

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 | S² 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

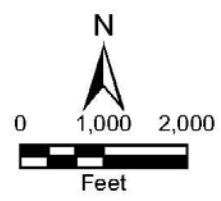
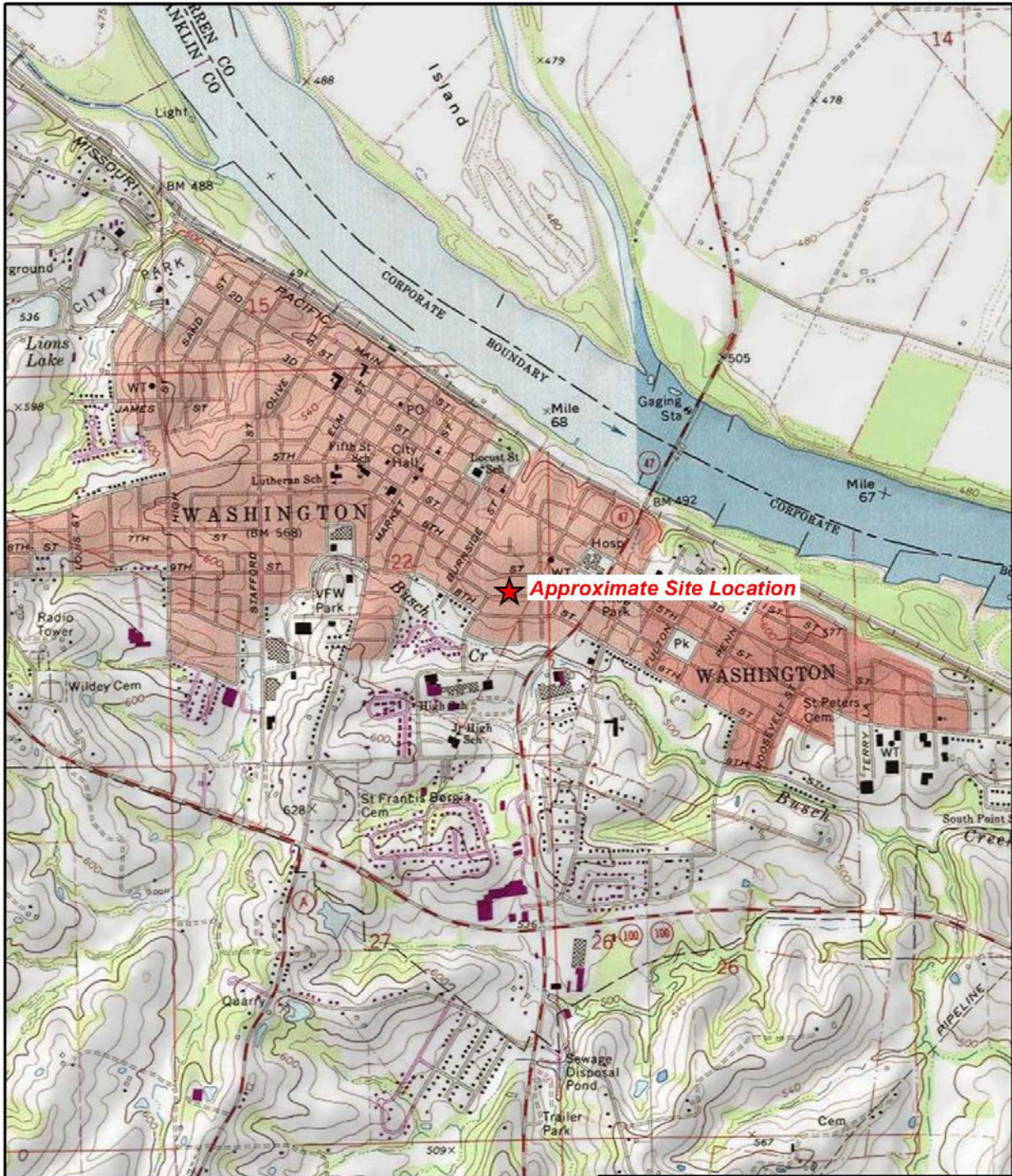
| Factor categories and factors | Maximum Value | Value Assigned |
|---|---------------|----------------|
| Subsurface Intrusion Component: AOE 1 | | |
| Likelihood of Exposure: | | |
| 1. Likelihood of Exposure | 550 | 550.0 |
| 2. Potential for Exposure | | |
| 2a. Structure Containment | 10 | NS |
| 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 |
| 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



