HAZARD RANKING SYSTEM (HRS) DOCUMENTATION RECORD COVER SHEET

Name of Site: Former Custom Cleaners

EPA ID No.: TNN000402275

Contact Persons

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Pathways, Components, or Threats Not Scored

The surface water migration, soil exposure, and air migration pathways were not scored in this Hazard Ranking System documentation record because the ground water migration pathway is sufficient to qualify the site for the National Priorities List (NPL). These pathways are of concern to the U.S. Environmental Protection Agency (EPA) and may be considered during future evaluation. At the time of the listing, the site score is sufficient without the pathways mentioned above.

Surface Water Migration Pathway: No surface water intakes are located along the 15 mile target distance limit (TDL). The estimated overland segment from Former Custom Cleaners (FCC) is greater than 2 miles.

Soil Exposure and Air Migration Pathways: The listing of the site would not be changed by scoring these pathways. No resident population subject to actual contamination has been documented. However, from 2013 to 2015, TDEC conducted numerous investigations at FCC that included collection of sub-slab soil gas and indoor air samples. Sub-slab soil gas samples contained PCE at up to 620,000 micrograms per meter cubed ($\mu g/m^3$), which exceeds its calculated vapor intrusion screening level for commercial air (1,600 $\mu g/m^3$), and indoor air samples contained PCE up to 429.78 $\mu g/m^3$, which exceeds the HRS substance cancer risk screening concentration benchmark of 10 $\mu g/m^3$.

HAZARD RANKING SYSTEM (HRS) DOCUMENTATION RECORD

Name of Site:	Former Custom Cleaners
EPA Region:	4
Date Prepared:	September 2016
Street Address of Site*:	3517 Southern Avenue
City, County, State, Zip:	Memphis, Shelby County, Tennessee, 38111
General Location in the State:	Southwestern Corner of Tennessee
Topographic Map:	Northeast Memphis, Southeast Memphis 1997
Latitude:	35° 06' 54.41" North
Longitude:	89° 56' 42.00" West

The coordinates above for Former Custom Cleaners were measured from sampling station CC10 within Source No. 1 (Refs. 4; 6, Appendix A, p. A-7) (see Figure 3 of this HRS documentation record).

* The street address, coordinates, and contaminant locations presented in this HRS documentation record identify the general area where 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, and not precisely delineated boundaries. A site is defined as where a hazardous substance has been "deposited, stored, disposed or placed, or has otherwise come to be located." Generally, HRS scoring and the subsequent listing of a release merely represent the initial determination that a certain area may need to be addressed under the Comprehensive Environmental Response, Compensation, and Liability Act (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.

Pathway	**Pathway Score**
Ground Water Migration	100.00
Surface Water Migration	NS
Soil Exposure	NS
Air Migration	NS
HRS SITE SCORE	**50.00**

Note:

NS Not scored

WORKSHEET FOR COMPUTING HRS SITE SCORE

	S Pathway	S^2 Pathway
Ground Water Migration Pathway Score (S_{gw})	100.00	10,000
Surface Water Migration Pathway Score (S_{sw})	NS	NS
Soil Exposure Pathway Score (S_s)	NS	NS
Air Migration Pathway Score (S_a)	NS	NS
$S^2_{gw} + S^2_{sw} + S^2_s + S^2_a$		10,000
$(S^2_{gw} + S^2_{sw} + S^2_s + S^2_a) / 4$		2,500
$\sqrt{(S^2_{gw} + S^2_{sw} + S^2_s + S^2_a) / 4}$		50.00

Note:

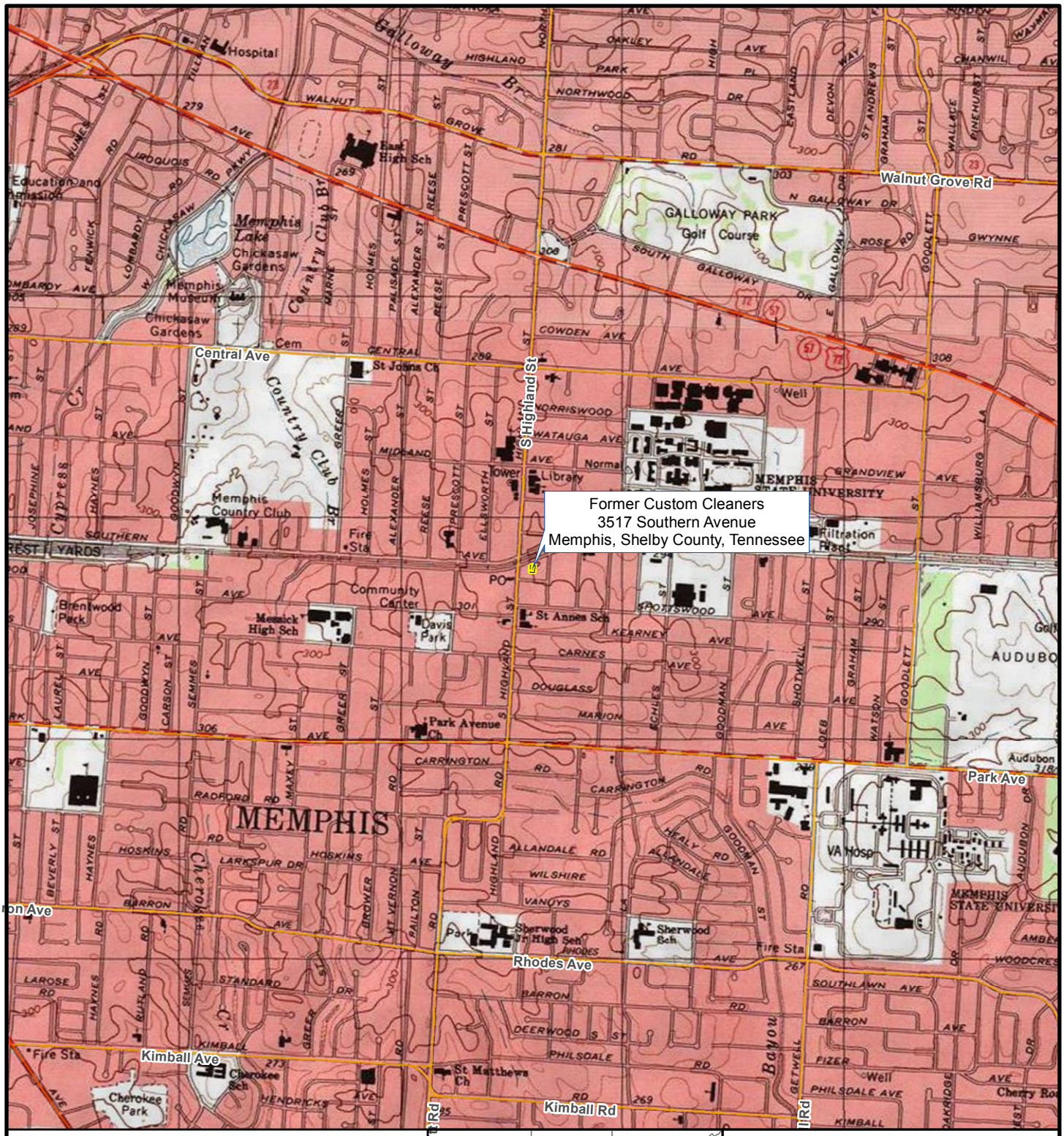
NS = Not scored

Table 3-1 --Ground Water Migration Pathway Scoresheet
Aquifer Evaluated: Interconnected shallow aquifer (where saturated), Cockfield Formation, and Memphis Aquifer

Factor Categories and Factors	Maximum Value	Value Assigned	
Likelihood of Release to an Aquifer:			
1. Observed Release	550	550	
2. Potential to Release:			
2a. Containment	10	NS	
2b. Net Precipitation	10	NS	
2c. Depth to Aquifer	5	NS	
2d. Travel Time	35	NS	
2e. Potential to Release [lines 2a(2b + 2c + 2d)]	500	NS	
3. Likelihood of Release (higher of lines 1 and 2e)	550		550
Waste Characteristics:			
4. Toxicity/Mobility	(a)	1,000	
5. Hazardous Waste Quantity	(a)	10	
6. Waste Characteristics	100		10
Targets:			
7. Nearest Well	50	9	
8. Population:			
8a. Level I Concentrations	(b)	NS	
8b. Level II Concentrations	(b)	NS	
8c. Potential Contamination	(b)	2,607	
8d. Population (lines 8a + 8b + 8c)	(b)	2,607	
9. Resources	5	NS	
10. Wellhead Protection Area	20	5	
11. Targets (lines 7 + 8d + 9 + 10)	(b)		2,621
Ground Water Migration Score for an Aquifer:			
12. Aquifer Score [(lines 3 x 6 x 11)/82,500][c]	100		100.00
Ground Water Migration Pathway Score:			
13. Pathway Score (S_{gw}), (highest value from line 12 for all aquifers valuated)[c]	100		100.00

Notes:

NS = Not scored
[a] = Maximum value applies to waste characteristics category
[b] = Maximum value not applicable
[c] = Do not round to nearest integer



Reference 6, Appendix A, p. A-7

Map Source:
USGS 7.5 Minute Topographic Quadrangle Map:
Northeast Memphis, TN 1997; Southeast Memphis, TN 1997.

United States
Environmental Protection Agency
Region 4

FIGURE 1

Property Location

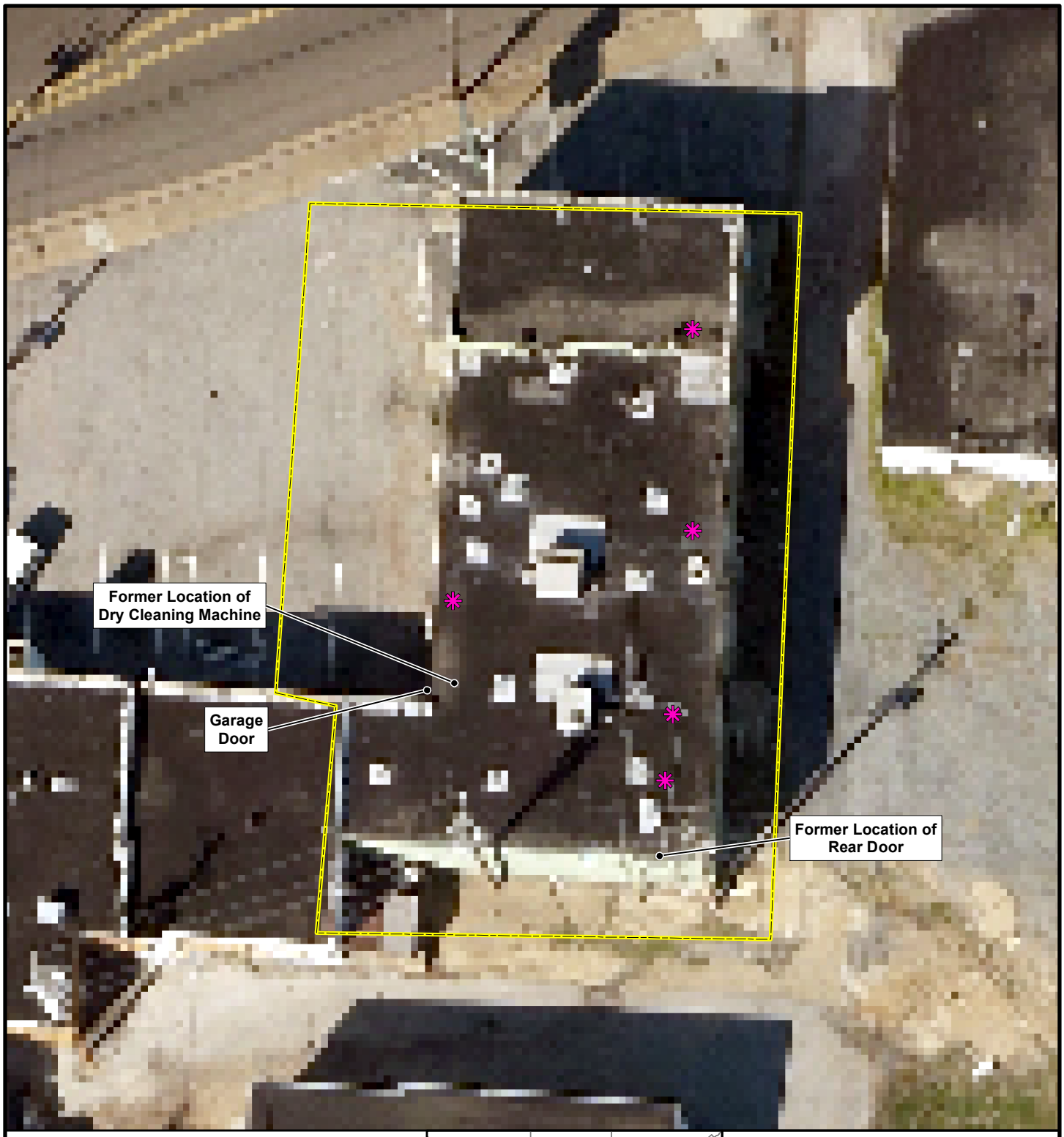
TDD Name: Former Custom Cleaners
TDD No.: TT-05-018

