HRS DOCUMENTATION RECORD COVER SHEET

Name of Site: Sherwin-Williams/Hilliards Creek

EPA ID No.: NJSFN0204181

Contact Persons

Documentation Record: Alicia G. Shultz, Project Manager
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Pathways, Components, or Threats Not Scored

The ground water migration, soil exposure, and air migration pathways were not evaluated because they are not expected to add significantly to the Hazard Ranking System (HRS) site score.

Ground Water Migration Pathway:

Although ground water contamination has been documented on site, the number of drinking water wells located within a 4-mile radius of the site is low (Reference [Ref.] 31, p. 2-13, 2-14).

Soil Exposure Pathway:

Lead-contaminated soil has been documented on one residential property. In October 2003, an interim removal action was completed on the property: the top 6 inches of soil were excavated from the property and disposed of (Ref. 50, pp. ES-1, 2-3). Lead-contaminated soil may remain on the property (Ref. 51, Table 4 and Appendix A) since only the top 6 inches of soil were removed from the property and the results for samples collected from below this depth indicated concentrations of lead greater than 400 milligrams per kilogram (Refs. 50, pp. 1-2, 2-3; 51, Appendix A). Soil samples were collected from within the 100-year flood plain of Hilliards Creek to evaluate whether periodic flooding transported contaminated sediments from Hilliards Creek to the banks (flood plain) of Hilliards Creek (Ref. 51, pp. 5, 8). As documented in the other sources section of this HRS documentation record, lead was detected in the flood plain soil samples at concentrations exceeding three times the background concentration along Hilliards Creek from Gibbsboro Road to sample location T-14, a distance of approximately 2,800 feet (Ref. 51, Figure 4; the other source section of this HRS documentation record). Six areas of concern were identified including the Hilliards Creek Wildlife Preserve (Ref. 51, p. 9). Many homes are located near the 100-year flood plain of Hilliards Creek. There is the potential for the lead-contaminated sediment in Hilliards Creek to be carried by floods onto residential properties located within or near the 100-year flood plain of Hilliards Creek (Ref. 97). However, current reference documentation does not indicate that contaminated soil is located on additional residential properties.

HRS DOCUMENTATION RECORD COVER SHEET (Continued)

Air Migration Pathway:

No air samples have been collected. Therefore, an observed release to the air migration pathway from on-site sources can not be documented. As documented in Section 2.4.1 for Source 1, volatile organic compounds (VOC) have been detected in free-phase product samples collected from ground water located near Buildings 55 and 67. VOCs also were detected in soil samples collected from Sources 1, 2, and 4, as documented in Section 2.4.1 for each source. There is the potential for the VOCs in the source areas to release to air and into occupied buildings.

HRS DOCUMENTATION RECORD

Name of Site:	Sherwin-Williams/Hilliards Creek
EPA Region:	2
Date Prepared:	February 8, 2006; Revised March 2008 (Pages 1, 17-20, 24, 28-29, 41-42, 47, 55-56, 179, 180, 188-201, and 215-218 revised March 2008; page 179a added March 2008)
Street Address of Site*:	Foster Avenue and Gibbsboro Road
City, County, State:	Gibbsboro, Camden County, New Jersey 08026
General Location in the State:	Central
Topographic Map:	Clementon, New Jersey
Latitude:	39.835525541° North
Longitude:	74.964976916° West

The coordinates of Sherwin-Williams/Hilliards Creek were calculated from the northwest corner of Building 67 shown on Reference 97.* The coordinates were measured using map interpolation from Clementon, New Jersey Quadrangle, using ArcGIS 9© software. Universal Transverse Mercator (UTM) coordinates converted to latitude and longitude NAD83 using CorpsCon software, US Army Corps of Engineers Topographic Engineering Center (Ref. 9).

* The street address, coordinates, and contaminant locations presented in this HRS documentation record identify the general site location. The information represents one or more locations U.S. Environmental Protection Agency (EPA) considers part of the site based on the screening information EPA used to evaluate the site for listing on the National Priorities List. EPA assigns national priorities from the known "releases or threatened releases" of hazardous substances; thus, the focus is on the release, and not on precisely delineated boundaries. A site is defined as an area where a hazardous substance has been "deposited, stored, placed, or otherwise have come to be located." Generally, HRS scoring and the subsequent listing of a release represent the initial determination that a certain area may need to be addressed under the Comprehensive Environmental Response, Compensation, and Liability Act. Accordingly, EPA contemplates that the preliminary description of site boundaries at the time of scoring will be refined as more information is developed on the location of contamination.

Scores	
Ground Water Migration Pathway	Not Scored
Surface Water Migration Pathway	100
Soil Exposure Pathway	Not Scored
Air Migration Pathway	Not Scored
HRS SITE SCORE	**50.00**

WORKSHEET FOR COMPUTING HRS SITE SCORE

		S	S^2
1.	Ground Water Migration Pathway Score (S_{gw}) (from Table 3-1, line 13)	0.00	0.00
2a.	Surface Water Overland/Flood Migration Component (from Table 4-1, line 30)	100	10,000
2b.	Ground Water to Surface Water Migration Component (from Table 4-25, line 28)	84	7,056
2c.	Surface Water Migration Pathway Score (S_{sw}) Enter the larger of lines 2a and 2b as the pathway score.	10,000	10,000
3.	Soil Exposure Pathway Score (S_s) (from Table 5-1, line 22)	0.00	0.00
4.	Air Migration Pathway Score (S_a) (from Table 6-1, line 12)	0.00	0.00
5.	Total of $S_{gw}^2 + S_{sw}^2 + S_s^2 + S_a^2$		10,000
6.	**HRS Site Score** Divide the value on line 5 by 4 and take the square root	50.00	

TABLE 4-1 --SURFACE WATER OVERLAND/FLOOD MIGRATION COMPONENT SCORE SHEET

Factor categories and factors			Maximum Value	Value Assigned	
Watershed Evaluated: Hilliards Creek					
	Drinking Water Threat				
Likelihood of Release:					
	1. Observed Release		550	550	
	2. Potential to Release by Overland Flow:				
		2a. Containment	10		
		2b. Runoff	10		
		2c. Distance to Surface Water	5		
		2d. Potential to Release by Overland Flow [lines 2a(2b + 2c)]	35		
	3.Potential to Release by Flood:				
		3a. Containment (Flood)	10		
		3b. Flood Frequency	50		
		3c. Potential to Release by Flood (lines 3a x 3b)	500		
	4. Potential to Release (lines 2d + 3c, subject to a maximum of 500)		500		
	5. Likelihood of Release (higher of lines 1 and 4)		550		550
Waste Characteristics:					
	6. Toxicity/Persistence		(a)	10000	
	7. Hazardous Waste Quantity		(a)	100	
	8. Waste Characteristics		100		32
Targets:					
	9. Nearest Intake		50		
	10. Population:				
		10a. Level I Concentrations	(b)		
		10b. Level II Concentrations	(b)		
		10c. Potential Contamination	(b)		
		10d. Population (lines 10a + 10b + 10c)	(b)		
	11. Resources		5		
	12. Targets (lines 9 + 10d + 11)		(b)		
Drinking Water Threat Score:					
	13. Drinking Water Threat Score [(lines 5x8x12)/82,500, subject to a max of 100]		100		0
	Human Food Chain Threat				
Likelihood of Release:					
	14. Likelihood of Release (same value as line 5)		550		550

