

## HAZARD RANKING SYSTEM (HRS) DOCUMENTATION RECORD COVER SHEET

**Name of Site:** PCE – Carriage Cleaners

**EPA ID No.** NEN000710226

### Contact Persons

Documentation Record:

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### Pathways, Components, or Threats Not Scored

The groundwater, surface water, and air migration pathways, and the soil exposure component of the soil exposure and subsurface intrusion pathway are not scored in this Hazard Ranking System (HRS) documentation record because the subsurface intrusion component of the soil exposure and subsurface intrusion pathway is sufficient to qualify the site for the National Priorities List (NPL). The groundwater, 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 a future evaluation. At the time of the listing, the site score is sufficient without the pathways and component mentioned above.

**Ground Water Migration Pathway:** The ground water migration pathway was not scored because although there is sampling to show a release of chlorinated solvents has occurred to shallow groundwater (Ref. 10, pp. 36-41, 64, 65, 73, 78, 79), there are few domestic wells in the site vicinity (Ref. 10, pp. 49, 50, 75). There are two registered domestic wells within one mile of the site and a total of 33 domestic wells within 4 miles of the site (Ref. 10, pp. 50, 75). Most of these wells are northwest and upgradient of the site (Ref. 10, p. 50). Furthermore, although there are indications of contaminated groundwater present that could threaten targets, it has not been scored because evaluation of the migration pathway would not significantly contribute to the overall site score.

**Surface Water Migration Pathway:** A release to surface water is unlikely as the nearest perennially flowing surface water feature, the Missouri River, is 0.7 mile east of the site (Ref. 10, pp. 50). The listing of this site would not be changed by evaluating this pathway.

**Soil Exposure Component, Soil Exposure and Subsurface Intrusion Pathway:** The soil exposure component was not scored because although there is sampling to show a release of chlorinated solvents has occurred to subsurface soils (Ref. 10, pp. 33-36), none of the samples were collected from the top 2 feet of soil and no soil samples were collected on properties other than the former dry cleaner (Ref. 10, p. 68).

**Air Migration Pathway:** Some outdoor air samples collected were analyzed for chlorinated volatile organic compounds and none were detected (Refs. 9, pp. 9, 13; 10 pp. 15, 19, 20, 28). The listing of this site would not be changed by evaluating this pathway.

**HRS DOCUMENTATION RECORD**

Name of Site: PCE – Carriage Cleaners

Date Prepared: September 2022

EPA Region: 7

Street Address of Site\*: 2110 South Franklin Street

City, County, State, Zip Code: Bellevue, Sarpy, Nebraska, 68005

General Location in the State: Eastern Nebraska

Topographic Map: Omaha South Quadrangle, Nebraska – Iowa, 7.5-Minute Series, 2021 (Ref. 3)

Latitude: 41.137721

Longitude: -95.894082

The coordinates above for the PCE - Carriage Cleaners Site were measured from within the center of the parcel where the dry cleaner was once located at the northwest corner of West 22<sup>nd</sup> Avenue and Franklin Street in Bellevue Nebraska (Ref. 4, pp. 1, 2).

\*The street address, coordinates, and contaminant locations presented in this HRS documentation record identify the general area the site is located. They represent one or more locations EPA considers to be part of the site based on the screening information EPA used to evaluate the site for NPL listing. EPA lists national priorities among the known "releases or threatened releases" of hazardous substances; thus, the focus is on the release, 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 the initial determination that a certain area may need to be addressed under CERCLA. Accordingly, EPA contemplates that the preliminary description of facility boundaries at the time of scoring will be refined as more information is developed as to where the contamination has come to be located.

Scores

|  |              |
|--|--------------|
| Air Pathway                                    | Not Scored   |
| Ground Water <sup>1</sup> Pathway              | Not Scored   |
| Soil Exposure and Subsurface Intrusion Pathway | 100          |
| Surface Water Pathway                          | Not Scored   |
| <b>HRS SITE SCORE</b>                          | <b>50.00</b> |

<sup>1</sup> “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

|   | <b>S</b> | <b>S<sup>2</sup></b> |
|---|----------|----------------------|
| 1. Groundwater Migration Pathway Score ( $S_{gw}$ )   | NS       | NS                   |
| 2a. Surface Water Overland/Flood Migration Component<br>(from Table 4-1, line 30)                                   | NS       | NS                   |
| 2b. Ground Water to Surface Water Migration Component<br>(from Table 4-25, line 28)                                 | NS       | NS                   |
| 2c. Surface Water Migration Pathway Score ( $S_{sw}$ )<br>Enter the larger of lines 2a and 2b as the pathway score. | NS       | NS                   |
| 3a. Soil Exposure Component Score ( $S_{se}$ )<br>(from Table 5-1, line 22)   | NS       | NS                   |
| 3b. Subsurface Intrusion Component Score ( $S_{ssi}$ )<br>(from Table 5-11, line 12)                                | 100      | 10,000               |
| 3c. Soil Exposure and Subsurface Intrusion Pathway Score ( $S_{sessi}$ )<br>(from Table 5-11, line 13)              | 100      | 10,000               |
| 4. Air Migration Pathway Score ( $S_a$ )  | NS       | NS                   |
| 5. Total of $S_{gw}^2 + S_{sw}^2 + S_{sessi}^2 + S_a^2$   |          | 10,000               |
| 6. <b>HRS Site Score</b><br>Divide the value on line 5 by 4 and take the square root                                |          | <b>50.00</b>         |

Note:

NS = Not scored

| <b>Table 5-11 – Subsurface Intrusion Component Scoresheet</b>   |                      |                       |
|---|----------------------|-----------------------|
| <b>Factor Categories and Factors</b>  | <b>Maximum Value</b> | <b>Value Assigned</b> |
| <b>Subsurface Intrusion Component</b>   |                      |                       |
| <b>Likelihood of Exposure:</b>  |                      |                       |
| 1. Observed Exposure  | 550                  | 550                   |
| 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                   |
| <b>Waste Characteristics:</b>   |                      |                       |
| 5. Toxicity/Degradation   | (a)                  | 10,000                |
| 6. Hazardous Waste Quantity   | (a)                  | 10,000                |
| 7. Waste Characteristics (subject to a maximum of 100)  | 100                  | 100                   |
| <b>Targets:</b>   |                      |                       |
| 8. Exposed Individual   | 50                   | 50                    |
| 9. Population:  |                      |                       |
| 9a. Level I Concentrations  | (b)                  | 484.2                 |
| 9b. Level II Concentrations   | (b)                  | 168.71                |
| 9c. Population within an Area of Subsurface Contamination   | (b)                  | NS                    |
| 9d. Total Population (lines 9a + 9b +9c)  | (b)                  | 652.91                |
| 10. Resources   | 5                    | 5                     |
| 11. Targets (lines 8 + 9d + 10)   | (b)                  | 707.91                |
| <b>Subsurface Intrusion Component Score:</b>  |                      |                       |
| 12. Subsurface Intrusion Component (lines 4 × 7 × 11)/82,500 <sup>c</sup> (subject to a maximum of 100) | 100                  | 100                   |
| <b>Soil Exposure and Subsurface Intrusion Pathway Score:</b>  |                      |                       |
| 13. Soil Exposure Component + Subsurface Intrusion Component (subject to a maximum of 100)              | 100                  | 100                   |

Notes:

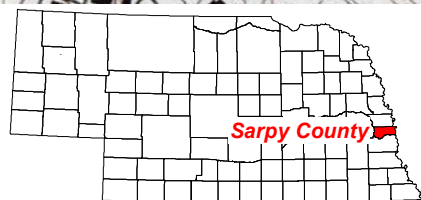
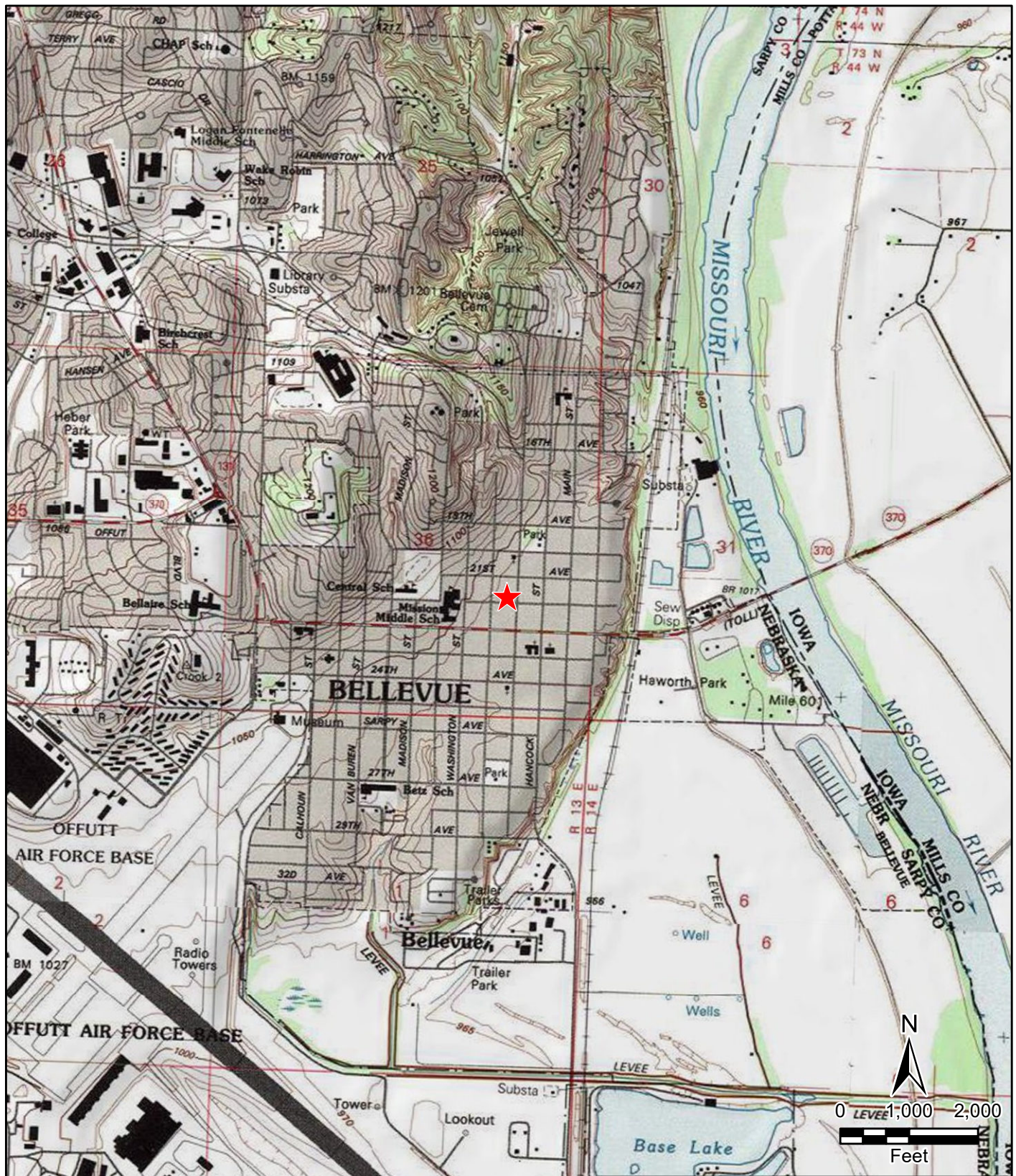
<sup>a</sup> Maximum value applies to waste characteristics category.

<sup>b</sup> Maximum value not applicable.

<sup>c</sup> Do not round to the nearest integer.

NS Not scored





**Legend**

- ★ Site reference point  
(Former Dry Cleaner)  
Lat: 41.137721  
Long: -95.894082

PCE - Carriage Cleaners  
Bellevue, Nebraska

**Figure 1**  
Site Location Map

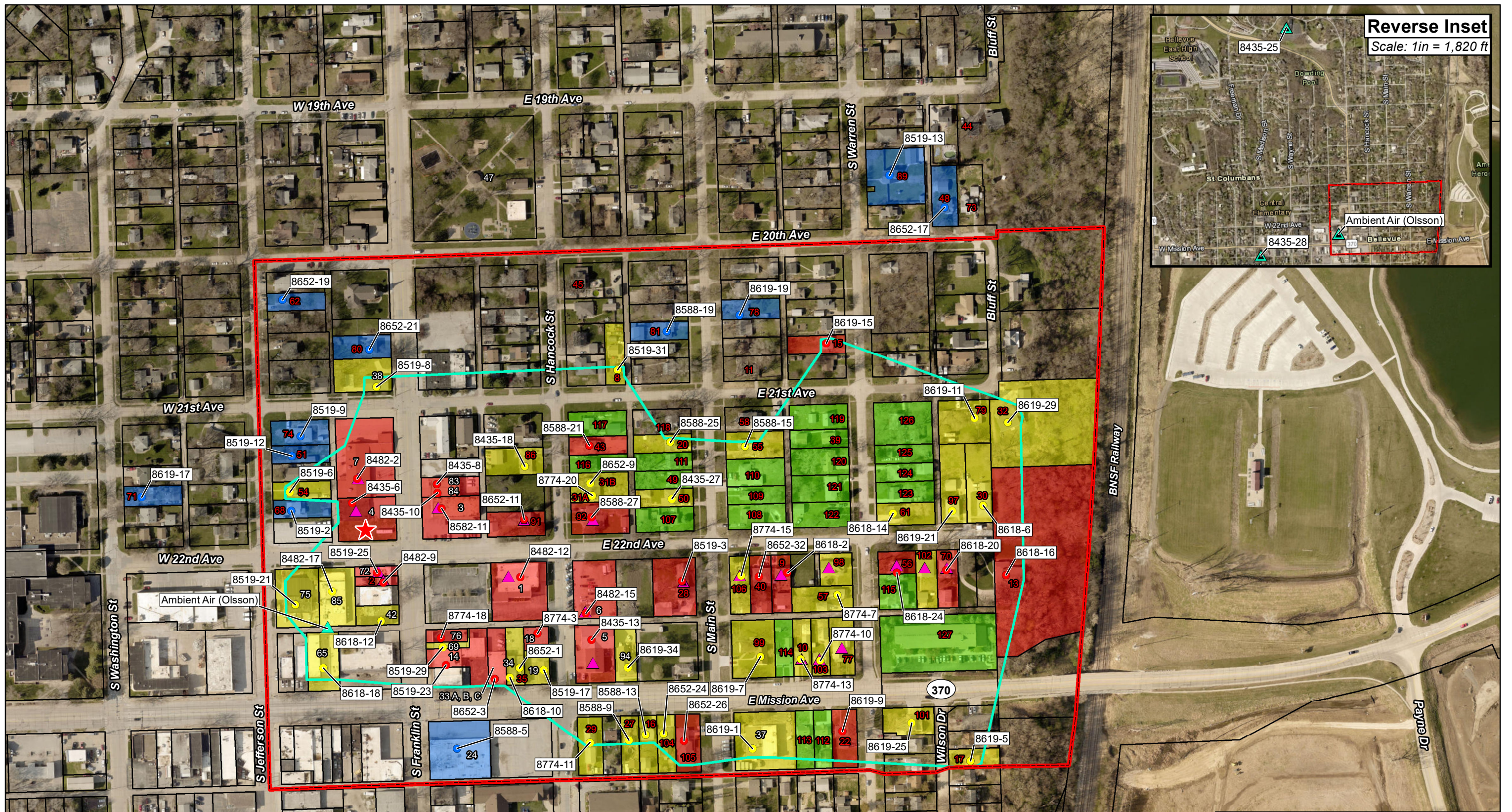


Source: USGS Council Bluffs South, NE 7.5 Minute Topo Quad, 1994;  
USGS Omaha South, NE 7.5 Minute Topo Quad, 1994;  
USGS Pacific Junction, NE 7.5 Minute Topo Quad, 1993;  
USGS Plattsmouth, NE 7.5 Minute Topo Quad, 1994

Date: 7/28/2022      Drawn By: Nick Wiederholt      Project No: X903021F0137.000

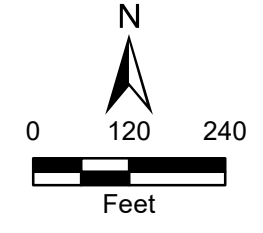
Notes: The source of this map image is Esri, used by EPA with Esri's permission.  
Ref. 10, p. 63





Legend

- ★ Former dry cleaner
- Background sample location
- Level 1 sample location
- Level 2 sample location
- ▲ Ambient air sample location
- ▲ Vapor mitigation system location
- Area of interest
- Area of observed exposure (AOE)
- Parcel boundary
- Background structure
- Level 1 structure
- Level 2 structure
- Level 2 structure (Inferred)
- 42 Regularly occupied commercial structure identification
- 18 Regularly occupied residential structure identification



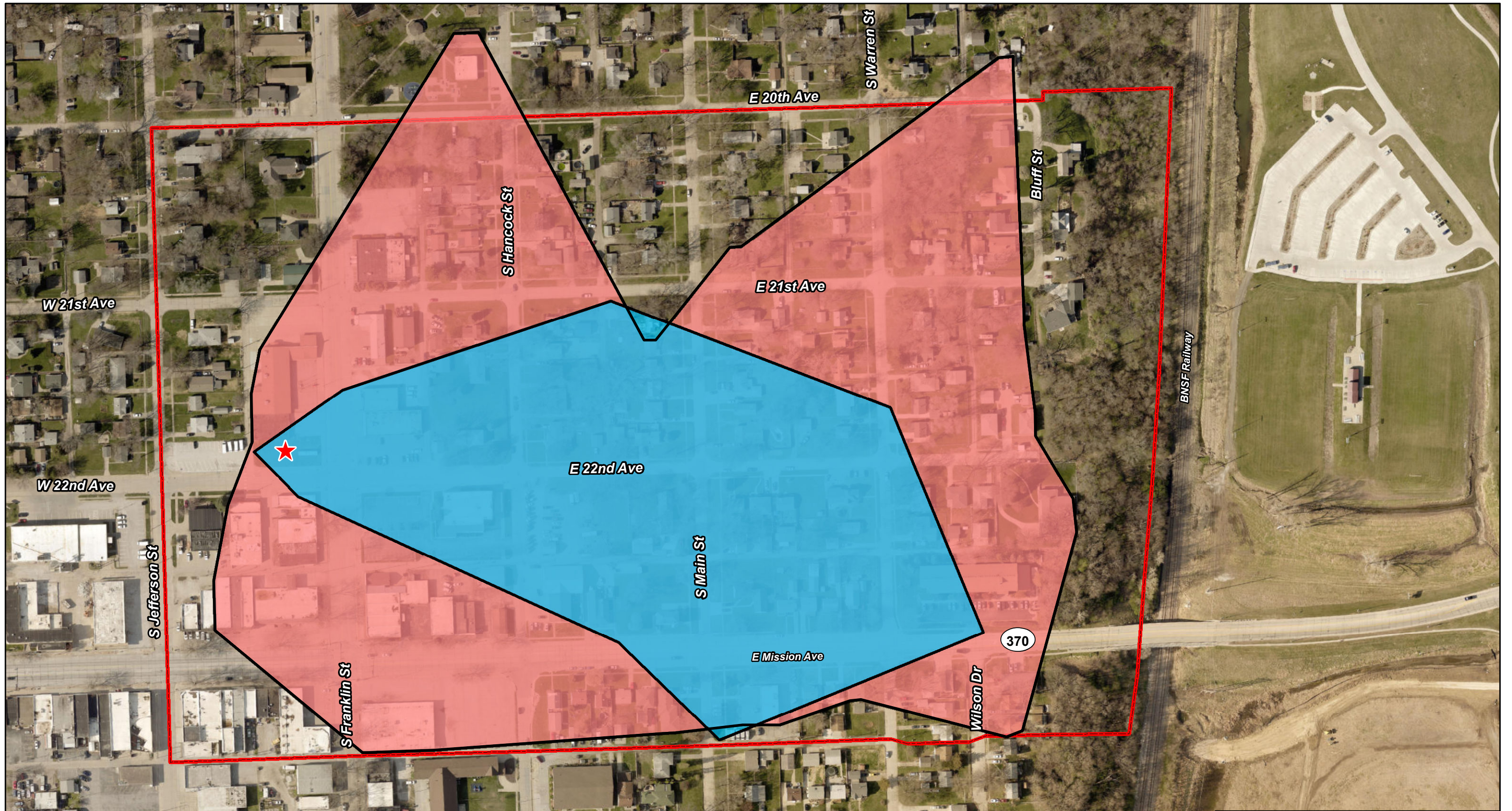
PCE - Carriage Cleaners  
Bellevue, Nebraska

**Figure 2**  
Area of Observed Exposure

TETRA TECH

Source: The source of this map image is Esri, used by EPA with Esri's permission; Sarpy County, Nebraska, GIS Portal, Parcel Dataset, 2021; Refs. 9, p. 13; 10, pp. 55, 66, 82-87; 13

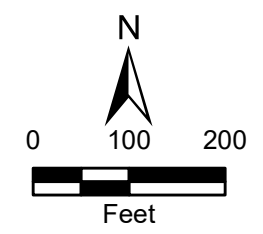




Legend

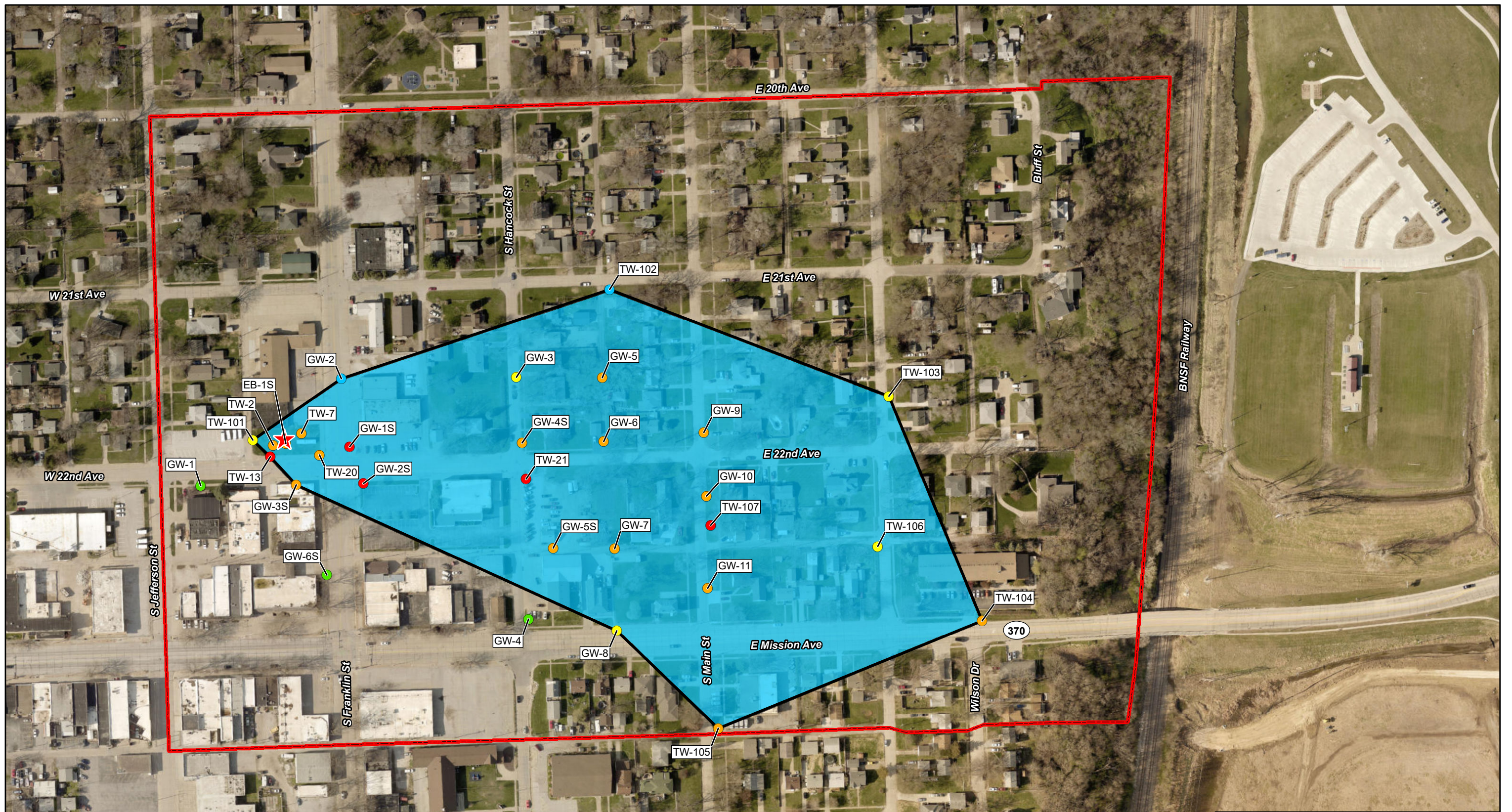
- ★ Former dry cleaner
- Area of interest
- Extent of groundwater contamination
- Extent of sub-slab vapor contamination