City:	County:	State:
Memphis	Shelby	Tennessee

TETRA TECH

Date: 2/29/2016
Analyst: Helen.Mayoral

File: C:\X\TT-05-018_Former Custom Cleaners\GIS\MXDs\Site_Location\Fig1_Site_Location.mxd



Legend

- Approximate Location of Possible Sumps
- Property Boundary

N
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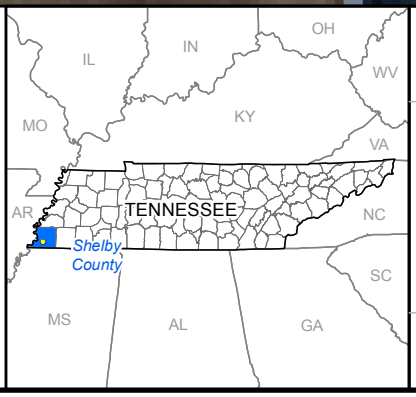
0 5 10 20
Feet

Reference 6, p. 14,
Appendix A, p. A-7; 10, pp. 1, 2, 7; 11

Map Source:
USGS National Map, 2012.



United States
Environmental Protection Agency
Region 4

FIGURE 2

Property Layout

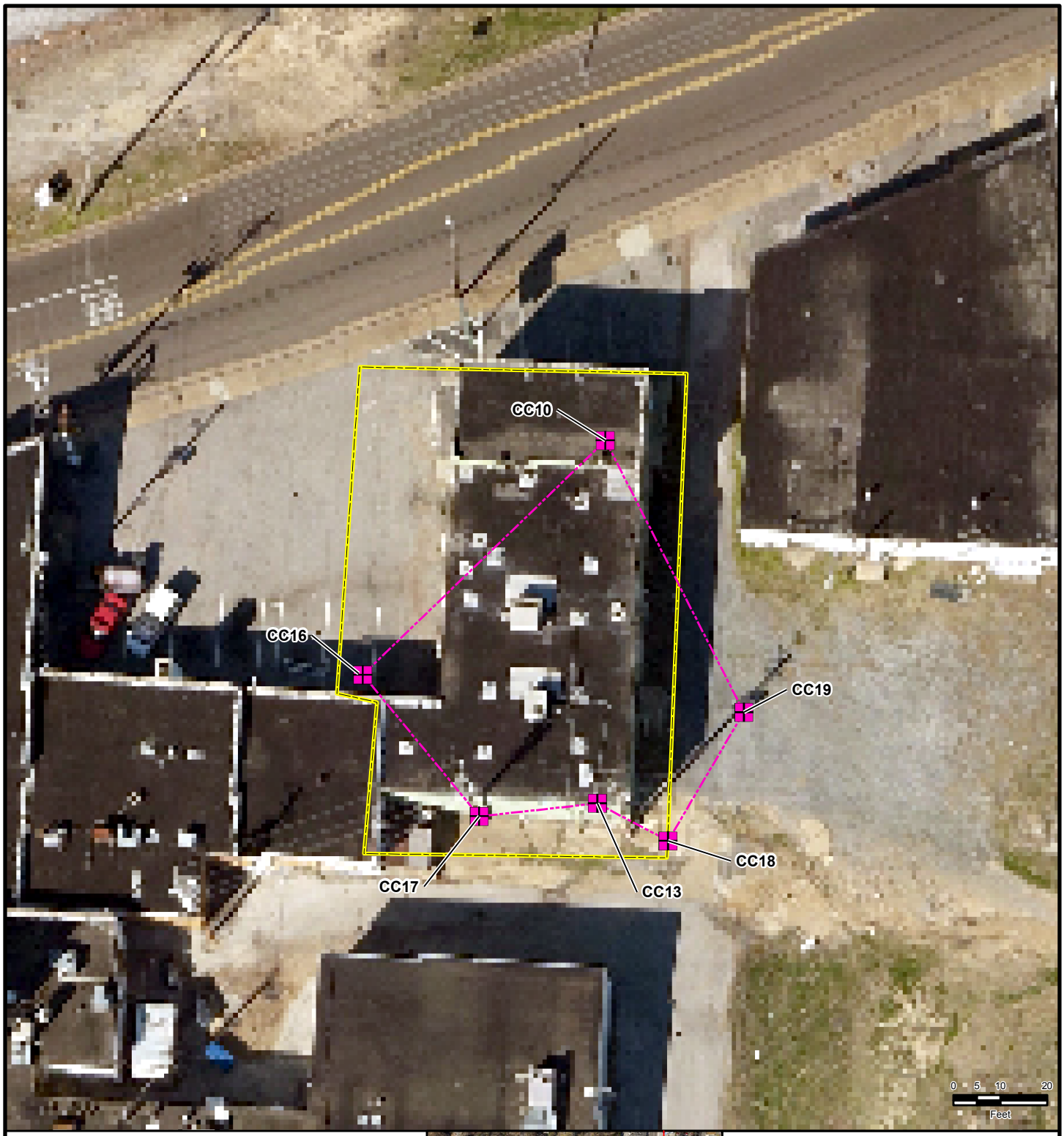
TDD Name: Former Custom Cleaners
TDD No.: TT-05-018

City:	County:	State:
Memphis	Shelby	Tennessee

TETRA TECH

Date: 3/25/2016
Analyst: Helen.Mayoral

File: C:\X\TT-05-018_Former Custom Cleaners\GIS\MXDs\Site_Layout\Fig2_Property_Layout.mxd



Legend

- Source No. 1 Sampling Stations
- Background Sampling Station
- Source Boundary
- Property Boundary

N
W E
S

Reference 6, pp. 18 through 29, Appendix A, p. A-7.

Map Source: USGS National Map, 2012.

United States Environmental Protection Agency
Region 4

FIGURE 3

Source Location

TDD Name: Former Custom Cleaners
TDD No.: TT-05-018

City:	County:	State:
Memphis	Shelby	Tennessee

TETRA TECH

Date: 3/25/2016
Analyst: Helen.Mayoral

File: C:\X\TT-05-018_Former Custom Cleaners\GIS\MXDs\Source_Location\Fig3_Source_Location_v2.mxd

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SITE DESCRIPTION

The Former Custom Cleaners (FCC) site is composed of one source, an area of contaminated soil, and an associated ground water observed release in monitoring well number (No.) CC19. Source No. 1 is an area of contaminated soil located at and in the vicinity of the locations of a former dry cleaning machine, former sumps, and a garage door (References [Refs.] 6, p. 14; 10, pp. 1, 2, 7). Hazardous substances including tetrachloroethylene (PCE) and cis-1,2-dichloroethylene (DCE), a degradation product of PCE, have been detected in Source No. 1 (see Section 2.2.1, Source No. 1 and Figure 3 of this HRS documentation record). Ground water underlying and in the vicinity of Source No. 1 contains the same constituents at concentrations greater than background levels, indicating that a release of hazardous substances has occurred to the ground water migration pathway, as documented in Sections 3.0 and 3.1 of this HRS documentation record. About 102,701 people are served by 22 municipal drinking water wells located within a 4-mile radius of Source No. 1; these wells are evaluated as potential contamination targets (see Section 3.3 of this HRS documentation record).

The FCC property is located at 3517 Southern Avenue in Memphis, Shelby County, Tennessee (Refs. 5; 7; 13; 16) (see Figure 1 of this HRS documentation record). The geographic coordinates of the site, as measured from sampling station CC10 within Source No. 1, are latitude 35º 06' 54.41" degrees north and longitude 89º 56' 42.00" degrees west (Refs. 4; 6, Appendix A, p. A-7). The EPA identification number as recorded in the Superfund Enterprise Management System (SEMS) database is TNN000402275 (Ref. 5). FCC occupied one unit of a strip mall associated with address 3523 Southern Avenue, according to the Shelby County Assessor of Property (Refs. 6, p. 1; 8 pp. 1, 2, 3). The two units of the strip mall west of FCC, associated with address 606 South Highland according to the Shelby County Assessor of Property, have been demolished and a McDonald's has been built on the property (Refs. 8, pp. 1, 4, 5, 6; 65, pp. 2, 3; 70, pp. 1, 2, 5, 6).

Land uses surrounding the FCC property are predominately commercial and residential (Ref. 6, p. 1) (see Figure 1 of this HRS documentation record). The FCC property is bounded by Southern Avenue to the north, a vacant building to the east, an alley to the south, and McDonald's to the west (Refs. 6, p. 1; 8, pp. 2, 3, 4, 5; 65, pp. 2, 3) (see Figure 2 of this HRS documentation record). FCC primarily consists of a building and a paved parking lot. Access to FCC is not restricted (Ref. 9) (see Figure 2 of this HRS documentation record).

OPERATIONAL AND REGULATORY HISTORY

Laundry and dry cleaning operations were conducted at FCC by various entities from 1945 until the mid-1990s (Refs. 10, p. 1; 12; 14). Custom Cleaners began operations at the property in 1974 (Refs. 14, p. 1). The eastern portion of the strip mall where Custom Cleaners operated (associated with 3523 Southern Avenue) was constructed in 1943, and the western portion of the strip mall (associated with 606 South Highland) was constructed in 1923 (Ref. 8, pp. 1 through 6). After FCC operations ceased, sometime in the mid-1990s, a discount art supply company leased the property. Sharri's Discount Arts operated at 3517 Southern Avenue from 1999 to 2014 (Refs. 10, pp. 1, 2; 68, p. 2).

PCE was used as the dry cleaning solvent during Custom Cleaners operations (Ref. 14). According to a previous tenant at FCC, sumps were possibly located along the eastern and western sides of the building, and drums containing unknown substances were located inside the building along the western wall (Ref. 10, pp. 2, 7). The dry cleaning machine was located along the western side of the building near the garage door (Ref. 6, p. 14, Appendix A, p. A-7) (see Figure 2 of this HRS documentation record). A 1996 Dry-Cleaning Facilities Registration form submitted by the owner of Custom Cleaners states that sludges, still bottoms, filters, lint, and dust were disposed of off site and that the dry-cleaning machine did not have a containment area (Ref. 14, p. 3).

In March 1999, the new owner of the FCC property submitted a Hazardous Waste Notification and Report. The report identified three waste streams, containing EPA waste code F002, associated with FCC, including filters contaminated with PCE (commonly referred to as perc), PCE, and sludge. The

generation process noted in the report was “site cleanup” and the annual frequency of generation was noted as “one time” (Refs. 17; 61, pp. 1 through 3; 62; 63).