TABLE 4-1 --SURFACE WATER OVERLAND/FLOOD MIGRATION COMPONENT SCORE SHEET			
Factor categories and factors	Maximum Value	Value Assigned	
Waste Characteristics:			
15. Toxicity/Persistence/Bioaccumulation	(a)	500,000,000	
16. Hazardous Waste Quantity	(a)	100	
17. Waste Characteristics	1000		320
Targets:			
18. Food Chain Individual	50	20	
19. Population			
19a. Level I Concentration	(b)		
19b. Level II Concentration	(b)		
19c. Potential Human Food Chain Contamination	(b)		
19d. Population (lines 19a + 19b + 19c)	(b)		
20. Targets (lines 18 + 19d)	(b)		20
Human Food Chain Threat Score:			
21. Human Food Chain Threat Score [(lines 14x17x20)/82,500, subject to max of 100]	100		42.67
Environmental Threat			
Likelihood of Release:			
22. Likelihood of Release (same value as line 5)	550		550
Waste Characteristics:			
23. Ecosystem Toxicity/Persistence/Bioaccumulation	(a)	500,000,000	
24. Hazardous Waste Quantity	(a)	100	
25. Waste Characteristics	1000		320
Targets:			
26. Sensitive Environments			
26a. Level I Concentrations	(b)	750	
26b. Level II Concentrations	(b)	25	
26c. Potential Contamination	(b)		
26d. Sensitive Environments (lines 26a + 26b + 26c)	(b)	775	
27. Targets (value from line 26d)	(b)		775
Environmental Threat Score:			
28. Environmental Threat Score [(lines 22x25x27)/82,500 subject to a max of 60]	60		60
Surface Water Overland/Flood Migration Component Score for a Watershed			
29. Watershed Score[c] (lines 13+21+28, subject to a max of 100)	100		100

Surface Water Overland/Flood Migration Component Score			
30. Component Score (S_{sw})[c] (highest score from line 29 for all watersheds evaluated)	100		100
[a] Maximum value applies to waste characteristics category [b] Maximum value not applicable [c] Do not round to nearest integer			

TABLE 4-25 --GROUND WATER TO SURFACE WATER MIGRATION COMPONENT SCORE SHEET

Factor categories and factors	Maximum Value		Value Assigned
Aquifer Evaluated: Surficial			
Drinking Water Threat			
Likelihood of Release to an Aquifer:			
1. Observed Release	550	550	
2. Potential to Release:			
2a. Containment	10		
2b. Net Precipitation	10		
2c. Depth to Aquifer	5		
2d. Travel Time	35		
2e. Potential to Release [lines 2a(2b + 2c + 2d)]	500		
3. Likelihood of Release (higher of lines 1 and 2e)	550		550
Waste Characteristics:			
4. Toxicity/Mobility	(a)	10000	
5. Hazardous Waste Quantity	(a)	100	
6. Waste Characteristics	100		32
Targets:			
7. Nearest Well	(b)	0	
8. Population:			
8a. Level I Concentrations	(b)		
8b. Level II Concentrations	(b)		
8c. Potential Contamination	(b)		
8d. Population (lines 8a + 8b + 8c)	(b)		
9. Resources	5		
10. Targets (lines 7 + 8d + 9)	(b)	0	
Drinking Water Threat Score:			
11. Drinking Water Threat Score ([lines 3 x 6 x 10]/82,500, subject to max of 100)	100		0
Human Food Chain Threat			
Likelihood of Release:			
12. Likelihood of Release (same value as line 3)	550		550
Waste Characteristics:			
13. Toxicity/Mobility/Persistence/Bioaccumulation	(a)	20000000	
14. Hazardous Waste Quantity	(a)	100	
15. Waste Characteristics	1000		180

TABLE 4-25 --GROUND WATER TO SURFACE WATER MIGRATION COMPONENT SCORE SHEET			
Factor categories and factors	Maximum Value	Value Assigned	
Targets:			
16. Food Chain Individual	20		
17. Population			
17a. Level I Concentration	(b)		
17b. Level II Concentration	(b)		
17c. Potential Human Food Chain Contamination	(b)		
17d. Population (lines 17a + 17b + 17c)	(b)		
18. Targets (lines 16 + 17d)	(b)		
Human Food Chain Threat Score:			
19. Human Food Chain Threat Score [(lines 12x15x18)/82,500,suject to max of 100]	100		24
Environmental Threat			
Likelihood of Release:			
20. Likelihood of Release (same value as line 3)	550		550
Waste Characteristics:			
21. Ecosystem Toxicity/Persistence/Bioaccumulation	(a)	50000000	
22. Hazardous Waste Quantity	(a)	100	
23. Waste Characteristics	1000		180
Targets:			
24. Sensitive Environments			
24a. Level I Concentrations	(b)	750	
24b. Level II Concentrations	(b)	25	
24c. Potential Contamination	(b)		
24d. Sensitive Environments (lines 24a + 24b + 24c)	(b)	775	
25. Targets (value from line 24d)	(b)		775
Environmental Threat Score:			
26. Environmental Threat Score [(lines 20x23x25)/82,500 subject to a max of 60]	60		60
Ground Water to Surface Water Migration Component Score for a Watershed			
27. Watershed Score[c] (lines 11 + 19 + 28, subject to a max of 100)	100		84
28. Component Score (S_{gs})[c] (highest score from line 27 for all watersheds evaluated, subject to a max of 100)	100		84
[a] Maximum value applies to waste characteristics category [b] Maximum value not applicable [c] Do not round to nearest integer			

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SITE SUMMARY

The Sherwin-Williams/Hilliards Creek site is located in Gibbsboro, Camden County, New Jersey. The Sherwin-Williams/Hilliards Creek site includes, but is not limited to, contaminated soil on and ground water underlying the former Lucas Paint Works Plant (Lucas plant) and contaminated soil and sediment associated with Hilliards Creek. The former Lucas plant encompassed 60 acres of land and was bounded to the north by Silver Lake and Route 561; to the east by United States (US) Avenue; to the south by vacant land, a cemetery, and Bridgewood Lake; and to the west by Clementon-Gibbsboro Road (Refs. 6, p. 2-1 and Figure 2-4; 9; 68, p. 2-1). Hilliards Creek, also known as Millard Creek, flows southwesterly through the former Lucas plant, under Foster Avenue, then turns west under W. Clementon Road, receives the outflow of Bridgewood Lake, and continues west to Kirkwood Lake. Approximately 1,000 feet upstream from Kirkwood Lake, Hilliards Creek receives surface water flow from Nichols Creek. Hilliards Creek merges with the Cooper River just before it enters Kirkwood Lake (Refs. 6, p. 2-11 and Figure 2-2; 9; see Reference 97, Sampling Location and Lucas Plant Area Map).

Hilliards Creek received surface water runoff and discharges from the Lucas plant (see Figure 2-4 in Reference 6). The Lucas plant began operation in 1851 and it manufactured varnishes, lacquers, and lead-based-paints, including dry colors, paste paints, and linseed oil liquid paints. Wastes generated from the plant were disposed of in Hilliards Creek, on-site wastewater lagoons, the Route 561 Dump Site, and the US Avenue Burn Site (Refs. 31, p. 2-5; 61, pp. 3, 4, 5). The Route 561 Dump Site and US Avenue Burn Site have been evaluated as separate sites and are therefore not included in this Hazard Ranking System (HRS) documentation record (Ref. 61, p. 5).