Source: The source of this map image is Esri, used by EPA with Esri's permission. Refs. Figures 4 & 5



|  |
|--|
| PCE - Carriage Cleaners<br>Bellevue, Nebraska                                    |
| <b>Figure 3</b><br>Extent of Subsurface Contamination                            |
| <b>TETRA TECH</b>  |
| Date: 7/28/2022      Drawn By: Nick Wiederholt      Project No: X903021F0137.000 |





Legend

★ Former dry cleaner

▭ Area of interest

▭ Extent of groundwater contamination

Groundwater sample location

● Non-detect

● > 0 µg/L to < 10 µg/L PCE

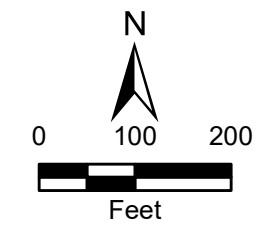
● ≥ 10 µg/L to < 100 µg/L PCE

● ≥ 100 µg/L to < 1,000 µg/L PCE

● ≥ 1,000 µg/L PCE

PCE Tetrachloroethene

µg/L Micrograms per liter



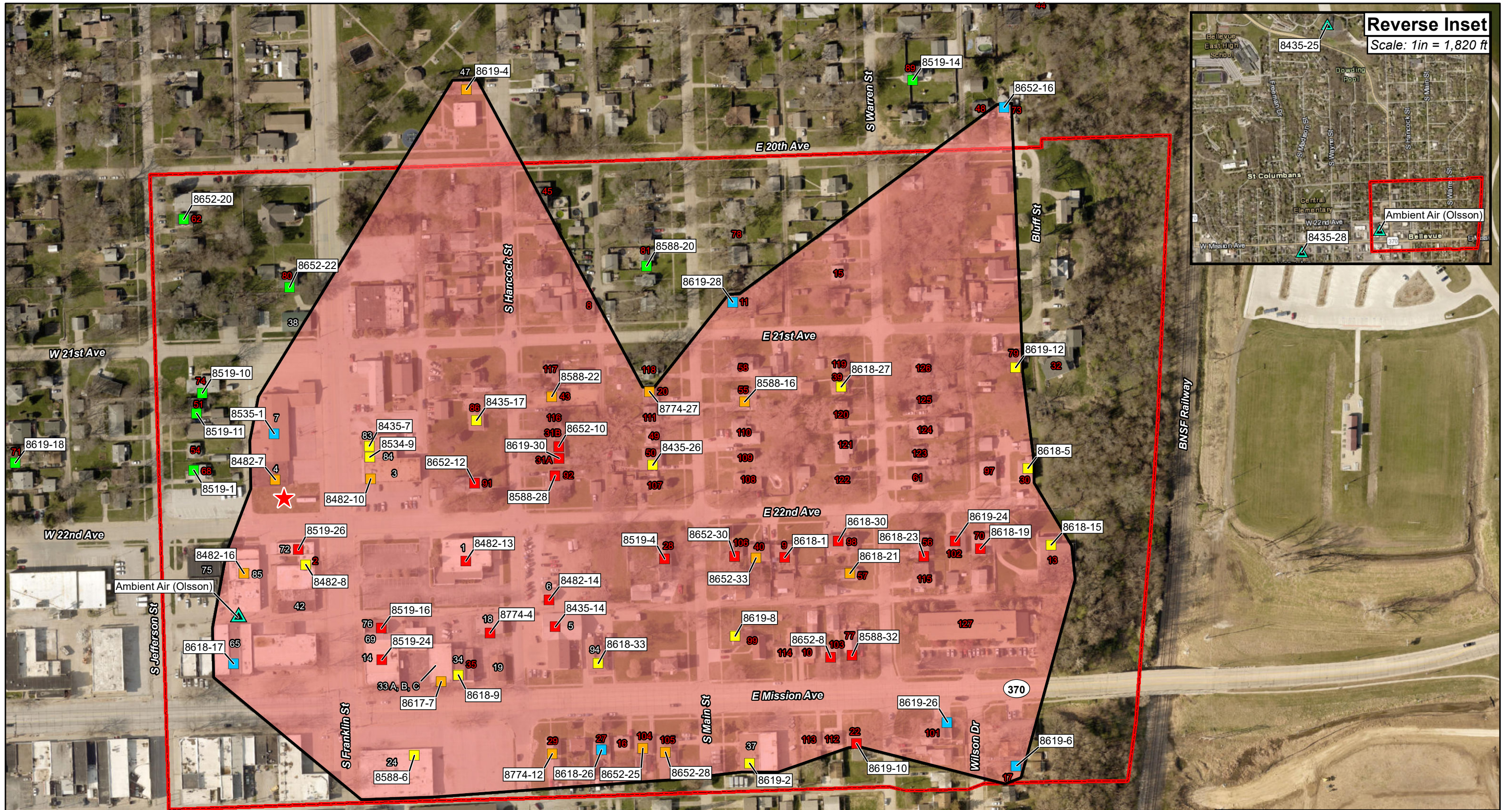
PCE - Carriage Cleaners  
Bellevue, Nebraska

**Figure 4**  
Extent of Groundwater Contamination



Source: The source of this map image is Esri, used by EPA with Esri's permission; Refs. 7, pp. 5, 9; 8, pp. 15, 16, 26, 30; 9, pp. 14, 20; 10, pp. 40, 41, 73



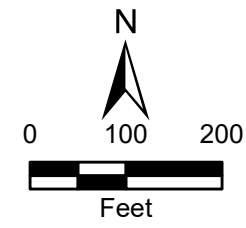


Legend

- ★ Former dry cleaner
- ▲ Ambient air sample location
- Area of interest
- Extent of sub-slab vapor contamination
- Sub-slab vapor sample location
  - Non-detect to < 2 µg/m³ PCE
  - ≥ 2 µg/m³ to < 10 µg/m³ PCE
  - ≥ 10 µg/m³ to < 100 µg/m³ PCE
  - ≥ 100 µg/m³ to < 1,000 µg/m³ PCE
  - ≥ 1,000 µg/m³ PCE
- 42 Regularly occupied commercial structure identification
- 16 Regularly occupied residential structure identification

PCE Tetrachloroethene  
µg/m³ Micrograms per cubic meter

Source: The source of this map image is Esri, used by EPA with Esri's permission. Ref. 10, pp. 82-87



PCE - Carriage Cleaners  
Bellevue, Nebraska

**Figure 5**  
Extent of Sub-slab Vapor Contamination

TETRA TECH

Date: 7/28/2022    Drawn By: Nick Wiederholt    Project No: X903021F0137.000



## REFERENCES

- Ref.  
No.      Description of the Reference
1. U.S. Environmental Protection Agency (EPA). Hazard Ranking System, Title 40 Code of Federal Regulations (CFR) Part 300, Appendix A (55 Federal Register [FR] 51583, Dec. 14, 1990, as amended at 82 FR 2779, Jan. 9, 2017; 83 FR 38037, Aug. 3, 2018), as published in the Code of Federal Regulations on July 1, 2019, with two attachments. Attachment A: Federal Register Vol. 55, No. 241. December 14, 1990. Hazard Ranking System Preamble. Attachment B: Federal Register Vol. 82, No. 5, January 9, 2017. Addition of a Subsurface Intrusion Component to the Hazard Ranking System Preamble. Available at <https://semspub.epa.gov/src/document/HQ/100002489>. 197 Pages.
  2. EPA. Superfund Chemical Data Matrix (SCDM). Accessed on August 2, 2022. Accessed on-line at: <https://www.epa.gov/superfund/superfund-chemical-data-matrix-scdm-query>. 9 Pages.
  3. U.S. Department of the Interior, U.S. Geological Survey (USGS). Omaha South Quadrangle, Nebraska-Iowa. 7.5 Minute Series (Topographic). Scale, 1:24,000. 2021. Note: Modified by Tetra Tech, Inc. (Tetra Tech) to add the location of the former Carriage Cleaners facility. 1 Map.
  4. Tetra Tech. Project Note to File with Attachment. Subject: Coordinates for PCE - Carriage Cleaners in Bellevue, Nebraska. Attachment: Google Earth Map. September 29, 2021. 2 Pages.
  5. EPA. Facility Registry Service (FRS) Facility Detail Report, PCE – Carriage Cleaners. Accessed on October 1, 2021. Accessed on-line at: [FRS Query | US EPA](#). 2 Pages.
  6. Thiele Geotech Inc. Phase I Environmental Site Assessment Report, Commercial Property, 2110 & 2112 Franklin Street, Omaha, Nebraska. Prepared for Buckley Construction. July 27, 2017. 212 pages.
  7. Thiele Geotech Inc. Phase II Environmental Site Assessment, Commercial Property, 2110 - 2112 Franklin Street, Bellevue, Nebraska. Prepared for Buckley Construction. September 18, 2017. 58 pages.
  8. Thiele Geotech Inc. Supplemental Environmental Site Assessment Report, Commercial Property, 2110 - 2112 Franklin Street, Bellevue, Nebraska. Prepared for Buckley Construction Co. July 31, 2018. 170 pages.
  9. Olsson Inc. Carriage Cleaners, Vapor Intrusion Assessment. Prepared for the Nebraska Department of Environmental Quality. June 21, 2019. 286 pages.
  10. Tetra Tech, Inc. Removal Site Evaluation and Site Inspection Report, PCE Carriage Cleaners, Bellevue, Nebraska. Prepared for EPA Region 7. July 9, 2021. 367 pages.
  11. Haldeman, D. Nebraska Department of Environment and Energy. Letter to M. Peterson, EPA Region 7. Subject: Request for Federal Action, Former Carriage Cleaners Site, Bellevue, NE. July 12, 2019. 5 pages.
  12. Tetra Tech. Project Note to File with Attachments. Subject: Reporting Limits for Analytic Services Requests (ASRs) 8435, 8482, 8519, 8588, 8618, 8619, 8652, 8774, and 8745. Prepared by: David Zimmermann, Project Manager. Attachments: Reporting Limits. October 15, 2021. 123 Pages.
  13. Tetra Tech. Project Note to File with Attachments. Subject: Area of Exposure – Regularly Occupied Structures. Prepared by: David Zimmermann, Project Manager. Attachments: List of Regularly Occupied Structures and Building Reports. October 20, 2021. 210 Pages.
  14. EPA, Solid Waste and Emergency Response. Dense Nonaqueous-phase Liquids (DNAPL) Remediation: Selected Projects Approaching Regulatory Closure, Status Update. EPA 542-R-04-016. December 2004. 34 Pages.
  15. EPA, Office of Emergency and Remedial Response. Estimating Potential for Occurrence of DNAPL at Superfund Sites, Quick Reference Fact Sheet. Publication: 9355.4-07FS. January 1992. 10 Pages.
  16. EPA. Office of Solid Waste and Emergency Response (OSWER) Technical Guide for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Vapor Sources to Indoor Air. OSWER Publication No. 9200.2-154. June 2015. 267 Pages.



17. U. S. Census Bureau. QuickFacts: Sarpy County, Nebraska. Accessed on-line at [U.S. Census Bureau QuickFacts: United States](#). 3 pages.
18. Tetra Tech. Project Note to File with Attachments. Subject: Property Information Forms from December 2019 for PCE - Carriage Cleaners in Bellevue Nebraska. Prepared by: David Zimmermann, Project Manager. Attachments: Property Questionnaires for December 2019 sampling effort. November 15, 2021. 12 Pages.
19. Tetra Tech. Project Note to File with Attachments. Subject: Electronic Field Sheets - Carriage Cleaners in Bellevue Nebraska. Prepared by: David Zimmermann, Project Manager. Attachments: Copies of electronic field sheets for ASR Numbers 8482, 8519, 8588, 8618, 8619, 8652, 8744, and 8775. January 5, 2022. 13 pages.
20. Tetra Tech. Trip Report and Data Summary – October 2021 Sampling Event, PCE Carriage Cleaners, Bellevue, Nebraska. Prepared for EPA Region 7. December 10, 2021. 309 pages.



## SITE SUMMARY

The PCE – Carriage Cleaners site in Bellevue Nebraska, as scored for HRS purposes, consists of one area of observed exposure (AOE), delineated by regularly occupied residential and workplace structures with documented observed exposures. The AOE includes 85 structures with samples meeting observed exposure criteria or inferred to be within the AOE. The site-attributable hazardous substances that have entered indoor air from the subsurface include the following chlorinated volatile organic compounds (CVOCs): tetrachloroethene (PCE), trichloroethene (TCE), *cis*-1,2-dichloroethene (*cis*-1,2-DCE), *trans*-1,2-DCE, and vinyl chloride (Ref. 10; see **Table 2** of this HRS documentation record see **Section 5.2.0**). The site includes documented indoor air contamination in 64 regularly occupied structures overlying soil and groundwater contaminated by the release of PCE and its chemical degradations from operations at the former dry-cleaning operation. Although soil and groundwater contamination is discussed, an area of subsurface contamination is not scored for HRS purposes. The EPA identification number for the site, as recorded in the Superfund Enterprise Management System (SEMS) database, is NEN000710226 (Ref. 5).

The site is within the City of Bellevue Nebraska and is on the loess bluff about 0.3 mile west of the Missouri River flood plain, and about 0.7 mile southwest of the river (Refs. 3; 10, p. 7). Elevation at the site is about 1,038 feet above mean sea level (AMSL), which is about 70 feet above the Missouri River floodplain's elevation (Refs. 3; 10, p. 7). Bellevue is in eastern Nebraska about 6 miles south of the Interstate 80 (I-80) bridge over the Missouri River at Omaha, Nebraska (Refs. 3; 10, p. 7).

The former Carriage Cleaners facility is currently a vacant lot at 2112 Franklin Street in Bellevue (Ref. 10, p. 7). The building was demolished in 2010 (Refs. 6, p. 66; 10, p. 7). The first listing for Carriage Cleaners in the city directories was 1976-1977 (Ref. 6, p. 78). Carriage Cleaners closed about 1994 and the property was sold through the Bankruptcy Court in 1996 (Refs. 6, p. 4; 10, p. 7). Property uses between about 1995 and 2010, when the building was demolished, are uncertain. The 2110 Franklin Street building was formerly used as a laundromat in the early 1990s and may have been the location of the Highlander Laundry, which shared the 2112 Franklin address in 1980-1981 (Ref. 6, pp. 18, 78).

Commercial businesses are generally present along Franklin Street between 21<sup>st</sup> and 23<sup>rd</sup> Avenue and along Mission Avenue, one block south of the former dry cleaner. The areas surrounding the commercial corridors are largely residential (Ref. 10, p. 8).

Historical investigations conducted in 2017-2020 identified PCE and TCE in soil, groundwater, and soil gas vapor samples collected at or near the former dry cleaner. A Phase II Environmental Site Assessment (ESA) of the former Carriage Cleaners property was conducted in 2017 (Ref. 7). Two soil samples were collected at the former dry cleaners during the Phase II ESA and PCE and TCE were detected at maximum concentrations of 3,010 micrograms per kilogram ( $\mu\text{g}/\text{kg}$ ) and 89.2  $\mu\text{g}/\text{kg}$  respectively, at 43-44 feet below ground surface (bgs) (Ref. 7, pp. 4, 9). Groundwater samples were collected from two temporary monitoring wells (Ref. 7, p. 2). In the shallow well (collected within about 15-25 feet bgs), PCE was detected at 201 micrograms per liter ( $\mu\text{g}/\text{L}$ ), and in the deep well (screened from 70-80 feet bgs), PCE was detected at 6.88  $\mu\text{g}/\text{L}$  (Ref. 7, pp. 2, 5). TCE was detected at 22.7  $\mu\text{g}/\text{L}$  in the shallow well and 3.45  $\mu\text{g}/\text{L}$  in the deep well sample. The PCE degradation products *cis*-1,2-DCE (103  $\mu\text{g}/\text{L}$ ) and *trans*-1,2-DCE (28.8  $\mu\text{g}/\text{L}$ ) were detected in the shallow well sample (Ref. 7, p. 5).

In June and July, 2018, a supplemental ESA was conducted that included sampling of soil, groundwater, soil gas, sub-slab vapor, and indoor air (Ref. 8, pp. 7, 111, 112, 134, 169). Soil samples were collected at the former dry cleaners, with the highest PCE concentrations detected near the western edge of the former building. PCE was detected at 1,090  $\mu\text{g}/\text{kg}$  at 5-6 feet bgs and at 4,440  $\mu\text{g}/\text{kg}$  at 15-16 feet bgs (Ref. 8, pp. 14, 26, 62-65). A soil gas vapor sample (SV-1) collected at 5 feet bgs near the center of the property where the former dry cleaner was located had a PCE concentration of 1,100,000 micrograms per cubic meter ( $\mu\text{g}/\text{m}^3$ ) (Ref. 8, pp. 17, 26, 119). A PCE concentration of 350,000  $\mu\text{g}/\text{m}^3$  was detected in a sub-slab vapor sample (SS-2) collected at the 2110 Franklin Street building (Ref. 8, pp. 17, 26, 124). Groundwater samples were collected from six shallow (about 25 feet bgs) and six deep (about 75 feet bgs) temporary monitoring wells within about 550 feet downgradient of the former dry cleaner (Ref. 8, pp. 9, 30). PCE was detected at all shallow wells except for a location cross-gradient to the south (Ref. 8, pp. 15, 16, 30). PCE was detected at 9,450  $\mu\text{g}/\text{L}$  and TCE was detected at 52.6  $\mu\text{g}/\text{L}$  in the shallow well and across Franklin Street from the former dry cleaner (Ref. 8, pp. 30, 76, 77). No contaminants were reported in the deep groundwater sample collected at that location, but PCE was detected at 1,360  $\mu\text{g}/\text{L}$  and TCE was detected at 16.1  $\mu\text{g}/\text{L}$  in the deep well at the southeast corner of Franklin Street and 22<sup>nd</sup> Avenue (Ref. 8, pp. 30, 74, 75, 78, 79).



During the supplemental ESA a deep boring was logged to better understand the lithology under the former dry cleaner and water levels were measured to understand groundwater flow direction (Ref. 8, pp. 7, 18, 19, 36-38). In shallow wells the depth to groundwater was measured at 13.08 to 15-93 feet below ground level; in the deep wells depth to groundwater was measured at 21.03 to 31.18 feet below ground level (Ref. 8, p. 19). Groundwater in the shallow wells was determined to be flowing to the east/southeast (Ref. 8, p. 19). The lithology logged for boring GW-2, about 90 feet southeast of the former dry cleaner property, consists primarily of Loveland Loess (high plasticity clays) deposits overlain by Peoria Loess (silts and silty lean clays) deposits generally overlain by fill (Ref. 8, pp. 12, 26, 36-38). Fill material ranged from 5.5 to 6.5 feet thick and consisted of lean clay. Peoria Loess was encountered beneath the fill to a depth of 74.5 feet. Loveland Loess consisting of red gray, wet, firm, fat, clay was encountered below the Peoria Loess (Ref. 8, pp. 12, 38). The thickness of the Loveland Loess is uncertain.

In 2019 the Nebraska Department of Environmental Quality (NDEQ) (now the Nebraska Department of Environment and Energy [NDEE]) conducted a vapor intrusion investigation of the areas north, south, and east of the former dry cleaner (Ref. 9, pp. 1, 4, 5, 13, 14). The investigation included the collection of indoor air and sub-slab vapor samples from eight commercial and three residential structures, one ambient air sample, and shallow groundwater samples (28 to 40 feet bgs) from 11 locations (Ref. 9, pp. 5, 6, 13, 14). Groundwater sampling documented PCE at concentrations exceeding 200 µg/L at three temporary wells on Main Street, more than 800 feet downgradient of the former dry cleaners (Refs. 9, pp. 12, 14, 20; 10, p. 65). Also documented was PCE levels in sub-slab vapors as high as 25,000 µg/m<sup>3</sup> and as high as 130 µg/m<sup>3</sup> in indoor air (Ref. 9, pp. 13, 17-19, 102, 103, 130, 137, 165). Based on these data, NDEE determined that contaminant concentrations in indoor air could present an immediate human health risk, and exceed established indoor air and/or sub-slab vapor Removal Management Levels (RMLs) for PCE and/or TCE (Ref. 11, p. 4).

In July 2019, NDEE submitted a Request for Federal Action, requesting that EPA consider the following types of actions: (1) mitigation of vapor intrusion (VI) into residences and businesses where NDEE had determined indoor air or sub-slab vapor concentrations exceed applicable risk-based standards for protection of human health, (2) additional indoor air and sub-slab sampling within the known area of contamination, and/or (3) additional soil and groundwater sampling to delineate and control the source(s) of contamination (Ref. 11).

Sampling for the EPA removal site evaluation/site investigation (RSE/SI) occurred between December 2019 and April 2021 (Ref. 10, p. 15). During the RSE, 25 soil samples from 15 direct-push technology (DPT) soil borings (SB), 12 groundwater samples from 12 DPT temporary wells (TW), 140 indoor air samples, and 116 sub-slab vapor samples were collected at or near the former dry cleaner facility (Ref. 10, pp. 16-19, 20-23, 33-34, 37, 38). In addition, membrane interface probe (MIP) and electrical conductivity (EC) logging to investigate soils at the former dry cleaner, and presence of clays and silts to the total depth logged was performed at 21 locations at or near the former dry cleaner. Also, vapor samples were collected from sanitary and stormwater sewer manholes in the site area (Ref. 10, pp. 31, 32, 43, 68, 74). The RSE/SI indicated presence of dry cleaner-related hazardous substances in soil, groundwater, indoor air, sub-slab vapors, and sanitary sewer vapor at the former dry cleaner and to the east. Maximum concentrations of PCE in the various media sampled are as follows: soil (45,000,000 µg/kg), groundwater (11,000 µg/L); sub-slab vapor (39,000 µg/m<sup>3</sup>), indoor air (400 µg/m<sup>3</sup>), and sanitary sewer vapor (8,300 µg/m<sup>3</sup>) (Ref. 10, pp. 24, 29, 35, 40, 45). At seven businesses and 13 single or multi-family residences, PCE concentrations in indoor air exceeded the EPA RML for residential or commercial/industrial settings (Ref. 10, p. 54). Sub-slab PCE vapor concentrations at 12 residential properties exceeded the 1,400 µg/m<sup>3</sup> removal management level (RML). PCE concentrations at six businesses exceeded the 5,800 µg/m<sup>3</sup> RML. In the indoor air at one commercial property, the TCE concentration exceeded the 6 µg/m<sup>3</sup> RML for commercial indoor air, and in one residential crawlspace, the PCE concentration exceeded the 42 µg/m<sup>3</sup> RML for residential indoor air.

EPA Region 7's Emergency and Rapid Response Services (ERRS) contractor installed vapor mitigation systems (VMS) at seven businesses and 13 residential properties between December 2019 and February 2021 (Ref. 10, p. 55, see Table 2 of this HRS documentation record). Most of these systems were installed based on detections of elevated concentrations in sub-slab samples (Ref. 10, pp. 54, 55).

