p. 13

Table 23: Analytical Results for AOE 1 – 2015, 2016, 2017, and 2018 Indoor Air Samples					
Property ID	Laboratory/ Sample ID	Hazardous Substance	Concentration (µg/m ³)	RL (µg/m ³)	Reference
131	7280-43/ 131-2	PCE	7.0	0.88	21, p. 71; 32, p. 13
	7280-44/ 131/3	TCE	0.88	0.27	21, p. 71; 32, pp. 13,14
		PCE	7.6	0.34	
	7368-19/ 131-2	TCE	0.67	0.27	21, p. 83; 33, p. 4,5
		PCE	4.1	0.34	
	7368-19-FD/ 131-2	TCE	0.66	0.27	21, p. 84; 33, p. 5
		PCE	3.9	0.34	
	7368-20/ 131-3	TCE	0.62	0.27	21, p. 84; 33, p. 5
		PCE	4.8	0.37	
	7520-44/ 131-2	TCE	0.84	0.27	49, p. 84; 34, p. 14
		PCE	22	0.34	
151	AC57013/ 150400	TCE	0.21	0.20	10, p. 351
		TCE	0.21	0.21	10, p. 352
153	AC57043/ 153123	TCE	3.9	0.20	10, p. 326; 43, p. 18
		VC	0.47	0.047	
	AC57043/ 153123	TCE	1.9	0.15	10, p. 326; 43, p. 20
176	AC57036/ 153113	TCE	0.25	0.18	10, p. 297; 43, p. 10
	AC57037/ 153114	TCE	0.27	0.18	10, p. 297; 43, p. 12
177	P1603961-009/ 177-2	PCE	4.6	0.14	12, p. 56
	P1603961-010/ 177-3	PCE	4.7	0.15	12, p. 57
	7280-14/ 177-2	PCE	2.2	0.34	21, p. 63; 32, p. 5
	7280-14D/ 177-2D	PCE	2.2	0.34	21, p. 63; 32, p. 5
	7280-16/ 178-1	PCE	2.2	0.34	21, p. 64; 32, p. 6
		TCE	0.30	0.27	49, p. 80; 34, p. 10
	7520-30/ 177-2	PCE	3.9	0.34	
		TCE	0.30	0.27	49, p. 80; 34, p. 10
180	7520-17/ 180-2	TCE	7.9	0.27	
		PCE	8.4	0.34	
	7520-18/ 180-3	TCE	0.89	0.27	49, p. 10; 34, p. 6
181	7280-2/ 181-2	TCE	6.7	0.27	21, p. 60; 32, p. 1,2
	7280-3/ 181-3	TCE	4.0	0.27	21, p. 60; 32, p. 2
		PCE	5.2	0.34	

Table 23: Analytical Results for AOE 1 – 2015, 2016, 2017, and 2018 Indoor Air Samples					
Property ID	Laboratory/ Sample ID	Hazardous Substance	Concentration (µg/m ³)	RL (µg/m ³)	Reference
186	P1603961-016/ 186-2	TCE	0.18	0.17	12, p. 96
		PCE	0.62	0.17	
	P1603961-017/ 186-2D	PCE	0.37	0.22	12, p. 97
	P1603961-018/ 186-3	PCE	0.29	0.13	12, p. 98
186	7368-25/ 186-2	TCE	0.35	0.27	21, p. 85; 33, p. 6
	7368-26/ 186-3	TCE	0.29	0.27	21, p. 86; 33, p. 6
191	7706-2/ 191-2	PCE	0.85	0.34	52, p.1
	7706-2-FD/ 191-2	PCE	0.91	0.34	52, pp. 1-2
	7706-3/ 191-3	PCE	0.46	0.34	52, p. 2
192	P1604058-006/ 192-2	PCE	0.70	0.16	12, p. 127
	P1604058-007/ 192-3	PCE	0.71	0.16	12, p. 128
	7520-15/ 192-3	PCE	0.69	0.34	49, p. 75; 34, p. 5
193	P1603935-003/ 193-3	PCE	2.5	0.18	12, p. 50
	P1603935-003/ 193-3	PCE	2.5	0.16	12, p. 51
	7520-3/ 193-3	TCE	0.85	0.27	49, p. 72; 34, pp. 1, 2
	7520-4/ 193-4	TCE	0.74	0.27	49, p. 72; 34, p. 2
	7705-16/ 193-3	PCE	1.1	0.34	49, p. 94; 51, p. 5
		TCE	2.4	0.27	
	7705-17/ 193-4	PCE	0.88	0.34	49, p. 94; 51, p. 6
		TCE	1.4	0.27	
195	7520-24/ 195-2	TCE	0.38	0.27	49, p. 78; 34, p. 8
213	7520-21/ 213-2	TCE	0.53	0.27	49, p. 77; 34, p. 9
	7520-22/ 213-3	TCE	0.53	0.27	49, p. 77; 34, p. 9

Notes:

ID Identification number
µg/m³ Micrograms per cubic meter
PCE Tetrachloroethene
RL Reporting limit.
TCE Trichloroethene
VC Vinyl chloride

Attribution

From 1939 until approximately 2005 the Sporlan Valve Plant produced valves for the refrigeration industry. The plant was an 80,000-square-foot brick building on a concrete slab, and was demolished in 2011. The building was constructed in 1939, with continuous expansion through 1968. The plant continued to operate at the 611 E. Seventh Street location until approximately 2005. Exact date of plant closure is unknown (Ref. 10, p. 7). The site lies within a primarily residential neighborhood, with single-family homes surrounding the site in every direction. Additionally, no environmental concerns regarding these residential properties were found, and an environmental regulatory agency database search conducted as part of a phase I environmental site assessment did not identify any facilities that were found to pose environmental concerns to the site (Ref. 9, pp. 6, 11, 12).

Operations at the plant included plating, degreasing, machining, brazing, assembling, and testing. Degreasing operations included use of the chlorinated solvent TCE. Over the course of the facility's manufacturing history, three ASTs, ranging in size from 200 to 2,000 gallons, were used to store TCE for the plant's degreasing processes (Ref. 9, p. 6). The 2,000-gallon AST was north of the former manufacturing building and positioned on a concrete pad with no secondary containment. An unknown amount of TCE and other CVOCs were released from the former valve factory for an unknown period of time (Ref. 18, p. 5).