Ground water at the Lucas plant occurs in two distinct zones: the shallow zone (30 to 40 feet thick) and a deeper zone (total thickness unknown). The two zones are separated by a silt unit that acts as a confining layer (Ref. 31, p. 4-2). The saturated thickness of the shallow zone is approximately 30 to 40 feet. Depth to ground water is between 1 to 15 feet below ground surface (bgs). The horizontal direction of ground flow is generally to the south-southwest. Locally, Hilliards Creek, White Sand Branch, and Bridgewood Lake act as discharge zones for shallow ground water (Ref. 31, p. 4-2).

Sherwin-Williams terminated production at the Lucas plant in late 1976. The entire operation and facility were permanently closed on September 1, 1978 (Ref. 31, pp. 2-2, 2-6). Robert K. Scarborough purchased a portion of the facility from Sherwin-Williams sometime between June 26, 1981, and September 7, 1983. In 1983, Scarborough demolished most of the Sherwin-Williams facility and undertook various construction projects (Refs. 31, p. 2-2; 32, p. 5). The Paints Works Corporate Associates I (the Paint Works), a New Jersey-based corporation, purchased a portion of the plant from Sherwin-Williams sometime between June 26, 1981, and September 7, 1983. The Paint Works re-graded the plant (Ref. 32, p. 5). The Lucas plant is currently used as an office and light industrial park and is called the Paint Works Corporate Center (the Paint Works) (Ref. 6, p. 2-1).

Current Conditions

In 1981, a majority of the land encompassing the former Lucas plant or Sherwin-Williams plant was sold to Robert K. Scarborough and developed as a light industrial park known as “The Paint Works Corporate Center” (Refs. 6, p. 2-1; 31, p. 1-1). Development of the property included demolition or renovation of existing structures and construction of new office, manufacturing, and warehouse space (Ref. 31, p. 2-1). The current layout is presented in Reference 31, Figure 2-2. The center is made up of nine buildings. As of November 2001 when the RI/FS Work Plan was revised, 20 tenant companies occupied office, warehouse, and manufacturing space at the park (Ref. 6, p.2-2). Two of the tenants used hazardous materials including Academy Paints and Scotko Sign & Display Company. Both Academy Paints and Scotko Sign & Display, Inc., were listed by EPA as large-quantity generators. Scotko was listed as generating D001, F003, and F005 wastes. Both have terminated their lease and left the park (Ref. 6, p. 2-6). According to Sherwin-Williams, as of July 2006 there are 53 tenants with approximately 720 employees occupying office and warehouse space, and there is no manufacturing activity at the facility.

The north boundary of the corporate center is bounded by Silver Lake, which discharges into Hilliards Creek. Hilliards Creek transverses the corporate center in a northeast-southwest direction. The corporate center is bisected by Foster Avenue. The portion of the corporate center north of Foster Avenue is occupied by numerous buildings including former Buildings 14, 33, 55, 57, 58, and 82, a new building paralleling Foster Avenue, and a shed. The grounds surrounding the buildings are paved parking lots. The northernmost part of the corporate center along US Avenue, north of all the buildings, is a gravel parking lot. The area immediately south of Foster Avenue is occupied by buildings and is surrounded by paved parking lots (Ref. 31, p. 2-1 and Figure 3-2).

The corporate center is surrounded by residential properties (Ref. 31, p. 2-15). A public school, library, and municipal offices are located approximately 0.2 mile west of the corporate center, along Kirkwood Road. Silver Lake is located on the corporate center. A pedestrian walk surrounds Silver Lake, and a shooting range is located on the southern shore of Bridgewood Lake. Bridgewood Lake is located south of the corporate center along the south border of the Sherwin-Williams facility. Silver Lake discharges into Hilliard Creek through an underground culvert system that crosses under the parking lot between the lake and Foster Avenue. The creek returns to open flow 200 feet south of Foster Avenue (Ref. 31, p. 2-17).

Generally, the topographic gradient is from northeast to southeast. The corporate center is flat and graded toward storm water collection points. Near Hilliards Creek and Bridgewood Lake, the topographic gradient slopes gently toward these water bodies (Ref. 31, p. 2-8). Surface water runoff from the northernmost portion of the corporate center discharges directly into Silver Lake. The north-central portion of the corporate center is occupied by buildings and paved areas. Runoff generated in the area between Silver Lake and Foster Avenue enters a network of catch basins and storm sewers, which discharge into Hilliards Creek, immediately south of Foster Avenue (Ref. 31, p. 2-9).

Operational History: John Lucas and Company

The Lucas business was first established in March 1849 to import white lead, paints, and colors (Ref. 13, p. 3). The company was called “Gibbsboro White Lead, Zinc, and Color Works” (Ref. 17, p. D-10). From 1851 to 1930, John Lucas and Company owned and operated a paint and varnish manufacturing facility at the Lucas plant (Refs. 31, p. 2-2; 32, p. 2; 60, p. 6). The Lucas plant was constructed at the former location of a sawmill and, subsequently, a grain mill (Refs. 13, p. 4; 31, p. 2-2; 60, p. 15). John Lucas and Company developed and manufactured oil-based paints, varnishes, and lacquer (Ref. 31, p. 2-2).

The plant was expanded at various stages to accommodate new operations such as grinding white lead and colors in oils (Ref. 60, pp. 19, 26, 30). A historical map that shows locations of old buildings and structures is presented in Reference 6, Figure 2-4 and Refs. 3, 4, and 5. The expansions included more than 53 buildings and occupied only a portion of the current 60-acre property (Refs. 14; 15; 31, p. 2-3). In the early 1880s, the plant operations included dry color production, color grinding in oil, varnish production, and production of ready-mixed oil paint (Ref. 60, p. 30). During World War II, John Lucas and Company supplied protective finishes for many types of equipment, such as trucks, tanks, gun carriages, and barracks. The company also supplied marine finishes to the Maritime Fleet (Ref. 13, p. 10). Information on the constituents of marine finishes was not identified in the reference documentation.

The primary products manufactured by the John Lucas and company were white lead paint, varnish, and lacquer. Other products included dry colors produced from chemical reactions, blending, filtering, and drying; oil-based paints produced from grinding pigments in oil and adding thinners, oils, and hardeners; and ready-mixed linseed oil paints produced from blending linseed oil with pigments and thinners (Refs. 31, p. 2-3; 60, pp. 6, 8, 12, 22, 26). A memorandum prepared by John Lucas lists the following as components for Chinese blue paint manufactured by Lucas Paints: prussiate potash, copper sulphate, sulphate of iron, clear nitric acid, and sulphuric acid (Ref. 11).

The manufacturing history of John Lucas and Company began in 1849, and dry colors were among the first products manufactured (Refs. 12; 13, p. 1). Dry color was the largest operation at the Lucas plant through the end of the 19th century (Ref. 60, p. 33). Chrome yellow and Prussian blue were the two major pigments produced at the Lucas plant (Ref. 60, p. 37). John Lucas made the first chrome greens and chrome yellows produced in America. Mr. Lucas also introduced the use of brightening agents. Paints produced included white lead, white zinc, iron blues, Paris green, chrome orange, zinc yellow, lithol, para and toluidine reds, scarlet and maroon lakes, and alizarine colors (Refs. 12; 13, p. 1; 60, pp. 11, 17, 19, 22, 23). Prussian blue, paste paints, pure linseed oil liquid paints, French greens, Swiss green, Chinese blue, and laundry blue also were manufactured (Refs. 13, pp. 3, 6, 7; 17, p. D-11; 60, pp. 17, 19, 22, 24). Reference 16 provides a comprehensive list of paints and products manufactured by Lucas. The basic pigments used by Lucas were lead and zinc oxides, white lead, non-lead chrome green, and chrome yellow. White lead was ground at the plant (Refs. 8, p. 3; 60, pp. 1, 19 20, 21, 42). Lucas produced 24 different varieties of varnish (Ref. 60, pp. 22, 73).