In October 2021 additional MIP and EC logging was done to further define the extent of contamination south of the former dry cleaner under W. 22<sup>nd</sup> Avenue (Ref. 20, pp. 13, 33, 34). Fourteen MIP/EC borings were advanced to depths ranging from about 60 to 80 feet below ground surface (Ref. 20, pp. 13-16). Soil sampling was performed at 18 borings at depths where most contamination was detected during MIP logging (Ref. 20, pp. 17-18). PCE was detected in 42 of the 44 samples submitted; TCE was detected in 11 (Ref. 20, p. 21). The maximum PCE concentration detected (13,000,000 µg/kg) was in SB-36 near the southwestern corner of the former dry cleaner at a depth of 58.5 – 59.5 feet below ground surface (Ref. 20, pp. 21, 22-23, 34).



## 5.0 SOIL EXPOSURE AND SUBSURFACE INTRUSION PATHWAY

For this site, the subsurface intrusion component is scored based on the actual intrusion of hazardous substances into regularly occupied structures that have structure containment values greater than zero and meet the criteria as being in an area of observed exposure (Ref. 1, Section 5.2.0).

### 5.2 SUBSURFACE INTRUSION COMPONENT

The subsurface intrusion component is evaluated because indoor air samples collected from within residential and workplace structures have documented observed exposures (Ref. 1, Section 5.2.1). The site includes one area of observed exposure (AOE) comprising 62 regularly occupied residential structures and 23 regularly occupied workplace structures that meet the criteria for observed exposure or are inferred to be within the AOE. The hazardous substances meeting observed exposure criteria in the AOE (i.e., in the indoor air of regularly occupied structures) include tetrachloroethene (PCE), trichloroethene (TCE), *cis*-1,2-dichloroethene (*cis*-1,2-DCE), *trans*-1,2-DCE, and vinyl chloride (VC). The AOE is based on 41 residential structures and 23 workplace structures with concentrations of these hazardous substances that meet observed exposure criteria, as documented through indoor air sampling (see **Observed Exposure by Chemical Analysis in Section 5.2.0**). Twenty-two additional residential structures are inferred to be within the AOE based on their location between the contaminated structures (see **Figure 2**) [Ref. 1, Section 5.2.0].

The origin of the indoor air contamination at the site is subsurface intrusion from an extensive groundwater and soil vapor contamination area that exists beneath the AOE (see **Figures 3, 4, 5**). This contamination originated from a former dry cleaning facility that operated at 2112 Franklin Street from the mid-1970s to early 1990s (Refs. 6, pp. 18; 10, pp. 8, 9). Soil samples collected at the former dry cleaning facility in 2021 documented the following chlorinated volatile organic compounds (CVOC) at the maximum concentrations; PCE (45,000,000 micrograms per kilogram [ $\mu\text{g}/\text{kg}$ ]), and TCE (4,000  $\mu\text{g}/\text{kg}$ ) (Ref. 10, pp. 33-36, 72, 288, 291). The hazardous substances detected most frequently and at the highest levels in the subsurface chlorinated volatile organic compound (CVOC) contamination area are PCE and TCE. The maximum concentrations reported in groundwater since 2017 are 11,000 micrograms per liter ( $\mu\text{g}/\text{L}$ ) for PCE; and 52.6  $\mu\text{g}/\text{L}$  for TCE (Ref. 10, pp. 40, 78). At the former dry cleaner, PCE in soil gas has been measured as high as 1,100,000 micrograms per cubic meter ( $\mu\text{g}/\text{m}^3$ ) (Ref. 8, pp. 17, 26, 119). Sub-slab soil vapor samples at the location of the former facility have documented PCE as high as 350,000  $\mu\text{g}/\text{m}^3$  (Ref. 8, pp. 17, 26, 124). Vapor samples from the sanitary sewer located south of the former drycleaner were collected in 2021. Several samples exhibited CVOCs, and the maximum concentrations were detected in sample 8745-207 from location Sewer-05 at the corner of Main and E. 22nd Ave, with PCE (up to 8,300  $\mu\text{g}/\text{m}^3$ ), TCE (up to 85  $\mu\text{g}/\text{m}^3$ ), *cis*-1,2-DCE (up to 28  $\mu\text{g}/\text{m}^3$ ), *trans*-1,2-DCE (up to 0.71  $\mu\text{g}/\text{m}^3$ ), and VC (up to 4.9  $\mu\text{g}/\text{m}^3$ ) (Ref. 10, pp. 42-46, 74, 283, 311). Off the former dry cleaner property, sub-slab soil vapor collected concurrently with the indoor air samples showed that CVOCs are present in the subsurface directly beneath the AOE, at levels up to 28,000  $\mu\text{g}/\text{m}^3$  (Ref. 10, pp. 24-27, 67, 196, 198). The extent of subsurface groundwater and soil vapor contamination is not fully delineated; most of the structures in the AOE are located above the CVOC subsurface contamination (see **Figures 2 – 5** of this HRS documentation record).

The upland geology of Eastern Nebraska is Pleistocene in age and consists of eolian (wind-blown) deposits of Peoria loess. The loess formed in dune-shaped hills and has been extensively eroded. The Peoria loess typically consists of silts and silty lean clays that are stiff when dry but become softer with increasing moisture content. Loveland Loess underlies the Peoria Loess. Loveland Loess typically consists of high plasticity clays that are stiff when wet and dry. The loess overlies Pleistocene glacial deposits of Kansan till. The till consists of lean to fat clays mixed with sand, gravel, and occasional cobbles (Ref. 8, p. 12).

Cretaceous sandstone and Pennsylvanian limestone and shale form the bedrock units underlying the region. The depth to bedrock is typically over 100 feet in upland areas, and varies due to erosion within the Missouri River valley (Ref. 8, p. 12). Based on borings performed at the PCE Carriage Cleaners facility by EPA and other investigators, the property is underlain from the ground surface down by Peoria loess and Loveland loess (Refs. 8, pp. 12, 36-38; 10, pp. 49, 71). The water table surface occurs in the Peoria loess at an approximate depth of 13 to 15.4 feet below ground surface (Ref. 8, p. 19). No known confining layers exist between ground surface and the top of the water table. In general, groundwater flows to the east/southeast (Ref. 8, p. 19).

The CVOC contamination is encountered throughout the Peoria loess, in temporary wells screened from 20 to 25 feet below ground surface and in temporary wells screened from 70 to 75 feet bgs (Ref. 8, pp. 9, 15). Dense nonaqueous phase liquid (DNAPL) is assumed present at the site due to the very high concentrations of PCE (45,000,000  $\mu\text{g}/\text{kg}$ ) in a soil sample (SB-13) collected at a depth of 13-14 feet bgs, and 9,200,000  $\mu\text{g}/\text{kg}$  in a soil sample (SB-23) collected from



43-44 feet bgs (below the water table) (Refs. 10, p. 35; 15, pp. 4, 5). Another indicator of possible DNAPL presence is that PCE in groundwater is found at a concentration which is greater than 1 percent of its pure phase solubility which is 2,000 µg/L (Ref. 14, pp. 3, 32). Three groundwater samples (TW-13, TW-21, TW-107) collected in April 2021 contained PCE at concentrations ranging from 2,100 to 11,000 µg/L (Ref. 10, pp. 40, 73).

The volatile compounds PCE and TCE, and their breakdown products *cis*-1,2-DCE, *trans*-1,2-DCE, and vinyl chloride, are part of a common class of chemicals with known vapor intrusion characteristics (Ref. 16, pp. 44, 58, 59, 266). Where vapor intrusion is involved, in general, the subsurface vapors may emanate from the contaminated groundwater and enter the pore space around and between the subsurface soil particles and soil column above the groundwater table. From there the hazardous vapors in the vadose zone (the soil between the surface and the groundwater table) may enter buildings by migrating through cracks, seams, interstices, and gaps in walls or foundations (Ref. 16, pp. 46, 48, 49). In April 2021, 13 samples of sanitary sewer gas and three samples of storm sewer gas were collected (Ref. 10, pp. 42, 45, 46, 74). Vapor samples from the sanitary sewer located south and east of the former drycleaner were collected in 2021. Several samples exhibited CVOCs, and the maximum concentrations were detected in sample 8745-207 from location Sewer-05 at the corner of Main and E. 22nd Ave, with PCE (up to 8,300 µg/m<sup>3</sup>), TCE (up to 85 J µg/m<sup>3</sup>), *cis*-1,2-DCE (up to 28 µg/m<sup>3</sup>), *trans*-1,2-DCE (up to 0.71 µg/m<sup>3</sup>), and VC (up to 4.9 µg/m<sup>3</sup>) (Ref. 10, pp. 42-46, 74, 283, 311). In general, sanitary sewers may be potential pathways for contaminants to enter structures (Ref. 16, pp. 44, 50).

During its investigations of the site, EPA has identified one historical and current possible origin of contamination. The first listing for Carriage Cleaners in the city directories was 1976-1977 (Ref. 6, p. 78). Carriage Cleaners closed about 1994 and the property was sold through the Bankruptcy Court in 1996 (Refs. 6, p. 4; 10, p. 7). Database searches and investigation results have not identified other potential sources of chlorinated solvent releases to the environment near the site (Ref. 6, pp. 13-17, 105, 108, 109, 124-150).

## 5.2.0 GENERAL CONSIDERATIONS

There is one identified area of observed exposure at the site where structures are subject to indoor air contamination due to subsurface intrusion, as shown in **Figure 2** of this HRS documentation record.

TABLE 1. SUMMARY OF REGULARLY OCCUPIED STRUCTURES WITHIN AREAS OF OBSERVED EXPOSURE

| AOE Number | Type of Structure      | Number(s) of Specific Type of Structure <sup>1</sup> | References |
|------------|------------------------|--|------------|
| AOE 1      | Residence<br>Workplace | 62<br>23   | Figure 2   |

<sup>1</sup> For multi-subunit structures (duplexes and apartments), the number of structures does not take into account subunits. Although most of the residential structures sampled during the December 2019 through February 2021 sampling events were single family homes, there were several instances where multiple subunits of the same building were sampled. At ROS 31A and 31B (identified as a duplex) both units were sampled (Refs. 10, pp. 29, 84; 13, pp. 57, 58). At commercial building ROS 33, three samples were collected at three different addresses associated with the building (33A, 33B, and 33C) (Refs. 10, pp. 29, 84; 13, pp. 61, 62). ROS 127 is a three-story apartment building with 42, 1-bedroom units where no sample was collected (Ref. 13, pp. 209, 210). ROS 98 is a residential property that was converted to 4 apartments (Ref. 13, pp. 153, 154). For all structures within the inferred areas of observed exposure, where the divisions of the subunits are unknown, a default value of one regularly occupied subunit on the lowest level is used for HRS scoring purposes.

### Area(s) of Observed Exposure

The results of the December 2019 through February 2021 sampling events document one area where regularly occupied structures are subject to Level I or Level II indoor air concentrations due to subsurface intrusion; these areas are presented as AOE 1 (see Figure 2 of this HRS documentation record).

#### *AOE 1 – Area of Observed Exposure 1*

Location, description and delineation of AOE (with reference to a map of the site):

There are 62 regularly occupied residential structures and 23 regularly occupied workplace structures within AOE 1. The AOE is delineated based on residential structures and workplace structures that had observed exposures of site-attributable hazardous substances, as documented through indoor air sampling (see **Observed Exposure by Chemical Analysis**



below and **Figure 2** of this HRS documentation record). Twenty-two additional residential structures are within AOE 1 and contamination in these structures is inferred based on their location between the structures that meet the observed exposure criteria through chemical analysis (see **Figure 2** of this HRS documentation record) [Ref. 1, Section 5.2.0].

Most of the structures in AOE 1 are located above the CVOC subsurface contamination discussed in this HRS documentation record (see **Figures 2 and 3** of this HRS documentation record).

Identification of all regularly occupied structures in the AOE:

TABLE 2. REGULARLY OCCUPIED STRUCTURES WITHIN THE AOE

| Type of Structure  | Regularly Occupied Structure ID | References   |
|--|---------------------------------|--|
| AOE 1  |                                 |  |
| Workplace (sample location) (VMS installed December 2019)        | ROS 01                          | 10, pp. 55, 82; 13, pp. 2, 5, 6; Figure 2                    |
| 2 unit apartment (sample location) (VMS installed December 2019) | ROS 02                          | 10, pp. 55, 82; 13, pp. 2, 7, 8; Figure 2                    |
| Workplace (sample location) (VMS installed December 2019)        | ROS 03                          | 10, pp. 55, 82; 13, pp. 2, 9, 10; Figure 2                   |
| Workplace (sample location) (VMS installed December 2019)        | ROS 04                          | 10, pp. 55, 82; 13, pp. 2, 11, 12; Figure 2                  |
| Workplace (sample location) (VMS installed December 2019)        | ROS 05                          | 10, pp. 55, 82; 13, pp. 2, 13, 14; Figure 2                  |
| Workplace (sample location) (VMS installed December 2019)        | ROS 06                          | 10, pp. 55, 82; 13, pp. 2, 15, 16; Figure 2                  |
| Workplace (sample location) (VMS installed December 2019)        | ROS 07                          | 10, pp. 55, 82; 13, pp. 2, 17, 18; Figure 2                  |
| SF Residence (sample location)                                   | ROS 08                          | 10, p. 82; 13, pp. 2, 19, 20; Figure 2                       |
| SF Residence (sample location) (VMS installed October 2020)      | ROS 09                          | 10, pp. 55, 82; 13, pp. 2, 21, 22; Figure 2                  |
| SF Residence (sample location) (VMS installed October 2020)      | ROS 10                          | 10, p. 55, 83; 13, pp. 2, 23, 24; Figure 2                   |
| SF Residence (sample location)                                   | ROS 13                          | 10, p. 83; 13, pp. 2, 28, 29; Figure 2                       |
| Workplace (sample location)                                      | ROS 14                          | 10, p. 83; 13, pp. 2, 30, 31; Figure 2                       |
| SF Residence (sample location)                                   | ROS 15                          | 10, p. 83; 13, pp. 2, 32, 33, 34; Figure 2                   |
| SF Residence (sample location)                                   | ROS 16                          | 10, p. 83; 13, pp. 2, 35, 36; Figure 2                       |
| SF Residence (sample location)                                   | ROS 17                          | 10, p. 83; 13, pp. 2, 37, 38; Figure 2                       |
| Workplace (sample location)                                      | ROS 18                          | 10, p. 83; 13, pp. 2, 39, 40; Figure 2                       |
| Workplace (sample location)                                      | ROS 19                          | 10, p. 83; 13, pp. 2, 41, 42; Figure 2                       |
| SF Residence (sample location)                                   | ROS 20                          | 10, p. 83; 13, pp. 2, 43, 44; Figure 2                       |
| SF Residence (sample location)                                   | ROS 22                          | 10, p. 83; 13, pp. 2, 45, 46; Figure 2                       |
| SF Residence (sample location)                                   | ROS 27                          | 10, p. 83; 13, pp. 2, 49, 50; Figure 2                       |
| SF Residence (sample location) (VMS installed June 2020)         | ROS 28                          | 10, pp. 55, 83; 13, pp. 2, 51, 52; Figure 2                  |
| SF Residence (sample location)                                   | ROS 29                          | 10, p. 83; 13, pp. 2, 53, 54; Figure 2                       |
| SF Residence (sample location)                                   | ROS 30                          | 10, p. 83; 13, pp. 2, 55, 56; Figure 2                       |
| Residence Duplex (sample location)                               | ROS 31A                         | 10, p. 84; 13, pp. 2, 57, 58; Figure 2                       |
| Residence Duplex (sample location)                               | ROS 31B                         | 10, p. 84; 13, pp. 2, 57, 58; Figure 2                       |
| SF Residence (sample location)                                   | ROS 32                          | 10, p. 84; 13, pp. 2, 59, 60; Figure 2                       |
| Workplace (sample location)                                      | ROS 33A                         | 10, p. 84; 13, pp. 2, 61, 62; Figure 2                       |
|  | ROS 33B                         |  |
|  | ROS 33C                         |  |
| Workplace (sample location)                                      | ROS 34                          | 10, p. 84; 13, pp. 2, 63, 64; Figure 2                       |
| Residence (sample location)                                      | ROS 35                          | 10, p. 84; 13, pp. 2, 63, 64; 10, p. 84; 19, p. 10; Figure 2 |
| Workplace (sample location)                                      | ROS 37                          | 10, p. 84; 13, pp. 2, 65, 66; Figure 2                       |
| Workplace (sample location)                                      | ROS 38                          | 10, p. 84; 13, pp. 2, 67, 68; Figure 2                       |



TABLE 2. REGULARLY OCCUPIED STRUCTURES WITHIN THE AOE

| Type of Structure  | Regularly Occupied Structure ID | References                                    |
|--|---------------------------------|---|
| SF Residence (inferred)  | ROS 39                          | 10, p. 8413, pp. 2, 69, 70;; Figure 2         |
| SF Residence (sample location)                                       | ROS 40                          | 10, p. 84; 13, pp. 2, 71, 72; Figure 2        |
| Workplace (sample location)  | ROS 42                          | 10, p. 84; 13, pp. 2, 73, 74; Figure 2        |
| SF Residence (sample location)                                       | ROS 43                          | 10, p. 84; 13, pp. 2, 75, 76; Figure 2        |
| SF Residence (sample location- inferred)                             | ROS 49                          | 10, p. 84; 13, pp. 2, 85, 86; Figure 2        |
| SF Residence (sample location)                                       | ROS 50                          | 10, p. 84; 13, pp. 2, 87, 88; Figure 2        |
| SF Residence (sample location)                                       | ROS 54                          | 10, p. 85; 13, pp. 3, 91, 92; Figure 2        |
| SF Residence (sample location)                                       | ROS 55                          | 10, p. 85; 13, pp. 3, 93, 94; Figure 2        |
| SF Residence (sample location) (VMS installed October 2020)          | ROS 56                          | 10, pp. 55, 85; 13, pp. 3, 95, 96; Figure 2   |
| SF Residence (sample location)                                       | ROS 57                          | 10, p. 85; 13, pp. 3, 97, 98; Figure 2        |
| SF Residence (sample location)                                       | ROS 61                          | 10, p. 85; 13, pp. 3, 101, 102; Figure 2      |
| Workplace (sample location)  | ROS 65                          | 10, p. 85; 13, pp. 3, 105, 106; Figure 2      |
| Workplace (sample location)  | ROS 69                          | 10, p. 85; 13, pp. 3, 109, 110; Figure 2      |
| SF Residence (sample location) (VMS installed October 2020)          | ROS 70                          | 10, pp. 55, 85; 13, pp. 3, 111, 112; Figure 2 |
| Workplace (sample location) (VMS installed June 2020)                | ROS 72                          | 10, pp. 55, 85; 13, pp. 3, 115, 116; Figure 2 |
| Workplace (sample location)  | ROS 75                          | 10, p. 85; 13, pp. 3, 121, 122; Figure 2      |
| Workplace (sample location)  | ROS 76                          | 10, p. 85; 13, pp. 3, 123, 124; Figure 2      |
| SF Residence (sample location) (VMS installed August 2020)           | ROS 77                          | 10, pp. 55, 85; 13, pp. 3, 125, 126; Figure 2 |
| SF Residence (sample location)                                       | ROS 79                          | 10, p. 86; 13, pp. 3, 129, 130; Figure 2      |
| Workplace (sample location)  | ROS 83                          | 10, p. 86; 13, pp. 3, 135, 136; Figure 2      |
| Workplace (sample location)  | ROS 84                          | 10, p. 86; 13, pp. 3, 135, 136; Figure 2      |
| Workplace (sample location)  | ROS 85                          | 10, p. 86; 13, pp. 3, 137; Figure 2           |
| SF Residence (sample location)                                       | ROS 86                          | 10, p. 86; 13, pp. 3, 139, 140; Figure 2      |
| SF Residence (sample location) (VMS installed November 2020)         | ROS 91                          | 10, pp. 55, 86; 13, pp. 3, 143, 144; Figure 2 |
| SF Residence (sample location) (VMS installed August 2020)           | ROS 92                          | 10, pp. 55, 86; 13, pp. 3, 145, 146; Figure 2 |
| Workplace (sample location)  | ROS 94                          | 10, p. 86; 13, pp. 3, 149, 150; Figure 2      |
| Residence Duplex (sample location)                                   | ROS 97                          | 10, p. 86; 13, pp. 3, 151, 152; Figure 2      |
| 4 Apartment Residence (sample location) (VMS installed October 2020) | ROS 98                          | 10, pp. 55, 86; 13, pp. 3, 153, 154; Figure 2 |
| SF Residence (sample location)                                       | ROS 99                          | 10, p. 86; 13, pp. 3, 155, 156; Figure 2      |
| SF Residence (sample location)                                       | ROS 101                         | 10, p. 86; 13, pp. 3, 157, 158; Figure 2      |
| SF Residence (sample location) (VMS installed February 2021)         | ROS 102                         | 10, pp. 55, 87; 13, pp. 3, 159, 160; Figure 2 |
| SF Residence (sample location) (VMS installed November 2020)         | ROS 103                         | 10, pp. 55, 87; 13, pp. 3, 161, 162; Figure 2 |
| SF Residence (sample location)                                       | ROS 104                         | 10, p. 87; 13, pp. 3, 163, 164; Figure 2      |
| SF Residence (sample location)                                       | ROS 105                         | 10, p. 87; 13, pp. 3, 165, 166; Figure 2      |
| SF Residence (sample location) (VMS installed December 2020)         | ROS 106                         | 10, pp. 55, 87; 13, pp. 3, 167, 168; Figure 2 |
| SF Residence (inferred AOE)  | ROS 107                         | 13, pp. 3, 169, 170; Figure 2                 |
| SF Residence (inferred AOE)  | ROS 108                         | 13, pp. 3, 171, 172; Figure 2                 |



TABLE 2. REGULARLY OCCUPIED STRUCTURES WITHIN THE AOE

| Type of Structure  | Regularly Occupied Structure ID | References                    |
|--|---------------------------------|-------------------------------|
| SF Residence (inferred AOE)                                  | ROS 109                         | 13, pp. 3, 173, 174; Figure 2 |
| SF Residence (inferred AOE)                                  | ROS 110                         | 13, pp. 3, 175, 176; Figure 2 |
| SF Residence (inferred AOE)                                  | ROS 111                         | 13, pp. 3, 177, 178; Figure 2 |
| SF Residence (inferred AOE)                                  | ROS 112                         | 13, pp. 3, 179, 180; Figure 2 |
| SF Residence (inferred AOE)                                  | ROS 113                         | 13, pp. 3, 181, 182; Figure 2 |
| SF Residence (inferred AOE)                                  | ROS 114                         | 13, pp. 3, 183, 184; Figure 2 |
| SF Residence (inferred AOE)                                  | ROS 115                         | 13, pp. 3, 185, 186; Figure 2 |
| SF Residence (inferred AOE)                                  | ROS 116                         | 13, pp. 3, 187, 188; Figure 2 |
| SF Residence (inferred AOE)                                  | ROS 117                         | 13, pp. 3, 189, 190; Figure 2 |
| SF Residence (inferred AOE)                                  | ROS 119                         | 13, pp. 4, 193, 194; Figure 2 |
| SF Residence (inferred AOE)                                  | ROS 120                         | 13, pp. 4, 195, 196; Figure 2 |
| SF Residence (inferred AOE)                                  | ROS 121                         | 13, pp. 4, 197, 198; Figure 2 |
| SF Residence (inferred AOE)                                  | ROS 122                         | 13, pp. 4, 199, 200; Figure 2 |
| SF Residence (inferred AOE)                                  | ROS 123                         | 13, pp. 4, 201, 202; Figure 2 |
| SF Residence (inferred AOE)                                  | ROS 124                         | 13, pp. 4, 203, 204; Figure 2 |
| SF Residence (inferred AOE)                                  | ROS 125                         | 13, pp. 4, 205, 206; Figure 2 |
| SF Residence (inferred AOE)                                  | ROS 126                         | 13, pp. 4, 207, 208; Figure 2 |
| 3 story, 42-unit Apartment Building Residence (inferred AOE) | ROS 127                         | 13, pp. 4, 209, 210; Figure 2 |

## Notes:

Regarding mitigation systems, HRS Section 5.2.1.2.2 instructs to include in the hazardous waste quantity all regularly occupied structures or subunits that have had mitigation systems installed as part of a removal or other temporary response action; HRS Section 5.2.1.3 instructs that if a removal or temporary response action has occurred that has not completely mitigated the release, count the initial targets as if the removal or temporary response action has not permanently interrupted target exposure from subsurface intrusion.