Shallow soils at the ASC and AOE belong to the Menfro silt loam series which consist of very deep, well drained, moderately permeable soils on uplands and high terraces that are formed in thick deposits of loess (Refs. 46, pp 1-5; 47, p. 92). Menfro silt loams are 22 to 29 percent clays and have a hydraulic conductivity of 3×10^{-4} to 9×10^{-4} cm/sec (Ref. 10, p. 14). Previous drilling investigations conducted on the Sporlan Valve property and south of the property identified bedrock refusal to range between 6.5 (at MW-1) and 49 feet bgs (at MW-12) (Refs. 7, pp. 24, 25, 36; 15, pp. 11, 12, 173).

Numerous soil sampling events documented in Section 2.2.1 of this documentation record have identified TCE in subsurface soil at the identified source area (See Figure 3 and Table 3 of the HRS documentation record). TCE concentrations in soil ranged from 13 µg/kg to 27,000 µg/kg (Ref. 26, pp. 10, 15). Other CVOCs positively identified in the soil samples included PCE, 1,1-DCE, *trans*-1,2-DCE, *cis*-1,2-DCE, and VC (Ref. 8, pp. 8, 9, 10, 12; 25, pp. 4-9; 26, pp. 4-13; 28, pp. 1-40; 43, pp. 10-23; 49, pp. 1-16; 50, pp. 1-9).

Groundwater infiltration issues have been documented in basements of at least two properties (i.e., 606 MacArthur Street [Property ID 120] and 608 MacArthur Street [Property ID 125]) east of the site (Refs. 22, pp. 16-17; 24, pp. 13, 16-17). According to the MDNR SI/RSE, previous investigations at the Sporlan Valve property and surrounding properties identified shallow groundwater at approximately 8 feet below residential basement elevations along 7th Street. Review of historic monitoring well data at MW-7 (located south of 7th Street) show observed temporal variability in groundwater depths, which

range nearly ± 7 feet. Therefore, groundwater surface and hazardous vapors may periodically be within a few feet of most basements at houses along 7th Street (Ref. 10, pp. 14-15).

Analytical data for groundwater collected from the monitoring well network has revealed a TCE-dominant plume migrating south-southeast from the former Sporlan Valve property, and is attributable to the historical use of TCE at the Sporlan Valve facility (Ref. 22, p. 26; Ref. 9, p. 10) (see Section 3.1.1 and Table 14 of this documentation record). TCE has been detected in water samples collected from every monitoring well installed to characterize groundwater (see Figure 4 and Table 14 of this documentation record). As shown in Figure 4, these wells are dispersed throughout the neighborhood.

Existing groundwater data indicate migration of TCE-contaminated shallow groundwater to the south and east, downgradient of the Sporlan Valve property, with upgradient background samples revealing no such contamination (Ref. 16, pp 10-11, 19, 22, 30-31, 34). Additional subsurface soil gas and VI sampling events conducted by Gore, MDNR, and Tetra Tech START have further delineated a VOC plume beneath the site and at least 39 nearby residential properties. Indoor air samples collected during these events identified 19 regularly-occupied residential structures with VOC concentrations that constitute observed exposures to residents (see Table 23 above) (Refs. 10, pp. 27-31; 12, pp. 16-20; 21, pp. 18-28; 29, pp. 1-19; 43, pp. 10-23; 49, pp. 1-16; 50, pp. 1-9). Concentrations of TCE, PCE, and vinyl chloride in sub-slab vapor samples are up to several orders of magnitude greater than concentrations in indoor air samples (Refs. 10, pp. 27-31; 12, pp. 16-20; 21, pp. 18-28; 29, pp. 1-19; 43, pp. 10-23; 49, pp. 1-16; 50, pp. 1-9). Additionally, outdoor ambient air samples collected during these events revealed minimal detections of site-related contaminants; therefore, VOCs in indoor air were attributed to the site source area (Refs. 10 p. 31; 12, pp. 35, 37, 38; 21, pp. 39, 41, 42, 43). Based on sub-slab and indoor air sampling results, it was concluded that cracks, crevices, pipe penetrations, and holes in the concrete floors; cracks in the basement walls; pits and trenches; process sewer lines; and floor drains are preferential pathways for migration of CVOC vapors into the residences via subsurface intrusion. Indoor air quality surveys conducted by Environ, MDNR, and Tetra Tech did not identify any household products that would cause anthropogenic sources of CVOCs in indoor air (Refs. 10, pp. 169-252; 24, pp. 23-97; 48, pp. 1-60).

Hazardous Substances in the Release

TCE
PCE
Vinyl chloride

Structure Containment

AOE 1 consists of 32 regularly occupied structures in which indoor air is contaminated with, or inferred to be contaminated with, TCE, PCE, and vinyl chloride at concentrations greater than three times the designated background levels or at concentrations greater than the corresponding SQLs (see Figure 5 of this HRS documentation record). All residences sampled within AOE 1 are regularly occupied structures

with no subunits (see Table 18 of this documentation record). Preferential pathways for subsurface intrusion into these regularly occupied structures include cracks, crevices, holes, pits, and floor drains in unsealed concrete floors and walls of the basements (Refs. 10, pp. 169-252; 24, pp. 23-97; 48, pp. 1-60). Table 24 below provides structure containment values for each regularly occupied structure within AOE 1. In the table below, if a structure showed evidence of observed exposure as presented in Tables 22 and 23 of this documentation record, a containment value of 10 was assigned (Ref. 1a, Table 5-12). If the regularly occupied structure had no visible open preferential pathway, a value of 4 was assigned (Ref. 1a, Table 5-12).