Many of the buildings on the Lucas plant were used to store paint and drums. Materials stored included varnish, colors, oil, lacquer, paint, dry colors, coal, and sludge (Refs. 4; 5; 14; 15, pp. 1 through 6; 60, p. 29) (see Figure 2-4 in Reference 6). Raw materials Lucas used included calcined acetate of lead, lead oxide, zinc oxide, lead chromate, ferrous sulfate, sulfuric acid, linseed oil, and various paint solvents (Refs. 31, p. 2-3; 60, pp. 10, 26). The operations south and southwest of Silver Lake involved manufacturing, refining, storage, handling, and transporting hazardous substances above ground and below ground. These areas contained drums of oils and varnishes and tank farms and railroad tankers of lacquers, solvents, caustic solutions, and petroleum-based products. All the products were used in the paint manufacturing industry (Ref. 10, p. 9).

During the 1880s, storage tanks for oils and oil-based paints were installed in the area of Tank Farm A. In 1887, a rail spur was installed at the facility to improve transportation and handling of raw materials and finished goods (Ref. 31, pp. 2-3, 2-4).

Several disasters occurred at the Lucas plant, including a flood in 1940 and two fires between 1905 and 1949 (Refs. 13, p. 11; 31, p. 2-5; 32, p. 3). In 1905, a fire occurred in Building 32, the Varnish Filter House, where varnish was thinned and filtered. The second fire occurred on September 18, 1915, inside Building 39, which was used as a dry color paint mill at the time (Refs. 31, pp. 2-5, 2-6; 60, pp. 33, 66).

Operational History: Sherwin-Williams Company

SITE SUMMARY (Continued)

In approximately 1930, Sherwin-Williams acquired control of Lucas plant; however, Mr. Lucas continued to operate the plant until 1967 (Refs. 8, p. 1; 17, p. D-12; 31, p. 2-2; 32, p. 2). Sherwin-Williams operated the Lucas plant from 1967 until production ended at the plant in late 1976 or early 1977 (Refs. 8, p. 1; 31, p. 2-2; 32, p. 2). Sherwin-Williams closed the plant permanently on September 1, 1978 (Ref. 31, p. 2-2).

When it was owned and operated by Sherwin-Williams, the plant included an area for unloading raw materials from railroad cars; tank farms for raw materials including storage tanks constructed prior to 1908; storage areas for drummed raw materials; an industrial and domestic wastewater treatment and disposal system consisting of unlined percolation/settling lagoons; a solid waste disposal area for paint sludges; an extensive system of pipes to transport raw materials; and a drum cleaning area. Raw materials were mixed and processed in a number of specialized buildings in the plant (Refs. 4; 5; 32, p. 2) (see Figure 2-4 in Reference 6). Raw materials stored on the plant included V.M.&P. naphtha (8,000 gallons), xylene (26,000 gallons), mineral spirits (100,000 gallons), toluene and solvent blends (65,000 gallons), and aromatic naphtha (1,500 gallons) (Refs. 4; 5; 31, Table 2-2; 32, pp. 2, 3).

From 1967, the plant manufactured interior and exterior house paint, latex, and oil-based interior and exterior house paint until 1975, lacquer finishes until 1975, and polymerized oils and formulated dyes until 1972 (Ref. 8, p. 1).

Sherwin-Williams expanded the operations at the plant. Office and manufacturing facilities occupied one-third of the property, with the center of the plant located around Foster Avenue. During the 1930s, Sherwin-Williams terminated dry color production, but the plant continued to produce oil-based paints, varnishes, lacquers, and emulsion paints until December 1975. In 1956, Sherwin-Williams began production of alkyd or synthetic varnish, but this operation terminated in December 1975. The plant produced emulsion paints only between December 1975 and early 1977 (Ref. 31, p. 2-4).

Raw products used from approximately the late 1950s included titanium dioxide, a major component for products. The following products were used in resin production: polymers, pigments, linseed oil, soya oil, ray linseed oil, mineral spirits, refined linseed soil, glycerine, V.M.&P. naphtha, and xylene (used in resin production). The following materials were used in lacquer production: isobutyl alcohol; c.p. acetone; methyl amyl acetate; isopropyl acetate; xylene; lacquer solvent; toluene; toluene-based solvent blend; methyl ethyl ketone; ethyl acetate; methyl butyl ketone; and aromatic naptha. Pulp pigments, liquid mixers, and solvents were used in production of Sher-dye (Ref. 8, p. 2).

Raw materials were stored in aboveground storage tanks (ASTs) and underground storage tanks (USTs) in two areas on the plant: Tank Farm Areas A and B. Raw materials (paint pigments) were also stored in 55-gallon drums. Raw materials and finished goods were typically stored in former Buildings 55, 56, 57, 58, 62, and 67 (Ref. 31, p. 2-4 and Figure 2-2; 4; 5 ; 60, p. 68) (see Reference 6, Figure 2-4 and Reference 31, Figure 3-2). Between 1950 and 1977, wastewater generated from the manufacturing process was treated and disposed of in four unlined lagoons on the southern portion of the property (Ref. 31, p. 2-5) (see Reference 6, Figure 2-4 and Reference 31, Figure 3-2).

Several fires occurred at the plant; according to Sherwin-Williams, fires occurred in 1905, 1915, 1930, and 1949. The fire on February 21, 1930 destroyed Building 36, a warehouse used to store raw materials. After the fire in the former Building 36, a concrete foundation pad was used for exterior storage of drummed materials. Subsequently, on July 30, 1949, a fire destroyed 1,000 drums of nitrocellulose and lacquer stored on the concrete pad at Building 36 (Refs. 31, pp. 2-5, 2-6; 60, pp. 33, 66).

SITE SUMMARY (Continued)

Operational History: Robert K. Scarborough

In June 1981, a majority of the Lucas plant was sold to developer Robert K. Scarborough. Scarborough developed the former plant into a light industrial complex named The Paint Works Corporate Center. The center is made up of nine buildings (Ref. 31, p. 2-16). At present, 20 tenant companies occupy office, warehouse, and manufacturing space on the former plant property. In December 1997, a portion of the former plant property was sold to Brandywine Reality Trust (Refs. 18, p. 1-1; 31, p. 2-2).

History of Investigations:

In January 1990, the New Jersey Department of Environmental Protection (NJDEP) issued a Spill Act Directive to Scarborough (the owner of the Lucas plant property) and Sherwin-Williams Corporation (the former owner of the Lucas plant property) requiring that a remedial investigation and feasibility study (RI/FS) be conducted at the former Lucas plant and immediately adjacent lands. Sherwin-Williams subsequently entered into an Administrative Consent Order (ACO) with NJDEP to conduct the RI/FS (Ref. 31, p. 1-1).