In February 2000, the owner of FCC submitted a Hazardous Waste and Used Oil Notification as well as a Hazardous Waste Stream and Annual Report to the Tennessee Department of Environment and Conservation (TDEC) for waste removal activities conducted at FCC (Refs. 18; 60, pp. 1 through 8). The report states that 218 kilograms of waste PCE bottoms and filters generated through the dry cleaning process (Waste Stream No. 1) and 460 kilograms of PCE (Waste Stream No. 2) were shipped off site. No sludge was disposed of during removal activities, and all liquid was disposed of with Waste Stream No. 2 (Refs. 18; 60, pp. 1, 3, 5, 6).

PREVIOUS INVESTIGATIONS

In June 2013, TDEC received a complaint from a tenant of FCC. The tenant complained of strong odors in the building, especially when the outdoor temperature was elevated (Refs. 10, p. 1; 19, p. 60). TDEC subsequently conducted passive soil gas and indoor air sampling in September and October 2013 (Ref. 19, pp. 6, 57, 58, 60, 61). Eight passive soil gas samples were collected along the perimeter of the FCC building (Ref. 19, p. 28). The passive soil gas samples contained PCE (up to 228,720 nanograms [ng]), trichloroethylene (TCE) (up to 32,400 ng), cis-1,2-DCE (up to 27,420 ng), trans-1,2-DCE (up to 4,224 ng), 1,1-DCE (up to 74 ng), and vinyl chloride (up to 20 ng) (Ref. 19, p. 7). Four indoor air samples were collected inside the FCC building (Ref. 19, p. 28). All indoor air samples contained PCE (up to 429.78 micrograms per cubic meter [µg/m^3]). All PCE concentrations were detected at levels that exceeded the HRS substance cancer risk screening concentration benchmark of 10 µg/m^3 (Refs. 2, p. 2; 19, p. 8). The highest concentration of PCE in passive soil gas samples was detected in the vicinity of the garage door (Refs. 10, p. 7; 19, pp. 7, 28, 63).

In March 2015, TDEC conducted a site inspection (SI) at FCC (Ref. 6, p. i). SI activities included collection of subsurface soil, ground water from newly installed permanent monitoring wells, and sub-slab soil gas samples (Ref. 6, pp. 7 through 10). Soil samples were collected at depths ranging from 0.5 to 153 feet below ground surface (bgs) and contained PCE (up to 7,100,000 µg/kg) and cis-1,2-DCE (up to 51 µg/kg) (Ref. 6, pp. 18 through 28). Ground water samples collected from the newly installed permanent monitoring well directly adjacent to the FCC property contained PCE (up to 140 micrograms per liter [µg/L]) (Ref. 6, p. 31). The sub-slab soil gas samples contained PCE (up to 620,000 µg/m^3) and TCE (up to 280 J [estimated] µg/m^3) (Ref. 6, p. 34).

2.2 SOURCE CHARACTERIZATION

2.2.1 SOURCE IDENTIFICATION

Number of source: 1

Name of source: Contaminated soil at and in the vicinity of the locations of the former dry cleaning machine, former sumps, and garage door

Source Type: Contaminated soil

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

Source No. 1 is an area of contaminated soil at and in the vicinity of the former dry cleaning machine, former sumps, and garage door (see Figures 2 and 3 of this HRS documentation record). Laundry and dry cleaning operations were conducted at FCC by various entities from 1945 until the mid-1990s (Refs. 10, p. 1; 12; 14). Custom Cleaners began operations at the property in 1974 (Refs. 14, p. 1). PCE was used as the dry cleaning solvent during Custom Cleaners operations (Refs. 14).

Soil samples collected to delineate Source No. 1 in March 2015 contained PCE and cis-1,2-DCE (Ref. 6, pp. 18 through 28). The highest concentrations of PCE (up to 7,100,000 µg/kg at a depth of 8 feet bgs) were detected in samples collected in the vicinity of the former dry cleaning machine and garage door (soil borings CC05 and CC15) (Ref. 6, pp. 18, 19, Appendix A, p. A-7). The March 2015 subsurface soil samples contained PCE and cis-1,2-DCE at concentrations above background levels (Ref. 6, pp. 18 through 28). Not all samples collected during the SI containing PCE at concentrations above background levels are used to evaluate Source No. 1 due to a possible removal action (see paragraph below). Data used for evaluating Source No. 1 is presented in Tables 1 through 4 of this HRS documentation record.

In January 2016, EPA conducted a removal site evaluation (RSE) at FCC to delineate the extent of the suspected source material in the vicinity of soil borings CC05 and CC15 advanced during the March 2015 TDEC SI. The samples were collected to assess whether excavation is an appropriate and feasible removal action (Refs. 30, p. 3; 48, pp. 1, 2). During the sampling event, 14 borings were advanced to a total depth of 20 feet bgs and one boring was advanced to a depth of 12 feet bgs. A total of 75 soil samples were collected (Ref. 48, p. 2, Enclosure 1, p. E1-2). PCE concentrations ranged from 184 µg/kg to 1,330,000 µg/kg (Ref. 48, Enclosure 2, pp. E2-1 through E2-4). The highest concentration of PCE was detected in the vicinity of CC05 (boring B105) at a depth of 16 to 17 feet bgs (Ref. 48, Enclosure 1, p. E1-2, Enclosure 2, p. E2-1). The approximate area to be excavated (date unknown) is about 221 square feet centered around soil borings CC05 and CC15 (Ref. 48, Enclosure 2, p. E2-1).

2.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE

March 2015 TDEC SI – Soil Samples

TDEC collected the subsurface soil samples listed in Tables 1 through 4 during the March 2015 SI (Ref. 6, pp. i, 7, 8, 18 through 28). The SI field activities were conducted in accordance with the EPA-approved quality assurance project plan (QAPP) (Refs. 6, p. 7; 34). Source No. 1 samples were collected at and in the vicinity of the former dry cleaning machine, former sumps, and garage door (Refs. 6, p. 14, Appendix A, p. A-7; 10, pp. 1, 2, 7).

During the SI, 12 designated background samples were collected at various depths (3 to 114 feet bgs) from a single sonic borehole location designated as CC20. The location of the background sampling station (CC20) is approximately 0.35 mile southwest of the FCC site at Charles Davis Park and Davis Community Center (Ref. 6, pp. 9, 15, Appendix A, pp. A-8, A-10). Historical aerial photographs dating back to 1956 depict Charles Davis Park and the Davis Community Center; no other buildings or structures are located on the property where boring CC20 was advanced (Ref. 31, pp. 1 through 10). This location was chosen to represent background conditions because it appeared to have been minimally affected by past facility operations or other industrial activities currently or previously located in the area (Refs. 6, Appendix A, p. A-8; 31, pp. 1 through 10). The release samples are compared to background samples of corresponding depths, with those substances at concentrations significantly greater than background levels for the corresponding depths presented in Table 4.

The background and Source No. 1 samples were collected by either direct push technology (DPT) or a sonic drill rig (Ref. 6, p. 7). The soil samples were collected in accordance with the EPA Region 4, Science and Ecosystem Support Division (SESD), Field Branches Quality System and Technical Procedures (FBQSTP) for Soil Sampling, SESDPROC-300-R3, August 2014 (Refs. 6, p. 7; 20). The samples were analyzed for volatile organic compounds (VOCs) in accordance with the EPA Contract Laboratory Program (CLP) Statement of Work (SOW) SOM01.2 (Ref. 6, Appendix F, pp. F-4, F-7, F-8, F-9; 21). EPA Region 4 SESD reviewed all data according to the contract SOW and EPA guidelines (Refs. 6, Appendix F, p. F-4; 22). The MRLs are listed on the analytical data sheets in Reference 6, Appendix F. Each MRL is sample-specific and corresponds to the lowest quantitative point on the calibration curve; it is adjusted for the amount of sample prepared and any dilutions performed, as well as for percent moisture. The MRLs are equivalent to sample quantitation limits (SQL) (Refs. 6, Appendix F, p. F-11; 23).

The lithology of each borehole and sample depth were noted during soil sampling to characterize the soil. Visual inspection and organic vapor analyzer readings of the borehole material were used to select the depths of samples collected from each interval in the boreholes (Ref. 6, pp. 7, 8). Logbook notes are contained in Reference 6, Appendix C. Field sample collection sheets, used to document sample locations, soil descriptions, collection times, and dates, are contained in Reference 6, Appendix C. Borehole logs documenting sample depths and soil descriptions for station locations CC19 and CC20 are contained in Reference 6, Appendix D.

The background and Source No. 1 subsurface soil samples were collected during the same sampling event, in accordance with the same sampling procedures, and from the same soil type at corresponding depth intervals (Refs. 6, p. 7, Appendix C, pp. C-5, C-7, C-8, C-9, C-11, C-12, C-19, C-20, C-21, C-23, C-25, C-26, C-46 to C-52, C-57, C-58, C-59, Appendix D, pp. D-6, D-7, D-8, D-13, D-14, D-15, Appendix F, pp. F-7, F-8, F-9; 20; 24). Additionally, Source No. 1 samples were compared to background samples of corresponding depth (see Tables 1 and 3 of this HRS documentation record).

The chain-of-custody forms are provided in Reference 24. The locations of the background and Source No. 1 samples are depicted in Reference 6, Appendix A, p. A-7. See also Figure 3 of this HRS documentation record.

TABLE 1: Background Samples – March 2015				
Station ID	**Sample ID**	**Sample Depth (feet bgs)**	**Date**	**References**
CC20	CC20-0315-SB1	3	3/12/2015	6, p. 18, Appendix D, p. D-13; 24, p. 5
CC20	CC20-0315-SB3	9	3/12/2015	6, Appendix C, p. C-23, Appendix D, p. D-13; 24, p. 5
CC20	CC20-0315-SB5	18	3/12/2015	6, Appendix C, p. C-23, Appendix D, p. D-13; 24, p. 5
CC20	CC20-0315-SB6	22	3/12/2015	6, Appendix C, p. C-23, Appendix D, p. D-13; 24, p. 5
CC20	CC20-0315-SB7	26	3/12/2015	6, Appendix C, p. C-23, Appendix D, p. D-13; 24, p. 5
CC20	CC20-0315-SB8	30	3/12/2015	6, Appendix C, p. C-23, Appendix D, p. D-14; 24, p. 5
CC20	CC20-0315-SB11	55	3/13/2015	6, Appendix C, p. C-25, Appendix D, p. D-14; 24, p. 7
CC20	CC20-0315-SB12	62	3/13/2015	6, Appendix C, p. C-25, Appendix D, p. D-15; 24, p. 7
CC20	CC20-0315-SB13	72.5	3/13/2015	6, Appendix C, p. C-26, Appendix D, p. D-15; 24, p. 7
CC20	CC20-0315-SB14	82	3/13/2015	6, Appendix C, p. C-26, Appendix D, p. D-15; 24, p. 7
CC20	CC20-0315-SB16	105	3/13/2015	6, Appendix C, p. C-26, Appendix D, p. D-16; 24, p. 7
CC20	CC20-0315-SB17	114	3/13/2015	6, Appendix C, p. C-26, Appendix D, p. D-16; 24, p. 7

Notes:

bgs	Below ground surface
CC	Former Custom Cleaners
ID	Identification
SB	Subsurface soil

2015 Site Inspection - Analytical Results for Background Samples:

Table 2 contains the analytical results for the background samples collected during the March 2015 TDEC SI.