Table 24: Containment Values and Square Footage for Evaluated Structures				
Location ID	Address	Approximate Square Footage	Structure Containment Value	Reference
117	704 MacArthur Street	850	10	24, p. 23; 48, pp. 2, 3
118	706 MacArthur Street	900	10	24, p. 29; 48, pp. 6, 7
124	606 MacArthur Street	960	10	48, pp. 10-11
125	608 MacArthur Street	1,000	10	50, pp. 7-8
129	548 E. 6 th Street	1,100	4	10, pp. 176-182
130	546 E. 6 th Street	930	10	48, pp. 14-16
131	544 E. 6 th Street	1,200	10	48, pp. 17-18
143	700 MacArthur Street	1,400	4	1a, Section 5.2.1.1.2.1
144	702 MacArthur Street	1,200	4	24, p. 35; 1a, Section 5.2.1.1.2.1
145	628 E. 7 th Street	1,300	4	24, p. 41; 1a, Section 5.2.1.1.2.1
146	626 E. 7 th Street	1,634	4	24, p. 47; 1a, Section 5.2.1.1.2.1
147	624 E. 7 th Street	1,200	4	1a, Section 5.2.1.1.2.1
148	622 E. 7 th Street	1,000	4	1a, Section 5.2.1.1.2.1
149	620 E. 7 th Street	1,000	4	24, p. 53; 1a, Section 5.2.1.1.2.1
150	618 E. 7 th Street	1,100	4	1a, Section 5.2.1.1.2.1
151	616 E. 7 th Street	1,100	2	10, pp. 204 - 207
152	614 E. 7 th Street	1,100	4	24, p. 65; 1a, Section 5.2.1.1.2.1
153	612 E. 7 th Street	750	2	24, pp. 70, 73
165	798 MacArthur Street	1,300	4	1a, Section 5.2.1.1.2.1
172	629 E. 8 th Street	1,500	4	1a, Section 5.2.1.1.2.1
176	615 E. 8 th Street	1,400	10	10, pp. 225 - 227
177	617 E. 8 th Street	1,100	10	48, pp. 29 - 31
178	619 E. 8 th Street	1,400	10	48, p. 33 - 35
179	621 E. 8 th Street	1,000	10	24, p. 88
180	623 E. 8 th Street	1,100	4	1a, Section 5.2.1.1.2.1
181	625 E. 8 th Street	960	10	24, p. 93
182	627 E. 8 th Street	1,600	10	48, p. 37, 38
186	624 E. 8 th Street	1,500	10	48, pp. 41 - 43

Table 24: Containment Values and Square Footage for Evaluated Structures				
Location ID	Address	Approximate Square Footage	Structure Containment Value	Reference
191	803 Schaper Avenue	2,300	4	1a, Section 5.2.1.1.2.1
192	620 E. 8 th Street	1,400	10	48, p. 47
193	616 E. 8 th Street	1,500	10	48, p. 49, 50
194	614 E. 8 th Street	1,600	10	48, p. 56
195	612 E. 8 th Street	1,120	10	48, pp. 57 - 58
213	802 MacArthur Street	1,000	4	1a, Section 5.2.1.1.2.1

Hazardous Waste Quantity

Table 25: Hazardous Waste Quantity		
Area of Observed Exposure Number	Total Indoor Area (square feet)	Reference
1	41,504	Table 24

AOE 1 includes 32 regularly occupied structures within a 6.95-acre area near the former Sporlan Valve property that contain elevated concentrations of TCE, PCE, and vinyl chloride in indoor air (see Tables 23 and 24 of this HRS documentation record). Approximate square footage of each regularly occupied structure is provided in Table 24 above.

Sum of values/13 (A/13): 3,193
Equation for Assigning Value (Ref. 1a, Table 5-19)

AOE Hazardous Waste Quantity Value: 100
(Ref. 1a, Table 2-6)

Area of Subsurface Contamination

Letter by which this area is to be identified: A

Name of ASC: ASC A is the 8.41-acre area encompassing 5 regularly occupied structures (see Figure 5 of this HRS documentation record)

Location and delineation of ASC A (see Figure 5 of this HRS documentation record):

The ASC consists of 5 regularly occupied structures (see Figure 5 of this HRS documentation record). The ASC was delineated based on analytical results from sub-slab soil gas samples collected beneath regularly occupied structures during the MDNR SI/RSE, Tetra Tech START ISA, and associated quarterly VI sampling events from July 2015 to February 2018 (Refs. 10, pp. 20-34; 12, pp. 40-141; 21, pp. 53-86; 29, pp. 6-19; 49, pp. 1-12; 50, pp. 1-9). Structures to be evaluated as part of ASC A only include regularly occupied buildings that were found to have underlying subsurface contamination, and are not included within the AOE.

Observed Release

Background Samples

Outdoor air samples collected from locations throughout the ASC were used to represent background concentrations, because each regularly occupied structure is ventilated with ambient air (Refs. 10, pp. 169-252; 24, pp. 23-97; 48, pp. 1-60). TCE and PCE are solvents that are not naturally occurring substances, and vinyl chloride is a breakdown product of TCE and PCE (Refs. 44 and 45, pp. 1, 3).

Outdoor ambient air samples listed in Table 20 were collected by MDNR and Tetra Tech during each VI sampling event (Refs. 10, p. 22; 12, pp. 35, 38; 21, pp. 48, 50, 52; 49, pp. 12-16). These samples were

collected from locations throughout the AOE in yards of regularly occupied structures. Table 21 above provides descriptions for background samples.

Background Concentrations

Concentrations of the VOCs presented in Table 22 are used to establish background levels for ASC 1 (Refs. 33 pp. 23, 24, 25; 34, pp. 31 to 36). Eurofins analyzed the July 2015 air samples for VOCs using EPA Method TO-15 and in accordance with laboratory SOPs VOA-TO15 (Ref. 16, p. 376, 390, 420). Eurofins utilized an independent validation in accordance with the EPA National Functional Guidelines for Organic Data Review and the analytical method (Ref. 10, pp. 318, 335, 346, 364, 377, 392, 406, 422, 435, 447, 458, 773, 803). RLs are listed on analytical data sheets in References 10, 32, 34, 51, and 52. Each RL is sample-specific and corresponds to the lowest demonstrated level of acceptable quantitation; it is adjusted for preparation weights and volumes, and any dilutions performed.

Contaminated Samples – Establishing ASC 1

The sub-slab soil gas samples listed in Table 26 were collected by Environ in February 2015 and Tetra Tech START in November 2016, August 2017, and February 2018. The sub-slab soil gas samples were collected from ports in the basements of residences within ASC 1 (see Table 27 below)(see also Figure 6 of this HRS documentation record). The chain-of-custody records are provided in References 16, 21, 29, and 54.