The RI report covers activities conducted at the Lucas plant from August 1991 through January 2000 (Refs. 31, pp. 1-1, 1-2; 59, Appendix II, p. II17). Seeps located on the facility were identified as an area of Immediate Environmental Concern (IEC). Sherwin-Williams entered into an ACO with NJDEP to address this IEC. A soil vapor extraction (SVE) system and a free-phase product removal system were installed in the area of the seeps, and a free-product removal system was installed in the area of former Tank Farm A (Ref. 31, p. 1-5). According to Sherwin-Williams, it has conducted "significant investigations at The Paint Works and Hilliards Creek under EPA since 2000." Sherwin-Williams submitted Attachment 1 to its comments listing a series of past and ongoing activities conducted by Sherwin Williams (EPA-HQ-SFUND-2006-0242-0014).

2.2 SOURCE CHARACTERIZATION

2.2.1 SOURCE IDENTIFICATION

Name of source: Free-Phase Product

Number of source: 1

Source Type: Other

This source includes free-phase product present in ground water underlying the former Lucas plant in the areas of Building 50, Building 67, and Tank Farm A (Ref. 31, pp. ES-6, 3-30, 4-18, 4-19, 4-20). The three locations where free-phase product have been identified are referred to as seeps in reference documentation and are shown on Figure 2-2 in Reference 31 as seep areas. The free-phase product is composed of benzene, ethylbenzene, xylene, naphthalene, and 2-methylnaphthalene (Ref. 31, p. 4-25 and Table 4-20). Analysis of the product indicates that it is paint thinner (Ref. 31, p. 4-26) because there was no evidence of any organolead or organomanganese in the samples of the product (Ref. 31, p. 4-27). A free-phase product recovery (FPR) and soil vapor extraction (SVE) system have been installed in the area of Buildings 50 and 67 to recover the free-phase product (Refs. 31, pp. 3-24, 3-25; 48, Figure 2-1). (A separate gasoline ground water plume is located west of Building 67 and is not evaluated in this HRS documentation record [Ref. 31, Figure 3-2 and Appendix K, Figures 4-11 and 4-12].)

The potential sources of the free-phase product plume are Tank Farm A (Ref. 31, pp. 2-3, 2-4, and Table 2-2); operations in Lucas plant Buildings 50, 55, and 67 (formerly Building 36) including the transfer and temporary storage of process chemicals (Refs. 6, Figure 2-4; 31, Figure 3-2; 59, Appendix II, p. II-57; 60, p. 68) and storage of product in Building 36 or platform 36 (Ref. 6, Figure 2-4); a 6-inch terra-cotta pipe leading from Building 50 (Paint Works Maintenance Shop) (Ref. 18, pp. 3-4, 3-5); two 6,000-gallon vertical steel AST formerly containing mineral spirits 66-2 and 802-15 alkyd resin adjacent to Building 50 (Ref. 18, pp. 3-5, 4-1); hazardous material and hazardous waste storage adjacent to Building 50 (Ref. 31, p. 6-3); the Lucas plant solvent railroad and truck tank unloading station on the north side of Building 67 (Refs. 7, pp. 4 through 11, 17; 6, Figure 2-4); storage areas for empty and dirty drums east of Building 67 (Ref. 5); contamination in the Building 67 parking lot (Ref. 31, p. 3-3); leakage of storage lagoons or drums that were once stored behind Building 67 (between Building 67 and 50); spillage from tank cars (Ref. 10, pp. 18, 19); and two USTs, one for oil and another for solvent, located in the parking lot located east of Building 67 (Ref. 65, p. 1). Storage lagoons are identified as a source in Reference 10, pages 18 and 19; however, no storage lagoons in the area of Buildings 50 and 67 are observed in aerial photographs or discussed in the reports for any other investigations at the plant.

The free-phase product plume present in the ground water underlying Buildings 50 and 67 and former Tank Farm A, has been characterized by the collection of product samples and soil samples as documented in the sections below. Numerous investigations have been conducted in the area of the free-phase product plume associated with Buildings 50 and 67. A summary of those investigations is provided in the section below.

Free-Phase Product - Buildings 50 and 67

The reference documentation for the free-phase product identified product on west side of Building 50 and on the north and east sides of Building 67. The narrative discussion in the reference documentation describes the two free-phase product locations together. It is therefore, difficult to separate the discussion of the free-phase product in area of Building 50 from the free-phase product in area of Building 67 (Ref. 31, Figure 2-2 [shown as seep areas], pp. 3-2 through 3-7, 3-8 through 3-12, 3-22, 3-23 through 3-25, 4-18 through 4-24, 5-5, 5-6). The two locations of free-phase product have a similar migration pathway. Free-phase product released to Hilliards Creek at the location where the creek emerges from underground, south of Foster Avenue, resulted from the migration of free-phase product into the storm sewer system from free-phase product located on the west side of Building 50 and east side of Building 67 (Ref. 31, p 3-6) (shown as seep areas on Figure 2-2 of Reference 31).

The free–phase product plume in ground water near Buildings 50 and 67 was initially identified in 1983 when an oily substance was observed in the parking lot between former Buildings 50 (currently police station) and 67 (also known as the Academy Paints Building). The oily substance flowed overland to a storm water catch basin in the parking lot then into a storm sewer that discharged into Hilliards Creek (Refs. 32, p. 5; 65, pp. 1, 2, 3). The product was observed on many occasions during construction of the corporate center that now occupies the former Lucas plant (Ref. 65, p. 1).

In February 1985 and 1987, product was observed in the parking lot between Buildings 50 and 67 and flowing from the eastern bank of Hilliards Creek (Refs. 6, Figure 2-4; 10, pp. 1, 2; 31, p. 3-3 and Figures 2-2 and 3-2; 32, pp. 5, 6).

Note: Numerous reports describing investigations conducted in this area refer to Building 67 as the former Academy Paints Building (former occupants of the building) and Building 50 as the Gibbsboro Police Station Building (current occupants of the building). Building 67 is the former location of Lucas plant Building 36 (Refs. 6, Figure 2-4; 31, Figure 3-2). On February 21, 1930, a fire destroyed Building 36, which was a warehouse used to store raw materials. After the fire, the concrete foundation pad for the former Building 36 was used for exterior storage of drummed materials (Refs. 31, pp. 2-5, 2-6; 60, pp. 33, 66; 7, p. 5). Lucas used Building 50 as a garage (Ref. 60, p. 99). Hazardous material and hazardous waste were stored adjacent to Building 50 (Ref. 31, p. 6-3).

In 1987, after free-phase product was observed flowing into Hilliards Creek, the New Jersey Department of Water Resources (DWR) issued a directive to Sherwin-Williams requesting that actions be taken to mitigate the release to Hilliards Creek (Ref. 10, p. 1). Sherwin-Williams refused to comply with the DWR directive. However, the owner of the property at the time, Scarborough, procured an environmental contractor to mitigate the release. An enclosure was constructed to prevent product from flowing through the parking lot into a storm water inlet and finally into Hilliards Creek. The product in the enclosure was pumped out and disposed of off the property. As of July 1987, 4,200 gallons of product were collected and disposed of off the property (Refs. 10, p. 2; 32, pp. 6, 7).

Observations during the 1987 investigations included product flowing from the bank of Hilliards Creek, product flowing from cracks in the pavement in the parking lot between Buildings 50 and 67 and other areas in the parking lot, and severe contamination in soil (Ref. 10, pp. 9, 18). Oil-absorbent booms and filter fences were installed in the area surrounding the seep and at the rip-rap channel and storm water conveyance to collect free-phase product. The rip-rap channel collected surface water runoff from the parking lot and directed the water to Hilliards Creek. A berm was constructed around the seep in the parking lot, and a temporary bypass was constructed in Hilliards Creek, conveying Hilliards Creek around the product that emanated from the creek. A bulkhead was constructed around the perimeter of the product that emanated into the creek (Ref. 10, pp. 2, 3).