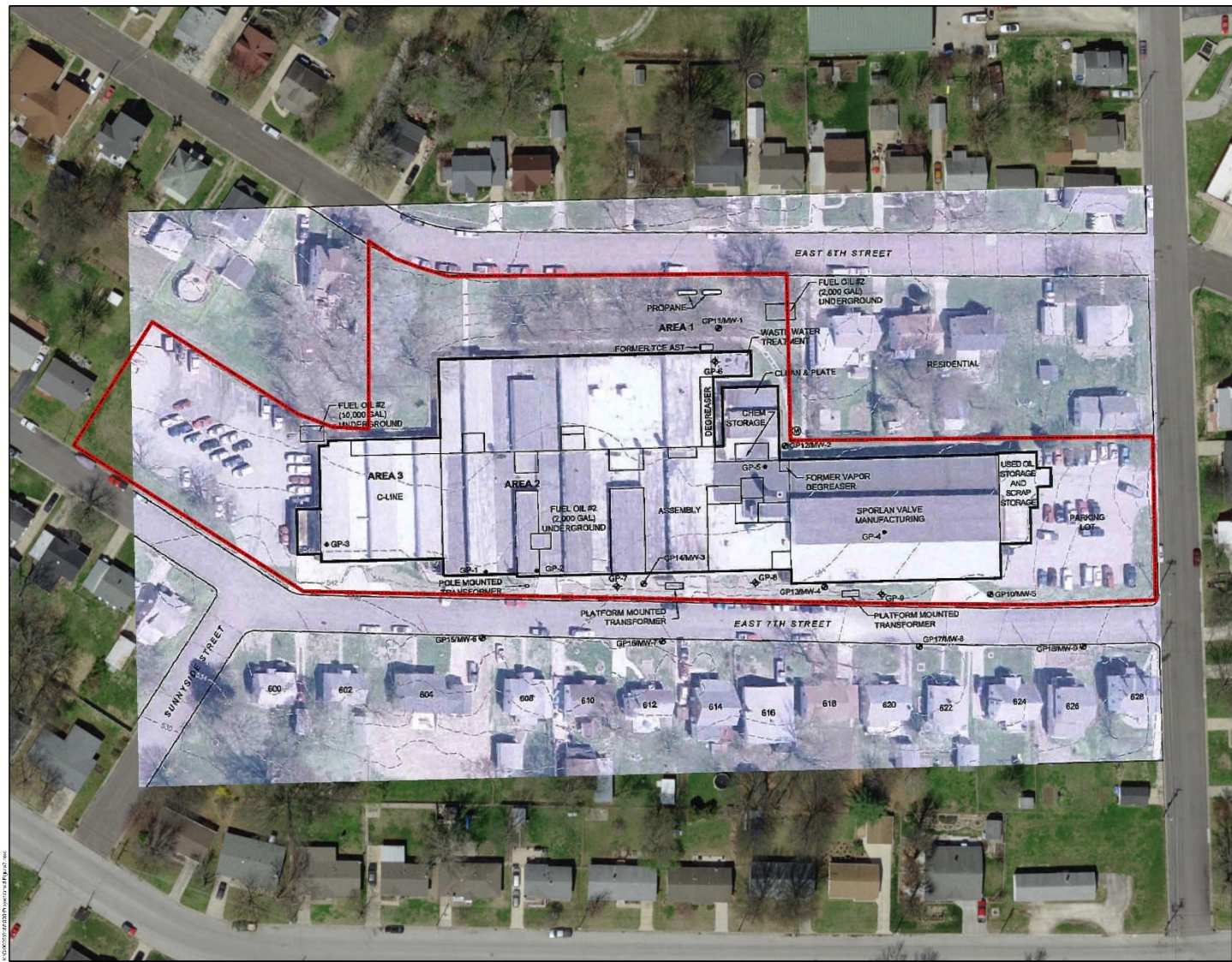
Sporlan Valve Plant #1 Site
 611 East Seventh Street
 Washington, Missouri

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: A3025.10.0105.000



- Legend
- Sporlan Valve property boundary
 - AST Aboveground storage tank
 - TCE Trichloroethene

EAST 6TH STREET

EAST 7TH STREET

SUNNYSIDE STREET

N
0 40 80
Feet

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 2
Site Layout Map

TETRA TECH

Map: 1/15/018 Drawn By: Nick Woodcock Project No: 30001-18-0-00103

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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 $\frac{1}{4}$, NE $\frac{1}{4}$, SE $\frac{1}{4}$, 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 [$\mu\text{g}/\text{kg}$]) 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.