Table 26: Background Sample Descriptions						
Property ID	Laboratory Sample ID	Sample Location	Volume of Air	Start Date and Time	End Date and Time	References
156	1502252A-01A	Sub-slab Basement	6 liters	Not reported	2/9/2015 @10:15	16, pp. 4, 26, 39, 138-140, 162; 49, p. 36
	1502252A-02A			Not reported	2/9/2015 @11:22	
	1502252A-03A			Not reported	2/9/2015 @11:22	
175	7280-22	Sub-slab Basement	6 liters	11/11/2016 @12:00	11/12/2016 @11:16	21, pp. 13, 21, 56, 65
	7520-46			8/31/2017 @16:53	9/1/2017 @16:21	49, pp. 13, 44, 70
185	7706-5	Sub-slab Basement	6 liters	2/19/2018 @09:40	2/20/2018 @09:18	49, pp. 15, 55, 100
	7706-5-FD			2/19/2018 @09:40	2/20/2018 @09:18	

Notes:

~ Approximately
ID Identification number

Contaminated Concentrations – Establishing ASC A

The sub-slab soil gas samples listed in Table 27 were collected by Environ in February 2015 and Tetra Tech START in November 2016, August 2017, and February 2018. The sub-slab soil gas samples were collected from ports in the basements of residences within ASC-A (Refs. 16, 21, and 50) (see also Figure 5 of this HRS documentation record). The chain-of-custody records are provided in References 16, 21, 29, and 54. RLs are listed on analytical data sheets in References 10, 32, 34, 51, and 52. Each RL is sample-specific and corresponds to the lowest demonstrated level of acceptable quantitation; it is adjusted for preparation weights and volumes, and any dilutions performed.

Table 27: Analytical Results for ASC 1 – 2015, 2016, 2017, and 2018 Soil Gas Samples					
Property ID	Laboratory Sample ID	Hazardous Substance	Concentration (µg/m³)	RL (µg/m³)	Reference
156	1502252A-01A	TCE	0.68	0.18	16, pp. 4, 26, 138
		PCE	0.53	0.23	
	1502252A-02A	PCE	2.8	0.21	16, pp. 4, 26, 139
	1502252A-03A	PCE	2.8	0.21	16, pp. 4, 26, 140
175	7280-22	PCE	0.77	0.34	21, pp. 13, 21, 65; 32 p. 7
	7520-46	PCE	0.68U	0.34	29, pp. 4, 18; 34, p. 15
185	7706-5	PCE	9.9	0.34	49, pp. 100, 103; 52, p. 2
	7706-5-FD	PCE	9.4	0.34	

Notes:

ID Identification number
µg/m³ Micrograms per cubic meter
PCE Tetrachloroethene

RL	Reporting limit. The RLs is the laboratory's reporting limit for that analyte with any dilution factor, volume adjustment, or percent solids for that sample analysis taken into account and is sometimes called the sample quantitation limit, SQL (Refs. 32, p. 1; 34, p. 1; 52, p. 1).
TCE	Trichloroethene

Attribution

From 1939 until approximately 2005 the Sporlan Valve Plant produced valves for the refrigeration industry. The plant was an 80,000-square-foot brick building on a concrete slab, and was demolished in 2011. The building was constructed in 1939, with continuous expansion through 1968. The plant continued to operate at the 611 E. Seventh Street location until approximately 2005. Exact date of plant closure is unknown (Ref. 10, p. 7). The site lies within a primarily residential neighborhood, with single-family homes surrounding the site in every direction. Additionally, no environmental concerns regarding these residential properties were found, and an environmental regulatory agency database search conducted as part of a phase I environmental site assessment did not identify any facilities that were found to pose environmental concerns to the site (Ref. 9, pp. 6, 11, 12).

Operations at the plant included plating, degreasing, machining, brazing, assembling, and testing. Degreasing operations included use of the chlorinated solvent TCE. Over the course of the facility's manufacturing history, three ASTs, ranging in size from 200 to 2,000 gallons, were used to store TCE for the plant's degreasing processes (Ref. 9, p. 6). The 2,000-gallon AST was north of the former manufacturing building and positioned on a concrete pad with no secondary containment. An unknown amount of TCE and other CVOCs were released from the former valve factory for an unknown period of time (Ref. 18, p. 5).

Shallow soils at the ASC and AOE belong to the Menfro silt loam series which consist of very deep, well drained, moderately permeable soils on uplands and high terraces that are formed in thick deposits of loess (Refs. 46, pp 1-5; 47, p. 92). Menfro silt loams are 22 to 29 percent clays and have a hydraulic conductivity of 3×10^{-4} to 9×10^{-4} cm/sec (Ref. 10, p. 14). Previous drilling investigations conducted on the Sporlan Valve property and south of the property identified bedrock refusal to range between 6.5 (at MW-1) and 49 feet bgs (at MW-12) (Refs. 7, pp. 24, 25, 36; 15, pp. 11, 12, 173).

Numerous soil sampling events documented in Section 2.2.1 of this documentation record have identified TCE in subsurface soil at the identified source area (See Figure 3 and Table 3 of the HRS documentation record). TCE concentrations in soil ranged from 13 µg/kg to 27,000 µg/kg (Ref. 26, pp. 10, 15). Other CVOCs positively identified in the soil samples included PCE, 1,1-DCE, *trans*-1,2-DCE, *cis*-1,2-DCE, and VC (Ref. 8, pp. 8, 9, 10, 12; 25, pp. 4-9; 26, pp. 4-13; 28, pp. 1-40; 43, pp. 10-23; 49, pp. 1-16; 50, pp. 1-9).

According to the MDNR SI/RSE, previous investigations at the Sporlan Valve property and surrounding properties identified shallow groundwater at approximately 8 feet below residential basement elevations along 7th Street. Review of historic monitoring well data at MW-7 (located south of 7th Street) show

observed temporal variability in groundwater depths, which range nearly ± 7 feet. Therefore, groundwater surface and hazardous vapors may periodically be within a few feet of most basements at houses along 7th Street (Ref. 10, pp. 14-15).

Analytical data for groundwater collected from the monitoring well network has revealed a TCE-dominant plume migrating south-southeast from the former Sporlan Valve property, and is attributable to the historical use of TCE at the Sporlan Valve facility (Ref. 22, p. 26; Ref. 9, p. 10) (see Section 3.1.1 and Table 14 of this documentation record). TCE has been detected in water samples collected from every monitoring well installed to characterize groundwater (see Figure 4 and Table 14 of this documentation record). As shown in Figure 4, these wells are dispersed throughout the neighborhood.