TABLE 2: Analytical Results for Background Samples – March 2015

Hazardous Substance	Sample ID	Depth (feet bgs)	Hazardous Substance Concentration	MRL	References
PCE	CC20-0315-SB1	3	4.7U µg/kg	4.7 µg/kg	6, Appendix F, p. F-163
cis-1,2-DCE	CC20-0315-SB1	3	4.7U µg/kg	4.7 µg/kg	6, Appendix F, p. F-163
PCE	CC20-0315-SB3	9	5.7U µg/kg	5.7 µg/kg	6, Appendix F, p. F-191
PCE	CC20-0315-SB5	18	2.8J[1] (28) µg/kg	5.5 µg/kg	6, Appendix F, p. F-195; 25
PCE	CC20-0315-SB6	22	3.6J[1] (36) µg/kg	5.5 µg/kg	6, Appendix F, p. F-197; 25
PCE	CC20-0315-SB7	26	1.9J[1] (19) µg/kg	6.0 µg/kg	6, Appendix F, p. F-199; 25
PCE	CC20-0315-SB8	30	2.0J[1] (20) µg/kg	5.7 µg/kg	6, Appendix F, p. F-201; 25
PCE	CC20-0315-SB11	55	0.59J[2] µg/kg	4.8 µg/kg	6, Appendix F, p. F-167; 25
PCE	CC20-0315-SB12	62	4.2U µg/kg	4.2 µg/kg	6, Appendix F, p. F-169
PCE	CC20-0315-SB13	72.5	5.5U µg/kg	5.5 µg/kg	6, Appendix F, p. F-171
PCE	CC20-0315-SB14	82	4.8U µg/kg	4.8 µg/kg	6, Appendix F, p. F-173
PCE	CC20-0315-SB16	105	5.0U µg/kg	5.0 µg/kg	6, Appendix F, p. F-177
PCE	CC20-0315-SB17	114	0.55J[2] (0.55) µg/kg	5.2 µg/kg	6, Appendix F, p. F-181; 25

Notes:

( )	Concentration was adjusted in accordance with References 25, 26, and 27.
1	Sample results should be considered estimated with a potential low bias (Ref. 25). The value presented parenthetically is the concentration obtained by applying EPA fact sheet *Using Qualified Data to Document and Observed Release and Observed Contamination* (November 1996) (Ref. 27, pp. 8, 12).
2	Concentration reported is less than the lowest standard on the calibration curve. Sample result should be considered estimated with no bias (Ref. 25).
bgs	Below ground surface
CC	Former Custom Cleaners
DCE	Dichloroethylene
ID	Identification
J	Estimated value (Ref. 6, Appendix F, p. F-10)
µg/kg	Micrograms per kilogram
MRL	Minimum reporting limit
PCE	Tetrachloroethylene
SB	Subsurface soil
U	The analyte was not detected at or above the reporting limit (Ref. 6, Appendix F, p. F-10)

2015 Site Inspection – Source Samples:

Subsurface soil samples collected at the FCC site that contained concentrations of hazardous substances significantly above background concentrations are presented in Table 3 below. The concentrations of hazardous substances detected are summarized in Table 4.

TABLE 3: Source Samples – March 2015

Station ID	Sample ID	Sample Depth (feet bgs)	Date	References
CC16	CC16-0315-SB1	1	3/10/2015	6, Appendix C, pp. C-5, C-48; 24, p. 1
CC18	CC18-0315-SB1	1	3/12/2015	6, Appendix C, pp. C-11, C-57; 24, p. 5
CC17	CC17-0315-SB1	1.5	3/11/2015	6, Appendix C, pp. C-9, C-52; 24, p. 3
CC10	CC10-0315-SB1	3.5	3/10/2015	6, Appendix C, pp. C-8, C-45; 24, p. 1
CC13	CC13-0315-SB1D	3.5	3/11/2015	6, Appendix C, pp. C-9, C-46; 24, p. 3
CC16	CC16-0315-SB2	6	3/10/2015	6, Appendix C, pp. C-5, C-48; 24, p. 1
CC16	CC16-0315-SB3	9	3/10/2015	6, Appendix C, pp. C-5, C-49; 24, p. 1
CC18	CC18-0315-SB3	10	3/12/2015	6, Appendix C, pp. C-12, C-58; 24, p. 5
CC16	CC16-0315-SB4	14.5	3/10/2015	6, Appendix C, pp. C-5, C-49; 24, p. 1
CC18	CC18-0315-SB5	18	3/12/2015	6, Appendix C, pp. C-12, C-59; 24, p. 5
CC16	CC16-0315-SB5	20	3/10/2015	6, Appendix C, pp. C-5, C-50; 24, p. 1
CC18	CC18-0315-SB6	22	3/12/2015	6, Appendix C, pp. C-12, C-59; 24, p. 6
CC16	CC16-0315-SB6	23	3/10/2015	6, Appendix C, pp. C-7, C-50; 24, p. 1
CC16	CC16-0315-SB7	26.5	3/10/2015	6, Appendix C, pp. C-7, C-51; 24, p. 1
CC16	CC16-0315-SB8	30	3/10/2015	6, Appendix C, pp. C-7, C-51; 24, p. 1
CC19	CC19-0315-SB4	31.5	3/10/2015	6, Appendix C, pp. C-19, Appendix D, p. D-6; 24, p. 1

TABLE 3: Source Samples – March 2015				
Station ID	**Sample ID**	**Sample Depth (feet bgs)**	**Date**	**References**
CC19	CC19-0315-SB6	55	3/10/2015	6, Appendix C, p. C-19, Appendix D, p. D-6; 24, p. 1
CC19	CC19-0315-SB7	62	3/10/2015	6, Appendix C, p. C-19, Appendix D, p. D-7; 24, p. 2
CC19	CC19-0315-SB8	72.5	3/10/2015	6, Appendix C, p. C-19, Appendix D, p. D-7; 24, p. 2
CC19	CC19-0315-SB9	82	3/10/2015	6, Appendix C, p. C-20, Appendix D, p. D-7; 24, p. 2
CC19	CC19-0315-SB11	105	3/11/2015	6, Appendix C, p. C-21, Appendix D, p. D-8; 24, p. 3
CC19	CC19-0315-SB12	110.5	3/11/2015	6, Appendix C, p. C-21, Appendix D, p. D-8; 24, p. 3

Notes:

bgs	Below ground surface. All soil samples were collected below asphalt or the FCC building. The depths below ground surface were measured from the point where soil was first encountered.
CC	Former Custom Cleaners
ID	Identification
SB	Subsurface soil

2015 Site Inspection - Analytical Results for Source Samples:

Table 4 contains the analytical results for the source samples collected during the March 2015 TDEC SI.

TABLE 4: Analytical Results for Source Samples – March 2015

Haz. Sub.	Sample ID	Sample Depth [A]	Haz. Sub. Conc. (µg/kg)	MRL	Background Sample[B]	Background Sample Depth [A] (see Table 2)	Back-ground Conc. (µg/kg) (see Table 2)	References
PCE	CC16-0315-SB1	1	54,000	2,500	CC20-0315-SB1	3	4.7U	6, Appendix F, p. F-67
PCE	CC18-0315-SB1	1	58	4.5	CC20-0315-SB1	3	4.7U	6, Appendix F, p. F-103
cis-1,2-DCE	CC18-0315-SB1	1	9.4	4.5	CC20-0315-SB1	3	4.7U	6, Appendix F, p. F-103
PCE	CC17-0315-SB1	1.5	5.4	4.9	CC20-0315-SB1	3	4.7U	6, Appendix F, p. F-84
PCE	CC10-0315-SB1	3.5	540	280	CC20-0315-SB1	3	4.7U	6, Appendix F, p. F-53
PCE	CC13-0315-SB1D	3.5	490J[3] (49)	350	CC20-0315-SB1	3	4.7U	6, Appendix F, p. F-61
PCE	CC16-0315-SB2	6	3,400	300	CC20-0315-SB3	9	5.7U	6, Appendix F, p. F-69
PCE	CC16-0315-SB3	9	3,700	300	CC20-0315-SB3	9	5.7U	6, Appendix F, p. F-71
PCE	CC18-0315-SB3	10	49	5.0	CC20-0315-SB3	9	5.7U	6, Appendix F, p. F-109
PCE	CC18-0315-SB5	18	110	4.7	CC20-0315-SB5	18	2.8J (28)	6, Appendix F, p. F-113
PCE	CC16-0315-SB5	20	26,000	1,200	CC20-0315-SB6	22	3.6J (36)	6, Appendix F, p. F-75
PCE	CC18-0315-SB6	22	87J[1] (87)	4.6	CC20-0315-SB6	22	3.6J (36)	6, Appendix F, p. F-115
PCE	CC16-0315-SB6	23	17,000	590	CC20-0315-SB6	22	3.6J (36)	6, Appendix F, p. F-77
PCE	CC16-0315-SB7	26.5	18,000	1,000	CC20-0315-SB7	26	1.9J (19)	6, Appendix F, p. F-79
PCE	CC16-0315-SB8	30	10,000	480	CC20-0315-SB8	30	2.0J (20)	6, Appendix F, p. F-82
PCE	CC19-0315-SB4	31.5	610	250	CC20-0315-SB8	30	2.0J (20)	6, Appendix F, p. F-149
PCE	CC19-0315-SB6	55	38	4.2	CC20-0315-SB11	55	0.59J	6, Appendix F, p. F-153
PCE	CC19-0315-SB7	62	86	5.2	CC20-0315-SB12	62	4.2U	6, Appendix F, p. F-155
PCE	CC19-0315-SB8	72.5	57	4.4	CC20-0315-SB13	72.5	5.5U	6, Appendix F, p. F-157
PCE	CC19-0315-SB9	82	4,500J[2] (450)	300	CC20-0315-SB14	82	4.8U	6, Appendix F, p. F-159
PCE	CC19-0315-SB11	105	15	4.3	CC20-0315-SB16	105	5.0U	6, Appendix F, p. F-132
PCE	CC19-0315-SB12	110.5	45	4.8	CC20-0315-SB17	114	0.55J	6, Appendix F, p. F-134

Notes:

( )	Concentration was adjusted in accordance with References 25, 26, and 27. Although not required, estimated data were adjusted to show relative increase in contaminant levels over background.
A	Depths are measured in feet below ground surface. All soil samples were collected below asphalt or below the FCC building floor. The depths below ground surface were measured from the point where soil was first encountered.
B	The background sample used for comparison to each source sample was collected at a similar depth as the source sample. Note that background contaminant levels are presented to show the relative increase of site-related compounds over background.
1	Sample originally analyzed within holding time; some QC requirements not met. The reported result is from a second analysis performed for confirmation that occurred after the holding time expired. Sample results should be considered estimated with a potential low bias (Ref. 25). The value presented parenthetically is the concentration obtained by applying EPA fact sheet *Using Qualified Data to Document and Observed Release and Observed Contamination* (November 1996) (Ref. 27, pp. 8, 12).
2	Analyte concentration high in continuing calibration verification standard. Sample results should be considered estimated with a potential high bias (Ref. 25). The value presented parenthetically is the concentration obtained by applying EPA fact sheet *Using Qualified Data to Document and Observed Release and Observed Contamination* (November 1996) (Ref. 27, pp. 8, 12).
3	Relative percent difference between the sample and duplicate sample results exceeds 20 percent. In accordance with the CLP National Functional Guidelines for Superfund Organics Data Review, the sample results were J qualified with an unknown bias (Ref. 25). The value presented parenthetically is the concentration obtained by applying EPA fact sheet *Using Qualified Data to Document and Observed Release and Observed Contamination* (November 1996) (Ref. 27, pp. 8, 12).
bgs	Below ground surface. All soil samples were collected below asphalt or the FCC building. The depths below ground surface were measured from the point where soil was first encountered.
CC	Former Custom Cleaners
Conc.	Concentration
DCE	Dichloroethylene
ft	Feet
Haz.	Hazardous
ID	Identification
J	Estimated value (Ref. 6, Appendix F, p. F-10)
µg/kg	Micrograms per kilogram
MRL	Minimum reporting limit
PCE	Tetrachloroethylene
SB	Subsurface soil
Sub.	Substance
U	The analyte was not detected at or above the reporting limit (Ref. 6, Appendix F, p. F-10)

2.2.3 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY

Soil samples collected from Source No. 1 contained PCE and cis-1,2-DCE at concentrations significantly greater than background levels (see Tables 2 and 4 of this HRS documentation record). Source No. 1 consists of an area of contaminated soil at and in the vicinity of the former dry cleaning machine, former sumps, and garage door (Refs. 6, p. 14, Appendix A, p. A-7; 10, pp. 1, 2, 7). Analytical results for ground water samples collected underlying Source No. 1 indicated that a release of hazardous substances has occurred to the ground water migration pathway, as documented in Section 3.0 of this HRS documentation record. During the March 2015 SI, a liner was not observed during sampling activities (Ref. 9). Therefore, a containment factor value of 10, as noted in Table 5, was assigned for Source No. 1 (Ref. 1, Section 3.1.2.1, Table 3-2).