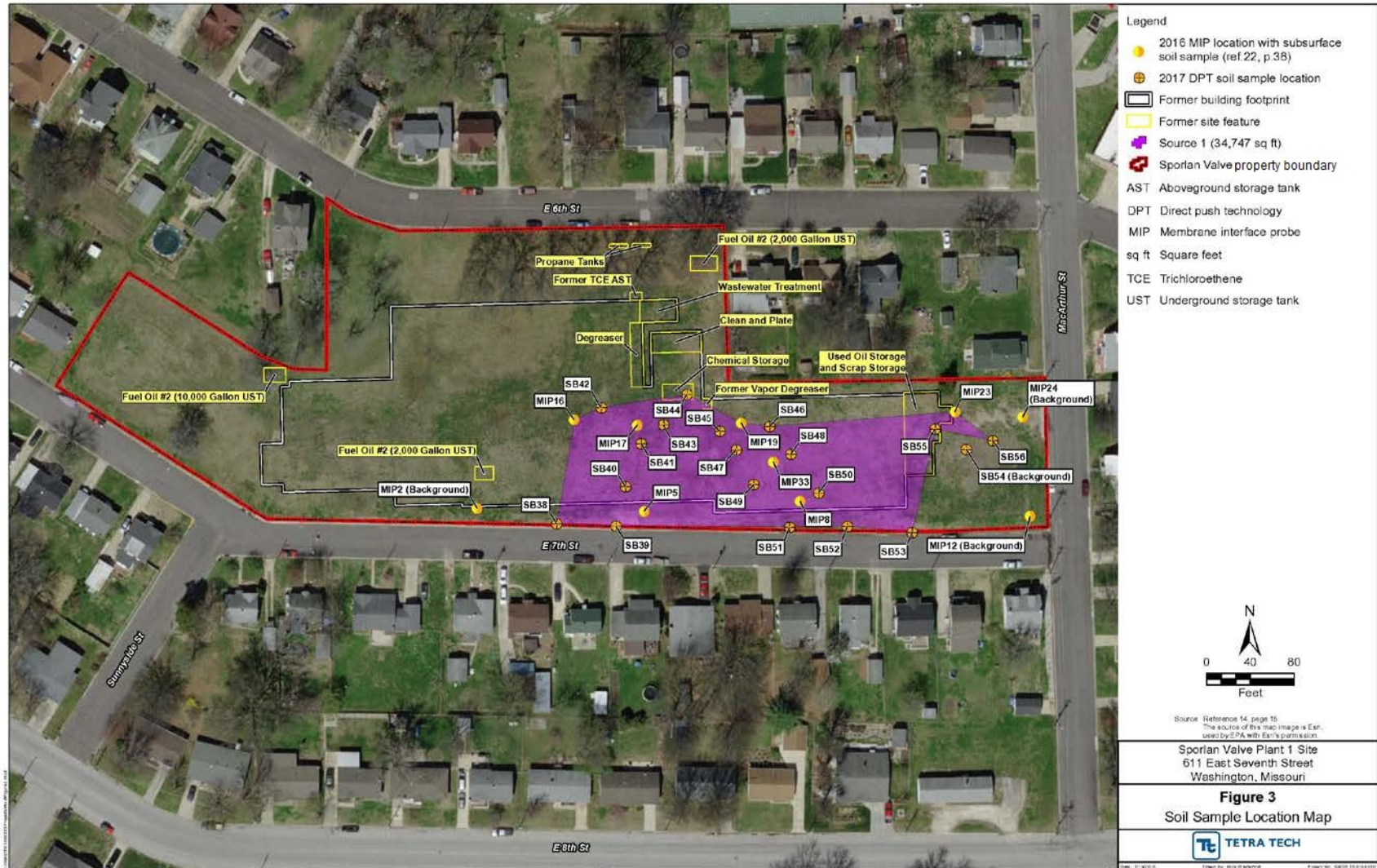
2.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE

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 | 6.6 U | 6.6 | 22, pp. 67, 86, 132, 144; 25, p. 10 |
| | | | | <i>cis</i> -1,2-DCE | 6.6 U | 6.6 | |
| | | | | <i>trans</i> -1,2-DCE | 6.6 U | 6.6 | |
| | | | | TCE | 6.6 U | 6.6 | |
| | | | | VC | 6.6 U | 6.6 | |
| MIP2 | 7257-101 | 10/31/2016 | 4-8 | 1,1-DCE | 6.1 U | 6.1 | 22, pp. 38, 67, 68, 121, 132, 139; 25, p. 4 |
| | | | | <i>cis</i> -1,2-DCE | 6.1 U | 6.1 | |
| | | | | <i>trans</i> -1,2-DCE | 6.1 U | 6.1 | |
| | | | | TCE | 6.1 U | 6.1 | |
| | | | | VC | 6.1 U | 6.1 | |
| MIP12 | 7257-112 | 11/01/2016 | 4-8 | 1,1-DCE | 5.1 U | 5.1 | 22, pp. 38, 67, 79, 121, 132, 142; 25, pp. 7, 8 |
| | | | | <i>cis</i> -1,2-DCE | 5.1 U | 5.1 | |
| | | | | <i>trans</i> -1,2-DCE | 5.1 U | 5.1 | |
| | 7257-113 | | 24 | TCE | 5.1 U | 5.1 | 22, pp. 38, 67, 80, 121, 132, 142; 25, p. 8 |
| | | | | VC | 5.1 U | 5.1 | |
| | | | | 1,1-DCE | 5.2 U | 5.2 | |
| MIP24 | 7257-117 | 11/01/2016 | 20 | <i>cis</i> -1,2-DCE | 5.2 U | 5.2 | 22, pp. 38, 67, 84, 121, 132, 143; 25, p. 9 |
| | | | | <i>trans</i> -1,2-DCE | 5.2 U | 5.2 | |
| | | | | TCE | 5.2 U | 5.2 | |
| | | | | VC | 5.2 U | 5.2 | |
| | | | | 1,1-DCE | 5.8 U | 5.8 | |
| SB-54 | 7522-33 | 08/01/2017 | 13.5 | <i>cis</i> -1,2-DCE | 5.8 U | 5.8 | 22, pp. 38, 67, 84, 121, 132, 143; 25, p. 9 |
| | | | | <i>trans</i> -1,2-DCE | 5.8 U | 5.8 | |
| | | | | TCE | 5.8 U | 5.8 | |
| | 7522-34 | | 19 | VC | 5.8 U | 5.8 | 35, pp. 19, 35, 46; 26, p. 12; 28, pp. 2, 35 |
| | | | | 1,1-DCE | 5.0 U | 5.0 | |
| | | | | <i>cis</i> -1,2-DCE | 5.0 U | 5.0 | |
| SB-54 | 7522-33 | 08/01/2017 | 13.5 | <i>trans</i> -1,2-DCE | 5.0 U | 5.0 | 35, pp. 19, 35, 46; 26, p. 12; 28, pp. 2, 35 |
| | | | | PCE | 5.0 U | 5.0 | |
| | | | | TCE | 5.0 U | 5.0 | |
| | | | | VC | 5.0 U | 5.0 | |
| | | | | 1,1-DCE | 5.4 U | 5.4 | |
| SB-54 | 7522-34 | 08/01/2017 | 19 | <i>cis</i> -1,2-DCE | 5.4 U | 5.4 | 35, pp. 19, 35, 46; 26, p. 12; 28, pp. 2, 36 |
| | | | | <i>trans</i> -1,2-DCE | 5.4 U | 5.4 | |
| | | | | PCE | 5.4 U | 5.4 | |
| | | | | TCE | 5.4 U | 5.4 | |
| | | | | VC | 5.4 U | 5.4 | |