Existing groundwater data indicate migration of TCE-contaminated shallow groundwater to the south and east, downgradient of the Sporlan Valve property, with upgradient background samples revealing no such contamination (Ref. 16, pp 10-11, 19, 22, 30-31, 34). Additional subsurface soil gas and VI sampling events conducted by Gore, MDNR, and Tetra Tech START have further delineated a VOC plume beneath the site and at least 39 nearby residential properties.

Structure Containment

For HRS scoring purposes, the ASC is currently defined as an 8.41-acre area that underlies 5 regularly occupied structures (see Figure 6 of this HRS documentation record). Table 28 below provides structure containment values and approximate square footages for each regularly occupied structure within ASC 1. Where square footage of the structure is unknown, an area of 1,740 square feet is used (Ref. 1a, Section 5.2.1.2.2). If containment is unknown, a value of greater than zero (>0) is assigned (Ref. 1a, Section 5.2.1.1.2.1).

Table 28: Containment Values and Square Footage for Evaluated Structures				
Location ID	Address	Approximate Square Footage	Structure Containment Value	Reference
154	610 E. 7 th Street	850	2	24, pp. 76
155	608 E. 7 th Street	1,740	>0	1a, Section 5.2.1.1.2.1
156	604 E. 7 th Street	1,740	>0	1a, Section 5.2.1.1.2.1
175	613 E. 8 th Street	1,740	>0	1a, Section 5.2.1.1.2.1
185	806 Schaper Avenue	1,740	>0	1a, Section 5.2.1.1.2.1

Hazardous Waste Quantity – Tier D

Table 29: Hazardous Waste Quantity		
Area of Subsurface Contamination Number	Total Indoor Area (square feet)	Reference
1	7,810	Table 30

For HRS scoring purposes, the ASC is currently defined as an 8.41-acre area that underlies 40 regularly occupied structures (see Figure 5 of this HRS documentation record). The ASC was delineated based on analytical results from sub-slab soil gas samples collected beneath regularly occupied structures during the MDNR SI/RSE, Tetra Tech START ISA, and associated quarterly VI sampling events from July 2015 to February 2018 (Refs. 10, pp. 20-34; 12, pp. 40-141; 21, pp. 53-86; 49, pp 11-16, 36, 37). Sub-slab soil vapor samples that meet observed release criteria were used to delineate ASC 1 (see Tables 26 and 27 of this HRS documentation record). In accordance with Section 5.2.0, General Considerations, of the HRS Rule, regularly occupied structures with documented to be underlain by contamination, but are not subject to Level I or II criteria, are included in ASC A (see also Figure 5 of this HRS documentation record). Approximate square footage of all regularly occupied structures in ASC 1 is provided in Table 29 above. Because an observed exposure has been documented at this site, a minimum hazardous waste quantity value of 100 is assigned.

Sum of values/13 (A/13): 600.77
Equation for Assigning Value (Ref. 1a, Table 5-19)

ASC Hazardous Waste Quantity Value: 100
(Ref. 1a, Table 2-6)

Summary of AOE and ASC

AOE Number /ASC Letter	Hazardous Waste Quantity Value	Hazardous Constituent Quantity Complete? (Y/N)
AOE 1	3,193	No
ASC A	600.77	No

5.2.1 SUBSURFACE INTRUSION COMPONENT

5.2.1.1 LIKELIHOOD OF EXPOSURE

5.2.1.1.1 Observed Exposure

Table 30: Chemical Analysis			
Location ID	Laboratory Sample ID	Hazardous Substance	Reference
117	P1603961-013	PCE	12, p. 93
	P1603961-014	PCE	12, p. 94
118	P1603961-020	PCE	12, p. 100
	P1603961-021	PCE	12, p. 101
	P1603961-022	PCE	12, p. 102
124	P1603961-007	TCE	12, p. 87
125	7706-8	TCE	52, p. 4
	7706-8	PCE	52, p. 4
	7706-8-FD	TCE	52, p. 4
	7706-8-FD	PCE	52, p. 4
	7706-9	TCE	52, p. 4
	7706-9-FD	TCE	52, p. 4
130	7520-38	TCE	49, p. 82; 34, p.12
	7520-38-FD	TCE	49, p. 82; 34, p. 13
	7520-39	TCE	49, p. 82; 34, p. 13
131	7280-43	PCE	21, p. 71; 32, p. 13
	7280-44	TCE	21, p. 71; 32, pp. 13,14
		PCE	
	7368-19	TCE	21, p. 83; 33, p. 4,5
		PCE	
	7368-19-FD	TCE	21, p. 84; 33, p. 5
		PCE	
	7368-20	TCE	21, p. 84; 33, p. 5
		PCE	
	7520-44	TCE	49, p. 84; 34, p. 14
		PCE	
	7520-45	TCE	49, p. 84; 34, p. 15
		PCE	
151	AC57013	TCE	10, p. 351
	AC57014	TCE	10, p. 352
153	AC57043	TCE	10, p. 326; 43, p. 18
		VC	
	AC57044	TCE	10, p. 326; 43, p. 20
		VC	
176	AC57036	TCE	10, p. 297; 43, p. 10
	AC57037	TCE	10, p. 297; 43, p. 12
177	P1603935-009	PCE	12, p. 56
	P1603935-010	PCE	12, p. 57
	7280-14	PCE	21, p. 63; 32, p. 5
	7280-14-FD	PCE	21, p. 63; 32, p. 5
	7280-16	PCE	21, p. 64; 32, p. 6
177	7520-30	TCE	49, p. 80; 34, p. 10