SF Single family  
VMS Vapor mitigation system  
AOE Area of observed exposure  
ROS Regularly occupied structure

### Observed Exposure by Direct Observation

Observed exposure by direct observation is not evaluated.

### Observed Exposure by Chemical Analysis

Multiple residential and workplace structures at this site have been identified as having indoor air concentrations for CVOCs that meet observed exposure criteria, as documented below. NDEE and EPA performed indoor air sampling and outdoor air sampling between May 2019 and February 2021. A contractor conducted a vapor intrusion assessment in the spring of 2019 that entailed collection of sub-slab vapor and indoor samples at eight commercial and three residential structures and one ambient air sample (Refs. 9, pp. 5, 13; 10, pp. 6, 12, 13). EPA removal management levels (RML) were exceeded at 5 commercial properties and one residential property (Ref. 11, p. 4). Following completion of the report, NDEE requested federal action to evaluate the site to determine if removal actions may be appropriate (Ref. 11). EPA initiated a removal site evaluation (RSE) and site inspection (SI) in the fall of 2019. As part of the RSE/SI vapor intrusion samples were collected under Analytical Services Request (ASR) numbers 8435 (December 2019), 8482 (January 2020), 8519 (March 2020), 8588 (June 2020), 8618 (July 2020), 8619 (August 2020), 8652 (September 2020), and 8774 (February 2021) (Ref.10, p. 15).

During the first EPA sampling event in December 2019, previous sampling locations were replicated, and vapor mitigation systems (VMS) were installed in six businesses and one residential property (Refs. 8, p. 26; 9, pp. 17-19; 10, pp. 16, 20, 55). During the first sampling event EPA collected two ambient air samples (Ref. 10, p. 20). During the second EPA sampling event in January 2020, EPA collected post VMS samples at six of the locations where the systems were installed in December 2019 and resampled a sensitive population location (Bellevue Senior Center) (Ref. 10, pp. 16, 20). Subsequent sampling events targeted residential and commercial buildings, generally to the east of the former dry cleaner location (Ref. 10, p. 66).

All indoor air, sub-slab vapor, ambient air, and sewer gas samples collected by EPA were analyzed by the Region 7 EPA laboratory by EPA Region 7 RLAB Method 3230.4 (air samples in canister at ambient levels by GC/MS) (Ref. 10, pp. 144, 187, 197, 211, 226, 241, 255, 270, 284). Samples were analyzed for the site-related compounds PCE, TCE, *cis*-1,2-DCE, *trans*-1,2-DCE, and VC (Ref. 10, p. 15). All air samples, except sewer gas samples, were collected into evacuated stainless-steel canisters equipped with a 24-hour passive flow regulator (Ref. 10, pp. 16-23). Sewer gas samples were collected as grab samples (Ref. 10, p. 42).

### ***Establishment of Background Levels***

During the December 2019 and January 2020 sampling events, EPA resampled only the structures that had elevated levels of contamination identified by NDEE. In March 2020 EPA collected indoor air and sub-slab vapor samples from three homes (ROS 51, 68, 74) ½ block west (hydrologically upgradient) of the former dry cleaner and one residential property (ROS 89) northeast of the former drycleaner. In June 2020 EPA sampled a commercial building (ROS 24) south/southeast and a residential structure (ROS 81) northeast of the former drycleaner. In August 2020 EPA sampled residential structure (ROS 71) located 1 ½ blocks west of the former drycleaner and another residential structure (ROS 78) located northeast. In September 2020 EPA sampled residential structures (ROS 48, 62 and 80). ROS 80 and 62 are located north and north/northwest of the former dry cleaner and ROS 48 is located northeast of the former dry cleaner. All of these structures used as representation of background concentrations are shown on **Figure 2** of this HRS documentation record. The results for these samples show the absence of indoor air CVOC contamination and are used to establish background levels as presented below. In addition to the absence of contamination in indoor air, all but one of the structures contained low concentrations (< 2.1 µg/m<sup>3</sup>) of PCE in the sub-slab vapor sample collected (Ref. 10, pp 84, 85, 86). The exception was the commercial structure (ROS 24) which contained PCE (16 µg/m<sup>3</sup>) and TCE (0.15 µg/m<sup>3</sup>) in the sub-slab vapor sampled (Ref. 10, p. 83)

All background and observed exposure indoor air samples were collected during the same timeframe (i.e., March, June, August, and September 2020). The samples were collected using laboratory evacuated 6-liter. All samples were delivered under chain-of-custody to the Region 7 EPA Laboratory in Kansas City Kansas, where they were analyzed for PCE, TCE, *cis*-1,2-DCE, *trans*-1,2-DCE and VC by EPA Method 3230.4 (air samples in canisters at ambient levels by GC/MS) (Ref. 10, pp. 144, 187, 197, 211, 226, 241, 255, 270). Data validation shows that all results are fully usable without qualification (Ref. 10, pp. 144, 187, 197, 211, 226, 241, 255, 270).

Ambient outdoor air samples were collected in May 2019 by an NDEE contractor (Ref. 9, pp. 165, 166) and by EPA in December 2019 (Ref. 10, p. 20). Locations of the ambient air samples is shown on **Figure 2** of this HRS documentation record. The ambient air sample collected by NDEE contractor Olsson, Inc. was equipped with a 24-hour regulator and was analyzed by Eurofins TestAmerica for VOCs by Method TO-15 (Ref. 9, pp. 5, 6, 13, 110, 111, 166). The two ambient air samples collected by EPA were equipped with 24-hour regulators and were analyzed by the EPA Region 7 laboratory for PCE, TCE, *cis*-1,2-DCE, *trans*-1,2-DCE and VC by EPA Method 3230.4 (air samples in canisters at ambient levels by GC/MS) (Ref. 10, pp. 15, 19, 20, 143, 144, 154, 179, 182). No VOCs were reported in the samples collected by EPA (samples 8435-25 and 8435-28) (Ref. 10, p. 151). No PCE, TCE, *cis*-1,2-DCE, *trans*-1,2-DCE or VC were detected in the sample collected by Olsson in May 2019 (Ref. 9, pp. 110, 111).

TABLE 3. AOE 1 BACKGROUND LOCATIONS

| Sample ID/<br>ROS ID | Sample Location  | Start<br>Date and<br>Time | End Date<br>and Time | Basis for Sample as<br>Background          | References                              |
|----------------------|--|---------------------------|----------------------|--|---|
| 8519-2/<br>ROS-68    | Basement utility closet; 150 feet<br>west/northwest of dry cleaner | 03/09/2020<br>10:28       | 03/10/2020<br>09:40  | Residence at west edge<br>of impacted area | 10, pp. 196, 206; 19,<br>p. 3; Figure 2 |



TABLE 3. AOE 1 BACKGROUND LOCATIONS

| Sample ID/<br>ROS ID | Sample Location   | Start<br>Date and<br>Time | End Date<br>and Time | Basis for Sample as<br>Background                 | References                            |
|----------------------|---|---------------------------|----------------------|---|---------------------------------------|
| 8519-9/<br>ROS-74    | Basement utility closet; 290 feet north/northwest of dry cleaner  | 03/09/2020<br>14:51       | 03/10/2020<br>12:13  | Residence at northwest edge of impacted area      | 10, pp. 196, 206; 19, p. 3; Figure 2  |
| 8519-12/<br>ROS-51   | Basement; 250 feet north/northwest of dry cleaner                 | 03/09/2020<br>16:10       | 03/10/2020<br>15:12  | Residence at northwest edge of impacted area      | 10, pp. 196, 206; 19, p. 3; Figure 2  |
| 8519-13/<br>ROS-89   | Basement; 1,640 feet northeast of dry cleaner                     | 03/09/2020<br>16:45       | 03/10/2020<br>15:28  | Residence at northeast edge of impacted area      | 10, pp. 196, 206; 19, p. 3; Figure 2  |
| 8588-5/<br>ROS-24    | Classroom on first floor; 620 feet south/southeast of dry cleaner | 06/15/2020<br>12:28       | 06/16/2020<br>10:30  | Business at south/southeast edge of impacted area | 10, pp. 210, 221; 19, p. 5; Figure 2  |
| 8588-19/<br>ROS-81   | Basement; 960 feet northeast of dry cleaner                       | 06/16/2020<br>08:48       | 06/17/2020<br>07:59  | Residence at northeast edge of impacted area      | 10, pp. 210, 221; 19, p. 5; Figure 2  |
| 8619-17/<br>ROS-71   | Not specified; 525 feet west/northwest of dry cleaner             | 08/25/2020<br>09:42       | 08/26/2020<br>08:45  | Residence west/northwest of impacted area         | 10, pp. 240, 250; 19, p. 8; Figure 2  |
| 8619-19/<br>ROS-78   | Not specified; 1,140 feet northeast of dry cleaner                | 08/25/2020<br>11:53       | 08/26/2020<br>10:15  | Residence at northeast edge of impacted area      | 10, pp. 240, 250; 19, p. 9; Figure 2  |
| 8652-17/<br>ROS-48   | Basement living area; 1,725 feet northeast of dry cleaner         | 09/15/2020<br>10:50       | 09/16/2020<br>09:26  | Residence at northeast edge of impacted area      | 10, pp. 254, 265; 19, p. 10; Figure 2 |
| 8652-19/<br>ROS-62   | Basement; 615 feet north/northwest of dry cleaner                 | 09/15/2020<br>11:30       | 09/16/2020<br>10:13  | Residence at northwest edge of impacted area      | 10, pp. 254, 265; 19, p. 10; Figure 2 |
| 8652-21/<br>ROS-80   | Basement back wall; 475 feet north of dry cleaner                 | 09/15/2020<br>11:50       | 09/16/2020<br>11:00  | Residence at north edge of impacted area          | 10, pp. 254, 265; 19, p. 10; Figure 2 |

Table 4 presents the analytical results for the background samples presented above.

TABLE 4. AOE 1 BACKGROUND SAMPLE CONCENTRATIONS

| Sample ID/<br>ROS ID | Eligible Hazardous<br>Substance  | Concentration<br>( $\mu\text{g}/\text{m}^3$ )  | Sample<br>Reporting<br>Limit ( $\mu\text{g}/\text{m}^3$ )* | References            |
|----------------------|--|--|--|-----------------------|
| 8519-2/<br>ROS 68    | Tetrachloroethene<br>Trichloroethene<br><i>cis</i> -1,2-Dichloroethene<br><i>trans</i> -1,2-Dichloroethene<br>Vinyl chloride | 0.34 U<br>0.14 U<br>0.20 U<br>0.20 U<br>0.13 U | 0.34<br>0.14<br>0.20<br>0.20<br>0.13                       | 10, p. 198; 12, p. 16 |
| 8519-9/<br>ROS 74    | Tetrachloroethene<br>Trichloroethene<br><i>cis</i> -1,2-Dichloroethene<br><i>trans</i> -1,2-Dichloroethene<br>Vinyl chloride | 0.34 U<br>0.14 U<br>0.20 U<br>0.20 U<br>0.13 U | 0.34<br>0.14<br>0.20<br>0.20<br>0.13                       | 10, p. 200; 12, p. 18 |
| 8519-12/<br>ROS 51   | Tetrachloroethene<br>Trichloroethene<br><i>cis</i> -1,2-Dichloroethene<br><i>trans</i> -1,2-Dichloroethene<br>Vinyl chloride | 0.34 U<br>0.14 U<br>0.20 U<br>0.20 U<br>0.13 U | 0.34<br>0.14<br>0.20<br>0.20<br>0.13                       | 10, p. 200; 12, p. 19 |
| 8519-13/<br>ROS 89   | Tetrachloroethene<br>Trichloroethene<br><i>cis</i> -1,2-Dichloroethene<br><i>trans</i> -1,2-Dichloroethene<br>Vinyl chloride | 0.34 U<br>0.14 U<br>0.20 U<br>0.20 U<br>0.13 U | 0.34<br>0.14<br>0.20<br>0.20<br>0.13                       | 10, p. 201; 12, p. 19 |

TABLE 4. AOE 1 BACKGROUND SAMPLE CONCENTRATIONS

| Sample ID/<br>ROS ID | Eligible Hazardous<br>Substance  | Concentration<br>( $\mu\text{g}/\text{m}^3$ )  | Sample<br>Reporting<br>Limit ( $\mu\text{g}/\text{m}^3$ )* | References            |
|----------------------|--|--|--|-----------------------|
| 8588-5/<br>ROS 24    | Tetrachloroethene<br>Trichloroethene<br><i>cis</i> -1,2-Dichloroethene<br><i>trans</i> -1,2-Dichloroethene<br>Vinyl chloride | 0.34 U<br>0.14 U<br>0.20 U<br>0.20 U<br>0.13 U | 0.34<br>0.14<br>0.20<br>0.20<br>0.13                       | 10, p. 213; 12, p. 26 |
| 8588-19/<br>ROS 81   | Tetrachloroethene<br>Trichloroethene<br><i>cis</i> -1,2-Dichloroethene<br><i>trans</i> -1,2-Dichloroethene<br>Vinyl chloride | 0.34 U<br>0.14 U<br>0.20 U<br>0.20 U<br>0.13 U | 0.34<br>0.14<br>0.20<br>0.20<br>0.13                       | 10, p. 216; 12, p. 30 |
| 8619-17/<br>ROS 71   | Tetrachloroethene<br>Trichloroethene<br><i>cis</i> -1,2-Dichloroethene<br><i>trans</i> -1,2-Dichloroethene<br>Vinyl chloride | 0.34 U<br>0.14 U<br>0.20 U<br>0.20 U<br>0.13 U | 0.34<br>0.14<br>0.20<br>0.20<br>0.13                       | 10, p. 246; 12, p. 49 |
| 8619-19/<br>ROS 78   | Tetrachloroethene<br>Trichloroethene<br><i>cis</i> -1,2-Dichloroethene<br><i>trans</i> -1,2-Dichloroethene<br>Vinyl chloride | 0.34 U<br>0.14 U<br>0.20 U<br>0.20 U<br>0.13 U | 0.34<br>0.14<br>0.20<br>0.20<br>0.13                       | 10, p. 246; 12, p. 50 |
| 8652-17/<br>ROS 48   | Tetrachloroethene<br>Trichloroethene<br><i>cis</i> -1,2-Dichloroethene<br><i>trans</i> -1,2-Dichloroethene<br>Vinyl chloride | 0.34 U<br>0.14 U<br>0.20 U<br>0.20 U<br>0.13 U | 0.34<br>0.14<br>0.20<br>0.20<br>0.13                       | 10, p. 260; 12, p. 58 |
| 8652-19/<br>ROS 62   | Tetrachloroethene<br>Trichloroethene<br><i>cis</i> -1,2-Dichloroethene<br><i>trans</i> -1,2-Dichloroethene<br>Vinyl chloride | 0.34 U<br>0.14 U<br>0.20 U<br>0.20 U<br>0.13 U | 0.34<br>0.14<br>0.20<br>0.20<br>0.13                       | 10, p. 260; 12, p. 59 |
| 8652-21/<br>ROS 80   | Tetrachloroethene<br>Trichloroethene<br><i>cis</i> -1,2-Dichloroethene<br><i>trans</i> -1,2-Dichloroethene<br>Vinyl chloride | 0.34 U<br>0.14 U<br>0.20 U<br>0.20 U<br>0.13 U | 0.34<br>0.14<br>0.20<br>0.20<br>0.13                       | 10, p. 261; 12, p. 59 |

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 (Ref. 12, pp. 16, 25, 45, 54).

ID Identification

U The analyte was not detected at or above the reporting limit (Ref. 10, pp. 195, 253).

$\mu\text{g}/\text{m}^3$  Micrograms per cubic meter

### Background Levels

The maximum background reporting limits for *cis*-1,2-DCE (0.20  $\mu\text{g}/\text{m}^3$ ); *trans*-1,2-DCE (0.20  $\mu\text{g}/\text{m}^3$ ); PCE (0.34  $\mu\text{g}/\text{m}^3$ ); TCE (0.14  $\mu\text{g}/\text{m}^3$ ); and vinyl chloride (0.13  $\mu\text{g}/\text{m}^3$ ) are selected as the background levels for establishing observed exposure because all background results for the five hazardous substances were non-detect (Ref. 1, Sections 2.3 and 5.2.1.1.1]. These levels are presented in Table 5 below.



TABLE 5. AOE 1 BACKGROUND LEVELS

| Eligible Hazardous Substance     | Background Level ( $\mu\text{g}/\text{m}^3$ ) | Concentrations used for Establishing an Observed Exposure ( $\mu\text{g}/\text{m}^3$ ) |
|----------------------------------|---|--|
| Tetrachloroethene                | 0.34 U  | $\geq 0.34$  |
| Trichloroethene                  | 0.14 U  | $\geq 0.14$  |
| <i>cis</i> -1,2-Dichloroethene   | 0.20 U  | $\geq 0.20$  |
| <i>trans</i> -1,2-Dichloroethene | 0.20 U  | $\geq 0.20$  |
| Vinyl chloride                   | 0.13 U  | $\geq 0.13$  |

Notes:

 $\mu\text{g}/\text{m}^3$  Micrograms per cubic meter

AOE Area of observed exposure

U The analyte was not detected at or above the reporting limit (Ref. 10, p. 253).

### Exposure Samples

Indoor air concentrations of PCE, TCE, *cis*-1,2-DCE; *trans*-1,2-DCE; and vinyl chloride greater than or equal to their respective site-specific background levels and attributable to the subsurface contamination are used to establish observed exposure [Ref. 1, Table 2-3]. Results for indoor air samples collected from 64 structures exhibited concentrations that exceed these site-specific background levels, as shown Tables 6 and 7 below. Where vapor mitigation systems were installed, pre- and post-installation indoor air samples are presented. Note that if a post-installation system sample was collected and no CVOCs were detected only the pre-installation sample is presented. If no post installation sample was collected, that is noted as well.

TABLE 6. AOE 1 OBSERVED EXPOSURE SAMPLE LOCATIONS

| ROS ID | Sample ID | Sample Location                | Start Date and Time | End Date and Time   | References                           |
|--------|-----------|--------------------------------|---------------------|---------------------|--------------------------------------|
| ROS 01 | 8435-22   | Indoor air                     | 12/03/2019<br>14:45 | 12/04/2019<br>10:38 | 10, pp. 143, 153, 176; Figure 2      |
|        | 8482-12   | Not specified                  | 01/29/2020<br>14:09 | 1/30/2020<br>11:04  | 10, p. 186, 193; 19, p. 2; Figure 2  |
| ROS 02 | 8435-20   | Dining Room, 2202 Franklin St. | 12/03/2019<br>14:02 | 12/04/2019<br>12:36 | 10, pp. 143, 153, 174; Figure 2      |
|        | 8482-9    | Kitchen, 2202 Franklin St.     | 01/29/2020<br>13:35 | 1/30/2020<br>10:43  | 10, p. 186, 193; 19, p. 2; Figure 2  |
| ROS 03 | 8435-16   | Office area                    | 12/03/2019<br>12:20 | 12/04/2019<br>10:24 | 10, pp. 143, 153, 170; Figure 2      |
|        | 8482-11   | Office area                    | 01/29/2020<br>13:52 | 1/30/2020<br>10:54  | 10, p. 186, 193; 19, p. 2; Figure 2  |
| ROS 04 | 8435-6    | Indoor air                     | 12/03/2019<br>10:26 | 12/04/2019<br>09:14 | 10, pp. 143, 153, 160; Figure 2      |
| ROS 05 | 8435-13   | In shop bay                    | 12/03/2019<br>12:20 | 12/04/2019<br>10:24 | 10, p. 143, 153, 167; Figure 2       |
| ROS 06 | 8435-12   | Storage shed                   | 12/03/2019<br>11:40 | 12/04/2019<br>09:43 | 10, pp. 143, 153, 166; Figure 2      |
|        | 8482-15   | Not specified                  | 01/29/2020<br>14:27 | 1/30/2020<br>11:14  | 10, p. 186, 193; 19, p. 2; Figure 2  |
| ROS 07 | 8482-2    | Dining hall                    | 01/29/2020<br>12:40 | 1/30/2020<br>09:54  | 10, p. 186, 193; 19, p. 2; Figure 2  |
|        | 8482-5    | Bar closet                     | 01/29/2020<br>13:17 | 1/30/2020<br>10:07  | 10, p. 186, 193; 19, p. 2; Figure 2  |
| ROS 08 | 8519-31   | Not specified                  | 03/11/2020<br>12:04 | 03/12/2020<br>09:30 | 10, p. 196, 207; 19, p. 4; Figure 2  |
| ROS 09 | 8618-2    | Not specified                  | 07/20/2020<br>11:02 | 07/21/2020<br>08:49 | 10, pp. 225, 236; 19, p. 6; Figure 2 |