TABLE 5: Containment Factors for Source No. 1

Containment Description	Containment Factor Value	References
Gas release to air	NS	NA
Particulate release to air	NS	NA
Release to ground water: No liner	10	1, Section 3.1.2.1, Table 3-2; 9
Release via overland migration and/or flood	NS	NA

Notes:

NA Not applicable
NS Not scored

2.4.2.1 HAZARDOUS WASTE QUANTITY

Insufficient information exists to evaluate hazardous constituent quantity, hazardous wastestream quantity, and volume. Therefore, the hazardous waste quantity value will be calculated using Tier D for the area of contaminated soil (Ref. 1, pp. 51590, 51591).

2.4.2.1.1 Hazardous Constituent Quantity (Tier A)

The hazardous constituent quantity for Source No. 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 in the source and releases from the source is not known and cannot be estimated with reasonable confidence (Ref. 1, pp. 51590, 51591 [Section 2.4.2.1.1]). Historical and current data (manifests, potentially responsible party [PRP] records, state records, permits, or waste concentration data) available are insufficient to adequately calculate the total or partial mass of all CERCLA hazardous substances in the source and the associated releases from the source. Therefore, there is insufficient information to evaluate the associated releases from the source to calculate the hazardous constituent quantity for Source No. 1 with reasonable confidence. Scoring proceeds to the evaluation of Tier B, Hazardous wastestream quantity (Ref. 1, p. 51591 [Section 2.4.2.1.1]).

Hazardous Constituent Quantity: Not Evaluated

2.4.2.1.2 Hazardous Wastestream Quantity (Tier B)

The hazardous wastestream quantity for Source No. 1 could not be adequately determined according to the HRS requirements; that is, the mass of the hazardous wastestreams plus the mass of any additional CERCLA pollutants and contaminants in the source and releases from the source is not known and cannot be estimated with reasonable confidence (Ref. 1, p. 51591 [Section 2.4.2.1.2]). There are insufficient historical and current data (manifests, PRP records, State records, permits, waste concentration data, etc.) available to adequately calculate the total or partial mass of the wastestream plus the mass of all CERCLA pollutants and contaminants in the source and the associated releases from the source. Therefore, there is insufficient information to evaluate the associated releases from the source to calculate the hazardous wastestream quantity for Source No. 1 with reasonable confidence. Scoring proceeds to the evaluation of Tier C, Volume (Ref. 1, p. 51591 [Section 2.4.2.1.2]).

Hazardous Wastestream Quantity: Not Evaluated

2.4.2.1.3 Volume (Tier C)

The information available on the depth of Source No. 1 is not sufficiently specific to support an exact volume of the contaminated soil with reasonable confidence. The lowest known point of contamination is measured at only one location (CC19); therefore, it is not possible to assign a volume (Tier C) for Source No. 1 (Ref. 1, p. 51591 [Section 2.4.2.1.3]). Source No. 1 has been assigned a value of 0 for the volume measure (Ref. 1, p. 51591[Section 2.4.2.1.3]). As a result, the evaluation of hazardous waste quantity proceeds to the evaluation of Tier D, area (Ref. 1, p. 51591 [Section 2.4.2.1.3]).

Volume Assigned Value: 0

2.4.2.1.4 Area (Tier D)

The estimated area of Source No. 1 was determined using Figure 3 of this HRS documentation record and Reference 6, Appendix A, page A-7 that depict the soil sampling locations from March 2015. The measuring tool in Nuance Power Portable Document Format (PDF) Advanced was used to calculate the square footage. The approximate area of Source No. 1 is 3,900 square feet (Refs. 1, Section 2.4.2.1.4; 59) (see Figure 3 of this HRS documentation record). Contamination between sampling points was inferred based on analytical results from indoor air samples, passive soil gas samples, and soil samples collected from areas within Source No. 1 during previous investigations (Refs. 19, pp. 7, 8, 28; 48, Enclosure 1, p. E1-2, Enclosure 2, pp. E2-1 to E2-3).

Sum (ft^2): 3,900
Equation for Assigning Value (Table 2-5): Area (A)/34,000

Area Assigned Value: 0.11

2.4.2.1.5 Source Hazardous Waste Quantity Value

The source hazardous waste quantity (HWQ) value for Source No. 1 is assigned a source HWQ value of 0.11 (Ref. 1, Section 2.4.2.1.5).

Source HWQ Value: 0.11

SUMMARY OF SOURCE DESCRIPTIONS

TABLE 6: Summary of Source Descriptions

Source No.	Source Hazardous Waste Quantity Value	Source Hazardous Constituent Quantity Complete? (Yes/No)	Containment Factor Value by Pathway			
			Ground Water (Ref. 1, Table 3-2)	Surface Water Overland/ Flood (Ref. 1, Table 4-2)	Air	
					Gas (Ref. 1, Table 6-3)	Particulate (Ref. 1, Table 6-9)
1	0.11	No	10	NS	NS	NS

Notes:

NS Not scored

Description of Other Possible On-Site Sources

No other possible on-site sources have been identified.

Possible areas of concern are the locations of former sumps that reportedly were located along the eastern and western sides of the building (Ref. 10, pp. 2, 7). No sumps or evidence of former sumps were observed during the March 2015 TDEC SI (Ref. 9).

3.0 GROUND WATER MIGRATION PATHWAY

3.0.1 GENERAL CONSIDERATIONS

Ground Water Migration Pathway Description

Regional Geology

The FCC site is located in the southern portion of Shelby County, Tennessee, within the Gulf Coastal Plain physiographic province (Ref. 40, p. 3). Surface topography in the area is relatively flat. FCC is located at about 300 feet above mean sea level (msl) (Ref. 6, p. A-2). The geology in the vicinity of Source No. 1 may include, in descending stratigraphic order, some or all of the following units: alluvium of Holocene and Pleistocene age, loess of Pleistocene age, fluvial deposits (terrace deposits) of Pleistocene and Pliocene age, the Upper Claiborne confining unit (includes the Cockfield and Cook Mountain Formations) of Eocene age, and the Memphis Sand of the Claiborne Group of Eocene age (Refs. 40, p. 5; 43, pp. 6, 7; 44, p. 389).

The alluvium occurs beneath alluvial plains of streams that drain the Gulf Coastal Plain and consists primarily of sand, gravel, silt, and clay. The alluvium ranges from 0 to 175 feet in thickness and is commonly less than 50 feet thick beneath the alluvial plains of major streams that drain the Gulf Coastal Plain (Ref. 43, p. 7). The loess is the principal unit at the surface in the upland areas of the Gulf Coastal Plain. The loess deposits consist of silt, silty clay, and minor sand and range in thickness from about 0 to 65 feet (Ref. 43, p. 6). The fluvial deposits occur beneath the uplands and valley slopes of the Gulf Coastal Plain and consist primarily of sand, gravel, and minor clay lenses. The deposits range from 0 to 100 feet in thickness (Ref. 43, p. 7). The thickness of the fluvial deposits is highly variable because of the erosional surfaces at the top and base of the unit; the fluvial deposits are absent in the Memphis area (Ref. 41, p. 8).

The Cockfield Formation consists of interfingering fine sand, silt, clay and local lenses of lignite. In most of the Memphis area, the formation is an erosional remnant, and the original thickness is preserved only beneath the higher hills and ridges in the northern part of the Memphis area. The formation ranges from 0 to 250 feet in thickness (Ref. 43, pp. 7, 9). The Cook Mountain Formation consists primarily of clay, but locally contains varying amounts of sand. The formation ranges from about 30 to 150 feet in thickness, but it is commonly 60 to 70 feet thick (Ref. 43, p. 9). The Cockfield and Cook Mountain Formations comprise the Upper Claiborne confining unit (Refs. 43, p. 7; 44, p. 389).

The Memphis Sand of the Claiborne Group underlies approximately 7,400 square miles in the Gulf Coastal Plain of western Tennessee (Ref. 15, p. 2). The Memphis Sand consists of a thick body of fine to very coarse sand with subordinate lenses of clay and silt at various stratigraphic horizons. Locally, the clay, silt, or sand contains thin lenses of lignite. The Memphis Sand ranges from 500 to 890 feet in thickness (Ref. 41, p. 8).

Regional Aquifer Description

The principal aquifers in the Memphis area, in descending order, are: (1) the alluvium and fluvial deposits that comprise the shallow aquifer and (2) the Memphis Sand that comprises the Memphis aquifer (Ref. 43, pp. 7, 8).

The fluvial terrace deposits and the sand and gravel in the lower part of the alluvium comprise the shallow aquifer (Refs. 11, p. 3; 44, p. 389). The maximum thickness of the shallow aquifer in the Memphis area is approximately 100 feet (Refs. 6, p. 43; 43, p. 7).

The Cockfield and Cook Mountain Formations comprise the lower confining unit for the shallow aquifer and upper aquitard for the Memphis aquifer; this unit is termed the Upper Claiborne confining unit. The thickness of clay beds in the confining unit varies from about 3 feet to 200 feet (1 to 61 meters),

suggesting that areas of hydrologic connectivity exist between the underling Memphis aquifer and the overlying shallow aquifer (Ref. 44, p. 389).

The Memphis aquifer is a thick sand-dominated aquifer ranging from about 390 to 898 feet (122 to 274 meters) in thickness (Ref. 44, p. 389). The aquifer is formed from fine- to coarse-grained sand interspersed with lenses of clay and small amounts of lignite (Ref. 46, pp. 1011, 1012). The Memphis aquifer provides about 95 percent of the water used for municipal and industrial water supplies in the Memphis area and is the sole source of water for the City of Memphis (Ref. 41, p. 8).

Site Geology/Hydrogeology

Stratum 1 (uppermost): Loess and Dry Fluvial Deposits

As shown by the borehole log for permanent well CC19 (300.19 feet above msl) within Source No. 1, Source No. 1 is underlain by approximately 30 feet of loess that contains silt, silty clay, and minor amounts of sand. Underlying the loess are the fluvial deposits that contain gravel, minor silt, and minor clay to a depth of about 117 feet bgs (183.19 feet above msl) (Refs. 6, p. 43, 44, Appendix C, pp. C-31 to C-61, Appendix D, pp. D-3, D-5 to D-10, D-20; 42, p. 567). During the 2015 TDEC SI, water was not encountered within the boring down to the base of the fluvial deposits underlying Source No. 1 (Ref. 6, pp. D-5 to D-9). The shallow aquifer has been dewatered at and in the vicinity of Source No. 1. The dewatering is due to the lack of a confining unit at CC19 within Source No. 1 and MLGW Well 99-S (K-163), about 0.86 mile southeast of Source No. 1, within MLGW Sheahan Wellfield (see Aquifer Interconnection below) (Refs. 6, Appendix D, pp. D-5 to D-10, D-20; 45, pp. 1, 15).

In addition, the geophysical log of USGS Well K-058 (307 feet above msl) located about 0.96 mile northeast of Source No. 1 indicates that the loess and fluvial deposits are encountered from land surface to 110 feet bgs (307 to 197 feet above msl) (Ref. 47, pp. 1, 2, 3).