Table 30: Chemical Analysis			
Location ID	Laboratory Sample ID	Hazardous Substance	Reference
	7520-31	PCE	49, p. 80; 34, p. 10
		TCE	
		PCE	
178	7520-6	PCE	34, p. 2
	7520-7	PCE	34, pp. 2-3
180	7520-17	TCE	49, p. 76; 34, p. 6
		PCE	
	7520-18	TCE	49, p. 10; 76, p. 6
181	7280-2	TCE	21, p. 60; 32, p. 1,2
	7280-3	TCE	21, p. 60; 32, p. 2
		PCE	
186	P1603961-016	TCE	12, p. 96
		PCE	
	P1603961-017	PCE	12, p. 97
	P1603961-018	TCE	12, p. 98
		PCE	
	7368-25	TCE	21, p. 85; 33, p. 6
191	7706-2	PCE	52, p.1
	7706-2-FD	PCE	52, pp. 1-2
	7706-3	PCE	52, p. 2
192	P1604058-006	PCE	12, p. 127
	P1604058-007	PCE	12, p. 128
	7520-15	PCE	49, p. 75; 34, p. 5
193	P1603935-003	PCE	12, p. 50
	P1603935-004	PCE	12, p. 51
	7520-3	TCE	49, p. 72; 34, pp. 1, 2
	7520-4	TCE	49, p. 72; 34, p. 2
	7705-16	TCE	49, p. 94
	7705-17	TCE	49, p. 94
195	7520-24	TCE	29, p. 12; 34, p. 8
213	7520-21	TCE	29, p. 7; 34, p. 9
	7520-22	TCE	29, p. 7; 34, p. 9

Notes:

ID Identification number
PCE Tetrachloroethylene
TCE Trichloroethylene
VC Vinyl chloride

5.2.1.2 WASTE CHARACTERISTICS

5.2.1.2.1 Toxicity/Degradation

Toxicity values for the hazardous substances detected in the area of observed exposure and area of subsurface contamination samples are summarized in Table 31.

Table 31: Subsurface Intrusion Toxicity					
Hazardous Substance	AOE Number	Toxicity Factor Value	Degradation	Toxicity/Degradation	Reference
Tetrachloroethene	1	100	1	100	3, p. 8; Ref. 1a, Section 5.2.1.2.1
Trichloroethene	1	1,000	1	1,000	3, p. 10; Ref. 1a, Section 5.2.1.2.1
Vinyl chloride	1	10,000	1	10,000	3, p. 10; Ref. 1a, Section 5.2.1.2.1

For the subsurface intrusion component, vinyl chloride has the highest toxicity/degradation factor value of 10,000 (Ref. 1a, Section 5.2.1.2.1.3). This hazardous substance meets the criteria for observed exposure (see Tables 20 and 22 of this HRS documentation record); therefore, a degradation factor value of 1 was assigned (Ref. 1a, Section 5.2.1.2.1.2).

Toxicity/Degradation Factor Value: 10,000
(Ref. 1a, Section 5.2.1.2.1.3)

5.2.1.2.2 Hazardous Waste Quantity

Table 32: Hazardous Waste Quantity	
Area of Observed Exposure Number	Hazardous Waste Quantity Based on Total Indoor Area within AOE
1	3,331

AOE 1 consists of 32 regularly occupied structures that contain elevated concentrations of TCE, PCE, and vinyl chloride in indoor air (Refs. 10, pp. 20-34; 12, pp. 40-141; 21, pp. 53-86; 29, pp. 6-19; 43, pp. 10-23; 49, pp. 1-16; 50, pp. 1-9) (see Tables 22 and 23 of this HRS documentation record). Approximate square footage of each regularly occupied structure is provided in Table 24 above. As specified in Reference 1a, Section 2.4.2.2, a minimum HWQ factor value of 100 was assigned because targets associated with the subsurface intrusion component of the soil exposure and subsurface intrusion pathway are subject to actual contamination at Level I concentrations (Ref. 1a, Section 2.4.2.2, pp. 27, 28).

Hazardous Waste Quantity Factor Value: 100
(Ref. 1a, Table 2-6)

5.2.1.2.3 Calculation of Waste Characteristics Factor Category Value

For the waste characteristics, vinyl chloride has the highest toxicity/degradation factor value of 10,000 (Ref. 3). The waste characteristics factor category was obtained by multiplying the toxicity/degradation and HWQ factor values. Based on this product, a value was assigned in accordance with Reference 1, Table 2-7.

Toxicity/Degradation Factor Value (see Section 5.2.1.2.1 of this HRS documentation record): 10,000
Hazardous Waste Quantity Factor Value: 100

Toxicity/Degradation Factor Value ×
Hazardous Waste Quantity Factor Value: 1×10^6

Waste Characteristics Factor Category Value: 32
(Ref. 1a, Table 2-7)

5.2.1.3 TARGETS

AOE 1 is comprised of 32 regularly occupied structures, and is encompassed by ASC A. VI field forms completed by Environ, MDNR, and Tetra Tech during sampling events include occupants per household (Refs. 10, pp. 169-252; 24, pp. 23-97; 48, pp. 1-60). However, if resident information was not available for assessed structures, 2017 U.S. Census Bureau data were used, which estimates that there are 2.52 residents per household in Franklin County, Missouri (Ref. 39, p. 1).

5.2.1.3.1 Exposed Individual

AOE Number: 1

Sample ID: 7520-17

Hazardous Substance: TCE

Hazardous Substance Concentration: 7.9 $\mu\text{g}/\text{m}^3$

Benchmark Concentration: 0.4 $\mu\text{g}/\text{m}^3$

Level of Contamination: Level I

References: 29, p. 10; 10, p. 25

Exposed Individual Factor Value: 50

5.2.1.3.2 Population

The indoor air samples listed in Table 20 were collected by MDNR in July 2015 and Tetra Tech START in August 2016, November/December 2016, March 2017, August 2017, January 2018, and February 2018 (see also Figure 5 of this HRS documentation record).

5.2.1.3.2.1 Level I Concentrations

Level I Concentrations

The indoor air samples listed in Table 20 were collected by MDNR in July 2015, and by Tetra Tech START in August 2016, November/December 2016, March 2017, August 2017, January 2018, and February 2018 (see also Figure 5 of this HRS documentation record). Eurofins analyzed the July 2015 samples for MDNR, ALS analyzed the August 2016 samples for Tetra Tech START, and the EPA Region 7 laboratory analyzed samples from the November/December 2016 through February 2018 sampling events (Refs. 10, p. 25; 12 p. 13; 21 pp. 14-15; 29 p. 1; 49, pp. 1-12; 50, pp. 1-9). All indoor air samples were analyzed using EPA Method TO-15 and in accordance with laboratory SOP VOA-TO15 (Refs. 10, p. 25; 12 p. 13; 21 pp. 14-15; 29 p. 1; 49, pp. 1-12; 50, pp. 1-9). Eurofins utilized an independent validation, and Tetra Tech START provided a Level II data validation for the ALS data – each validation was in accordance with the EPA National Functional Guidelines for Organic Data Review and the analytical method (Refs. 10, pp. 318, 335, 346, 364, 377, 392, 406, 422, 435, 447, 458, 773, 803; 12, pp. 133). The following table provides regularly occupied residences where indoor air concentrations exceed the SCDM cancer-risk benchmark, which meet Level I criteria.