TABLE 6. AOE 1 OBSERVED EXPOSURE SAMPLE LOCATIONS

| ROS ID                        | Sample ID | Sample Location              | Start Date and Time | End Date and Time   | References                               |
|-------------------------------|-----------|------------------------------|---------------------|---------------------|--|
| ROS 10                        | 8618-4    | Not specified                | 07/20/2020<br>11:28 | 07/21/2020<br>09:01 | 10, pp. 225, 236; 19, p. 6; Figure 2     |
|                               | 8774-13   | Kitchen                      | 02/15/2021<br>15:11 | 02/16/2021<br>13:48 | 10, pp. 269, 278; 19, p. 11; Figure 2    |
| ROS 13                        | 8618-16   | Not specified                | 07/21/2020<br>08:23 | 07/22/2020<br>07:40 | 10, pp. 225, 236; 19, p. 6; Figure 2     |
| ROS 14                        | 8519-23   | Basement                     | 03/10/2020<br>13:30 | 03/11/2020<br>10:14 | 10, pp. 196, 206; 19, p. 3; Figure 2     |
|                               | 8774-22   | Basement                     | 02/16/2021<br>14:21 | 02/17/2021<br>12:46 | 10, pp. 269, 278; 19, p. 11; Figure 2    |
| ROS 15                        | 8619-15   | Not specified                | 08/25/2020<br>08:06 | 08/26/2020<br>07:23 | 10, pp. 240, 250; 19, p. 8; Figure 2     |
| ROS 16                        | 8588-13   | Basement                     | 06/15/2020<br>15:51 | 06/16/2020<br>15:56 | 10, pp. 210, 221; 19, p. 5; Figure 2     |
| ROS 17                        | 8619-5    | Not specified                | 08/24/2020<br>11:26 | 08/25/2020<br>09:24 | 10, pp. 240, 250; 19, p. 8; Figure 2     |
| ROS 18                        | 8774-3    | Lower level                  | 02/15/2021<br>11:42 | 02/16/2021<br>10:04 | 10, pp. 269, 278; 19, p. 11; Figure 2    |
| ROS 19                        | 8519-17   | Office                       | 03/10/2020<br>10:11 | 03/11/2020<br>08:44 | 10, p. 196, 206; 19, p. 3; Figure 2      |
| ROS 20                        | 8588-25   | Basement                     | 06/16/2020<br>13:02 | 06/17/2020<br>10:12 | 10, pp. 210, 222; 19, p. 5; Figure 2     |
| ROS 22                        | 8619-9    | Not specified                | 08/24/2020<br>16:15 | 08/25/2020<br>15:12 | 10, pp. 240, 250; 19, p. 8; Figure 2     |
| ROS 27                        | 8588-9    | Basement                     | 06/15/2020<br>14:36 | 06/16/2020<br>14:18 | 10, pp. 210, 221; 19, p. 5; Figure 2     |
| ROS 28                        | 8519-3    | Basement                     | 03/09/2020<br>11:04 | 03/10/2020<br>10:46 | 10, pp. 196, 206; 19, p. 3; Figure 2     |
|                               | 8618-31   | First floor                  | 07/21/2020<br>17:05 | 07/22/2020<br>13:26 | 10, pp. 83, 225, 237; 19, p. 7; Figure 2 |
|                               | 8618-32   | Basement                     | 07/21/2020<br>17:06 | 07/22/2020<br>13:26 | 10, pp. 83, 225, 237; 19, p. 7; Figure 2 |
| ROS 29                        | 8774-11   | Basement living room         | 02/15/2021<br>14:41 | 02/16/2021<br>13:21 | 10, pp. 269, 278; 19, p. 11; Figure 2    |
| ROS 30                        | 8618-6    | Not specified                | 07/20/2020<br>12:07 | 07/21/2020<br>11:32 | 10, pp. 225, 236; 19, p. 6; Figure 2     |
| ROS 31A                       | 8774-20   | Basement on stairs           | 02/16/2021<br>09:58 | 02/17/2021<br>08:56 | 10, pp. 269, 278; 19, p. 11; Figure 2    |
| ROS 31B                       | 8652-9    | Basement pool table          | 09/14/2020<br>15:16 | 09/15/2020<br>15:00 | 10, pp. 254, 265; 19, p. 10; Figure 2    |
| ROS 32                        | 8619-29   | Not specified                | 08/26/2020<br>08:00 | 08/27/2020<br>07:11 | 10, pp. 240, 251; 19, p. 9; Figure 2     |
| ROS 33A<br>ROS 33B<br>ROS 33C | 8652-3    | Main room near back entrance | 09/14/2020<br>11:04 | 09/15/2020<br>09:20 | 10, pp. 254, 265; 19, p. 10; Figure 2    |
|                               | 8652-5    | Main room                    | 09/14/2020<br>11:20 | 09/15/2020<br>09:20 | 10, pp. 254, 265; 19, p. 10; Figure 2    |
|                               | 8652-6    | Main room                    | 09/15/2020<br>11:22 | 09/16/2020<br>09:20 | 10, pp. 254, 265; 19, p. 10; Figure 2    |
| ROS 34                        | 8618-10   | Not specified                | 07/20/2020<br>13:53 | 07/21/2020<br>12:05 | 10, pp. 225, 236; 19, p. 6; Figure 2     |
| ROS 35                        | 8652-1    | Living room                  | 09/14/2020<br>10:40 | 09/15/2020<br>08:30 | 10, pp. 254, 265; 19, p. 10; Figure 2    |
| ROS 37                        | 8619-1    | Not specified                | 08/24/2020<br>10:00 | 08/25/2020<br>08:50 | 10, pp. 240, 250; 19, p. 8; Figure 2     |



TABLE 6. AOE 1 OBSERVED EXPOSURE SAMPLE LOCATIONS

| ROS ID | Sample ID | Sample Location              | Start Date and Time | End Date and Time   | References                            |
|--------|-----------|------------------------------|---------------------|---------------------|---------------------------------------|
| ROS 38 | 8519-8    | Office                       | 03/09/2020<br>14:15 | 03/10/2020<br>13:07 | 10. p. 196, 206; 19, p. 3; Figure 2   |
| ROS 40 | 8652-32   | Basement left room           | 09/15/2020<br>16:44 | 09/16/2020<br>14:56 | 10, pp. 254, 266; 19, p. 10; Figure 2 |
| ROS 42 | 8618-12   | Not specified                | 07/20/2020<br>14:30 | 07/21/2020<br>12:19 | 10, pp. 225, 236; 19, p. 6; Figure 2  |
| ROS 43 | 8588-21   | Basement                     | 06/16/2020<br>09:27 | 06/17/2020<br>08:07 | 10, pp. 210, 221; 19, p. 5; Figure 2  |
| ROS 50 | 8435-27   | Basement utility/bathroom    | 12/03/2019<br>16:38 | 12/04/2019<br>15:00 | 10, p. 143, 154, 181; Figure 2        |
| ROS 54 | 8519-6    | First floor – living room    | 03/09/2020<br>12:36 | 03/10/2020<br>09:48 | 10. p. 196, 206; 19, p. 3; Figure 2   |
| ROS 55 | 8588-15   | Basement                     | 06/15/2020<br>14:00 | 06/16/2020<br>14:42 | 10, pp. 210, 221; 19, p. 5; Figure 2  |
| ROS 56 | 8618-24   | Not specified                | 07/21/2020<br>14:17 | 07/22/2020<br>10:03 | 10, pp. 225, 236; 19, p. 7; Figure 2  |
|        | 8774-9    | Basement laundry room        | 02/15/2021<br>13:55 | 02/16/2021<br>12:49 | 10, pp. 269, 278; 19, p. 11; Figure 2 |
| ROS 57 | 8774-7    | Basement bedroom by bathroom | 02/15/2021<br>13:14 | 02/16/2021<br>11:48 | 10, pp. 269, 278; 19, p. 11; Figure 2 |
| ROS 61 | 8618-14   | Not specified                | 07/20/2020<br>15:35 | 07/21/2020<br>13:54 | 10, pp. 225, 236; 19, p. 6; Figure 2  |
| ROS 65 | 8618-18   | Not specified                | 07/21/2020<br>10:28 | 07/22/2020<br>08:09 | 10, pp. 225, 236; 19, p. 7; Figure 2  |
| ROS 69 | 8519-29   | Not specified                | 03/11/2020<br>10:50 | 03/12/2020<br>08:23 | 10. pp. 196, 207; 19, p. 3; Figure 2  |
| ROS 70 | 8618-20   | Not specified                | 07/21/2020<br>11:11 | 07/22/2020<br>08:28 | 10, pp. 225, 236; 19, p. 7; Figure 2  |
|        | 8774-16   | Basement entrance            | 02/15/2021<br>17:10 | 02/16/2021<br>16:00 | 10, pp. 269, 278; 19, p. 11; Figure 2 |
| ROS 72 | 8519-25   | Office                       | 03/10/2020<br>13:57 | 03/11/2020<br>10:20 | 10, pp. 196, 207; 19, p. 3; Figure 2  |
|        | 8618-25   | Not specified                | 07/21/2020<br>14:44 | 07/22/2020<br>11:25 | 10, pp. 225, 237; 19, p. 7; Figure 2  |
| ROS 75 | 8519-21   | Office                       | 03/10/2020<br>11:32 | 03/11/2020<br>09:13 | 10. p. 196, 206; 19, p. 3; Figure 2   |
| ROS 76 | 8774-18   | Back office by garage        | 02/16/2021<br>09:07 | 02/17/2021<br>08:06 | 10, pp. 269, 278; 19, p. 11; Figure 2 |
| ROS 77 | 8588-31   | Basement                     | 06/16/2020<br>16:38 | 06/17/2020<br>11:15 | 10, pp. 210, 222; 19, p. 5; Figure 2  |
| ROS 79 | 8619-11   | Not specified                | 08/24/2020<br>16:50 | 08/25/2020<br>16:04 | 10, pp. 240, 250; 19, p. 8; Figure 2  |
| ROS 83 | 8435-8    | Workshop                     | 12/03/2019<br>10:40 | 12/04/2019<br>09:28 | 10, p. 143, 153, 162; Figure 2        |
| ROS 84 | 8435-10   | Ice room                     | 12/03/2019<br>10:55 | 12/04/2019<br>10:12 | 10, p. 143, 153, 164; Figure 2        |
| ROS 85 | 8482-17   | Not specified                | 01/29/2020<br>14:39 | 1/30/2020<br>11:20  | 10, p. 186, 193; 19, p. 2; Figure 2   |
| ROS 86 | 8435-18   | Basement                     | 12/03/2019<br>13:30 | 12/04/2019<br>12:23 | 10, p. 143, 153, 172; Figure 2        |
| ROS 91 | 8652-11   | Basement near port           | 09/14/2020<br>16:35 | 09/15/2020<br>15:10 | 10, pp. 254, 265; 19, p. 10; Figure 2 |
|        | 8774-17   | Basement back room by port   | 02/16/2021<br>08:05 | 02/17/2021<br>07:09 | 10, pp. 269, 278; 19, p. 11; Figure 2 |

TABLE 6. AOE 1 OBSERVED EXPOSURE SAMPLE LOCATIONS

| ROS ID  | Sample ID | Sample Location                   | Start Date and Time | End Date and Time   | References                            |
|---------|-----------|-----------------------------------|---------------------|---------------------|---------------------------------------|
| ROS 92  | 8588-27   | Basement                          | 06/16/2020<br>13:50 | 06/17/2020<br>10:22 | 10, pp. 210, 222; 19, p. 5; Figure 2  |
|         | 8652-23   | First floor on wood burning stove | 09/15/2020<br>13:29 | 09/16/2020<br>11:56 | 10, pp. 254, 265; 19, p. 10; Figure 2 |
| ROS 94  | 8618-34   | Not specified                     | 07/21/2020<br>17:26 | 07/22/2020<br>13:34 | 10, pp. 225, 237; 19, p. 7; Figure 2  |
| ROS 97  | 8619-21   | Not specified                     | 08/25/2020<br>13:50 | 08/26/2020<br>12:45 | 10, pp. 240, 250; 19, p. 9; Figure 2  |
| ROS 98  | 8618-30   | Not specified                     | 07/21/2020<br>16:43 | 07/22/2020<br>13:15 | 10, pp. 225, 237; 19, p. 7; Figure 2  |
| ROS 99  | 8619-7    | Not specified                     | 08/24/2020<br>13:00 | 08/25/2020<br>11:04 | 10, pp. 240, 250; 19, p. 8; Figure 2  |
| ROS 101 | 8619-25   | Not specified                     | 08/25/2020<br>15:50 | 08/26/2020<br>14:12 | 10, pp. 240, 250; 19, p. 9; Figure 2  |
| ROS 102 | 8619-23   | Not specified                     | 08/25/2020<br>14:15 | 08/26/2020<br>12:53 | 10, pp. 240, 250; 19, p. 9; Figure 2  |
| ROS 103 | 8652-7    | Basement main room                | 09/14/2020<br>17:18 | 09/15/2020<br>16:28 | 10, pp. 254, 265; 19, p. 10; Figure 2 |
|         | 8774-10   | Basement main room                | 02/15/2021<br>14:25 | 02/16/2021<br>13:11 | 10, pp. 269, 278; 19, p. 11; Figure 2 |
| ROS 104 | 8652-24   | Basement back room                | 09/15/2020<br>14:10 | 09/16/2020<br>12:55 | 10, pp. 254, 265; 19, p. 10; Figure 2 |
| ROS 105 | 8652-26   | Basement bar area                 | 09/15/2020<br>14:42 | 09/16/2020<br>13:13 | 10, pp. 254, 266; 19, p. 10; Figure 2 |
| ROS 106 | 8652-29   | Basement hallway shelf            | 09/15/2020<br>15:32 | 09/16/2020<br>14:05 | 10, pp. 254, 266; 19, p. 10; Figure 2 |
|         | 8774-15   | Basement back right corner        | 02/15/2021<br>15:46 | 02/16/2021<br>14:29 | 10, pp. 269, 278; 19, p. 11; Figure 2 |

## Notes:

AOE Area of observed exposure  
 ROS Regularly occupied structure  
 ID Identification

TABLE 7. AOE OBSERVED EXPOSURE SAMPLE CONCENTRATIONS

| Sample ID/<br>ROS ID | Eligible Hazardous<br>Substance  | Concentration<br>( $\mu\text{g}/\text{m}^3$ ) | Sample Reporting<br>Limit ( $\mu\text{g}/\text{m}^3$ )* | References            |
|----------------------|----------------------------------|---|---|-----------------------|
| 8435-22/<br>ROS 01   | Tetrachloroethene                | 88  | 0.34  | 10, p. 150; 12, p. 8  |
| 8482-12/<br>ROS 01   | Tetrachloroethene                | 74  | 0.34  | 10, p. 190; 12, p. 14 |
|                      | Trichloroethene                  | 0.28  | 0.14  |                       |
|                      | Vinyl chloride                   | 0.15  | 0.15  |                       |
| 8435-20/<br>ROS 02   | Tetrachloroethene                | 16  | 0.34  | 10, p. 149; 12, p. 7  |
| 8482-9/<br>ROS 02    | Tetrachloroethene                | 12  | 0.34  | 10, p. 190; 12, p. 13 |
| 8435-16/<br>ROS 03   | Tetrachloroethene                | 9.8   | 0.34  | 10, p. 148; 12, p. 6  |
|                      | Trichloroethene                  | 7.1   | 0.27  |                       |
|                      | <i>cis</i> -1,2-Dichloroethene   | 1.4   | 0.20  |                       |
|                      | <i>trans</i> -1,2-Dichloroethene | 4.7   | 0.20  |                       |
|                      | Vinyl chloride                   | 0.58  | 0.13  |                       |
| 8482-11/<br>ROS 03   | Tetrachloroethene                | 4.5   | 0.34  | 10, p. 190; 12, p. 14 |
|                      | Trichloroethene                  | 360   | 1.4   |                       |
|                      | <i>cis</i> -1,2-Dichloroethene   | 0.91  | 0.20  |                       |



TABLE 7. AOE OBSERVED EXPOSURE SAMPLE CONCENTRATIONS

| Sample ID/<br>ROS ID | Eligible Hazardous<br>Substance  | Concentration<br>( $\mu\text{g}/\text{m}^3$ ) | Sample Reporting<br>Limit ( $\mu\text{g}/\text{m}^3$ )* | References                 |
|----------------------|----------------------------------|---|---|----------------------------|
|                      | <i>trans</i> -1,2-Dichloroethene | 5.0   | 0.20  |                            |
|                      | Vinyl chloride                   | 0.31  | 0.13  |                            |
| 8435-6/<br>ROS 04    | Tetrachloroethene                | 11  | 0.34  | 10, p. 146; 12, p. 3       |
| 8435-13/<br>ROS 05   | Tetrachloroethene                | 380   | 3.4   | 10, p. 148; 12, p. 5       |
| 8435-12/<br>ROS 06   | Tetrachloroethene                | 7.3   | 0.34  | 10, p. 147; 12, p. 5       |
| 8482-15/<br>ROS 06   | Tetrachloroethene                | 4.9   | 0.34  | 10, p. 191; 12, p. 15      |
|                      | Trichloroethene                  | 0.52  | 0.14  |                            |
| 8482-2/<br>ROS 07    | Tetrachloroethene                | 0.44  | 0.34  | 10, p. 188; 12, p. 11      |
|                      | Trichloroethene                  | 0.66  | 0.14  |                            |
| 8482-5/<br>ROS 07    | Tetrachloroethene                | 0.69  | 0.34  | 10, p. 189; 12, p. 12      |
|                      | Trichloroethene                  | 0.37  | 0.14  |                            |
| 8519-31/<br>ROS 08   | Tetrachloroethene                | 1.9   | 0.34  | 10, p. 205; 12, p. 24      |
| 8618-2/<br>ROS 09    | Tetrachloroethene                | 1.1   | 0.34  | 10, p. 227; 12, p. 35      |
|                      | Trichloroethene                  | 0.53  | 0.14  |                            |
| 8618-4/<br>ROS 10    | Tetrachloroethene                | 8.4   | 0.34  | 10, p. 227; 12, p. 36      |
| 8774-13/<br>ROS 10   | Tetrachloroethene                | 0.39  | 0.34  | 10, p. 274; 12, p. 66      |
| 8618-16/<br>ROS 13   | Trichloroethene                  | 1.6   | 0.14  | 10, p. 230; 12, p. 39      |
| 8519-23/<br>ROS 14   | Tetrachloroethene                | 7.5   | 0.34  | 10, p. 203; 12, p. 22      |
|                      | Trichloroethene                  | 3.4   | 0.14  |                            |
|                      | Vinyl chloride                   | 0.62  | 0.13  |                            |
| 8774-22/<br>ROS 14   | Tetrachloroethene                | 8.5   | 0.34  | 10, p. 276; 12, pp. 68, 69 |
|                      | Trichloroethene                  | 1.7   | 0.14  |                            |
|                      | Vinyl chloride                   | 0.33  | 0.13  |                            |
| 8619-15/<br>ROS 15   | Tetrachloroethene                | 14  | 0.34  | 10, p. 245; 12, p. 49      |
| 8588-13/<br>ROS 16   | Tetrachloroethene                | 0.62  | 0.34  | 10, p. 215; 12, p. 28      |
| 8619-5/<br>ROS 17    | Tetrachloroethene                | 6.7   | 0.34  | 10, p. 243; 12, p. 46      |
| 8774-3/<br>ROS 18    | Tetrachloroethene                | 38  | 0.34  | 10, p. 271; 12, p. 63      |
| 8519-17/<br>ROS 19   | Tetrachloroethene                | 0.57  | 0.34  | 10, p. 202; 12, p. 20      |
| 8588-25/<br>ROS 20   | Tetrachloroethene                | 0.45  | 0.34  | 10, p. 218; 12, p. 31      |
| 8619-9/<br>ROS 22    | Tetrachloroethene                | 26  | 0.34  | 10, p. 244; 12, p. 47      |
| 8588-9/<br>ROS 27    | Tetrachloroethene                | 1.1   | 0.34  | 10, p. 214; 12, p. 27      |
| 8519-3/<br>ROS 28    | Tetrachloroethene                | 65  | 0.34  | 10, p. 198; 12, p. 16      |
| 8618-31/<br>ROS 28   | Tetrachloroethene                | 1.3   | 0.34  | 10, p. 234; 12, p. 43      |
| 8618-32/<br>ROS 28   | Tetrachloroethene                | 1.4   | 0.34  | 10, p. 234; 12, p. 43      |
| 8774-11/<br>ROS 29   | Tetrachloroethene                | 1.0   | 0.34  | 10, p. 273; 12, p. 66      |
| 8618-6/<br>ROS 29    | Tetrachloroethene                | 1.4   | 0.34  | 10, p. 228; 12, p. 36      |

TABLE 7. AOE OBSERVED EXPOSURE SAMPLE CONCENTRATIONS

| Sample ID/<br>ROS ID | Eligible Hazardous<br>Substance                       | Concentration<br>( $\mu\text{g}/\text{m}^3$ ) | Sample Reporting<br>Limit ( $\mu\text{g}/\text{m}^3$ )* | References            |
|----------------------|---|---|---|-----------------------|
| ROS 30               |   |   |   |                       |
| 8774-20/<br>ROS 31A  | Tetrachloroethene                                     | 4.0   | 0.34  | 10, p. 275; 12, p. 68 |
| 8652-9/<br>ROS 31B   | Tetrachloroethene                                     | 3.7   | 0.34  | 10, p. 258; 12, p. 56 |
| 8619-29/<br>ROS 32   | Tetrachloroethene                                     | 0.46  | 0.34  | 10, p. 249; 12, p. 52 |
| 8652-3/<br>ROS 33A   | Tetrachloroethene<br>Trichloroethene                  | 230<br>0.49                                   | 3.4<br>0.14   | 10, p. 256; 12, p. 54 |
| 8652-5/<br>ROS 33B   | Tetrachloroethene<br>Trichloroethene                  | 200<br>0.32                                   | 3.4<br>0.14   | 10, p. 257; 12, p. 55 |
| 8652-6/<br>ROS 33C   | Tetrachloroethene<br>Trichloroethene                  | 200<br>0.28                                   | 3.4<br>0.14   | 10, p. 257; 12, p. 55 |
| 8618-10/<br>ROS 34   | Tetrachloroethene                                     | 9.1   | 0.34  | 10, p. 229; 12, p. 37 |
| 8652-1/<br>ROS 35    | Tetrachloroethene                                     | 5.7   | 0.34  | 10, p. 256; 12, p. 54 |
| 8619-1/<br>ROS 37    | Tetrachloroethene                                     | 9.6 J   | 0.34  | 10, p. 242; 12, p. 45 |
| 8519-8/<br>ROS 38    | Tetrachloroethene                                     | 0.38  | 0.34  | 10, p. 199; 12, p. 18 |
| 8652-32/<br>ROS 40   | Tetrachloroethene                                     | 22  | 0.34  | 10, p. 263; 12, p. 62 |
| 8618-12/<br>ROS 42   | Tetrachloroethene                                     | 1.5   | 0.34  | 10, p. 229; 12, p. 38 |
| 8588-21/<br>ROS 43   | Tetrachloroethene<br>Trichloroethene                  | 14<br>0.32                                    | 0.34<br>0.14  | 10, p. 217; 12, p. 30 |
| 8435-27/<br>ROS 50   | Tetrachloroethene                                     | 1.5   | 0.34  | 10, p. 151; 12, p. 9  |
| 8519-6/<br>ROS 54    | Tetrachloroethene                                     | 1.2   | 0.34  | 10, p. 199; 12, p. 17 |
| 8588-15/<br>ROS 55   | Tetrachloroethene                                     | 0.36  | 0.34  | 10, p. 215; 12, p. 29 |
| 8618-24/<br>ROS 56   | Tetrachloroethene                                     | 12  | 0.34  | 10, p. 232; 12, p. 41 |
| 8774-9/<br>ROS 56    | Tetrachloroethene                                     | 0.43  | 0.34  | 10, p. 273; 12, p. 65 |
| 8774-7/<br>ROS 57    | Tetrachloroethene                                     | 0.73  | 0.34  | 10, p. 272; 12, p. 65 |
| 8618-14/<br>ROS 61   | Tetrachloroethene<br><i>cis</i> -1,2-Dichloroethene   | 1.5<br>0.35                                   | 0.34<br>0.20  | 10, p. 230; 12, p. 38 |
| 8618-18/<br>ROS 65   | Tetrachloroethene<br><i>trans</i> -1,2-Dichloroethene | 0.37<br>17                                    | 0.34<br>0.20  | 10, p. 231; 12, p. 39 |
| 8519-29/<br>ROS 69   | Tetrachloroethene                                     | 2.7   | 0.34  | 10, p. 205; 12, p. 23 |
| 8618-20/<br>ROS 70   | Tetrachloroethene                                     | 23  | 0.34  | 10, p. 231; 12, p. 40 |
| 8774-16/<br>ROS 70   | Tetrachloroethene                                     | 1.1   | 0.34  | 10, p. 274; 12, p. 67 |
| 8519-25/<br>ROS 72   | Tetrachloroethene                                     | 11  | 0.34  | 10, p. 204; 12, p. 22 |
| 8618-25/<br>ROS 72   | Tetrachloroethene                                     | 1.3   | 0.34  | 10, p. 233; 12, p. 41 |
| 8519-21/<br>ROS 75   | Tetrachloroethene                                     | 0.40  | 0.34  | 10, p. 203; 12, p. 21 |