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 | 400 J ¹ | 5.0 | 35, pp. 35, 42; 26, p. 7; 28, pp. 1, 21 |
| | <i>cis</i> -1,2-DCE | | | 5,400 J ¹ | 5.0 | | |
| | | | | <i>trans</i> -1,2-DCE | 49 | 5.0 | |
| | | | | TCE | 10,000 J ¹ | 5.0 | |
| | | | | VC | 1,100 J ¹ | 5.0 | |
| | 7522-20 | | 13 | 1,1-DCE | 410 J ¹ | 5.0 | 35, pp. 35, 42; 26, p. 7; 28, pp. 1, 22 |
| | | | | <i>cis</i> -1,2-DCE | 11,000 | 250 | |
| | | | | <i>trans</i> -1,2-DCE | 74 | 5.0 | |
| | | | | TCE | 27,000 J ¹ | 250 | |
| | | | | VC | 410 J ¹ | 5.0 | |
| SB-48 | 7522-21 | 07/31/2017 | 14 | <i>cis</i> -1,2-DCE | 270 | 6.0 | 35, pp. 35, 43; 26, p. 8; 28, pp. 1, 23 |
| | TCE | | | 480 | 6.8 | | |
| | | | | VC | 21 | 6.0 | |
| | 7522-22 | | 19 | 1,1-DCE | 25 | 5.0 | 35, pp. 35, 43; 26, p. 8; 28, pp. 1, 24 |
| | | | | <i>cis</i> -1,2-DCE | 430 | 240 | |
| | | | | TCE | 1,900 | 490 | |
| | | | | VC | 140 | 5.0 | |
| SB-49 | 7522-23 | 07/31/2017 | 13 | <i>cis</i> -1,2-DCE | 110 | 6.2 | 35, pp. 35, 43; 26, p. 8; 28, pp. 1, 25 |
| | TCE | | | 64 | 6.2 | | |
| | 7522-24 | | 20 | <i>cis</i> -1,2-DCE | 120 | 4.8 | 35, pp. 35, 43; 26, p. 9; 28, pp. 1, 26 |
| | | | | TCE | 3,500 | 320 | |
| | | | | VC | 63 | 4.8 | |
| SB-50 | 7522-25 | 07/31/2017 | 18.5 | 1,1-DCE | 9.1 | 4.9 | 35, pp. 35, 144; 26, p. 9; 28, pp. 2, 27 |
| | <i>cis</i> -1,2-DCE | | | 140 | 4.9 | | |
| | | | | TCE | 740 | 280 | |
| | | | | VC | 70 | 4.9 | |
| | 7522-26 | | 20.5 | 1,1-DCE | 66 | 6.6 | 35, pp. 35, 44; 26, p. 9; 28, pp. 2, 28 |
| | | | | <i>cis</i> -1,2-DCE | 560 | 380 | |
| | | | | <i>trans</i> -1,2-DCE | 7.7 | 6.6 | |
| | | | | PCE | 7.8 | 6.6 | |
| | | | | TCE | 4,300 | 760 | |
| | | | | VC | 370 J ¹ | 6.6 | |
| SB-51 | 7522-27 | 08/01/2017 | 16 | <i>cis</i> -1,2-DCE | 19 | 5.0 | 35, pp. 35, 44; 26, p. 10; 28, pp. 2, 29 |
| | TCE | | | 1,400 | 280 | | |
| | | | | VC | 16 | 5.0 | |
| | 7522-28 | | 21 | 1,1-DCE | 75 | 7.2 | 35, pp. 35, 44; 26, p. 10; 28, pp. 2, 30 |
| | | | | <i>cis</i> -1,2-DCE | 1,400 | 920 | |
| | | | | <i>trans</i> -1,2-DCE | 18 | 7.2 | |
| | | | | TCE | 3,100 | 920 | |
| | | | | VC | 660 J ¹ | 7.2 | |
| 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 | 25 | 6.0 | 35, pp. 35, 45; 26, p. 11; 28, pp. 2, 32 |
| | | | | <i>cis</i> -1,2-DCE | 270 | 6.0 | |
| | | | | TCE | 3,700 | 330 | |
| | | | | VC | 140 | 6.0 | |
| SB-53 | 7522-31 | 08/01/2017 | 16 | <i>cis</i> -1,2-DCE | 18 | 5.4 | 35, pp. 35, 45; 26, p. 11; 28, pp. 2, 33 |
| | TCE | | | 220 | 5.4 | | |
| | 7522-32 | | 25 | 1,1-DCE | 8.8 | 6.6 | 35, pp. 35, 45; 26, p. 11; 28, pp. 2, 34 |
| | | | | <i>cis</i> -1,2-DCE | 140 | 6.6 | |
| | | | | TCE | 3,600 | 600 | |
| | | | | VC | 58 J ² | 6.6 | |

| 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 | $3 \times 10^{-4} - 9 \times 10^{-4}$ | 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 | $1 \times 10^{-4} - 1 \times 10^{-3}$ | 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 | | | |
| | 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 | Bedding separations and fractures; Low permeability | $9 \times 10^{-13} - 3 \times 10^{-11}$ | St. Francois Confining Unit |
| | 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.

| 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 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^{-5} to 5.86^{-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.

| 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.