Table 33: Level I Concentrations								
Property Location ID	Sample ID	Hazardous Substance	Concentration (µg/m ³)	Background Level	Benchmark Concentration (µg/m ³)	Benchmark	Population Value	References
125	7706-8	TCE	7	ND	0.4	CR	2.52	3, p. 11; 50, pp. 7-8
	7706-9	TCE	2.3	ND	0.4	CR		
131	7368-19	TCE	0.67	ND	0.4	CR	2	3, p. 11; 21, p. 83; 33, p. 4-5; 48, p. 17
	7368-19-FD	TCE	0.66	ND	0.4	CR		
	7368-20	TCE	0.62	ND	0.4	CR		
	7520-44	TCE	0.84	ND	0.4	CR		3, p. 9; 29, p. 18; 34, pp. 14-15; 48, p. 17
		PCE	22	ND	10	CR		
	7520-45	PCE	22	ND	10	CR		
153	AC57043	TCE	3.9	ND	0.4	CR	2	3, pp. 11, 13; 10, p. 22, 25, 218, 326
		VC	0.47	ND	0.16	CR		
	AC57044	TCE	1.9	ND	0.4	CR		
180	7520-17	TCE	7.9	ND	0.4	CR	2.52	3, p. 11; 29, p. 10; 34, p. 6; 39, p. 1
	7520-18	TCE	0.89	ND	0.4	CR		
181	7280-2	TCE	6.7	ND	0.4	CR	2.52	

Table 33: Level I Concentrations								
Property Location ID	Sample ID	Hazardous Substance	Concentration (µg/m³)	Background Level	Benchmark Concentration (µg/m³)	Benchmark	Population Value	References
	7280-3	TCE	4.0	ND	0.4	CR		3, p. 11; 21, p. 60; 32, pp. 1-2; 39, p. 1
193	7520-3	TCE	0.85	ND	0.4	CR	2	3, p. 11; 29, p. 6; 34, pp. 1, 2; 48, p. 49
	7520-4	TCE	0.74	ND	0.4	CR		
213	7520-21	TCE	0.53	ND	0.4	CR	2.52	3, p. 11; 29, p. 11; 34, pp. 6-7, 9; 39, p. 1
	7520-22	TCE	0.54	ND	0.4	CR		

Notes:

CR Subsurface Intrusion Cancer Risk Benchmark
ID Identification number
µg/m³ Micrograms per cubic meter
ND Analyte not detected above laboratory reporting limit
PCE Tetrachloroethene
TCE Trichloroethene
VC Vinyl chloride

Level I Population

Sum of regularly occupied structures total population values subject to Level I concentrations: 16.08

Sum of regularly occupied structure's total population values subject to Level I concentrations × 10
(Ref. 1a, Section 5.2.1.3.2): 160.8

Level I Concentrations Factor Value: 160.8

5.2.1.3.2.2 Level II Concentrations

Level II Concentrations

The indoor air samples listed in Table 20 were collected by MDNR in July 2015, and by Tetra Tech START in August 2016, November/December 2016, March 2017, August 2017, January 2018, and February 2018 (Refs. 10, pp. 20-34; 12, pp. 40-141; 21, pp. 53-86; 29, pp. 6-19; 49, pp. 1-12; 50, pp. 1-9) (see also Figure 5 of this HRS documentation record). Eurofins analyzed the July 2015 samples from MDNR, ALS analyzed the August 2016 samples for Tetra Tech START, and the EPA Region 7 laboratory analyzed samples for the November/December 2016 through February 2018 sampling events (Refs. 10, p. 25; 12 p. 13; 21 pp. 14-15; 29 p. 1; 49, pp. 1-12; 50, pp. 1-9). All indoor air samples were analyzed using EPA Method TO-15 and in accordance with laboratory SOP VOA-TO15 (Refs. 10, p. 25; 12 p. 13; 21 pp. 14-15; 29 p. 1; 49, pp. 1-12; 50, pp. 1-9). Eurofins utilized an independent validation and Tetra Tech START provided a Level II data validation for the ALS data – each validation was in accordance with the EPA National Functional Guidelines for Organic Data Review and the analytical method (Refs. 10, pp. 318, 335, 346, 364, 377, 392, 406, 422, 435, 447, 458, 773, 803; 12, pp. 133-141).

The following table provides regularly occupied residences where indoor air concentrations exceed the SCDM cancer-risk benchmark, which meet Level II criteria.

Also, Level II concentrations for inferred targets were assigned per Section 5.2.0 in Reference 1a. That is, targets within regularly occupied structures without documented observed exposures but are surrounded by structures in which observed exposures were identified within AOE 1 were assigned Level II weighting (Ref. 1a, pp. 11, 36)

Table 34: Level II Concentrations								
Property Location ID	Sample ID	Hazardous Substance	Concentration (µg/m³)	Background Level	Benchmark Concentration (µg/m³)	Benchmark	No. of Targets	References
117	P1603961-013	PCE	3.4	ND	10	CR	1	12, pp. 93, 94; 48, p. 1
	P1603961-014	PCE	1.4	ND	10	CR		
118	P1603961-020	PCE	0.20	ND	10	CR	2	12, pp. 100-102; 48, p. 5
	P1603961-021	PCE	0.21	ND	10	CR		
	P1603961-022	PCE	0.21	ND	10	CR		
124	P1603961-007	TCE	0.18	ND	0.4	CR	4	12, p. 87; 48, p. 9
130	7520-38	TCE	0.29	ND	0.4	CR	2	29, p. 16; 34, pp.12, 13; 48, p. 13
	7520-38-FD	TCE	0.30	ND	0.4	CR		
	7520-39	TCE	0.29	ND	0.4	CR		
143	Inferred Level II Concentrations						2.52	39, p. 1
144	Inferred Level II Concentrations						1	39, p. 1; 48, p. 21
145	Inferred Level II Concentrations						2.52	39, p. 1
146	Inferred Level II Concentrations						2.52	39, p. 1
147	Inferred Level II Concentrations						2.52	39, p. 1
148	Inferred Level II Concentrations						2.52	39, p. 1
149	Inferred Level II Concentrations						2.52	39, p. 1
150	Inferred Level II Concentrations						2.52	39, p. 1
151	AC57013	TCE	0.21	ND	0.4	CR	2	10, pp. 204, 351-352, 382
	AC57014	TCE	0.21	ND	0.4	CR		
152	Inferred Level II Concentrations						4	10, p. 211
165	Inferred Level II Concentrations						2.52	39, p. 1
172	Inferred Level II Concentrations						2.52	39, p. 1
176	AC57036	TCE	0.25	ND	0.4	CR	5	10, pp. 225, 297, 411
	AC57037	TCE	0.22	ND	0.4	CR		
177	P1603935-009	PCE	4.6	ND	10	CR	4	12, pp. 56-57; 48, p. 29 21, pp. 63-64; 32, p. 4-6; 48, p. 29
	P1603935-010	PCE	4.7	ND	10	CR		
	7280-14	PCE	2.2	0.41	10	CR		
	7280-14-FD	PCE	2.2	0.41	10	CR		
	7280-16	PCE	1.6	0.41	10	CR		