Free-phase product entered the storm sewer system when the water table was high, indicating the product is associated with a ground water plume underlying the Lucas plant and extending to Hilliards Creek (Refs. 6, p. 3-47; 18, p. 2-3). On February 19, 1988, and again on February 25, 1988, NJDEP observed product discharging into Hilliards Creek (Refs. 36; 37).

In 1989, NJDEP submitted a sample of the product to an analytical laboratory for comparison to known petroleum and solvent products. The comparison indicated that constituents in the product sample were most similar to a mixture of solvents and to 627 solvent (a solvent), Varsol 18 (an oil), and mineral spirits (a solvent) (Refs. 63, pp. 1, 2; 56).

In 1994, free-phase product began to enter a storm sewer north of Building 67. The free-phase product was removed (Ref. 31, p. 3-22). Based on the potential for repeated seepage of product into a leaky storm water system, NJDEP identified this area as an area of IEC. NJDEP issued a directive to Sherwin-Williams to address this IEC. A FPR and SVE system were installed after a focused feasibility study (FFS) and a remedial action work plan (RAW) had been completed for the area of free-phase product. Passive skimmers were installed in the thickest free-phase product to recover mobile product. The leaky portion of the storm sewer was excavated and replaced with a sealed system to prevent infiltration of free-phase product. Free-phase product removal equipment was also installed in the area of former Tank Farm A (Ref. 31, pp. 1-5, 3-22, 3-23).

In 1995, Sherwin-Williams entered into an ACO with NJDEP to conduct an RI/FS in the area os Source 1 and to remove free-phase product (Refs. 18, p. 1-1; 61).

Sherwin-Williams conducted the following remedial actions in the area of Source 1:

- Removal and disposal of the former wooden containment structure installed by the owner of the property when the contamination was discovered.

- Removal and disposal of contaminated soils and ground water from the area east of Hilliards Creek and west of the police station (Building 50) (Ref. 18, p. 1-1).

- Excavation of exploratory trenches in the area immediately west of the police station building (Building 50).

- Replacement of storm sewer immediately north of the Building 67.

- Installation of a FPR and SVE system on the east side of Building 67 (Refs. 6, pp. 3-47 through 3-52; 18, p. 1-2; 31, pp. 3-22, 3-23, 3-24; 48, Figure 2-1).

The aboveground treatment system consisted of a free-phase product collection and holding tank and the SVE/Thermal Oxidizer skid (Ref. 31, p. 3-25).

In 1996, while investigating the free-phase product plume at Buildings 50 and 67, a 6-inch terra-cotta pipe leading from Building 50 to Hilliards Creek was uncovered. The pipe end was encountered 3 feet bgs, and the pipe extended 10 feet to the west from Building 50 toward Hilliards Creek. The end of the pipe was exposed. The pipe terminated abruptly, and no french drain or sump was found at its terminus. Free-phase product was present in the interior of the pipe. The pipe was traced to a floor drain in Building 50. The pipe was above the water table; therefore, the product found in the pipe was not introduced by contaminated ground water. The seep on the west side of Building 50 was attributed to the pipe (Ref. 18, pp. 3-4, 3-5, 4-1). Since John Lucas and Company used Building 50 as a garage, the free-phase product may have resulted from the discharge of petroleum-type wastes (Refs. 6, Figure 2-4; 60, p. 99).

Also while investigating the free-phase product plume at Buildings 50 and 67, additional product was identified in the former location of two ASTs used by Academy Paint, a tenant of Building 67, to store mineral spirits 66-2 and 802-15 alkyd resin (Ref. 18, pp. 3-4, 3-5, 4-1, Figure 3-1). The AST were located on the south side of Building 50 (Ref. 18, Figure 3-1).

During the removal action in 1996, Sherwin-Williams recovered 13,910 gallons of the mixture of nonhazardous liquid, water, and oil from Buildings 50 and 67 free-phase product plume and disposed of the material off the property (Refs. 18, pp. ES-1, 3-5; 31, p. 3-24). After remedial action was completed, residual contamination remained in the area of the Lucas plant property and Hilliards Creek (Refs. 18, pp. ES-1, 4-1; 31, Figure 3-2).

In November 1997, the installation of the FPR and SVE system was completed east and north of Building 67 and south of Building 50 (Ref. 48, pp. 1-1, 2-2, 3-1, Figure 2-1). As of June 20, 2002, a total of 44,785 gallons of product/water mixture have been recovered and removed off site for disposal since startup of the system in November 1997. Approximately 8,275 gallons of this total volume collected was primarily product from the product recovery tank. The remaining 36,510 gallons of product/water mixture were collected during the ground water seep response and recovery efforts associated with the FPR and SVE system (Ref. 48, p. 2-1).

On April 9, 2002, free-phase product from the free-phase product recovery system was observed in the storm water drain north of Building 67 and in Hilliards Creek. Product was pumped out of the storm water drain, and additional measures were taken to prevent further releases to the drain and Hilliards Creek (Refs. 48, p. 2-3; 72, pp. 2, 4; 73, pp. 2, 4).

Location of the source, with reference to a map of the site: Source 1 is located on the west side of Building 50, on the east and southeast sides of Building 67, the storm sewer system north of Building 67, and in the area of Tank Farm A. Figure 2-2 of Reference 31 shows the three seep areas: one on the west side of Building 50, one on the east side of Building 67, and one in the area of Tank Farm A and the location of the sewer. The seep areas are the locations where free-phase product was observed at the ground surface or in on-site monitoring wells.

Containment:

__Release to ground water__: Migration of hazardous substances from the source area has been documented; therefore, a containment factor value of 10 is assigned to this source. Additionally, as documented in the section above, the source does not have a liner or containment system (Ref. 1, Table 3-2).

__Release via overland migration and/or flood__: Migration of hazardous substances from the source area has been documented; therefore, a containment factor value of 10 is assigned to this source. Additionally, as documented in the section above, a maintained engineered cover, or functioning and maintained run-on control system and runoff management system, is not associated with Source 1 (Ref. 1, Table 4-2).

__Gas release to air__: The air migration pathway was not scored.

__Particulate release to air__: The air migration pathway was not scored.

2.4 WASTE CHARACTERISTICS

2.4.1 Hazardous Substances:

Samples of free-phase product and soil are used to characterize the hazardous substances associated with Source 1. The soil samples were collected from locations where free-phase product was observed. The sections below provide a description and documentation of the free-phase product and soil samples collected to characterize Source 1.

Free-Phase Product

On February 7, 1985, NJDEP personnel collected an aqueous sample of product while it was discharging into Hilliards Creek (Ref. 32, pp. 5, 6). The following hazardous substances were detected in product sample: 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, naphthalene, xylenes, ethylbenzene, cumene, and tetrachloroethene (Ref. 32, pp. 6, 7).

In February 1987, product was observed in the parking lot between Buildings 50 and 67 and flowing from the eastern bank of Hilliards Creek. An aqueous sample was collected from the product flowing into Hilliards Creek, and a sediment sample was collected below the bituminous layer of the parking lot where the product was observed (Refs. 6, Figure 2-4; 10, pp. 1, 2; 31, p. 3-3 and Figures 2-2 and 3-2).