Stratum 2 (middle): Cockfield Formation

Underlying the fluvial deposits at Source No. 1 (CC19) is the Cockfield Formation. At CC19, the Cockfield Formation is composed of light gray to light brown fine-grained sand with minor amounts of silt. Clay nodules were noted from 126 to 129.5 feet bgs (174.19 to 170.69 feet above msl) (Ref. 6, Appendix D, pp. D-9, D-10). The Cockfield Formation was first encountered at CC19 within Source No. 1 at about 118 feet bgs (182.19 feet above msl) and extended to the end of the boring at 161 feet bgs (139.19 feet above msl) (Refs. 6, Appendix D, pp. D-3, D-9; 45, p. 2). Water was first encountered within the Cockfield Formation at 124.76 feet bgs (175.43 feet above msl) (Ref. 6, Appendix D, p. D-3). CC19 was installed within the Cockfield Formation at the uppermost saturated interval that an observation well can be screened (Ref. 45, pp. 1, 2).

At MLGW Well 99-S (K-163), elevation of 278 feet amsl and located about 0.86 mile southeast of Source No. 1, the Cockfield Formation was encountered from 96.5 to 152 feet bgs (181.5 to 126 feet above msl) (Ref. 45, pp. 2, 5 through 15).

The geophysical log for USGS Well K-058, elevation of 307 feet above msl and located about 0.96 mile northeast of Source No. 1, indicates that the loess and fluvial deposits are directly underlain by the Cook Mountain Formation. The Cook Mountain Formation is encountered from 111 to 155 feet bgs (196 to 152 feet above msl) (Ref. 47, pp. 1, 2, 3).

It should be noted that the lithologies of the Cockfield and Cook Mountain Formations and the upper part of the Memphis Sand are very difficult to identify and correlate due to their similarities in the Memphis area where the confining unit is absent (within Source No. 1 and the MLGW Sheahan Wellfield at Well 99-S [K-163] about 0.86 mile southeast of Source No. 1) (see Aquifer Inconnectivity below). The entire Tertiary-unit interval primarily is composed of sand that could be Cockfield, Cook Mountain, the upper part of the Memphis Sand, or any combination of these units and or zones (Refs. 43, p. 7; 45, p. 1).

Aquifer/Stratum 3 (lowest): Memphis Sand/Memphis Aquifer

The well construction log for MLGW Well 99-S (278 feet above msl) located about 0.86 mile southeast of Source No. 1 indicates that the Memphis aquifer (Memphis Sand) directly underlies the Cockfield Formation at about 152 feet bgs (126 feet above msl) (Ref. 45, pp. 2, 5 through 15). The Memphis Sand consists primarily of a thick body of sand that includes subordinate lenses of clay and silt at various horizons and ranges from about 500 to 900 feet in thickness (Ref. 43, p. 9). Within a 2-mile radius of Source No. 1, the top of the Memphis Sand/Memphis aquifer is encountered from 150 to 191 feet bgs (144 to 88 feet above msl) (Refs. 45, p. 2; 47, pp. 1, 2, 3).

The geophysical log of USGS Well K-058 (elevation of 307 feet above msl), located about 0.96 mile northeast of Source No. 1, indicates that the Cook Mountain Formation is directly underlain by the Memphis Sand. The Memphis Sand is encountered from 155 to 950 feet bgs (152 feet above msl to 643 feet below msl) (Ref. 47, pp. 1, 2, 3).

Ground water flow within the shallow aquifer (where saturated), where first water is generally encountered in the interval typically composed of fine sand between the base of the fluvial deposits and the top of the Memphis Sand (within the Cockfield Formation), and the Memphis aquifer is towards the MLGW Sheahan Wellfield (Ref. 45, p. 2). The MLGW Sheahan Wellfield is located north, east, northeast, and southeast of Source No. 1 (Refs. 3; 43, Plate 1). In all hydrogeologic units present above the Memphis aquifer, ground water flows towards the MLGW Sheahan Wellfield (Refs. 43, Plate 1; 45, p. 2).

Aquifer Interconnectivity

The Upper Claiborne confining unit is not present in CC19, 300.19 feet above msl, within Source No. 1 (Ref. 45, p. 2). A Professional Geologist (PG) with TDEC reviewed the boring log for CC19 and noted that the top of the Jackson Formation/Upper Claiborne unit was expected to be encountered at approximately 116 feet bgs (184.19 feet above msl) (Ref. 45, p. 2).

The Upper Claiborne confining unit is not present in MLGW Well 99-S (K-163), 278 feet above msl, located about 0.86 mile southeast of Source No. 1 and within the MLGW Sheahan Wellfield (Ref. 45, pp. 2, 5 through 15). A PG with TDEC reviewed the well construction log and noted the following: (1) the base of the fluvial deposits was encountered at 96.5 feet bgs (181.5 feet above msl), (2) the Cockfield Formation was encountered at 96.5 to 152 feet bgs (181.5 to 126 feet above msl), (3) the top of the Memphis aquifer was encountered at 152 feet bgs (126 feet above msl), (4) the confining unit was expected to be encountered from around 120 to 150 feet bgs (158 to 128 feet above msl), (5) the confining unit was not encountered in the borehole which was advanced to 155 feet bgs (123 feet above msl), and (6) the Memphis aquifer (top of the Memphis Sand) was encountered at 152 feet bgs (126 feet above msl). Therefore, the confining unit is absent within the MLGW Sheahan Wellfield at Well No. 99-S (K-163) located about 0.86 mile southeast of Source No. 1 (Ref. 45, pp. 2, 5 through 15).

The absence of the confining unit within Source No. 1 and the MLGW Sheahan Wellfield has resulted in the dewatering of the fluvial deposits (which comprise the surficial aquifer where saturated) in the surrounding areas and first water generally occurs in the interval typically composed of fine sand between the base of the fluvial deposits and the top of the Memphis Sand (Ref. 45, p. 2). At CC19, first water was encountered in the Cockfield Formation at 124.76 feet bgs (175.43 feet above msl) and at MLGW Well 99-S (K-163) at 132 feet bgs (146 feet above msl), also within the Cockfield Formation (Refs. 6, Appendix D, p. D-3; 45, p. 5). The entire saturated part of the interval beginning with the fine sand at the base of the fluvial deposits to the top of the Memphis Sand behaves like a single aquifer that is interconnected hydraulically because of the lithologic similarities and the lack of a confining unit. Therefore, the shallow aquifer (where saturated), the area where first water is encountered within the Cockfield Formation, and the Memphis aquifer are interconnected at and within a 2-mile radius of Source No. 1 (Ref. 45, p. 2).

Aquifer Discontinuity

The Memphis aquifer is continuous within a 4-mile radius of Source No. 1. No surface water bodies or geologic units incise the aquifer to form a discontinuity (Refs. 41, pp. 2, 3, 8; 45, p. 2).

SUMMARY OF AQUIFERS BEING EVALUATED

TABLE 7: Summary of Aquifers Being Evaluated

Aquifer Name	Is Aquifer Interconnected with Upper Aquifer within 2 Miles? (Yes/No/NA)	Is Aquifer Continuous within 4-mile TDL? (Yes/No)	Is Aquifer Karst? (Yes/No)	References
Shallow aquifer (where saturated)	N/A	No	No	Refs. 6, Appendix D, pp. D-3, D-5 to D-10; 45, p. 2
Cockfield Formation	Yes	No	No	
Memphis aquifer	Yes	Yes	No	

Notes:

NA Not applicable
TDL Target distance limit

3.1 LIKELIHOOD OF RELEASE

3.1.1 OBSERVED RELEASE

Aquifer Being Evaluated: Interconnected shallow aquifer (where saturated), Cockfield Formation, and Memphis Aquifer

Chemical Analysis

An observed release by chemical analysis is established by showing that the hazardous substance in release samples are significantly greater in concentration than in the background level and by documenting that at least part of the significant increase is due to a release from the site being evaluated. The significant increase can be documented in one of two ways for HRS purposes. If the background concentration is not detected, an observed release is established when the sample measurement equals or exceeds the appropriate quantitation limit. If the background sample concentration equals or exceeds the detection limit, an observed release is established when the sample measurement is three times or more the background concentration and above the appropriate quantitation limit (Ref. 1, p. 51589, Table 2-3). All hazardous substances in the ground water observed release tables meet these criteria.

Basis for Chemical Analysis:

Data collected during the SI from the newly installed monitoring well document an observed release by chemical analysis to the interconnected shallow aquifer (where saturated), Cockfield Formation, and Memphis aquifer (Ref. 6, pp. 31, 43, 44; 45, p. 2). The data from the SI used to document an observed release are discussed below. The SI field activities were conducted by TDEC between March 10 and 18, 2015, and were completed in accordance with the EPA-approved quality assurance project plan (QAPP) (Refs. 6, p. 7; 34).

March 2015 SI

Background Sample

The background ground water sample listed in Table 8 was collected by TDEC during the March 2015 SI sampling event (Ref. 6, pp. 7, 9). The background well is located about 0.35 mile southwest of Source No. 1 (Refs. 6, p. 9; 42, p. 568) (see Figure 3 of this HRS documentation record).

Ground water flow in the interconnected shallow aquifer (where saturated), Cockfield Formation, and Memphis aquifer is towards the MLGW Sheahan Wellfield located north, northeast, east, and southeast of Source No. 1(Refs. 43, Plate 1; 45, p. 2). The background ground water sample listed in Table 8 is screened between 130 and 150 feet bgs (176.16 to 156.16 feet above msl) and the result will be compared with the observed release ground water sample collected from the same screened interval (Ref. 6, Appendix D, pp. D-3, D-11).

Background and release ground water samples were collected with the same sampling procedures and from wells screened at the same depth intervals with similar constructions (Ref. 6, pp. 9, 10, 12, Appendix D, pp. D-3, D-11). The permanent monitoring wells were installed in accordance with the EPA Region 4 SESD FBQSTP, Design and Installation of Monitoring Wells, SESDGUID-101-R1, January 2013 (Refs. 6, pp. 8, 9; 32). The construction details for the monitoring wells as well as the boring logs are provided in Reference 6, Appendix D. Ground water samples were collected in accordance with the EPA Region 4 SESD FBQSTP, Groundwater Sampling, SESDPROC-301-R3, March 2013 (Ref. 6, p. 10; 33).

The location of the background ground water sample is depicted in Appendix A, page A-8, of Reference 6. Logbook notes and field sheets are contained in Reference 6, Appendix C (also see Figure 3 of this HRS documentation record). The chain-of-custody record is contained in Reference 24.

TABLE 8: Background Ground Water Sample					
Sample ID	**Sample ID**	**Screened Intervals feet bgs (feet above msl)**	**Date Sampled**	**Location**	**References**
CC20	CC20-0315-GW	130 to 150 (176.16 to 156.16)	3/18/2015	Charles Davis Park, about 0.35 mile southwest of Source No. 1	6, pp. 9, 10, Appendix C, p. C-63, Appendix D, p. D-11; 24, p. 9; 42, p. 568

Notes:

bgs	Below ground surface
CC	Former Custom Cleaners
GW	Ground water
ID	Identification number
msl	Mean sea level

Background Concentration

The background ground water sample listed in Table 9 was collected during the TDEC March 2015 SI (Ref. 6, pp. 7, 12; 24, p. 9). The sample was analyzed for VOCs in accordance with EPA CLP SOW SOM01.2 (Refs. 6, Appendix F, pp. F-4, F-8; 21). EPA Region 4 SESD reviewed all data according to the contract SOW and EPA guidelines (Refs. 6, Appendix F, p. F-4; 22). The MRLs are listed on the analytical data sheets in Reference 6, Appendix F. Each MRL is sample-specific and corresponds to the lowest quantitative point on the calibration curve; it is adjusted for the amount of sample prepared and any dilutions performed. The MRLs are equivalent to SQLs (Ref. 23).