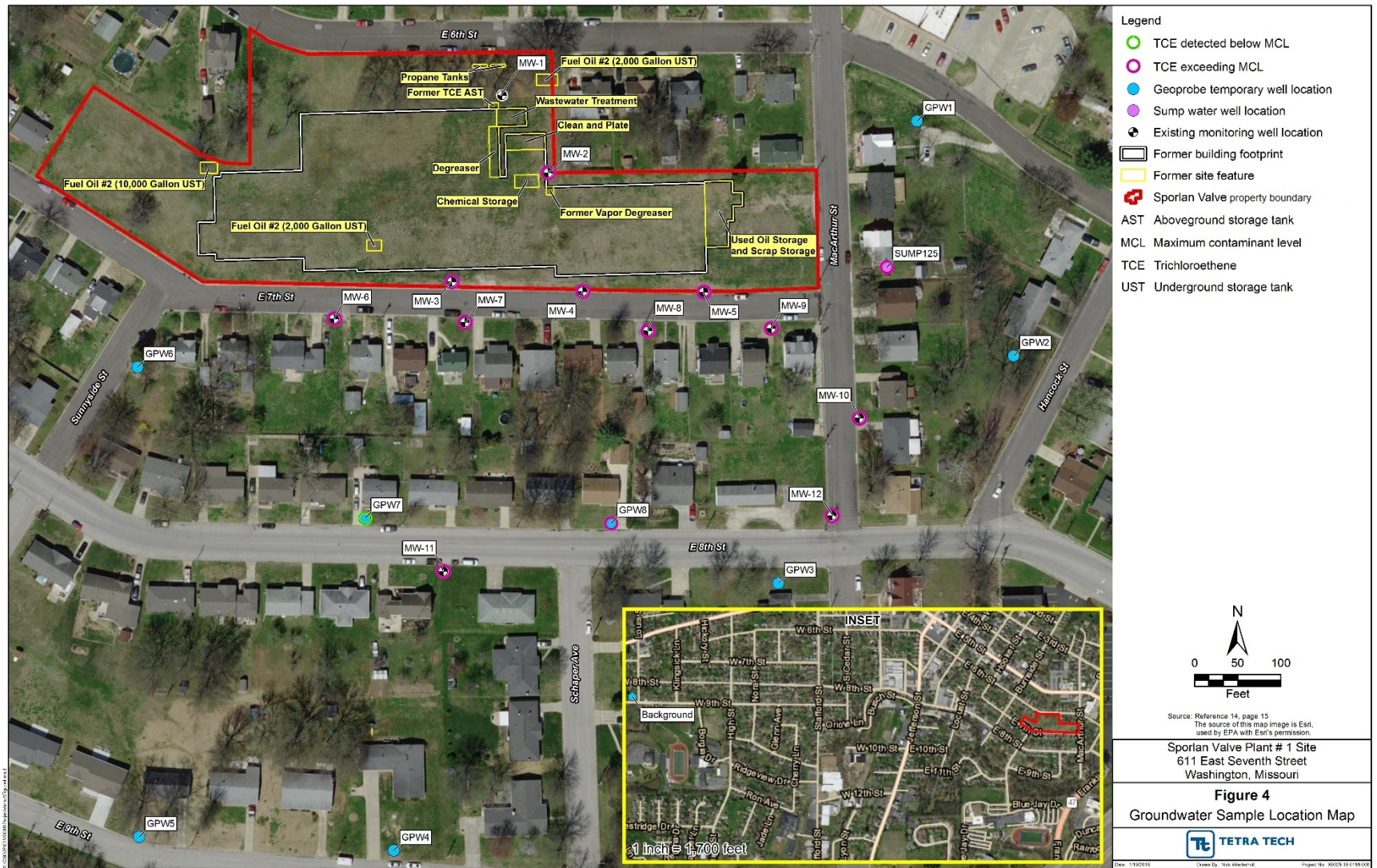
| Table 12: Background Sample Concentrations | | | | | |
|--|---------------|--------------------------------|----------------------|-----------------------------------|---------------------------------|
| Well ID | Sample Number | Hazardous Substance | Concentration (µg/L) | Sample Quantitation Limit* (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 |
| | | <i>cis</i> -1,2-Dichloroethene | 30 | 25 | |
| MW-4 | 7257-315 | Trichloroethene | 720 | 50 | 22, pp. 45, 133, 148; 25, pp. 15, 16 |
| | | <i>cis</i> -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 |
| | | <i>cis</i> -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 |
| | | <i>cis</i> -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 | |
| | | <i>cis</i> -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 |
| | | <i>cis</i> -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 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 $\mu\text{g}/\text{kg}$ to 27,000 $\mu\text{g}/\text{kg}$ 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.

| 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

| 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) | 1,543 | 1, Section 3.3.2.4; 31, pp. 6, 8 | 1,013 |
| | 4 Private Wells Total ¼ – ½ | 10.08 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) | 1,543 | 1, Section 3.3.2.4; 31, pp. 6, 8, 9 | 939 |
| | Well #5 (104380) | 1,543 | | |
| | Well #6 (104382) | 1,543 | | |
| | Well #8 (104383) | 1,543 | | |
| | Well #9 (104384) | 1,543 | | |
| | 39 private wells Total 1 - 2 | 98.28 7,813.28 | | |
| 2 - 3 | Washington Municipal Wells Well #10 (104977) | 1,543 | 1, Section 3.3.2.4; 31, pp. 6, 9, 10, 11 | 678 |
| | Well #7 (104377) | 1,543 | | |
| | 93 private wells | 234.36 | | |
| | Total 2 - 3 | 3,320.36 | | |
| 3 - 4 | Washington Municipal Wells Well #11 (104978) | 1,543 | 1, Section 3.3.2.4; 31, pp. 6, 12, 13, 14, 15 | 131 |
| | 144 private wells | 362.88 | | |
| | 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 | |

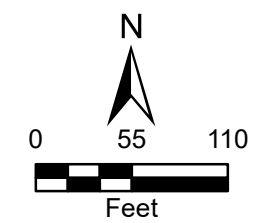
Notes:

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

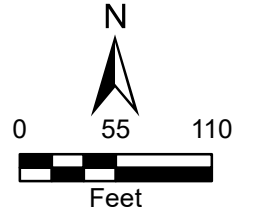
Figure 5
Area of Observed Exposure Map





- 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.