TABLE 7. AOE OBSERVED EXPOSURE SAMPLE CONCENTRATIONS

| Sample ID/<br>ROS ID | Eligible Hazardous<br>Substance  | Concentration<br>( $\mu\text{g}/\text{m}^3$ ) | Sample Reporting<br>Limit ( $\mu\text{g}/\text{m}^3$ )* | References               |
|----------------------|--|---|---|--------------------------|
| 8774-18/<br>ROS 76   | Tetrachloroethene  | 58  | 0.34  | 10, p. 275; 12, p. 67    |
| 8588-31/<br>ROS 77   | Tetrachloroethene  | 8.8   | 0.34  | 10, p. 219; 12, p. 33    |
| 8619-11/<br>ROS 79   | Tetrachloroethene  | 4.3   | 0.34  | 10, p. 244; 12, p. 48    |
| 8435-8/<br>ROS 83    | Tetrachloroethene<br>Trichloroethene                                     | 31<br>0.64                                    | 0.34<br>0.27  | 10, p. 146; 12, p. 4     |
| 8435-10/<br>ROS 84   | Tetrachloroethene<br>Trichloroethene<br><i>trans</i> -1,2-Dichloroethene | 9.4<br>0.59<br>0.32                           | 0.34<br>0.27<br>0.20                                    | 10, p. 147; 12, pp. 4, 5 |
| 8482-17/<br>ROS 85   | Tetrachloroethene  | 5.9   | 0.34  | 10, p. 192; 12, p. 15    |
| 8435-18/<br>ROS 86   | Tetrachloroethene  | 2.4   | 0.34  | 10, p. 149; 12, p. 7     |
| 8652-11/<br>ROS 91   | Tetrachloroethene  | 19  | 0.34  | 10, p. 258; 12, p. 57    |
| 8774-17/<br>ROS 91   | Tetrachloroethene  | 9.9   | 0.34  | 10, p. 275; 12, p. 67    |
| 8588-27/<br>ROS 92   | Tetrachloroethene  | 13  | 0.34  | 10, p. 218; 12, p. 32    |
| 8652-23/<br>ROS 92   | Tetrachloroethene  | 2.8   | 0.34  | 10, p. 261; 12, p. 60    |
| 8618-34/<br>ROS 94   | Tetrachloroethene  | 9.2   | 0.34  | 10, p. 235; 12, p. 44    |
| 8619-21/<br>ROS 97   | Tetrachloroethene<br>Trichloroethene                                     | 3.8<br>0.33                                   | 0.34<br>0.14  | 10, p. 247; 12, p. 50    |
| 8618-30/<br>ROS 98   | Tetrachloroethene  | 2.0   | 0.34  | 10, p. 234; 12, p. 43    |
| 8619-7/<br>ROS 99    | Tetrachloroethene  | 2.9   | 0.34  | 10, p. 243; 12, p. 47    |
| 8619-25/<br>ROS 101  | Tetrachloroethene<br>Trichloroethene                                     | 1.8<br>0.16                                   | 0.34<br>0.14  | 10, p. 248; 12, p. 51    |
| 8619-23/<br>ROS 102  | Tetrachloroethene  | 5.3   | 0.34  | 10, p. 247; 12, p. 51    |
| 8652-7/<br>ROS 103   | Tetrachloroethene  | 5.6   | 0.34  | 10, p. 257; 12, p. 51    |
| 8774-10/<br>ROS 103  | Tetrachloroethene  | 1.2   | 0.34  | 10, p. 273; 12, p. 65    |
| 8652-24/<br>ROS 104  | Tetrachloroethene  | 0.91  | 0.34  | 10, p. 261; 12, p. 60    |
| 8652-26/<br>ROS 105  | Tetrachloroethene  | 20  | 0.34  | 10, p. 262; 12, p. 61    |
| 8652-29/<br>ROS 106  | Tetrachloroethene  | 6.2   | 0.34  | 10, p. 263; 12, p. 61    |
| 8774-15/<br>ROS 106  | Tetrachloroethene  | 1.5   | 0.34  | 10, p. 274; 12, p. 67    |

## 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 (Ref. 12, pp. 2, 11, 16, 25, 35, 45, 54, 63).

J The identification of the analyte is acceptable; the reported value is an estimate. Tetrachloroethene was J-coded in sample 9619-1. Although the analyte in question has been positively identified in the sample, the quantitation is an estimate due to poor precision obtained for this analyte (14%, limit is 11%) in the laboratory duplicate sample (Ref. 10, pp. 239, 241)

$\mu\text{g}/\text{m}^3$  Micrograms per cubic meter

AOE Area of observed exposure

ROS Regularly occupied structure

ID Identification

### *Attribution to Subsurface and Site*

The former Carriage Cleaners facility was a documented user of PCE (also known as tetrachloroethene or perchloroethene [perc]). Carriage Cleaners initiated hazardous waste reporting in 1986 (Ref. 6, pp. 4, 210, 211). Waste generated at the dry cleaner in 1986 was F002 cartridge filters (156 per year) (Ref. 6, pp. 4, 210, 211). In 1988, the cartridge filters were steam cleaned to remove perchlorethylene so they could be disposed of at the Douglas County landfill (Ref. 6, pp. 4, 201-204). Approximately 4,000 to 18,000 pounds of waste perchlorethylene was generated at Carriage Cleaners from 1988 to 1992 (Ref. 6, p. 4). In December 1993 Carriage Cleaners submitted a notification to the State of Nebraska indicating that the facility had purchased an estimated 2,500 gallons of perchloroethylene for its dry-cleaning operations for use in a transfer type dry cleaning machine that had been installed in 1955 (Ref. 6, pp. 171, 172, 174). The waste management practices the facility employed after the dry-cleaning machine was installed in 1955 and when the facility initiated hazardous waste reporting in 1986 are unknown. Also unknown is whether any spills of PCE to the soil occurred during the operation or if releases to the sanitary sewer from steam stripping of filters occurred. In October 1995 the NDEQ was notified that the facility was no longer doing business and had filed Chapter 7 Bankruptcy (Ref. 6, pp. 4, 170). Although no specific spill was recorded, the weight of evidence discussed in this HRS documentation record (such as sampling results, concentration gradients, high levels detected directly under the former facility) indicate chlorinated solvents were released from the facility into the environment; environmental samples collected at the former facility, subsequent to its operation, suggest a release occurred.

Cretaceous sandstone and Pennsylvanian limestone and shale form the bedrock units underlying the region. The depth to bedrock is typically over 100 feet in upland areas, and varies due to erosion within the Missouri River valley (Ref. 8, p. 12). Based on borings performed at the PCE Carriage Cleaners facility by EPA and other investigators, the site is underlain from the ground surface down by Peoria loess and Loveland loess (Refs. 8, pp. 12, 36-38; 10, pp. 49, 71; 20, pp. 34, 88-90). The material is described as clay and silt, low to moderate plasticity, to about 73 to 74 feet bgs where clay is logged to 80 feet (Refs. 7, pp. 3, 9, 11-14; 20, pp. 88-90). The water table surface occurs in the Peoria loess at an approximate depth of 13 to 15.4 feet below ground surface (Ref. 8, p. 19). Chlorinated solvent contamination in soils is documented in SB-36 throughout the entire formation to a depth of 79 to 80 feet (Ref. 20, pp. 22, 34, 161-186). In general, groundwater flows to the east/southeast (Ref. 8, p. 19).

The CVOC contamination is encountered throughout the Peoria loess, in temporary wells screened from 20 to 25 feet below ground surface and in temporary wells screened from 70 to 75 feet bgs (Ref. 8, pp. 9, 15). Dense nonaqueous phase liquids (DNAPL) is assumed present at the site due to the very high concentrations of PCE (45,000,000  $\mu\text{g}/\text{kg}$ ) in a soil sample collected (SB-13) at a depth of 13-14 feet bgs, and 9,200,000  $\mu\text{g}/\text{kg}$  in a soil sample (SB-23) collected from 43-44 feet bgs (below the water table) (Refs. 10, p. 35; 15, pp. 4, 5). Another indicator of possible DNAPL presence is that PCE in groundwater is found at a concentration which is greater than 1 percent of its pure phase solubility which is 2,000  $\mu\text{g}/\text{L}$  (Ref. 14, pp. 3, 32). Three groundwater samples (TW-13, TW-21, TW-107) collected in April 2021 contained PCE at concentrations ranging from 2,100 to 11,000  $\mu\text{g}/\text{L}$  (Ref. 10, pp. 40, 73). In June and July 2018, a supplemental ESA was conducted that included sampling of soil gas, sub-slab vapor, and indoor air (Ref. 8, pp. 7, 111, 112, 134, 169). A soil gas vapor sample (SV-1) collected at 5 feet bgs near the center of the former dry cleaner property had a PCE concentration of 1,100,000 micrograms per cubic meter ( $\mu\text{g}/\text{m}^3$ ) (Ref. 8, pp. 17, 26, 119). A PCE concentration of 350,000  $\mu\text{g}/\text{m}^3$  (SS-2) was detected in a sub-slab vapor sample collected at the 2110 Franklin Street building (Ref. 8, pp. 17, 26, 124). Isoconcentration maps of groundwater and subsurface vapors show highest concentrations near the former dry cleaner property and diminishing with distance to the east (Refs. 10, pp. 65, 67; 20, p. 32).

During the EPA RSE/SI sampling events, sub-slab soil vapor samples collected concurrently with the indoor air samples showed that CVOCs are present in the subsurface directly beneath the AOE. Off the former dry cleaner property, sub-slab soil vapor collected concurrently with the indoor air samples showed that CVOCs are present in the subsurface directly beneath the AOE, at levels up to 28,000  $\mu\text{g}/\text{m}^3$  (Ref. 10, pp. 24-27, 67, 82-86, 196, 198, see **Figure 5** of this HRS documentation record). Subslab vapor samples collected west (upgradient) of the drycleaner showed that PCE was either non-detect or less than 2  $\mu\text{g}/\text{m}^3$  indicating the absence of an upgradient source (See **Figure 5** of this documentation record). The extent of subsurface groundwater and soil vapor contamination is not fully delineated; all the structures in the AOE are located above the CVOC subsurface contamination (see **Figures 2, 4 and 5** of this HRS documentation record). The sub-slab soil vapor and indoor air results indicate that the observed exposures at the site are associated with



soil vapor intrusion. **Figures 3, 4 and 5** of this HRS documentation record illustrate the extent of subsurface contamination.

Consideration of Indoor Anthropogenic Origins

During the numerous indoor air sampling events, EPA or START would visually inspect sample locations for commercial products that might impact sampling results and note their presence. Products were observed at the commercial structures (ROS 03, ROS 05, and ROS 33) (Ref. 10, pp. 82, 84). At these locations, PCE in sub-slab vapors was measured as high as 25,000 µg/m<sup>3</sup> (ROS 03), 15,000 µg/m<sup>3</sup> (ROS 05), and 400 µg/m<sup>3</sup> (ROS 33) (Ref. 10, pp. 82, 84). While small amounts of anthropogenic substances were noted or suspected to be used the high concentrations of PCE in the sub-slab vapors beneath these structures suggest at least a portion of the PCE in indoor air may have resulted from vapor intrusion. At ROS 83 and adjacent ROS 84 elevated concentrations of PCE and TCE were noted in indoor air (Ref. 10, p. 86). A building survey form identified a spray bottle (spray cap missing) that contained a chlorinated solvent as an ingredient. The survey form noted that the container was inoperable and had not been used for several months (Ref. 18, p. 9). Because PCE was also found in sub-slab vapors (Ref. 10, p. 86), and the product had not been used for several months, the concentrations in indoor air are believed to be from vapor intrusion.

Consideration of Outdoor Air Contamination

Outdoor air sampling was conducted May 2019 and December 2019 to demonstrate that increased levels of hazardous substances in indoor air sample are the result of subsurface intrusion and not outdoor air that has migrated into the structures (Refs. 1, Section 5.2.1.1.1; 9, pp. 5, 13, 68, 86, 110, 111, 166; 10, p. 20). Sampling of outdoor air was conducted simultaneously with the corresponding indoor air sample(s); the sample collection, analytical, and validation procedures were identical for indoor air samples and their corresponding outdoor air samples (Ref. 10, p. 19). The outdoor air sampling information and results are presented below in Tables 8 and 9.

**TABLE 8. AOE 1 OUTDOOR (AMBIENT) AIR ATTRIBUTION SAMPLE LOCATION**

| Sample ID               | Sample Location   | Start Date and Time | End Date and Time | References   |
|-------------------------|---|---------------------|-------------------|--|
| Ambient Air 320-50452-5 | Behind (south) of Building  | 05/15/2019 18:15    | 05/16/2019 16:10  | 9, pp. 5, 6, 13, 25, 52, 54, 68, 86, 166: Figure 2 |
| 8435-25                 | Ambient air at First Presbyterian church (1220 Bellevue Blvd S.)            | 12/03/2019 15:50    | 12/04/2019 14:03  | 10, pp. 20, 143, 154, 179: Figure 2                |
| 8435-28                 | Ambient air south side of building at Bellevue Florist (509 W. Mission Ave) | 12/04/2019 11:02    | 12/05/2019 09:03  | 10, pp. 20, 143, 154, 182: Figure 2                |

Notes:  
 ID Identification

**TABLE 9. AOE 1 OUTDOOR (AMBIENT) AIR ATTRIBUTION SAMPLE CONCENTRATIONS**

| Sample ID                  | Eligible Hazardous Substance     | Concentration (µg/m³) | Reporting Limit (µg/m³) | References                |
|----------------------------|----------------------------------|-----------------------|-------------------------|---------------------------|
| Ambient Air<br>320-50452-5 | Tetrachloroethene                | ND                    | 2.7                     | 9, pp. 110, 111           |
|                            | Trichloroethene                  | ND                    | 2.1                     |                           |
|                            | <i>cis</i> -1,2-Dichloroethene   | ND                    | 1.6                     |                           |
|                            | <i>trans</i> -1,2-Dichloroethene | ND                    | 1.6                     |                           |
|                            | Vinyl chloride                   | ND                    | 1.0                     |                           |
| 8435-25                    | Tetrachloroethene                | 0.34 U                | 0.34                    | 10, p. 151; 12, p. 9      |
|                            | Trichloroethene                  | 0.27 U                | 0.27                    |                           |
|                            | <i>cis</i> -1,2-Dichloroethene   | 0.20 U                | 0.20                    |                           |
|                            | <i>trans</i> -1,2-Dichloroethene | 0.20 U                | 0.20                    |                           |
|                            | Vinyl chloride                   | 0.13 U                | 0.13                    |                           |
| 8435-28                    | Tetrachloroethene                | 0.34 U                | 0.34                    | 10, p. 151; 12, pp. 9, 10 |
|                            | Trichloroethene                  | 0.27 U                | 0.27                    |                           |
|                            | <i>cis</i> -1,2-Dichloroethene   | 0.20 U                | 0.20                    |                           |
|                            | <i>trans</i> -1,2-Dichloroethene | 0.20 U                | 0.20                    |                           |
|                            | Vinyl chloride                   | 0.13 U                | 0.13                    |                           |

Notes:

- ND Not Detected at the reporting limit (or method detection limit [MDL] or estimated detection limit [EDL] if shown) (Ref. 9, p. 93).
- U The analyte was not detected at or above the reporting limit; sometimes called the sample quantitation limit (Refs. 10, p. 142; 12, p. 2).

**Structure Containment**

As presented above in the AOE, there are 63 regularly occupied structures that have observed exposure documented through chemical analysis and are therefore assigned a containment value of 10 [Ref. 1, Table 5-12]. EPA Region 7's Emergency and Rapid Response Services (ERRS) contractor installed vapor mitigation systems (VMS) at seven businesses and 13 residential properties between December 2019 and February 2021 (Ref. 10, p. 55). Consistent with HRS Section 5.2.1.1.2.1, for all the regularly occupied structures with unknown containment features, a structure containment value of greater than zero is assigned. Where multiple containment factor values could apply to a given structure, per, HRS Section 5.2.1.1.2.1, the highest value is considered assigned.

**TABLE 10. AOE 1 – STRUCTURE CONTAINMENT**

| Regularly Occupied Structure ID   | Structure Containment Factor Value (Ref. 1, Table 5-12) | Rationale  | References                          |
|---|---|--|-------------------------------------|
| ROS 01-10, 13-20, 22, 27-35, 37, 38, 40, 42, 43, 50, 54-57, 61, 65, 69, 70, 72,75-77, 79, 83-86, 91, 92, 94, 97-99, 101-106 | 10  | Evidence of subsurface intrusion with documented observed exposure                   | See AOE description above: Figure 2 |
| ROS 01-07, 09, 10, 28, 56, 70, 72, 77, 91, 92, 98, 102, 103, 106  | 2   | Engineered, active vapor mitigation system without documented institutional controls | 10, pp. 54, 55                      |
| All other structures in AOE 1   | Greater than 0  | Unknown containment features   | Ref. 1, Section 5.2.1.1.2.1         |

**AOE Hazardous Waste Quantity**

**Tier A Hazardous Constituent Quantity:**

The total hazardous constituent quantity for AOE 1 could not be adequately determined according to the HRS requirements; that is, the total mass of all Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) hazardous substances to have entered the structures is not known and cannot be estimated with reasonable confidence (Ref. 1, Section 2.4.2.1.1 and 5.2.1.2.2). Insufficient historical and current data (air concentration data, air



flow data, etc.) are available to adequately calculate the total mass, or a partial estimate, of all CERCLA hazardous substances to have entered the structures. Therefore, there is insufficient information to calculate a total or partial hazardous constituent quantity estimate for AOE 1 with reasonable confidence. Scoring proceeds to the evaluation of Tier B, Hazardous Wastestream Quantity (Ref. 1, Sections 2.4.2.1.1 and 5.2.1.2.2).

Hazardous Constituent Quantity Assigned Value: Not Scored  
(Ref. 1, Table 5-19)

Hazardous Constituent Quantity Complete? (Y/N): No

***Tier B Hazardous Wastestream Quantity:***

The hazardous wastestream quantity for AOE 1 could not be adequately determined according to the HRS requirements; that is, the total mass, or a partial estimate, of all hazardous wastestreams and CERCLA pollutants and contaminants to have entered the structures is not known and cannot be estimated with reasonable confidence (Ref. 1, Section 2.4.2.1.2 and 5.2.1.2.2). Insufficient historical and current data (air concentration data, air flow data, etc.) are available to adequately calculate the total mass, or a partial estimate, of all hazardous wastestreams and CERCLA pollutants and contaminants to have entered the structures. Therefore, there is insufficient information to adequately calculate or extrapolate a total or partial Hazardous Wastestream Quantity for AOE 1 with reasonable confidence. Scoring proceeds to the evaluation of Tier C, Volume (Ref. 1, Sections 2.4.2.1.2 and 5.2.1.2.2).

Hazardous Wastestream Quantity Assigned Value: Not Scored

***Tier C Volume:***

There are 62 occupied residential structures and 23 commercial/industrial structures (i.e., workplaces) within the AOE (see **Figure 2**). Volume is calculated for each regularly occupied structure located within the areas of observed exposure that was sampled by EPA during the RSE/SI, some of which were shown by chemical analysis to be within the AOE and others of which are inferred to be within the AOE [Ref. 1, Section 5.2.1.2.2].

The area in square feet (ft<sup>2</sup>) of each structure is obtained from assessors records (Ref. 13). The actual ceiling height of each structure when provided, was used. When not provided, a ceiling height of 8 feet is used to calculate volume for each structure [Ref. 1, Section 5.2.1.2.2]. Volume calculations for these regularly occupied structures within AOE 1 are shown below.

**TABLE 11. AOE 1 VOLUME**

| Regularly Occupied Structure ID | Area (ft <sup>2</sup> ) (Regularly Occupied Structures) | Ceiling Height (ft) | Volume (yd <sup>3</sup> )<br>Area × Height / 27<br>(Ref. 1, Section 5.2.1.2.2) | References                   |
|---------------------------------|---|---------------------|--|------------------------------|
| ROS 01                          | 7,868   | 12                  | 3,497  | 10, p. 82; 13, pp. 2, 5, 6   |
| ROS 02                          | 360   | 9                   | 120  | 10, p. 82; 13, pp. 2, 7, 8   |
| ROS 03                          | 6,000   | 14                  | 3,111  | 10, p. 82; 13, pp. 2, 9, 10  |
| ROS 04                          | 4,169   | 10                  | 1,544  | 10, p. 82; 13, pp. 2, 11, 12 |
| ROS 05                          | 6,880   | 14                  | 3,567  | 10, p. 82; 13, pp. 2, 13, 14 |
| ROS 06                          | 624   | 8                   | 185  | 10, p. 82; 13, pp. 2, 15, 16 |
| ROS 07                          | 10,136  | 11                  | 4,129  | 10, p. 82; 13, pp. 2, 17, 18 |
| ROS 08                          | 1,848   | 8                   | 548  | 10, p. 82; 13, pp. 2, 19, 20 |
| ROS 09                          | 1,680   | 8                   | 498  | 10, p. 82; 13, pp. 2, 21, 22 |
| ROS 10                          | 840   | 8                   | 249  | 10, p. 82; 13, pp. 2, 23, 24 |
| ROS 13                          | 3,612   | 8                   | 1,070  | 10, p. 83; 13, pp. 2, 28, 29 |
| ROS 14                          | 1,704   | 10                  | 631  | 10, p. 83; 13, pp. 2, 30, 31 |

TABLE 11. AOE 1 VOLUME

| Regularly Occupied Structure ID | Area (ft <sup>2</sup> ) (Regularly Occupied Structures) | Ceiling Height (ft) | Volume (yd <sup>3</sup> )<br>Area × Height / 27<br>(Ref. 1, Section 5.2.1.2.2) | References                       |
|---------------------------------|---|---------------------|--|----------------------------------|
| ROS 15                          | 1,454   | 8                   | 431  | 10, p. 83; 13, pp. 2, 32, 33, 34 |
| ROS 16                          | 1,440   | 8                   | 427  | 10, p. 83; 13, pp. 2, 35, 36     |
| ROS 17                          | 1,036   | 8                   | 307  | 10, p. 83; 13, pp. 2, 37, 38     |
| ROS 18                          | 4,320   | 9                   | 1,440  | 10, p. 83; 13, pp. 2, 39, 40     |
| ROS 19                          | 1,194   | 10                  | 442  | 10, p. 83; 13, pp. 2, 41, 42     |
| ROS 20                          | 1,746   | 8                   | 517  | 10, p. 83; 13, pp. 2, 43, 44     |
| ROS 22                          | 1,794   | 8                   | 532  | 10, p. 83; 13, pp. 2, 45, 46     |
| ROS 27                          | 1,519   | 8                   | 450  | 10, p. 83; 13, pp. 2, 49, 50     |
| ROS 28                          | 2,770   | 8                   | 821  | 10, p. 83; 13, pp. 2, 51, 52     |
| ROS 29                          | 1,536   | 8                   | 455  | 10, p. 83; 13, pp. 2, 53, 54     |
| ROS 30                          | 2,400   | 8                   | 711  | 10, p. 83; 13, pp. 2, 55, 56     |
| ROS 31A                         | 1,728   | 8                   | 512  | 10, p. 84; 13, pp. 2, 57, 58;    |
| ROS 31B                         | 1,728   | 8                   | 512  | 10, p. 84; 13, pp. 2, 57, 58     |
| ROS 32                          | 4,064   | 8                   | 1,204  | 10, p. 84; 13, pp. 2, 59, 60     |
| ROS 33A                         | 7,360   | 10                  | 2,726  | 10, p. 84; 13, pp. 2, 61, 62     |
| ROS 33B                         |   |                     |  |                                  |
| ROS 33C                         |   |                     |  |                                  |
| ROS 34                          | 2,943   | 12                  | 1,308  | 10, p. 84; 13, pp. 2, 63, 64     |
| ROS 35                          |   |                     |  | 10, p. 84; 13, pp. 2, 63, 64     |
| ROS 37                          | 6,645   | 12                  | 2,953  | 10, p. 84; 13, pp. 2, 65, 66     |
| ROS 38                          | 2,400   | 10                  | 889  | 10, p. 84; 13, pp. 2, 67, 68     |
| ROS 39                          | 1,392   | 8                   | 412  | 10, p. 84; 13, pp. 2, 69, 70     |
| ROS 40                          | 2,490   | 8                   | 738  | 10, p. 84; 13, pp. 2, 71, 72     |
| ROS 42                          | 3,916   | 10                  | 1,450  | 10, p. 84; 13, pp. 2, 73, 74     |
| ROS 43                          | 1,938   | 8                   | 574  | 10, p. 84; 13, pp. 2, 75, 76     |
| ROS 49                          | 1,836   | 8                   | 544  | 10, p. 84; 13, pp. 2, 85, 86     |
| ROS 50                          | 2,008   | 8                   | 595  | 10, p. 84; 13, pp. 2, 87, 88     |
| ROS 54                          | 961   | 8                   | 285  | 10, p. 85; 13, pp. 3, 91, 92     |
| ROS 55                          | 1,595   | 8                   | 473  | 10, p. 85; 13, pp. 3, 93, 94     |
| ROS 56                          | 2,156   | 8                   | 639  | 10, p. 85; 13, pp. 3, 95, 96     |
| ROS 57                          | 1,564   | 8                   | 463  | 10, p. 85; 13, pp. 3, 97, 98     |
| ROS 61                          | 720   | 8                   | 213  | 10, p. 85; 13, pp. 3, 101, 102   |
| ROS 65                          | 8,412   | 12                  | 3,739  | 10, p. 85; 13, pp. 3, 105, 106   |
| ROS 69                          | 1,197   | 10                  | 443  | 10, p. 85; 13, pp. 3, 109, 110   |
| ROS 70                          | 2,140   | 8                   | 634  | 10, p. 85; 13, pp. 3, 111, 112   |
| ROS 72                          | 1,796   | 8                   | 532  | 10, p. 85; 13, pp. 3, 115, 116   |
| ROS 75                          | 5,015   | 11                  | 2,043  | 10, p. 85; 13, pp. 3, 121, 122   |
| ROS 76                          | 1,200   | 8                   | 356  | 10, p. 85; 13, pp. 3, 123, 124   |
| ROS 77                          | 1,825   | 8                   | 541  | 10, p. 85; 13, pp. 3, 125, 126   |
| ROS 79                          | 1,868   | 8                   | 553  | 10, p. 86; 13, pp. 3, 129, 130   |
| ROS 83                          | 1,799   | 14                  | 933  | 10, p. 86; 13, pp. 3, 135, 136   |