Table 34: Level II Concentrations								
Property Location ID	Sample ID	Hazardous Substance	Concentration (µg/m³)	Background Level	Benchmark Concentration (µg/m³)	Benchmark	No. of Targets	References
	7520-30	PCE	3.9	ND	10	CR		29, p. 14; 34, pp.10; 48, p. 29
		TCE	0.30	ND	0.4	CR		
	7520-31	PCE	3.5	ND	10	CR		
		TCE	0.30	ND	0.4	CR		
178	Inferred Level II Concentrations						1	48, p. 37
182	Inferred Level II Concentrations						2	10, p. 239; 48, p. 37
186	P1603961-016	TCE	0.18	ND	0.4	CR	3	12, p. 96-98; 48, p. 41
		PCE	0.62	ND	10	CR		
	P1603961-017	PCE	0.37	ND	10	CR		
	P1603961-018	PCE	0.29	ND	10	CR		
	7368-25	TCE	0.35	ND	0.4	CR		21, pp. 85-86; 33, p. 6; 48, p. 41
	7368-26	TCE	0.29	ND	0.4	CR		
191	7706-2	PCE	0.85	ND	10	CR	2.52	39, p. 1; 52, pp. 1-2
	7706-2-FD	PCE	0.91	ND	10	CR		
	7706-3	PCE	0.46	ND	10	CR		
192	P1604058-006	PCE	0.70	ND	10	CR	2.52	12, pp. 127-128; 39, p. 1
	P1604058-007	PCE	0.71	ND	10	CR		
	7520-14	PCE	0.68U	ND	10	CR		29, p. 9; 34, p. 5-7; 39, p. 1
	7520-15	PCE	0.69	ND	10	CR		
194	Inferred Level II Concentrations						1	39, p. 1; 48, p. 53
195	7520-24	TCE	0.38	ND	0.4	CR	1	29, p. 12; 34, p. 8; 48, p. 57

Notes:

* VI data collected from Property ID 129 indicate that no observed exposure occurred at this residence.

CR Subsurface Intrusion Cancer Risk Benchmark

ID Identification number

µg/m³ Micrograms per cubic meter

ND Analyte not detected above laboratory reporting limit

NE Not established

PCE Tetrachloroethylene

TCE Trichloroethene

VC Vinyl chloride

Level II Population

Sum of regularly occupied structure's total population values subject to Level II concentrations: 60.72

Sum of regularly occupied structure's total population values subject to Level II concentrations × 1
(Ref. 1a, Section 5.2.1.3.2.2): 60.72

Level II Concentrations Factor Value: 60.72

5.2.1.3.2.3 Population within an Area of Subsurface Contamination

The sub-slab soil gas samples listed in Table 29 were collected by Environ in February 2015, and by Tetra Tech START in November 2016, August 2017, and February 2018. The sub-slab soil gas samples were collected from ports in basements of residences within ASC 1 (Refs. 16, 21, and 50) (see also Figure 5 of this HRS documentation record). The chain-of-custody records are provided in References 16, pages 102-103 21, 29, and 54. RLs are listed on analytical data sheets in References 10, 32, 34, 51, and 52. Each RL is sample-specific and corresponds to the lowest demonstrated level of acceptable quantitation; it is adjusted for preparation weights and volumes, and any dilutions performed. The RLs are equivalent to SQLs as defined in HRS Section 1.1, Definitions (Refs. 1, Section 1.1; 37).

Table 35: ASC 1 Population						
Property Location ID	Depth to Contamination	Associated Sample Media	No. of Exposed Residents	Weighting Factor Value (HRS Table 5-21)	Population Value	References
154	< 5 feet	Sub-slab soil gas	2.52	0.9	2.268	24, p. 17; 1a, Section 5.2.1.3.2.3; 39, p. 1
155			2.52	0.4	1.008	1a, Section 5.2.1.3.2.3; 39, p. 1
156			2.52	0.4	1.008	1a, Section 5.2.1.3.2.3; 39, p. 1
175			3	0.4	1.2	1a, Section 5.2.1.3.2.3; 48, p. 25
185			2.52	0.4	1.008	1a, Section 5.2.1.3.2.3; 39, p. 1

Notes:

< Less than
ID Identification number
HRS Hazard Ranking System

ASC 1 Population

Sum of regularly occupied structures total population values: 6.492

ASC Factor Value: 6.492

5.2.1.3.2.4 Calculation of Population Factor Value

Level I Concentrations Factor Value: 160.8

Level II Concentrations Factor Value: 60.72

Population within an Area of Subsurface Contamination Factor Value: 6.49

Level I Concentrations + Level II Concentrations + Population within an Area of Subsurface
Contamination: 228.01

Population Factor Value: 228.01

5.2.1.3.3 Resources

No resources have been documented in ASC 1 or AOE 1.

Resources Factor Value: 0

5.2.1.3.4 Calculation of Targets Factor Category Value

Exposed Individual Factor Value: 50

Population Factor Value: 228.01

Resources Factor Value: 0

Exposed Individual + Population + Resources: 278.01

Targets Factor Category Value: 278.01