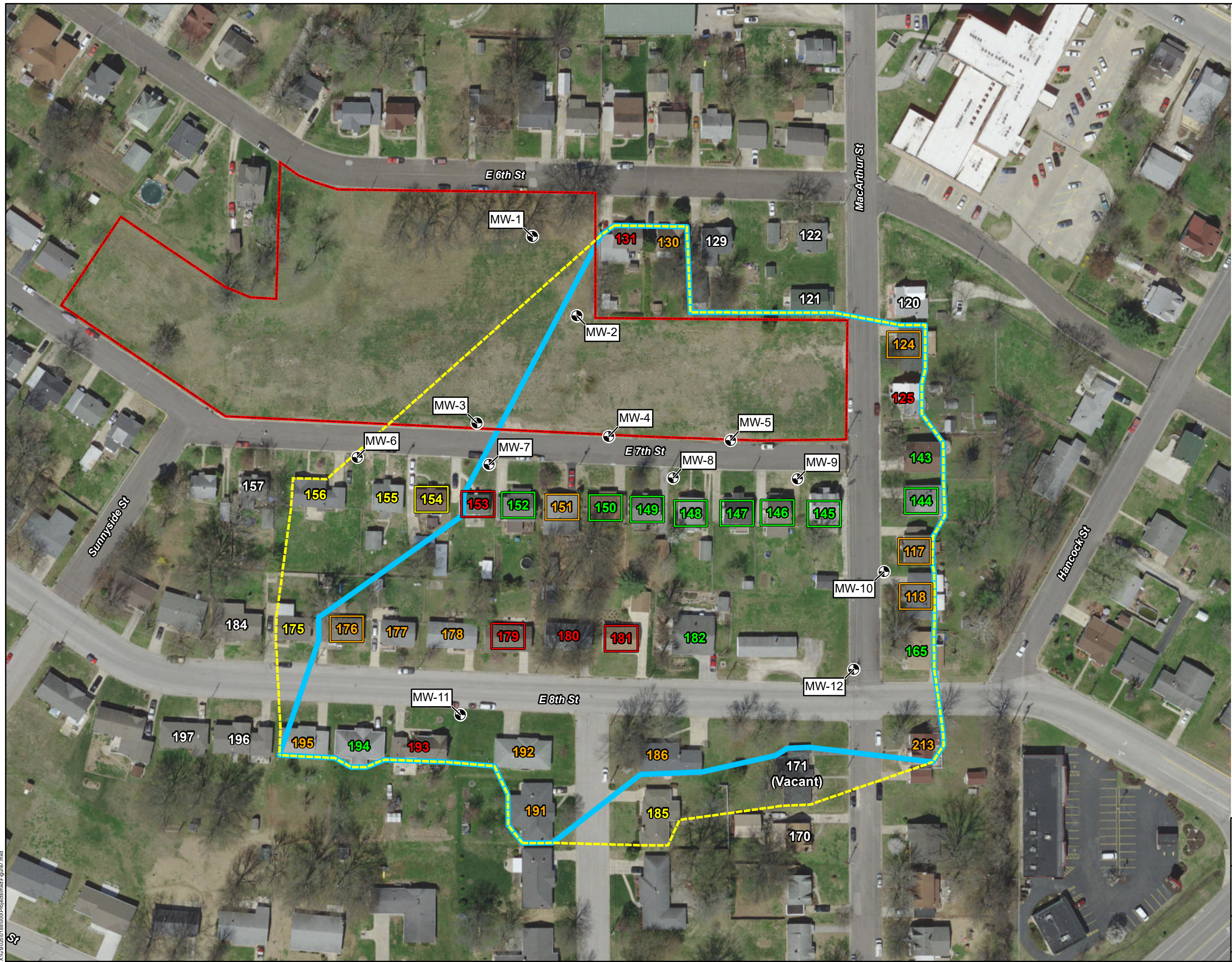


Source: Reference 14, page 15
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Sporlan Valve Plant #1 Site
611 East Seventh Street
Washington, Missouri

Figure 6
Area of Subsurface Contamination Map

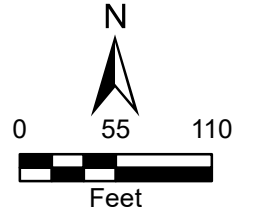




Legend

- Existing monitoring well location
- Area of observed exposure
- 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 7
Areas of Concern Map