The free-phase product ground water plume was investigated during five phases of the RI for the Lucas plant (Ref. 31, p. 3-3). The RI identifies five areas of environmental concern (AEC). The seep areas or areas where free-phase product was observed at the surface in the areas of Buildings 50 and 67, were identified as AEC III. AEC III was combined with AEC I, Tank Farm A, because of similarities in the nature of contaminants (Ref. 31, p. 3-1). Figure 3-1 of Reference 31 shows the AECs, and Figure 2-2 of Reference 31 shows the location of three seeps one on the west side of Building 50, one on the east side of Building 67, and one in the southern section of the former location of Tank Farm A.

The RI report for the five phases of the investigation refers to AEC I/III when presenting analytical data collected for the free-phase product ground water plume. Figure 3-2 of Reference 31 was used to identify sampling locations specifically associated with the free-phase product.

During Phase II activities, from June 1993 through October 1993, three well points (WP-1, WP-2, and WP-3) were installed to delineate the free-phase product ground water plume detected in MW-13 (Ref. 31, pp. 3-3, 3-15). Samples of free-phase product were collected from the MW-11 (located on the southern end of Tank Farm A) and MW-13 (located east of Building 67) (Ref. 31, p. 3-17, Figure 3-2). Analytical results for the product sample collected from MW-11 on August 6, 1993 indicated the presence of 2-methylnaphthalene (360 milligrams per liter [mg/L]), 4-chloroaniline (320 mg/L), naphthalene (930 mg/L), chlorobenzene (100 mg/L), ethylbenzene (at an estimated concentration of 520 mg/L), and xylene (at 4,600 mg/L) (Ref. 31, Table 4-20). The product sample collected from MW-13 on August 6, 1993 contained 2-methylnaphthalene (1,800 mg/L), naphthalene (6,200 mg/L), benzene (at 110 mg/L), ethylbenzene (1,200 mg/L), and xylene (2,100 mg/L) (Ref. 31, Table 4-20).

During Phase III activities, from July 1995 through August 1995, 45 hand-augered borings were located throughout the seep area to attempt to delineate the extent of free-phase product through photoionization detector (PID) field screening and visual observation. No samples were collected from these locations (Ref. 31, pp. 3-3, 3-18). Additional monitoring wells were installed, and two rounds of ground water samples were collected (Ref. 31, p. 3-19). On July 14, 1995, samples of the free-phase product were collected from the MW-11 (located on the southern end of Tank Farm A), MW-13 (located east of Building 67), and MW-21 (southeast of Building 67) (Ref. 31, p. 3-17, Figure 3-2). Anaytical results for the product sample collected from MW-11 indicated the presence of naphthalene (at an estimated concentration of 600 mg/L), ethylbenzene (66 mg/L), and xylene (2,500 mg/L). The product sample collected from MW-13 contained naphthalene (at 3,200 mg/L), benzene (at 570 mg/L), ethylbenzene (at 1,400 mg/L), and xylene (at 7,500 mg/L). Analytical results for the product sample collected from MW-26 indicated 2-methylnaphthalene (at an estimated concentration of 460 mg/L), naphthalene (1,600 mg/L), and xylene (420 mg/L) (Ref. 31, Table 4-20).

Also during the Phase III activities, free-phase product was measured for the mobile thickness of the product, the volume of recoverable product, and the recharge rates of the product (Ref. 31, p. 3-20). A bail-down test was conducted to identify the thickness of the product (Ref. 31, Appendix K, Tables E1 through E4).

The bail-down test completed in WP-3 in the area of the Building 50 indicated that the thickness of the product in July 1995 as 0.33 foot and in August 1995 as 0.48 foot (Ref. 31, Figures 4-11 and 4-12). The bail-down test completed in the area of the Building 67 indicated that the thickness of the product in July 1995 at MW-21 as 2.21 feet, at MW-13R as 0.98 foot, and at WP-1 as 1.33 feet (Ref. 31, Figure 4-11). In August 1995 the thickness of product was recorded at MW-21 as 0.66 foot, at MW-13R as 1.28 feet, and at WP-1 as 1.33 feet (Ref. 31, Figure 4-12). The bail-down test completed in MW-11 in the area of the Tank Farm A identified the thickness of product as 1.47 feet in July 1995 and 0.45 foot in August 1995 (Ref. 31, Appendix K, Table E2, and Figures 4-11 and 4-12). The lateral extent of three separate product plumes in ground water are shown on Figures 4-11 and 4-12, Appendix K, Reference 31. The plumes are considered separate because of the absence of product in the monitoring wells located between the plumes (Ref. 31, p. 4-20).

The hazardous substance and concentrations detected in product samples collected from MW-11, in the area of Tank Farm A, and from MW-13, in the area of Building 67 are similar (Ref. 31, Table 4-20, Figure 3-2). The fingerprint analysis of a sample of free-phase product from the storm sewer indicated that the product most closely resembled degraded mineral spirits (Ref. 75, p. 15). Therefore, the product in ground water in the areas of Tank Farm A and Building 67 may be from the release of mineral spirits from Tank Farm A and Building 67. Both areas were used for the storage of mineral spirits (Refs. 4; 5; 6; 31, 2-4, Table 2-2, Figure 2-2; 60, pp. 68 and 99).

According to the RI report, the source of free-phase product on the west side of Building 50 may be from the discharge of waste oils to soils over time, migration of free-phase product from the former Academy Paints hazardous materials storage area, or the Lucas maintenance shop formerly located in Building 50 (Ref. 31, pp. 4-23 and 4-24).

The RI report provides a discussion of the composition of the free-phase product. Much of the analytical data supporting the discussion are not in the RI report. Analytical data are presented for product samples collected from MW-11, MW-13, MW-21, and MW-26 in Table 4-20 of the RI report. The report stated that xylene was the VOC detected at the highest concentration, and of the base/neutral acids, naphthalene was detected at the highest concentration. The majority of the product constituents are tentatively identified compounds (TIC). VOC TICs consist primarily of unknown substituted benzenes. Semivolatile organic compound (SVOC) TICs include cycloalkanes, alkanes, benzenes, and unknown polycyclic aromatic hydrocarbons (PAH) (Ref. 31, p. 4-25). Two free-phase product samples collected from MW-11 and SVE Vent No. 6 located west of Building 67 were analyzed by American Society for Testing and Materials (ASTM) D5134 (Component Analysis) (Refs. 31, p. 4-26, Figure 3-2; 48, Figure 2-1). The ASTM D5134 analysis provided identification of an exhaustive list (the list was not provided in the RI report) of hydrocarbon compounds, that are not typically analyzed for and quantified by routine SW846 methods. The result of the free-phase product analyses were compared to the results of analyses of fresh samples of gasoline and paint-thinner. The comparison was done by principal component analysis (PCA). The PCA suggested that the samples were more related to paint-thinner rather than gasoline. However, because the comparison was of unweathered and degraded standard against weathered and biodegraded environmental samples, the correlation was regarded with limited confidence (Ref. 31, p. 4-26).

One ground water sample (MW-36 located 150 feet south of Building 67) was collected and analyzed by Modified EPA Method 8015 (capillary gas chromatography). No free-phase hydrocarbons could be recovered from the ground water sample (Ref. 31, p. 4-26, Figure 3-2).