TABLE 11. AOE 1 VOLUME

| Regularly Occupied Structure ID | Area (ft <sup>2</sup> ) (Regularly Occupied Structures) | Ceiling Height (ft) | Volume (yd <sup>3</sup> )<br>Area × Height / 27<br>(Ref. 1, Section 5.2.1.2.2) | References                     |
|---------------------------------|---|---------------------|--|--------------------------------|
| ROS 84                          | 1,799   | 14                  | 933  | 10, p. 86; 13, pp. 3,135, 136  |
| ROS 85                          | 8,350   | 8                   | 2,474  | 10, p. 86; 13, pp. 3, 137      |
| ROS 86                          | 2,324   | 8                   | 689  | 10, p. 86; 13, pp. 3, 139, 140 |
| ROS 91                          | 3,217   | 8                   | 953  | 10, p. 86; 13, pp. 3, 143, 144 |
| ROS 92                          | 2,494   | 8                   | 739  | 10, p. 86; 13, pp. 3, 145, 146 |
| ROS 94                          | 2,621   | 8                   | 777  | 10, p. 86; 13, pp. 3, 149, 150 |
| ROS 97                          | 2,400   | 8                   | 711  | 10, p. 86; 13, pp. 3, 151, 152 |
| ROS 98                          | 3,114   | 8                   | 923  | 10, p. 86; 13, pp. 3, 153, 154 |
| ROS 99                          | 2,091   | 8                   | 620  | 10, p. 86; 13, pp. 3, 155, 156 |
| ROS 101                         | 2,652   | 8                   | 786  | 10, p. 86; 13, pp. 3, 157, 158 |
| ROS 102                         | 2,240   | 8                   | 664  | 10, p. 87; 13, pp. 3, 159, 160 |
| ROS 103                         | 1,680   | 8                   | 498  | 10, p. 87; 13, pp. 3, 161, 162 |
| ROS 104                         | 1,984   | 8                   | 588  | 10, p. 87; 13, pp. 3, 163, 164 |
| ROS 105                         | 3,049   | 8                   | 903  | 10, p. 87; 13, pp. 3, 165, 166 |
| ROS 106                         | 2,201   | 8                   | 652  | 10, p. 87; 13, pp. 3, 167, 168 |
| ROS 107                         | 1,926   | 8                   | 571  | 13, pp. 3, 169, 170            |
| ROS 108                         | 1,707   | 8                   | 506  | 13, pp. 3, 171, 172            |
| ROS 109                         | 1,440   | 8                   | 427  | 13, pp. 3, 173, 174            |
| ROS 110                         | 1,728   | 8                   | 512  | 13, pp. 3, 175, 176            |
| ROS 111                         | 1,568   | 8                   | 465  | 13, pp. 3, 177, 178            |
| ROS 112                         | 1,454   | 8                   | 431  | 13, pp. 3, 179, 180            |
| ROS 113                         | 1,754   | 8                   | 520  | 13, pp. 3, 181, 182            |
| ROS 114                         | 1,440   | 8                   | 427  | 13, pp. 3, 183, 184            |
| ROS 115                         | 2,747   | 8                   | 814  | 13, pp. 3, 185, 186            |
| ROS 116                         | 1,392   | 8                   | 412  | 13, pp. 3, 187, 188            |
| ROS 117                         | 1,566   | 8                   | 464  | 13, pp. 3, 189, 190            |
| ROS 119                         | 1,963   | 8                   | 582  | 13, pp. 4, 193, 194            |
| ROS 120                         | 1,521   | 8                   | 451  | 13, pp. 4, 195, 196            |
| ROS 121                         | 2,112   | 8                   | 626  | 13, pp. 4, 197, 198            |
| ROS 122                         | 1,392   | 8                   | 412  | 13, pp. 4, 199, 200            |
| ROS 123                         | 720   | 8                   | 213  | 13, pp. 4, 201, 202            |
| ROS 124                         | 2,364   | 8                   | 700  | 13, pp. 4, 203, 204            |
| ROS 125                         | 2,424   | 8                   | 718  | 13, pp. 4, 205, 206            |
| ROS 126                         | 2,904   | 8                   | 860  | 13, pp. 4, 207, 208            |
| ROS 127                         | 32,178  | 8                   | 9,534  | 13, pp. 4, 209, 210            |

## Notes:

HRS Section 5.2.1.2.2 instructs to include in the hazardous waste quantity all regularly occupied structures or subunits that have had mitigation systems installed as part of a removal or other temporary response action.

ID Identification  
 ROS Regularly occupied structure  
 ft feet  
 ft<sup>2</sup> Square feet  
 yd<sup>3</sup> Cubic yards

Sum of values: 84,501  
 Sum of values/2.5 (V/2.5): 33,800.4  
 Equation for Assigning Value (Ref. 1, Table 5-19)  
 Volume Assigned Value: 33,800.4

**Tier D Area:**

Area of the regularly occupied structures was not evaluated because the volume was adequately determined.

Sum of values: Not evaluated  
 Sum of values/13 (A/13): Not applicable  
 Equation for Assigning Value (Ref. 1, Table 5-19)  
 Area Assigned Value: Not Evaluated

**AOE Hazardous Waste Quantity Value:**

AOE 1 Hazardous Waste Quantity

Per the HRS, the highest values assigned to the source for hazardous constituent quantity (Tier A), hazardous wastestream quantity (Tier B), volume (Tier C), or area (Tier D) should be assigned as the source hazardous waste quantity value (Ref. 1, Section 2.4.2.1.5).

**TABLE 12. AOE 1 Hazardous Waste Quantity**

| Tier Evaluated | AOE 1 Values  |
|----------------|---------------|
| A              | Not Scored    |
| B              | Not Scored    |
| C              | 33,800.4      |
| D              | Not evaluated |

AOE 1 Hazardous Waste Quantity Factor Value: 10,000  
 (Ref. 1, Table 2-6, Section 2.4.2.2)



## 5.2.1 SUBSURFACE INTRUSION COMPONENT

### 5.2.1.1 LIKELIHOOD OF EXPOSURE

#### 5.2.1.1.1 Observed Exposure

The documentation and analytical results presented above in Section 5.2.0 demonstrate that hazardous substances have been released into regularly occupied structures via the subsurface, thereby establishing observed exposure for the site (Ref. 1, Section 5.2.1.1.1). Specifically, indoor air samples from 40 occupied residential structures and 23 occupied workplace structures exhibited concentrations of PCE, TCE, *cis*-1,2-DCE, *trans*-1,2-DCE, and vinyl chloride that meet observed exposure criteria (see Observed Exposure by Chemical Analysis in Section 5.2.0). The indoor air samples that meet observed exposure criteria are listed in Table 13 below. See **Figure 2** of this HRS documentation record for the release sample locations and see Tables 6 and 7 for observed exposure sample location descriptions and analytical results.

**TABLE 13. SAMPLES DOCUMENTING OBSERVED EXPOSURE**

| AOE Number | Regularly Occupied Structure ID | Evidence   | Eligible Hazardous Substance(s)  | References                 |
|------------|---------------------------------|--|--|----------------------------|
| 1          | ROS 01                          | 8482-12  | Tetrachloroethene<br>Trichloroethene<br>Vinyl chloride   | 10, p. 190; 12, p. 14      |
|            | ROS 02                          | 8482-9   | Tetrachloroethene  | 10, p. 190; 12, p. 13      |
|            | ROS 03                          | 8482-11  | Tetrachloroethene<br>Trichloroethene<br><i>cis</i> -1,2-Dichloroethene<br><i>trans</i> -1,2-Dichloroethene<br>Vinyl chloride | 10, p. 190; 12, p. 14      |
|            | ROS 06                          | 8482-15  | Tetrachloroethene<br>Trichloroethene   | 10, p. 191; 12, p. 15      |
|            | ROS 07                          | 8482-2   | Tetrachloroethene<br>Trichloroethene   | 10, p. 188; 12, p. 11      |
|            | ROS 13                          | 8618-16  | Trichloroethene  | 10, p. 230; 12, p. 39      |
|            | ROS 14                          | 8519-23  | Tetrachloroethene<br>Trichloroethene<br>Vinyl chloride   | 10, p. 203; 12, p. 22      |
|            |                                 | 8774-22  | Tetrachloroethene<br>Trichloroethene<br>Vinyl chloride   | 10, p. 276; 12, pp. 68, 69 |
|            | ROS 15                          | 8619-15  | Tetrachloroethene  | 10, p. 245; 12, p. 49      |
|            | ROS 18                          | 8774-3   | Tetrachloroethene  | 10, p. 271; 12, p. 63      |
|            | ROS 22                          | 8619-9   | Tetrachloroethene  | 10, p. 244; 12, p. 47      |
|            | ROS 40                          | 8652-32  | Tetrachloroethene  | 10, p. 263; 12, p. 62      |
|            | ROS 43                          | 8588-21  | Tetrachloroethene<br>Trichloroethene   | 10, p. 217; 12, p. 30      |
|            | ROS 76                          | 8774-18  | Tetrachloroethene  | 10, p. 275; 12, p. 67      |
|            | ROS 83                          | 8435-8   | Tetrachloroethene<br>Trichloroethene   | 10, p. 146; 12, p. 4       |
| ROS 84     | 8435-10                         | Tetrachloroethene<br>Trichloroethene<br><i>trans</i> -1,2-Dichloroethene | 10, p. 147; 12, pp. 4, 5   |                            |
| ROS 105    | 8652-26                         | Tetrachloroethene  | 10, p. 262; 12, p. 61  |                            |

Notes:

AOE Area of observed exposure  
ID Identification  
ROS Regularly occupied structure

An observed exposure factor value of 550 is assigned because observed exposure is established in regularly occupied structures (Ref. 1, Sec. 5.2.1.1.1).

SsI Component Observed Exposure Factor Value: 550

### **5.2.1.1.3 Calculation of Likelihood of Exposure Factor Category Value**

A likelihood of exposure factor category value is assigned because observed exposure is established for the site (Ref. 1, Section 5.2.1.1.3).

Likelihood of Exposure Factor Category Value: 550  
(Ref. 1, Sec. 5.2.1.1.3)

## 5.2.1.2 WASTE CHARACTERISTICS

### 5.2.1.2.1 Toxicity/Degradation

The hazardous substances associated with the site include PCE, TCE, *cis*-1,2-DCE, *trans*-1,2-DCE, and vinyl chloride, all of which are present in the AOE (see **Section 5.2.0**). Therefore, per the HRS Section 2.2.2 (*Identify hazardous substances associated with a source*), these substances are eligible for consideration in an SSI evaluation as they are found in samples meeting observed exposure criteria. The toxicity and degradation factor values for the AOE contaminants are shown below.

#### *Toxicity Factor Value*

**TABLE 14. TOXICITY FACTOR VALUES**

| Eligible Hazardous Substance     | AOE Number | Toxicity Factor Value | References |
|----------------------------------|------------|-----------------------|------------|
| Tetrachloroethene                | 1          | 100                   | 2, p. 4    |
| Trichloroethene                  | 1          | 1,000                 | 2, p. 5    |
| <i>cis</i> -1,2-Dichloroethene   | 1          | 1,000                 | 2, p. 2    |
| <i>trans</i> -1,2-Dichloroethene | 1          | 100                   | 2, p. 3    |
| Vinyl chloride                   | 1          | 10,000                | 2, p. 6    |

#### *Degradation Factor Value*

**TABLE 15. DEGRADATION FACTOR VALUES**

| Eligible Hazardous Substance     | AOE Number | Substance Present in AOE or NAPL? (Y/N) | Depth to Contamination (Ref. 1, Sec. 5.2.1.1.2.2) | Half-life (Days) | Degradation Factor Value <sup>1</sup> (Ref. 1, Table 5-18) | References |
|----------------------------------|------------|---|---|------------------|--|------------|
| Tetrachloroethene                | 1          | Y                                       | NA  | NA               | 1  | TABLE 7    |
| Trichloroethene                  | 1          | Y                                       | NA  | NA               | 1  | TABLE 7    |
| <i>cis</i> -1,2-Dichloroethene   | 1          | Y                                       | NA  | NA               | 1  | TABLE 7    |
| <i>trans</i> -1,2-Dichloroethene | 1          | Y                                       | NA  | NA               | 1  | TABLE 7    |
| Vinyl chloride                   | 1          | Y                                       | NA  | NA               | 1  | TABLE 7    |

Notes:

<sup>1</sup> Any hazardous substance that meets the criteria for observed exposure (i.e., the substances present in the AOE) have an assigned degradation factor value of 1 (Ref. 1, Section 5.2.1.2.1.2).

AOE Area of observed exposure

NAPL Non-aqueous phase liquids

Y Yes

N No

NA Not applicable



*Toxicity/Degradation Factor Value*

**TABLE 16. TOXICITY/DEGRADATION FACTOR VALUES**

| Eligible Hazardous Substance     | AOE Number | Toxicity | Degradation Factor Value (Ref. 1, Table 5-18) | Toxicity/Degradation Factor Value |
|----------------------------------|------------|----------|---|-----------------------------------|
| Tetrachloroethene                | 1          | 100      | 1   | 100                               |
| Trichloroethene                  | 1          | 1,000    | 1   | 1,000                             |
| <i>cis</i> -1,2-Dichloroethene   | 1          | 1,000    | 1   | 1,000                             |
| <i>trans</i> -1,2-Dichloroethene | 1          | 100      | 1   | 100                               |
| Vinyl chloride                   | 1          | 10,000   | 1   | 10,000                            |

The substance with the highest combined toxicity/degradation factor value: Vinyl chloride  
Toxicity/Degradation Factor Value: 10,000

**5.2.1.2.2 Hazardous Waste Quantity for Subsurface Intrusion Component**

**TABLE 17. HAZARDOUS WASTE QUANTITY FOR SUBSURFACE INTRUSION COMPONENT**

| AOE Number | AOE 1 Hazardous Waste Quantity |
|------------|--------------------------------|
| 1          | 33,800.4                       |

Sum of AOE Values: 33,800.4

The hazardous waste quantity value of 33,800.4, which is based on estimates of AOE structure volumes corresponds to a hazardous waste quantity factor value of 10,000 (Ref. 1, Table 2-6). The hazardous constituent quantity is not adequately determined for the areas of observed exposure, and targets are subject to Level I or Level II concentrations. In this situation, the HRS prescribes assigning the higher of the value from Table 2-6 or a value of 100, whichever is greater, as the hazardous waste quantity factor value for the SSI component (Ref. 1, Section 5.2.1.2.2). Therefore, a value of 10,000 is assigned as the hazardous waste quantity factor value.

Hazardous Waste Quantity Factor Value: 10,000

**5.2.1.2.3 Calculation of Waste Characteristics Factor Category Value**

The waste characteristics factor category value is determined by multiplying the toxicity/degradation and hazardous waste quantity factor values, subject to a maximum product of  $1 \times 10^8$ , and assigning a value from HRS Table 2-7 based on the product (Ref. 1, Section 5.2.1.2.3). The product for the site is  $1 \times 10^8$ , which corresponds to a waste characteristics factor category value of 100 in HRS Table 2-7.

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

Toxicity Factor Value x Hazardous Waste Quantity Factor Value:  $1 \times 10^8$  or 100,000,000

Waste Characteristics Factor Category Value: 100  
(Ref. 1, Table 2-7)

### 5.2.1.3 TARGETS

There are 62 regularly occupied residential structures and 23 regularly occupied workplace structures within AOE 1, for a total of 85 regularly occupied structures which constitute the site (see **Figure 2 and Section 5.2.0** of this HRS documentation record).

**TABLE 18. TYPES OF STRUCTURE/POPULATIONS IN AOE 1**

| AOE Number | Type of Structure                                      | Number(s) of Specific Type of Structure <sup>1</sup> | Type of Population | References                              |
|------------|--|--|--------------------|---|
| 1          | Residence (single family)                              | 58   | Residents          | 13, pp. 2-4; Figure 2                   |
|            | Residence (apartment building, multi-unit, multilevel) | 1: ROS 127 <sup>2</sup>                              | Residents          | 13, pp. 209, 210; Figure 2              |
|            | Residence (apartment, multi-unit)                      | 1: ROS 02  | Residents          | 13, pp. 7, 8; Figure 2                  |
|            | Residence duplex or multi-unit                         | 2; ROS 31A, 31B, 98 <sup>3</sup>                     | Residents          | 13, pp. 2-4, 57, 58, 153, 154; Figure 2 |
|            | Workplace  | 23   | Workers            | 13, pp. 2-4; Figure 2                   |

Notes:

<sup>1</sup> The number of structures is counted; individual subunits are listed for residential structures.

<sup>2</sup> ROS 127 is a three-story apartment building consisting of 42, 1 bedroom apartments where contamination is inferred. 14 apartments (42 divided by three) are assumed to exist on each of the three levels.

<sup>3</sup> ROS 31A and 31B is a duplex, both units were sampled; ROS 98 is a four apartment building whose configuration is not known.

**TABLE 19. HAZARDOUS SUBSTANCES THAT EQUAL OR EXCEED HEALTH-BASED BENCHMARKS IN AOE 1**

| ROS ID | Sample ID | Eligible Hazardous Substance | Hazardous Substance Concentration (µg/m <sup>3</sup> ) | Benchmark Concentration (µg/m <sup>3</sup> ) | Benchmark (Ref. 1, Table 5-20) | References          |
|--------|-----------|------------------------------|--|--|--------------------------------|---------------------|
| ROS 01 | 8435-22   | Tetrachloroethene            | 88   | 10.8<br>41.7                                 | Cancer risk<br>Non-cancer risk | 2, p. 4; 10, p. 150 |
|        | 8482-12   | Tetrachloroethene            | 74   | 10.8<br>41.7                                 | Cancer risk<br>Non-cancer risk | 2, p. 4; 10, p. 190 |
| ROS 02 | 8435-20   | Tetrachloroethene            | 16   | 10.8   | Cancer risk                    | 2, p. 4; 10, p. 149 |
|        | 8482-9    | Tetrachloroethene            | 12   | 10.8   | Cancer risk                    | 2, p. 4; 10, p. 190 |
| ROS 03 | 8435-16   | Trichloroethene              | 7.1  | 0.478<br>2.09                                | Cancer risk<br>Non-cancer risk | 2, p. 5; 10, p. 148 |
|        |           | Vinyl chloride               | 0.58   | 0.168  | Cancer risk                    | 2, p. 6; 10, p. 148 |
|        | 8482-11   | Trichloroethene              | 360  | 0.478<br>2.09                                | Cancer risk<br>Non-cancer risk | 2, p. 5; 10, p. 190 |
|        |           | Vinyl chloride               | 0.31   | 0.168  | Cancer risk                    | 2, p. 6; 10, p. 190 |
| ROS 04 | 8435-6    | Tetrachloroethene            | 11   | 10.8   | Cancer risk                    | 2, p. 4; 10, p. 146 |
| ROS 05 | 8435-13   | Tetrachloroethene            | 380  | 10.8<br>41.7                                 | Cancer risk<br>Non-cancer risk | 2, p. 4; 10, p. 148 |
| ROS 06 | 8482-15   | Trichloroethene              | 0.52   | 0.478  | Cancer risk                    | 2, p. 5; 10, p. 191 |
| ROS 07 | 8482-2    | Trichloroethene              | 0.66   | 0.478  | Cancer risk                    | 2, p. 5; 10, p. 188 |
| ROS 09 | 8618-2    | Trichloroethene              | 0.53   | 0.478  | Cancer risk                    | 2, p. 5; 10, p. 227 |

**TABLE 19. HAZARDOUS SUBSTANCES THAT EQUAL OR EXCEED HEALTH-BASED BENCHMARKS IN AOE 1**

| ROS ID  | Sample ID | Eligible Hazardous Substance | Hazardous Substance Concentration ( $\mu\text{g}/\text{m}^3$ ) | Benchmark Concentration ( $\mu\text{g}/\text{m}^3$ ) | Benchmark (Ref. 1, Table 5-20) | References          |
|---------|-----------|------------------------------|--|--|--------------------------------|---------------------|
| ROS 13  | 8618-16   | Trichloroethene              | 1.6  | 0.478  | Cancer risk                    | 2, p. 5; 10, p. 230 |
| ROS 14  | 8519-23   | Trichloroethene              | 3.4  | 0.478<br>2.09  | Cancer risk<br>Non-cancer risk | 2, p. 5; 10, p. 203 |
|         |           | Vinyl chloride               | 0.62   | 0.168  | Cancer risk                    | 2, p. 6; 10, p. 203 |
|         | 8774-22   | Trichloroethene              | 1.7  | 0.478  | Cancer risk                    | 2, p. 5; 10, p. 276 |
|         |           | Vinyl chloride               | 0.33   | 0.168  | Cancer risk                    | 2, p. 6; 10, p. 276 |
| ROS 15  | 8619-15   | Tetrachloroethene            | 14   | 10.8   | Cancer risk                    | 2, p. 4; 10, p. 245 |
| ROS 18  | 8774-3    | Tetrachloroethene            | 38   | 10.8   | Cancer risk                    | 2, p. 4; 10, p. 271 |
| ROS 22  | 8619-9    | Tetrachloroethene            | 26   | 10.8   | Cancer risk                    | 2, p. 4; 10, p. 244 |
| ROS 28  | 8519-3    | Tetrachloroethene            | 65   | 10.8<br>41.7   | Cancer risk<br>Non-cancer risk | 2, p. 4; 10, p. 198 |
| ROS 33A | 8652-3    | Tetrachloroethene            | 230  | 10.8<br>41.7   | Cancer risk<br>Non-cancer risk | 2, p. 4; 10, p. 256 |
|         |           | Trichloroethene              | 0.49   | 0.478  | Cancer risk                    | 2, p. 5; 10, p. 256 |
| ROS 33B | 8652-5    | Tetrachloroethene            | 200  | 10.8<br>41.7   | Cancer risk<br>Non-cancer risk | 2, p. 4; 10, p. 257 |
| ROS 33C | 8652-6    | Tetrachloroethene            | 200  | 10.8<br>41.7   | Cancer risk<br>Non-cancer risk | 2, p. 4; 10, p. 257 |
| ROS 40  | 8652-32   | Tetrachloroethene            | 22   | 10.8   | Cancer risk                    | 2, p. 4; 10, p. 263 |
| ROS 43  | 8588-21   | Tetrachloroethene            | 14   | 10.8   | Cancer risk                    | 2, p. 4; 10, p. 217 |
| ROS 56  | 8618-24   | Tetrachloroethene            | 12   | 10.8   | Cancer risk                    | 2, p. 4; 10, p. 232 |
| ROS 70  | 8618-20   | Tetrachloroethene            | 23   | 10.8   | Cancer risk                    | 2, p. 4; 10, p. 231 |
| ROS 72  | 8519-25   | Tetrachloroethene            | 11   | 10.8   | Cancer risk                    | 2, p. 4; 10, p. 204 |
| ROS 76  | 8774-18   | Tetrachloroethene            | 58   | 10.8<br>41.7   | Cancer risk<br>Non-cancer risk | 2, p. 4; 10, p. 275 |
| ROS 83  | 8435-8    | Tetrachloroethene            | 31   | 10.8   | Cancer risk                    | 2, p. 4; 10, p. 146 |
|         |           | Trichloroethene              | 0.64   | 0.478  | Cancer risk                    | 2, p. 5; 10, p. 146 |
| ROS 84  | 8435-10   | Trichloroethene              | 0.59   | 0.478  | Cancer risk                    | 2, p. 5; 10, p. 147 |
| ROS 91  | 8652-11   | Tetrachloroethene            | 19   | 10.8   | Cancer risk                    | 2, p. 4; 10, p. 258 |
| ROS 92  | 8588-27   | Tetrachloroethene            | 13   | 10.8   | Cancer risk                    | 2, p. 4; 10, p. 218 |
| ROS 105 | 8652-26   | Tetrachloroethene            | 20   | 10.8   | Cancer risk                    | 2, p. 4; 10, p. 262 |

Notes:

$\mu\text{g}/\text{m}^3$  Micrograms per cubic meter

ID Identification

ROS Regularly occupied structure



### 5.2.1.3.1 Exposed Individual

There are exposed individuals in 26 regularly occupied structures subject to Level I concentrations (i.e., concentrations above health-based benchmarks), as shown above in **Table 19** and as displayed in **Figure 2** of this HRS documentation record.