TABLE 9: Analytical Results for March 2015 Background Sample

Sample ID	Hazardous Substance	Concentration	MRL	Reference
CC20-0315-GW	PCE	0.14J (0.14) µg/L	0.50 µg/L	6, Appendix F, p. F-161; 25

Notes:

( )	Concentration was adjusted in accordance with Refs. 25 and 27.
CC	Former Custom Cleaners
GW	Ground water
ID	Identification number
J	Concentration reported is less than the lowest standard on the calibration curve; the reported concentration is estimated with no bias (Ref. 6, Appendix F, pp. F-10, F-161; 25).
µg/L	Micrograms per liter
MRL	Minimum reporting limit
PCE	Tetrachloroethylene

Contaminated Samples

The contaminated ground water samples listed in Table 10 were collected during the TDEC March 2015 SI (Ref. 6, p. 7; 24, p. 9). The contaminated samples were collected from ground water underlying Source No. 1 (Refs. 6, pp. 12) (see Figure 3 and Section 2.2.1, Source No. 1 of this HRS documentation record).

Background and release ground water samples were collected with the same sampling procedures and from wells screened in the same aquifer (Ref. 6, pp. 9, 10, 12, Appendix D, pp. D-3, D-11). Permanent monitoring wells were installed in accordance with the EPA Region 4 SESD FBQSTP, Design and Installation of Monitoring Wells, SESDGUID-101-R1, January 2013 (Refs. 6, p. 9; 32). The ground water samples were collected in accordance with the EPA Region 4 SESD FBQSTP, Groundwater Sampling, SESDPROC-301-R3, March 2013 (Ref. 6, p. 10; 33).

The location of the contaminated ground water samples are depicted in Appendix A, page A-7, of Reference 6 (also see Figure 3 of this HRS documentation record). Logbook notes and field sheets are contained in Reference 6, Appendix C. Borehole logs are contained in Reference 6, Appendix D. The chain-of-custody record is contained in Reference 24.

TABLE 10: Release Ground Water Sample

Station ID	Sample ID	Screened Intervals feet bgs (feet above msl)	Date Sampled	Location	References
CC19	CC19-0315-GW	130 to 150 (169.99 to 149.99)	3/18/2015	About 20 feet east of the eastern side of the FCC building	6, Appendix A, p. A-5, Appendix C, p. C-62, Appendix D, p. D-3; 24, p. 9; 42, p. 567
CC19	CC19-0315-GWD	130 to 150 (169.99 to 149.99)	3/18/2015	About 20 feet east of the eastern side of the FCC building	6, Appendix A, p. A-5, Appendix C, p. C-62, Appendix D, p. D-3; 24, p. 9; 42, p. 567

Notes:

above msl	Above mean sea level
bgs	Below ground surface
CC	Former Custom Cleaners
D	Duplicate
GW	Ground water
ID	Identification

Contaminated Concentrations

Ground water samples listed in Table 11 were collected from ground water underlying Source No. 1 during the March 2015 TDEC SI (Refs. 6, pp. 7, 12, Appendix A, p. A-7; 24, p. 9) (see Figure 3 and Section 2.2.1, Source No. 1 of this HRS documentation record). The samples were analyzed for VOCs in accordance with the EPA CLP SOW SOM01.2 (Refs. 6, Appendix F, pp. F-4, F-8; 21). EPA Region 4 SESD reviewed all data according to the contract SOW and EPA guidelines (Refs. 6, Appendix F, p. F-4; 22). The MRLs are listed on the analytical data sheets in Reference 6, Appendix F. Each MRL is sample-specific and corresponds to the lowest quantitative point on the calibration curve; it is adjusted for the amount of sample prepared and any dilutions performed. The MRLs are equivalent to SQLs (Ref. 23).

TABLE 11: Analytical Results for March 2015

Sample ID	Hazardous Substance	Concentration	MRL	References
CC19-0315-GW	PCE	140 µg/L	10 µg/L	6, Appendix F, p. F-123
CC19-0315-GWD	PCE	120 µg/L	8.3 µg/L	6, Appendix F, p. F-125

Notes:

D	Duplicate
GW	Ground water
ID	Identification number
µg/L	Micrograms per liter
MRL	Minimum reporting limit
PCE	Tetrachloroethylene

Attribution

Laundry and dry cleaning operations were conducted at FCC by various entities from 1945 until the mid-1990s (Refs. 10, p. 1; 12; 14). Custom Cleaners began operations at the property in 1974 (Refs. 14, p. 1). From approximately 1980 to 1995, PCE was used as the dry cleaning solvent during Custom Cleaners operations (Ref. 14). According to a previous tenant at FCC, sumps were possibly located along the eastern and western sides of the building, and drums containing unknown substances were located along the western wall (Ref. 10, pp. 1, 2, 7). The dry cleaning machine was located on the southwestern side of the building near the garage door (Ref. 6, p. 14). A 1996 Dry-Cleaning Facilities Registration form submitted by the owner of FCC states that sludges, still bottoms, filters, lint, and dust were disposed of off site and the dry cleaning machine did not have a containment area (Ref. 14).

In March 1999, the new owner of FCC submitted a Hazardous Waste Notification and Report to TDEC. The report identified three waste streams, containing EPA waste code F002, associated with FCC, including filters contaminated with PCE (commonly referred to as perc), PCE, and sludge (Refs. 17; 61, pp. 1 through 3; 62; 63). In February 2000, a Hazardous Waste and Used Oil Notification as well as a Hazardous Waste Stream and Annual Report were submitted to TDEC for waste removal conducted at FCC (Refs. 18; 60, pp. 1 through 8). The report states that 218 kilograms of waste PCE bottoms and filters generated through the dry cleaning process (Waste Stream No. 1) and 460 kilograms of PCE (Waste Stream No. 2) were shipped off site (Refs. 18; 60, pp. 1, 3, 5, 6).

In June 2013, TDEC received a complaint from a tenant of FCC. The tenant complained of strong odors in the building, especially when the outdoor temperature was elevated (Refs. 10, p. 1; 19, p. 60). From 2013 to 2015, TDEC and EPA conducted numerous investigations at FCC that included collection of sub-slab soil gas, indoor air, soil, and ground water samples (Refs. 6, pp. 7 through 10; 19, pp. 6, 57, 58, 60, 61; 48, pp. 1, 2, Enclosure 2, pp. E2-1 through E2-4). Sub-slab soil gas samples contained PCE at up to 620,000 µg/m^3, which exceeds its calculated vapor intrusion screening level for commercial air (1,600 µg/m^3), and indoor air samples contained PCE up to 429.78 µg/m^3, which exceeds the HRS substance cancer risk screening concentration benchmark of 10 µg/m^3 (Refs. 2, p. 3; 6, pp. 33, 34; 19, p. 8).

PCE and its breakdown product cis-1,2-DCE, have been documented in Source No. 1 (see Tables 2 and 4 and Section 2.2.1, Source No. 1 of this HRS documentation record). Subsurface soil samples collected from Source No. 1 contained PCE (up to 54,000 µg/kg) and cis-1,2-DCE (up to 9.4 µg/kg) (see Tables 2 and 4 of this HRS documentation record). The highest concentrations of PCE (up to 54,000 µg/kg) were detected from subsurface soil samples collected from a single borehole, station location CC16, in the vicinity of the garage door and former dry cleaning machine (Ref. 6, pp. 18 through 22, Appendix A, p. A-7) (see Figures 2 and 3 of this HRS documentation record). The estimated concentrations of PCE in the soil moisture in all subsurface soil samples collected from this station exceed the pure phase solubility limit of 2,000 µg/L for PCE (Refs. 54, p. 5; 55, pp. 1, 3, B-1; 56, p. 128; 57, p. 2; 58).

PCE and its breakdown products have been detected at concentrations above background levels in ground water (Cockfield Formation) underlying Source No. 1, indicating that a release has occurred or is occurring at the FCC site (see Section 3.1.1, Observed Release, of this HRS documentation record). Ground water samples collected from the newly installed monitoring well underlying Source No. 1 contained PCE at concentrations above background levels. Specifically, PCE concentrations were detected at 140 µg/L (CC19-0315-GW) and 120 µg/L (CC19-0315-GW-DUP) (Ref. 6, p. 31) (see Tables 9 and 11 of this HRS documentation record).

Other possible offsite sources may exist in the vicinity of the FCC site. According to City of Memphis Directories, historical dry cleaners operated at 618 South Highland (located about 175 feet southwest of Source No. 1), 627 South Highland (located about 430 feet southwest of Source No. 1), and 545½ South Highland (located about 680 feet northwest of Source No. 1 (Refs. 12; 49). Additional information regarding these historical dry cleaners is not available.

According to the EPA Facility Registry System, three dry cleaners are located within 2 miles of the FCC site (Refs. 50, pp. 1 through 7; 51; 52; 53). Each of these facilities is a conditionally exempt small quantity generator that provides dry cleaning and laundry services (Refs. 51; 52; 53). The first dry cleaner is located 0.9 mile west of Source No. 1 (Refs. 6, pp. 42, 49, Appendix I, p. I-2; 51). The second dry cleaner is located about 1 mile north of Source No. 1 (Refs. 6, pp. 42, 49, Appendix I, p. I-2; 52). The third dry cleaner is located about 1.7 miles northwest of Source No. 1 (Refs. 6, pp. 42, 49, Appendix I, p. I-2; 53). Additional information regarding these dry cleaners is not available.

PCE, a dry cleaning solvent, was used at FCC for 15 years (Refs. 14; 60, pp. 1, 3). Common industry wide practices for dry cleaners that operated from the 1960s to the 1990s include dumping spent PCE or sludge out the back door and storing PCE saturated spent cartridge filters behind the building (Refs.66, pp. 3, 4; 67, p. 13) . Consequently, the greatest concentrations of PCE (up to 7,100,000 µg/kg) detected during the 2015 SI were in samples collected in the vicinity of the former dry cleaning machine and garage door (SI borings CC05 and CC15) at depths between 1 and 9 feet bgs (Ref. 6, pp. 14, 19, Appendix A, p. A-7). Samples collected from SI borings CC05 and CC15 were not evaluated in the HRS documentation record due to the upcoming time critical removal action (date unknown) (Ref. 28, pp. 2, 3).

The EPA Scientific Support Section (SSS) reviewed data obtained during past FCC investigations (TDEC 2015 SI and January 2016 RSE) as well as FCC file information (Ref. 28, p. 3). EPA SSS stated that ground water samples collected in the vicinity of FCC indicate that ground water has been impacted by PCE. PCE is present at such elevated levels in subsurface soil that the waste material may be acting as source material threatening the ground water (Ref. 28, p. 3). EPA SSS concluded that the conditions at FCC support the considerations of a time-critical removal action to remove source material that has and is continuing to impact ground water upgradient from local municipal drinking water wells (Ref. 28, pp. 3, 4). This removal action is not expected to address the contamination scored in this HRS documentation record.

PCE has been detected in soil samples within Source No. 1 at concentrations up to 54,000 µg/kg, which is indicative of DNAPL (Ref. 58). PCE has been detected in surface and subsurface soils at intervals ranging from 1 foot bgs at sampling stations CC16 (sample CC16-0315-SB1) and CC18 (sample CC18-0315-SB1) to up to 110.5 feet bgs at sampling station CC19 (sample CC19-0315-SB12) within Source No. 1 (Refs. 6, Appendix D, p. D-8, Appendix F, pp. F-67, F-103, F-134). PCE has also been detected in the ground water sample collected from the same sampling station (CC19) at a depth of 130 feet bgs (Ref. 6, Appendix C, p. C-62, Appendix D, p. D-3, Appendix F, pp. F-123, F-125). Water was first encountered at 124.76 feet bgs at CC19 (Ref. 6, Appendix D, p. D- 9). The vertical distance between the lowest documented point of subsurface soil contamination and ground water contamination is only14.26 feet (Ref. 6, Appendix C, pp. C-21, C-62, Appendix D, pp. D-3, D-8, Appendix F, pp. F-123, F-125, F-134). The boring log of CC19 indicates that poorly sorted sand, fine to large grain sand, and abundant small to large gravel is present between the lowest known point of subsurface soil contamination (110.5 feet bgs) and ground water contamination (124.76 feet bgs) (Ref. 6, Appendix D, pp. D-8, D-9). The short distance between the lowest known point of subsurface soil contamination and ground water as well as the geologic materials present (sands and gravel) between the lowest known point of subsurface contamination and ground water indicates that a release to ground water is likely ongoing.