X:\GIS\2018\180000\Project\mwf\Figure7.mxd

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 $\mu\text{g}/\text{m}^3$. 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 $\mu\text{g}/\text{m}^3$ (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

AA Ambient air
 ID Identification number

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 ($\mu\text{g}/\text{m}^3$) | RL ($\mu\text{g}/\text{m}^3$) | Reference |
|------------------------|------------------------|----------------------|--|---------------------------------|-----------------------------------|
| 121 | AC57031/ 153107 | TCE | Not detected | 0.16 | 10, pp. 296, 382, 412 |
| | | VC | Not detected | 0.051 | |
| | AC57032/ 153108 | TCE | Not detected | 0.19 | 10, pp. 296, 382, 413 |
| | | VC | Not detected | 0.045 | |
| | 7280-30/ 121-3 | PCE | 0.34 U | 0.34 | 32, p. 10; 21, pp. 55, 56, 59, 67 |
| | | TCE | 0.35 U ² | 0.27 | |
| | | VC | 0.14 | 0.13 | |
| | 7280-31/ 121-4 | PCE | 0.34 U | 0.34 | 32, p. 10; 21, pp. 55, 56, 68 |
| | | TCE | 0.27 U | 0.27 | |
| | | VC | 0.13 U | 0.13 | |
| 7368-09/ 121-3 | PCE | 0.34 U | 0.34 | 33, p. 3 | |
| | TCE | 0.27 U | 0.27 | | |
| | VC | 0.13 U | 0.13 | | |
| 7368-10/ 121-4 | PCE | 0.34 U | 0.34 | 33, p. 3 | |
| | TCE | 0.27 U | 0.27 | | |
| | VC | 0.13 U | 0.13 | | |
| 7520-34/ 121-3 | PCE | 0.68 U ² | 0.34 | 34, p. 11; 49, p. 71 | |
| | TCE | 0.27 U | 0.27 | | |
| | VC | 0.13 UJ ¹ | 0.13 | | |
| 7520-35/ 121-4 | PCE | 0.68 U ² | 0.34 | 34, p. 11; 49, p. 71 | |
| | TCE | 0.27 U | 0.27 | | |
| | VC | 0.13 UJ ¹ | 0.13 | | |
| 129 | AC57023/ 153099 | TCE | Not detected | 0.15 | 10, pp. 271, 294, 383 |
| | | VC | Not detected | 0.035 | |
| 129 | AC57024/ 153100 | TCE | Not detected | 0.21 | 10, pp. 271, 294, 384 |
| | | VC | Not detected | 0.049 | |
| 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 ($\mu\text{g}/\text{m}^3$) | RL ($\mu\text{g}/\text{m}^3$) | 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 $\mu\text{g}/\text{m}^3$ to 0.68 $\mu\text{g}/\text{m}^3$ due to concerns of residual canister contamination (Ref. 49, p. 71).

ID Identification number

$\mu\text{g}/\text{m}^3$ 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 ($\mu\text{g}/\text{m}^3$) | RL ($\mu\text{g}/\text{m}^3$) | 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 | | |
| 7520-45/ 131-3 | TCE | 0.36 | 0.27 | 49, p. 84; 34, p. 15 | |
| | PCE | 22 | 0.34 | | |
| 151 | AC57013/ 150400 | TCE | 0.21 | 0.20 | 10, p. 351 |
| | AC57014/ 153089 | 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 |
| | 7520-30/ 177-2 | TCE | 0.30 | 0.27 | 49, p. 80; 34, p. 10 |
| | | PCE | 3.9 | 0.34 | |
| | P1603961-009/ 177-2 | TCE | 0.30 | 0.27 | 49, p. 80; 34, p. 10 |
| PCE | | 3.5 | 0.34 | | |
| 180 | 7520-17/ 180-2 | TCE | 7.9 | 0.27 | 49, p. 76; 34, p. 6 |
| | | 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 ($\mu\text{g}/\text{m}^3$) | RL ($\mu\text{g}/\text{m}^3$) | 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
 $\mu\text{g}/\text{m}^3$ 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 $\mu\text{g}/\text{kg}$ to 27,000 $\mu\text{g}/\text{kg}$ (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.

| 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.

| Property ID | Laboratory Sample ID | Hazardous Substance | Concentration (µg/m ³) | RL (µg/m ³) | 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 $\mu\text{g}/\text{kg}$ to 27,000 $\mu\text{g}/\text{kg}$ (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 | |
| 7368-26 | TCE | 21, p. 86; 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 | | |
| | | 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/m ³) | Background Level | Benchmark Concentration (µg/m ³) | 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/m ³) | Background Level | Benchmark Concentration (µg/m ³) | 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 |
| | 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/m ³) | Background Level | Benchmark Concentration (µg/m ³) | 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