AOE Number: AOE 1  
 Regularly Occupied Structure ID: ROS 1  
 Sample ID: 8482-12  
 Eligible Hazardous Substance: Tetrachloroethene  
 Hazardous Substance Concentration: 74  $\mu\text{g}/\text{m}^3$   
 Benchmark Concentration: 10.8  $\mu\text{g}/\text{m}^3$  (cancer risk), 41.7  $\mu\text{g}/\text{m}^3$  (non-cancer risk)  
 Level of Contamination (Level I/Level II/Potential): Level I  
 Reference: 2, p. 4; 10, p. 190

AOE Number: AOE 1  
 Regularly Occupied Structure ID: ROS 14  
 Sample ID: 8519-23  
 Eligible Hazardous Substance: Trichloroethene  
 Hazardous Substance Concentration: 3.4  $\mu\text{g}/\text{m}^3$   
 Benchmark Concentration: 0.478  $\mu\text{g}/\text{m}^3$  (cancer risk), 2.09  $\mu\text{g}/\text{m}^3$  (non-cancer risk)  
 Level of Contamination (Level I/Level II/Potential): Level I  
 Reference: 2, p. 5; 10, p. 203

AOE Number: AOE 1  
 Regularly Occupied Structure ID: ROS 14  
 Sample ID: 8519-23  
 Eligible Hazardous Substance: Vinyl chloride  
 Hazardous Substance Concentration: 0.62  $\mu\text{g}/\text{m}^3$   
 Benchmark Concentration: 0.168  $\mu\text{g}/\text{m}^3$  (cancer risk)  
 Level of Contamination (Level I/Level II/Potential): Level I  
 Reference: 2, p. 6; 10, p. 203

These data demonstrate that there is at least one exposed individual in one or more regularly occupied structures subject to Level I concentrations; therefore, a value of 50 is assigned as the exposed individual factor value (Ref. 1, Section 5.2.1.3.1).

Exposed Individual Factor Value: 50

### 5.2.1.3.2 Population

Population is evaluated based on two factors, Level I concentrations and Level II concentrations. Population within an area of subsurface contamination is not considered for this scoring evaluation.

For the structures that were documented in AOE 1 through chemical analysis, the actual population is used (if reported). For residential structures where the actual population was not reported and for residential structures in the inferred AOE, where the actual population counts were not readily available, the Sarpy County average of 2.72 persons per household is used (Refs, 1, Section 5.2.1.3.2; 17, p. 1). For commercial and industrial structures (i.e., workplaces) where the actual population was not reported and was not readily available, a default value of 1 full-time worker per structure is used.

5.2.1.3.2.1 *Level I Concentrations*

Level I concentrations are media-specific concentrations for the target that meet the criteria for observed exposure for the pathway and are at or above SSI component-specific benchmark values, as shown in **Table 19** above (Refs. 1, Section 2.5; 2, pp. 4, 5, 6). Information for AOE 1 can be found in **Section 5.2.0**. The regularly occupied structures that meet observed exposure criteria and exhibit Level I concentrations are listed below.

Level I Population

**TABLE 20. LEVEL I POPULATION IN AOE 1**

| Regularly Occupied Structure ID | Sample ID                  | Number of Exposed Individuals (non-workers) | Number of Full-time Workers |                     | Number of Part-time Workers |                     | Regularly Occupied Structure's Total Population Value | References                                |
|---------------------------------|----------------------------|---|-----------------------------|---------------------|-----------------------------|---------------------|---|---|
|                                 |                            |   | Actual Number               | Adjusted (Number/3) | Actual Number               | Adjusted (Number/6) |   |   |
| ROS 01                          | 8482-12                    |   | 1                           | 0.33                | 7                           | 1.16                | 1.49  | 2, p. 4; 10, p. 190; 18, p. 12            |
| ROS 02                          | 8482-9                     | 1   |                             |                     |                             |                     | 1   | 2, p. 3; 10, p. 190; 18, p. 3             |
| ROS 03                          | 8482-11                    |   | 6                           | 2                   | 1                           | 0.16                | 2.16  | 2, p. 4; 10, p. 190; 18, p. 10            |
| ROS 04                          | 8435-6                     |   |                             |                     | 1                           | 0.16                | 0.16  | 2, p. 4; 10, p. 146; 18, p. 2             |
| ROS 05                          | 8435-13                    |   | 1                           | 0.33                |                             |                     | 0.33  | 2, p. 4; 10, p. 148                       |
| ROS 06                          | 8482-15                    |   | 6                           | 2                   | 2                           | 0.33                | 2.33  | 2, p. 5; 10, p. 191; 18, p. 6             |
| ROS 07                          | 8482-2                     |   |                             |                     | 24                          | 4                   | 4   | 2, p. 5; 10, p. 188; 18, p. 7             |
| ROS 09                          | 8618-2                     | 2.72  |                             |                     |                             |                     | 2.72  | 2, p. 5; 10, p. 227, 17, p. 1             |
| ROS 13                          | 8618-16                    | 2.72  |                             |                     |                             |                     | 2.72  | 2, p. 5; 10, p. 230; 17, p. 1             |
| ROS 14                          | 8519-23                    |   | 1                           | 0.33                |                             |                     | 0.33  | 2, pp. 5, 6; 10, pp. 203, 276;            |
|                                 | 8774-22                    |   |                             |                     |                             |                     |   |   |
| ROS 15                          | 8619-15                    | 2.72  |                             |                     |                             |                     | 2.72  | 2, p. 4; 10, p. 245; 10, p. 245; 17, p. 1 |
| ROS 18                          | 8774-3                     |   | 1                           | 0.33                |                             |                     | 0.33  | 2, p. 4; 10, p. 271;                      |
| ROS 22                          | 8619-9                     | 2.72  |                             |                     |                             |                     | 2.72  | 2, p. 4; 10, p. 244; 17, p. 1             |
| ROS 28                          | 8519-3                     | 2.72  |                             |                     |                             |                     | 2.72  | 2, p. 4; 10, p. 206; 17, p. 1             |
| ROS 33A,<br>33 B,<br>33 C       | 8652-3<br>8652-5<br>8652-6 |   | 1                           | 0.33                |                             |                     | 0.33  | 2, pp. 4, 5; 10, pp. 256, 257             |
| ROS 40                          | 8652-32                    | 2.72  |                             |                     |                             |                     | 2.72  | 2, p. 4; 10, p. 263; 17, p. 1             |
| ROS 43                          | 8588-21                    | 2.72  |                             |                     |                             |                     | 2.72  | 2, p. 4; 10, p. 217; 17, p. 1             |
| ROS 56                          | 8618-24                    | 2.72  |                             |                     |                             |                     | 2.72  | 2, p. 4; 10, p. 232; 17, p. 1             |

**TABLE 20. LEVEL I POPULATION IN AOE 1**

| Regularly Occupied Structure ID | Sample ID | Number of Exposed Individuals (non-workers) | Number of Full-time Workers |                     | Number of Part-time Workers |                     | Regularly Occupied Structure's Total Population Value | References                        |
|---------------------------------|-----------|---|-----------------------------|---------------------|-----------------------------|---------------------|---|-----------------------------------|
|                                 |           |   | Actual Number               | Adjusted (Number/3) | Actual Number               | Adjusted (Number/6) |   |                                   |
| ROS 70                          | 8618-20   | 2.72  |                             |                     |                             |                     | 2.72  | 2, p. 4; 10, p. 231; 17, p. 1     |
| ROS 72                          | 8519-25   |   | 1                           | 0.33                |                             |                     | 0.33  | 2, p. 4; 10, p. 204               |
| ROS 76                          | 8774-18   |   | 1                           | 0.33                |                             |                     | 0.33  | 2, p. 4; 10, p. 275;              |
| ROS 83                          | 8435-8    |   | 3                           | 1                   | 1                           | 0.16                | 1.16  | 2, pp. 4, 5; 10, p. 146; 18, p. 9 |
| ROS 84                          | 8435-10   |   | 3                           | 1                   | 3                           | 0.5                 | 1.5   | 2, p. 5; 10, p. 147; 18, p. 11    |
| ROS 91                          | 8652-11   | 2.72  |                             |                     |                             |                     | 2.72  | 2, p. 4; 10, p. 258; 17, p. 1     |
| ROS 92                          | 8588-27   | 2.72  |                             |                     |                             |                     | 2.72  | 2, p. 4; 10, p. 218; 17, p. 1     |
| ROS 105                         | 8652-26   | 2.72  |                             |                     |                             |                     | 2.72  | 2, p. 4; 10, p. 262; 17, p. 1     |

Notes:

HRS Section 5.2.1.3 instructs that if a removal or temporary response action has occurred that has not completely mitigated the release, count the initial targets as if the removal or temporary response action has not permanently interrupted target exposure from subsurface intrusion.

ID Identification

ROS Regularly occupied structure

Sum of regularly occupied structures' total population values subject to Level I concentrations: 48.42  
Sum of regularly occupied structures' total population values subject to Level I concentrations x 10: 484.2

Level I Concentrations Factor Value: 484.2

### 5.2.1.3.2.2 Level II Concentrations

Level II concentrations are exhibited by structures with one or more samples that meet the criteria for observed exposure by chemical analysis but do not exhibit Level I concentrations (Ref. 1, Sec. 5.2.1.3.1). There are 39 structures with documented Level II concentrations that do not exhibit Level I concentrations. Structures that are inferred to be in the AOE are also assigned Level II concentrations (Ref. 1, Section 5.2.1.3.1). Information for AOE 1 can be found in **Section 5.2.0**. The structures that exhibit Level II concentrations through chemical analysis or are inferred to be in AOE 1 due to their locations are listed below.

#### Level II Population

**TABLE 21. LEVEL II POPULATION IN AOE 1**

| Regularly Occupied Structure ID | Sample ID/Inferred Indoor Air Contamination | Number of Exposed Individuals (non-workers) | Number of Full-time Workers |                     | Number of Part-time Workers |                     | Regularly Occupied Structure's Total Population Value | References           |
|---------------------------------|---|---|-----------------------------|---------------------|-----------------------------|---------------------|---|----------------------|
|                                 |   |   | Actual Number               | Adjusted (Number/3) | Actual Number               | Adjusted (Number/6) |   |                      |
| ROS 08                          | 8519-31                                     | 2.72  |                             |                     |                             |                     | 2.72  | 2, p. 3; 10, p. 205; |

**TABLE 21. LEVEL II POPULATION IN AOE 1**

| Regularly Occupied Structure ID | Sample ID/Inferred Indoor Air Contamination | Number of Exposed Individuals (non-workers) | Number of Full-time Workers |                     | Number of Part-time Workers |                     | Regularly Occupied Structure's Total Population Value | References                        |
|---------------------------------|---|---|-----------------------------|---------------------|-----------------------------|---------------------|---|-----------------------------------|
|                                 |   |   | Actual Number               | Adjusted (Number/3) | Actual Number               | Adjusted (Number/6) |   |                                   |
| ROS 10                          | 8774-13                                     | 2.72  |                             |                     |                             |                     | 2.72  | 2, p. 3; 10, p. 274; 17, p. 1     |
| ROS 16                          | 8588-13                                     | 2.72  |                             |                     |                             |                     | 2.72  | 2, p. 3; 10, p. 215; 17, p. 1     |
| ROS 17                          | 8619-5                                      | 2.72  |                             |                     |                             |                     | 2.72  | 2, p. 3; 10, p. 243; 17, p. 1     |
| ROS 19                          | 8519-17                                     |   | 1                           | 0.33                |                             |                     | 0.33  | 2, p. 3; 10, p. 202               |
| ROS 20                          | 8588-25                                     | 2.72  |                             |                     |                             |                     | 2.72  | 2, p. 3; 10, p. 218; 17, p. 1     |
| ROS 27                          | 8588-9                                      | 2.72  |                             |                     |                             |                     | 2.72  | 2, p. 3; 10, p. 17, p. 1          |
| ROS 29                          | 8774-11                                     | 2.72  |                             |                     |                             |                     | 2.72  | 2, p. 3; 10, p. 273; 17, p. 1     |
| ROS 30                          | 8618-6                                      | 2.72  |                             |                     |                             |                     | 2.72  | 2, p. 3; 10, p. 228; 17, p. 1     |
| ROS 31A                         | 8774-20                                     | 2.72  |                             |                     |                             |                     | 2.72  | 2, p. 3; 10, p. 275; 17, p. 1     |
| ROS 31B                         | 8652-9                                      | 2.72  |                             |                     |                             |                     | 2.72  | 2, p. 3; 10, p. 258; 17, p. 1     |
| ROS 32                          | 8619-29                                     | 2.72  |                             |                     |                             |                     | 2.72  | 2, p. 3; 10, p. 249; 17, p. 1     |
| ROS 34                          | 8618-10                                     |   | 1                           | 0.33                |                             |                     | 0.33  | 2, p. 3; 10, p. 229               |
| ROS 35                          | 8652-1                                      | 2.72  |                             |                     |                             |                     | 2.72  | 2, p. 3; 10, p. 256; 17, p. 1     |
| ROS 37                          | 8619-1                                      |   | 1                           | 0.33                |                             |                     | 0.33  | 2, p. 3; 10, p. 242               |
| ROS 38                          | 8519-8                                      |   | 1                           | 0.33                |                             |                     | 0.33  | 2, p. 3; 10, p. 199               |
| ROS 39                          | Inferred                                    | 2.72  |                             |                     |                             |                     | 2.72  | 17, p. 1; Figure 2                |
| ROS 42                          | 8618-12                                     |   | 1                           | 0.33                |                             |                     | 0.33  | 2, p. 3; 10, p. 229               |
| ROS 49                          | Inferred                                    | 2.72  |                             |                     |                             |                     | 2.72  | 17, p. 1; Figure 2                |
| ROS 50                          | 8435-27                                     | 2   |                             |                     |                             |                     | 2   | 2, p. 3; 10, p. 151; 18, p. 5     |
| ROS 54                          | 8519-6                                      | 2.72  |                             |                     |                             |                     | 2.72  | 2, p. 3; 10, p. 199; 17, p. 1     |
| ROS 55                          | 8588-15                                     | 2.72  |                             |                     |                             |                     | 2.72  | 2, p. 3; 10, p. 215; 17, p. 1     |
| ROS 57                          | 8774-7                                      | 2.72  |                             |                     |                             |                     | 2.72  | 2, p. 3; 10, p. 272; 17, p. 1     |
| ROS 61                          | 8618-14                                     | 2.72  |                             |                     |                             |                     | 2.72  | 2, pp. 1, 3; 10, p. 230; 17, p. 1 |
| ROS 65                          | 8618-18                                     |   | 1                           | 0.33                |                             |                     | 0.33  | 2, pp. 2, 3; 10, p. 231           |
| ROS 69                          | 8519-29                                     |   | 1                           | 0.33                |                             |                     | 0.33  | 2, p. 3; 10, p. 205               |
| ROS 75                          | 8519-21                                     |   | 1                           | 0.33                |                             |                     | 0.33  | 2, p. 3; 10, p. 203               |
| ROS 77                          | 8588-31                                     | 2.72  |                             |                     |                             |                     | 2.72  | 17, p. 1; Figure 2                |
| ROS 79                          | 8619-11                                     | 2.72  |                             |                     |                             |                     | 2.72  | 2, p. 3; 10, p. 244; 17, p. 1     |



**TABLE 21. LEVEL II POPULATION IN AOE 1**

| Regularly Occupied Structure ID | Sample ID/Inferred Indoor Air Contamination | Number of Exposed Individuals (non-workers) | Number of Full-time Workers |                     | Number of Part-time Workers |                     | Regularly Occupied Structure's Total Population Value | References                        |
|---------------------------------|---|---|-----------------------------|---------------------|-----------------------------|---------------------|---|-----------------------------------|
|                                 |   |   | Actual Number               | Adjusted (Number/3) | Actual Number               | Adjusted (Number/6) |   |                                   |
| ROS 85                          | 8482-17                                     |   | 2                           | 0.66                | 1                           | 0.16                | 0.82  | 2, p. 3; 10, p. 192; 18, p. 8     |
| ROS 86                          | 8435-18                                     | 2   |                             |                     |                             |                     | 2   | 2, p. 3; 10, p. 149; 18, p. 4     |
| ROS 94                          | 8619-34                                     |   | 1                           | 0.33                |                             |                     | 0.33  | 2, p. 3; 10, p. 235               |
| ROS 97                          | 8619-21                                     | 2.72  |                             |                     |                             |                     | 2.72  | 2, p. 3; 10, p. 247; 17, p. 1     |
| ROS 98                          | 8618-30                                     | 2.72  |                             |                     |                             |                     | 2.72  | 17, p. 1; Figure 2                |
| ROS 99                          | 8619-7                                      | 2.72  |                             |                     |                             |                     | 2.72  | 2, p. 3; 10, p. 243; 17, p. 1     |
| ROS 101                         | 8619-25                                     | 2.72  |                             |                     |                             |                     | 2.72  | 2, pp. 3, 4; 10, p. 248; 17, p. 1 |
| ROS 102                         | 8619-23                                     | 2.72  |                             |                     |                             |                     | 2.72  | 17, p. 1; Figure 2                |
| ROS 103                         | 8774-10                                     | 2.72  |                             |                     |                             |                     | 2.72  | 2, p. 3; 10, p. 273; 17, p. 1     |
| ROS 104                         | 8652-24                                     | 2.72  |                             |                     |                             |                     | 2.72  | 2, p. 3; 10, p. 261; 17, p. 1     |
| ROS 106                         | 8774-15                                     | 2.72  |                             |                     |                             |                     | 2.72  | 2, p. 3; 10, p. 274; 17, p. 1     |
| ROS 107                         | Inferred                                    | 2.72  |                             |                     |                             |                     | 2.72  | 17, p. 1; Figure 2                |
| ROS 108                         | Inferred                                    | 2.72  |                             |                     |                             |                     | 2.72  | 17, p. 1; Figure 2                |
| ROS 109                         | Inferred                                    | 2.72  |                             |                     |                             |                     | 2.72  | 17, p. 1; Figure 2                |
| ROS 110                         | Inferred                                    | 2.72  |                             |                     |                             |                     | 2.72  | 17, p. 1; Figure 2                |
| ROS 111                         | Inferred                                    | 2.72  |                             |                     |                             |                     | 2.72  | 17, p. 1; Figure 2                |
| ROS 112                         | Inferred                                    | 2.72  |                             |                     |                             |                     | 2.72  | 17, p. 1; Figure 2                |
| ROS 113                         | Inferred                                    | 2.72  |                             |                     |                             |                     | 2.72  | 17, p. 1; Figure 2                |
| ROS 114                         | Inferred                                    | 2.72  |                             |                     |                             |                     | 2.72  | 17, p. 1; Figure 2                |
| ROS 115                         | Inferred                                    | 2.72  |                             |                     |                             |                     | 2.72  | 17, p. 1; Figure 2                |
| ROS 116                         | Inferred                                    | 2.72  |                             |                     |                             |                     | 2.72  | 17, p. 1; Figure 2                |
| ROS 117                         | Inferred                                    | 2.72  |                             |                     |                             |                     | 2.72  | 17, p. 1; Figure 2                |
| ROS 119                         | Inferred                                    | 2.72  |                             |                     |                             |                     | 2.72  | 17, p. 1; Figure 2                |
| ROS 120                         | Inferred                                    | 2.72  |                             |                     |                             |                     | 2.72  | 17, p. 1; Figure 2                |
| ROS 121                         | Inferred                                    | 2.72  |                             |                     |                             |                     | 2.72  | 17, p. 1; Figure 2                |
| ROS 122                         | Inferred                                    | 2.72  |                             |                     |                             |                     | 2.72  | 17, p. 1; Figure 2                |
| ROS 123                         | Inferred                                    | 2.72  |                             |                     |                             |                     | 2.72  | 17, p. 1; Figure 2                |
| ROS 124                         | Inferred                                    | 2.72  |                             |                     |                             |                     | 2.72  | 17, p. 1; Figure 2                |
| ROS 125                         | Inferred                                    | 2.72  |                             |                     |                             |                     | 2.72  | 17, p. 1; Figure 2                |
| ROS 126                         | Inferred                                    | 2.72  |                             |                     |                             |                     | 2.72  | 17, p. 1; Figure 2                |
| ROS 127                         | Inferred                                    | 33.08 <sup>1</sup>                          |                             |                     |                             |                     | 33.08   | 17, p. 1; Figure 2                |

Notes:  
HRS Section 5.2.1.3 instructs that if a removal or temporary response action has occurred that has not completely mitigated the release, count the initial targets as if the removal or temporary response action has not permanently interrupted target exposure from subsurface intrusion.  
<sup>1</sup> The population value is based of 14 apartment units on the first floor times the county average of 2.72 persons per household

Sum of regularly occupied structures' total population values subject to Level II concentrations: 168.71

Level II Concentrations Factor Value: 168.71

#### **5.2.1.3.2.3 Population within Area(s) of Subsurface Contamination**

Population within an area of subsurface contamination (ASC) is not evaluated for this site.

Population within an Area of Subsurface Contamination Factor Value: Not scored

#### **5.2.1.3.2.4 Calculation of Population Factor Value**

The population factor value is the sum of the factor values for Level I concentrations, Level II concentrations, and population within the ASCs (Ref. 1, Section 5.2.1.3.2.4).

Level I Concentrations Factor Value: 484.2

Level II Concentrations Factor Value: 168.71

Population within an Area of Subsurface Contamination Factor Value: Not scored

Level I Concentrations + Level II Concentrations + Population within an Area of Subsurface Contamination: 652.91

Population Factor Value: 652.91

#### **5.2.1.3.3 Resources**

ROS 85 is the Bellevue Senior Center and ROS 07 is an event space (Bellevue Volunteer Firefighters Hall) that are used by the community (Refs. 10, pp. 8, 18, pp. 7, 8). These buildings are routinely used by the community and qualify as a resource. Therefore, a value of 5 is assigned for the resources factor (Ref. 1, Section 5.2.1.3.3).

Resources Factor Value: 5

#### **5.2.1.3.4 Calculation of Targets Factor Category Value**

The sum of the values for the exposed individual, population, and resources factors is assigned as the targets factor category value for the subsurface intrusion component (Ref. 1, Section 5.2.1.3.4).

Exposed Individual Factor Value: 50

Population Factor Value: 652.91

Resources Factor Value: 5

Exposed Individual + Population + Resources: 707.91

Targets Factor Category Value: 707.91