Hazardous Substances in the Release

Tetrachloroethylene

Ground Water Observed Release Factor Value: 550
(Ref. 1, Section 3.1.1)

3.1.2 POTENTIAL TO RELEASE

Potential to release was not scored in this HRS documentation record because an observed release by chemical analysis has been documented. However, potential to release was evaluated as shown in Reference 69.

3.2 WASTE CHARACTERISTICS

3.2.1 TOXICITY/MOBILITY

Table 12 summarizes the toxicity and mobility values and combined factor values for the hazardous substances associated with Source No. 1. All hazardous substances listed in Table 12 have been documented in either soil or ground water samples from Source No. 1. These hazardous substances were detected at concentrations significantly above background levels.

TABLE 12: Ground Water Toxicity/Mobility

Hazardous Substance	Source No.	Toxicity Factor Value	Mobility Factor Value*	Does Hazardous Substance Meet Observed Release?**	Toxicity/ Mobility (Ref. 1, Table 3-9)	Reference
PCE	1	100	1	Yes	100	2, p. 2
cis-1,2-DCE	1	1,000	1	No	1,000	2, p. 1

Notes:

* Liquid, non-karst mobility factor used (Ref. 1, Section 3.2.1.2).
** See Section 3.1.1 of this HRS documentation record
DCE Dichloroethylene
No. Number
PCE Tetrachloroethylene

Cis-1,2-DCE is the hazardous substance with the highest toxicity/mobility factor value of 1,000.

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

3.2.2 HAZARDOUS WASTE QUANTITY

TABLE 13: Hazardous Waste Quantity		
Source No.	**Source Type**	**Source Hazardous Waste Quantity**
1	Contaminated soil	0.11

Source No. 1 is composed of PCE- and cis-1,2-DCE-contaminated soil located at and in the vicinity of the former dry cleaning machine, former sumps, and garage door (Refs. 6, pp. 14, 18 through 28, Appendix A, p. A-7; 10, pp. 1, 2, 7) (see Figure 3 and Tables 2 and 4 of this HRS documentation record).

The estimated area of Source No. 1 was determined using Figure 3 of this HRS documentation record and Reference 6, Appendix A, page A-7 that depict the soil sampling locations from March 2015. Contamination between sampling points was inferred based on analytical results from indoor air samples, passive soil gas samples, and soil samples collected from areas within Source No. 1 during previous investigations (Refs. 19, pp. 7, 8, 28; 48, Enclosure 1, p. E1-2, Enclosure 2, pp. E2-1 to E2-3). The approximate area of Source No. 1 is 3,900 square feet (Ref. 59) (see Figure 3 of this HRS documentation record). No removal actions have occurred or are anticipated within the area of contaminated soil evaluated as Source No. 1 at the time of this HRS documentation record, and no Level I or Level II concentrations have been determined. As specified in Reference 1, Section 2.4.2.2, an HWQ factor value of 10 was assigned.

Hazardous Waste Quantity Factor Value: 10
(Ref. 1, Sec. 2.4.2.2)

3.2.3 WASTE CHARACTERISTICS FACTOR CATEGORY VALUE

The waste characteristics factor category was obtained by multiplying the toxicity, mobility, and HWQ factor values, subject to a maximum product of 1×10^8. Based on this product, a value was assigned in accordance with Reference 1, Table 2-7.

Toxicity/Mobility Factor Value: 1,000
Hazardous Waste Quantity Factor Value: 10

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

Waste Characteristics Factor Category Value: 10
(Ref. 1, Table 2-7)

3.3 TARGETS

The public water supplies for the City of Memphis are provided by MLGW and consist of eight water treatment plants and wellfields supplied by 130 wells which are part of a blended system (Ref. 35, pp. 1, 2). Of the eight wellfields, the MLGW Sheahan Wellfield is located within a 4-mile radius of Source No. 1 (Refs. 3; 35, pp. 4, 7, 8; 36, pp. 1, 2). The MLGW Sheahan Wellfield consists of 22 wells, 12 of which are located within a 0.5- to 1-mile radius of Source No. 1; the remaining 10 wells are located within a 1- to 2-mile radius of Source No. 1 (Refs. 3; 35, pp. 1, 4, 7, 8). All municipal wells within the MLGW Sheahan Wellfield withdraw water from the Memphis aquifer (Ref. 29, p. 1). The depths of wells located within the MLGW Sheahan Wellfield range from 371 to 883 feet bgs, and the depths to the top of screen range between 297 and 777 feet bgs (Ref. 35, p. 4). No one well contributes more than 40 percent of the total water supply; therefore, the population served by each well is apportioned equally among the 130 active wells (Refs. 1, Section 3.3.2; 35, pp. 2; 71). MLGW serves about 228,147 residential customers (residential connections) (Refs. 35, p. 2; 37). According to the U.S. Bureau of the Census, the persons per household value for Shelby County, Tennessee (2010 to 2014), is 2.66 (Ref. 38). Therefore, MLGW serves about 606,871.02 people (228,147 residential connections × 2.66 persons per household). Each well servers about 4,668.23 people (606,871.02 people ÷ 130 wells). MLGW sells water to the Cities of Bartlett, Collierville, Germantown, and Millington in Tennessee as well as Olive Branch, Mississippi. MLGW does not purchase water from any other community water system (Ref. 35, p. 3). Private wells may be located within a 4-mile radius of Source No. 1; however, their exact locations are not known.

Municipal wells located within a 4-mile radius of Source No. 1 provide drinking water to about 102,701 people. The population served by these wells per distance ring is distributed as follows: > 0 to 0.25 mile, 0 people; > 0.25 to 0.50 mile, 0 people; > 0.50 to 1 mile, 56,018.76 people; > 1 to 2 miles, 46,682.30 people; > 2 to 3 miles, 0 people; > 3 to 4 miles, 0 people (Refs. 3; 35, p. 2; 37; 38).

TABLE 14: MLGW Supply Wells – Sheahan Wellfield Memphis Aquifer									
Distance Ring (Miles)	**Number of Wells**	**Well No. (MLGW No.)**	**Total Depth (feet bgs)**	**Screen Depth (feet bgs)**	**Level I Cont. (Y/N)**	**Level II Cont. (Y/N)**	**Potential Cont. (Y/N)**	**Population Served**	**References**
0 to 0.25	0	NA	NA	NA	NA	NA	NA	NA	3; 29, pp. 1, 2; 35, pp. 2, 4; 37; 38;
> 0.25 to 0.5	0	NA	NA	NA	NA	NA	NA	NA	3; 29, pp. 1, 2; 35, pp. 2, 4; 37; 38;
> 0.5 to 1	12	52B 54B 55B 57C 58C 74A 76A 78B 79A 80A 87A 99	724 456 706 454 489 569 377 530 757 495 371 459	620-724 370-456 545-706 368-454 385-489 505-569 297-377 411-530 651-757 415-495 311-371 355-459	No	No	Yes	56,018.76	3; 35, pp. 2, 4; 37; 38
> 1 to 2	10	63A 70A 72A 88 91 93 95 96 97 98	421 532 499 454 624 796 883 792 574 594	316-421 458-532 413-499 339-454 521-624 690-796 777-883 692-792 471-574 490-594	No	No	Yes	46,682.30	3; 35, pp. 2, 4, 37; 38
> 2 to 3	0	NA	NA	NA	NA	NA	NA	NA	3; 29, pp. 1, 2; 35, pp. 2, 4; 37; 38;

TABLE 14: MLGW Supply Wells – Sheahan Wellfield Memphis Aquifer									
Distance Ring (Miles)	**Number of Wells**	**Well No. (MLGW No.)**	**Total Depth (feet bgs)**	**Screen Depth (feet bgs)**	**Level I Cont. (Y/N)**	**Level II Cont. (Y/N)**	**Potential Cont. (Y/N)**	**Population Served**	**References**
> 3 to 4	0	NA	NA	NA	NA	NA	NA	NA	3; 29, pp. 1, 2; 35, pp. 2, 4; 37; 38

Notes:

>	Greater than
bgs	Below ground surface
Cont.	Contamination
ID	Identification number
MLGW	Memphis Light, Gas and Water
N	No
NA	Not applicable
No.	Number
Y	Yes

3.3.1 NEAREST WELL

The closest municipal drinking water well to Source No. 1 is MLGW Sheahan Wellfield Well 55B. This well is located about 0.64 mile east of Source No. 1 (Refs. 3; 35, p. 4).

Well ID: MLGW Sheahan Wellfield Well 55B
Level of Contamination (I, II, or potential): Potential

If potential contamination, distance from source in miles: about 0.64 mile east of Source No. 1 (Refs. 3; 35, p. 4) (see Figure 3 of this HRS documentation record).

In accordance with Section 3.3.1 and Table 3-11 of the HRS rule, a nearest well factor value of 9 is assigned (Ref. 1, Section 3.3.1).

Nearest Well Factor Value: 9
(Ref. 1, Section 3.3.1)

3.3.2 POPULATION

3.3.2.1 Level of Contamination

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

3.3.2.2 Level I Concentrations

Not Scored.

3.3.2.3 Level II Concentrations

Not Scored.

3.3.2.4 Potential Contamination

Distance-weighted population values for potential contamination ground water targets for the interconnected shallow aquifer (where saturated), Cockfield Formation, and Memphis aquifer are presented in Table 15.

TABLE 15: Distance-Weighted Population Values – Other than Karst

Distance Category (Miles)	Population	Distance-Weighted Population Value (Ref. 1, Table 3-12)	References
Greater than 0 to 0.25	0	0	3
Greater than 0.25 to 0.5	0	0	3
Greater than 0.5 to 1	56,018.76	16,684	3; 35, pp. 2, 4; 37; 38
Greater than 1 to 2	46,682.30	9,385	3; 35, pp. 2, 4; 37; 38
Greater than 2 to 3	0	0	3
Greater than 3 to 4	0	0	3

Calculations:

Sum of Distance - Weighted Population Values: 26,069
Sum of Distance - Weighted Population Values ÷ 10: 2,606.9

Potential Contamination Factor Value: 2,607

3.3.3 RESOURCES

Resources were not evaluated because they do not significantly contribute to the overall site score.

Resources Factor Value: NS

3.3.4 WELLHEAD PROTECTION AREA

The Federal Safe Drinking Water Act Amendments of 1986 established the initial step toward prevention of contamination of public water supplies. Each state was required to develop a wellhead protection program to protect the water source of public water systems relying on ground water (Ref. 39, p. 5). Tennessee's Wellhead Protection Program was approved by EPA on July 27, 1994 (Ref. 64, pp. 93, 94). The Safe Drinking Water Act was amended in 1996 (Section 1453 of the 1996 Safe Drinking Water Act) and required that all states establish Source Water Assessment Programs detailing how each state would delineate source water protection areas, inventory significant contaminants in these areas, and determine the susceptibility of each public water supply to contamination (Ref. 39, p. 5). Tennessee's Source Water Assessment Program was approved by EPA in November 1999 (Ref. 39, p. 5).

Twenty-three MLGW municipal wells and their wellhead protection areas are located within the 4-mile radius of Source No. 1. Two wellhead protection zones are established for each well: an inner fixed radius zone (Zone 1) around the well to protect the immediate area from spills, and a larger management zone (Zone 2) that takes into account the wide variety of geologic conditions across Tennessee to provide for long term management for the well and wellfield (Refs. 35, pp. 7, 8; 39, pp. 5, 7).

Wellhead Protection Area Factor Value: 5.00