The RI report states that 14 free-phase product samples were analyzed for petroleum hydrocarbon products. Analytical data for the analysis of the product samples are not presented in the RI report. No evidence of the presence of any organolead or organomanganese compounds were found in any of the free-phase product samples. Two free-phase product samples collected from SVE-3 and MW-36, located east and south of Building 67, respectively, contained no petroleum product (Refs. 31, p. 4-27, Figure 3-2; 48, Figure 2-1). (Note: The location and definition of SVE-3 is not in the RI report. SVE probably indicates soil vapor extraction and the number represents the vent number as shown on Figure 2-1 of Reference 48). The report indicates that analytical results for product samples revealed the presence of a biodegraded, low boiling point petroleum hydrocarbon (Ref. 31, p. 4-27). From the report is not clear where these product samples were collected. However, the report does indicate that the product in the area of Source 1 may be a mixture of solvents and waste petroleum product.

On April 9, 2002, free-phase product from the FPR and SVE system was observed in the storm water system (catch basin A and inlet C) and rip-rap north of Building 67 and in Hilliards Creek. The product was pumped out of the storm water drain, and additional measures were taken to prevent further releases to the drain and Hilliards Creek (Refs. 48, p. 2-3; 72, pp. 2, 4; 73, pp. 2, 4). As shown on Figure 2-4 of Reference 48, inlet A is the catch basin in the parking lot north of Building 67 that drains to the storm sewer that runs from east to west to rip-rap and finally to Hilliards Creek. Inlet C is located on the western end to the storm sewer system just east of the discharge point of the storm water system to the rip-rap (Ref. 48, Figure 2-4). Figure 2-1 of Reference 48 shows the location of the vertical vents and the layout of the FPR and SVE system.

On April 10, 2002, samples of the free-phase product were collected and analyzed for VOCs, petroleum products, and fingerprinted (Ref. 75, pp. 2, 4, 5). The concentrations of hazardous substances detected in the product sample are in the units of micrograms per kilogram (µg/kg) indicating that the sample was analyzed as a solid. Analytical results for the samples indicated the presence of benzene (up to 240,000 µg/kg), ethylbenzene (up to 4,600,000 µg/kg), xylene (up to 26,000,000 µg/kg), naphthalene (up to 1,800,000 µg/kg), 2-methylnaphthalene (up to an estimated concentration of 400,000 µg/kg), and numerous TICs (Ref. 75, pp. 6, 7, 8). The fingerprint analysis indicated that the product samples most closely resembled degraded mineral spirits (Ref. 75, p. 15).

Analytical results for the wastewater sample from the product tank indicated an estimated concentration of benzene and ethylbenzene and the presence of m/p xylenes, naphthalene, and 2-methylnaphthalene (Refs. 76, pp. 8, 9; 77, p. 35). Metals detected in the product tank include aluminum, arsenic, chromium, copper, iron, lead, magnesium, manganese, selenium, and zinc (Ref. 77, p. 75). The toxicity characteristic leaching procedure (TCLP) analysis revealed benzene (230 micrograms per liter [μg/L]) (Ref. 77, p. 31). The inlet C sample analysis revealed an estimated concentration of benzene and the presence of ethylbenzene, m/p- xylenes, naphthalene, and 2-methylnaphthalene (Refs. 76, pp. 10, 11; 77, p. 39). The only TCLP metal detected in the inlet C sample was lead (455 μg/L) (Ref. 77, p. 82). The inlet C water sample analysis revealed an estimated concentration of benzene, the presence of ethylbenzene and m/p-xylenes, and estimated concentrations of naphthalene, 2-methylnaphthalene, and fluoranthene (Ref. 76, pp. 12, 13, 19, 20). Metals were also detected in the inlet C water sample, including aluminum, arsenic, barium, chromium, copper, iron, lead, magnesium, manganese, and zinc (Ref. 77, p. 76).

As of June 30, 2002, the FPR system recovered approximately 44,785 gallons of product and /or water since startup of the recovery system in November 1997. Approximately 8,275 gallons of this total volume collected is primarily product from the product recovery tank. The remaining 36,510 gallons or product/water mix were collected during the ground water seep response and recovery efforts associated with inlets A and C (Ref. 48, p. 2-1).

In May 2003, EPA's environmental consultant collected samples of the free-phase product mixed with water from basin A, inlet C, and the rip-rap. The samples were analyzed for target compound list (TCL) VOCs, SVOC, pesticides and polychlorinated biphenyls (PCB), target analyte list (TAL) metals and cyanide, gasoline range organics (GRO), diesel range organics (DRO), percent sulfur, percent ash, Kjeldahl nitrogen, pH, and flashpoint. The analytical results confirmed the presence of benzene, ethylbenzene, xylene, naphthalene, and 2-methylnaphthalene (Ref. 78, pp. 16, 11). Other constituents of the product sample included the following metals: aluminum (up to 9,150 μg/L), arsenic (up to 51.2 μg/L), barium (up to 408 μg/L), chromium (up to 33.3 μg/L), copper (up to 79.0 μg/L), iron (up to 95,200 μg/L), lead (up to 139 μg/L), magnesium (up to 23,000 μg/L), manganese (up to 1,380 μg/L), and zinc (up to 413 μg/L) (Ref. 78, pp. 15, 16).

Hazardous substances associated with the analytical results from product samples collected from Source 1 and discussed above are summarized in Table 1 (Ref. 31, pp. 4-18 through 4-24). As documented in Table 1, free-phase product samples were collected from seeps (product) emanating from the ground surface, monitoring wells, and the FPR and SVE system. The analytical data presented in Table 1 from Reference 31 are from the analysis of free-phase product samples collected from on-site monitoring wells. Reference 32 provides analytical data for the analysis of a discharge to a creek. The seep (free-phase product) was continuously discharging into the creek (Ref. 32, pp. 5, 6). The analytical data presented in References. 76 and 77 are for a product sample collected from the product tank associated with the FPR system, inlet C, and rip-rap area where the storm sewer discharges (Refs. 77, p. 2; 48, Figure 2-4). The analytical data presented in Reference 78 are from basin A (the storm sewer basin in the parking lot adjacent to Building 67), inlet C, and the rip-rap area (Refs. 78, p. 1; 79). The analytical data presented in Reference 79 are from a sample collected from the product tank associated with the FPR system and a bi-phase sample collected from inlet C (an inlet in the storm sewer) (Refs. 48, Figure 2-4; 76, p. 1).

TABLE 1

HAZARDOUS SUBSTANCES ASSOCIATED WITH SOURCE 1

Hazardous Substance	Evidence	Reference
Metals		
Aluminum	Product sample	77, pp. 1, 2, 75, 76; 78, pp. 1, 5, 16
Arsenic	Product sample	77, pp. 1, 2, 75, 76; 78, pp. 1, 15, 16
Barium	Product sample	77, pp. 1, 2, 76; 78, pp. 1, 15, 16
Chromium	Product sample	77, pp. 1, 2, 75, 76; 78, pp. 1, 15, 16
Copper	Product sample	77, pp. 1, 2, 75, 76; 78, pp. 1, 15, 16
Iron	Product sample	77, pp. 1, 2, 75, 76; 78, pp. 1, 15, 16
Lead	Product sample	77, pp. 1, 2, 75, 76; 78, pp. 1, 15, 16
Magnesium	Product sample	77, pp. 1, 2, 75, 76; 78, pp. 1, 15, 16
Manganese	Product sample	77, pp. 1, 2, 75, 76; 78, pp. 1, 15, 16
Zinc	Product sample	77, pp. 1, 2, 75, 76; 78, pp. 1, 15, 16
Volatile Organic Compounds		
Benzene	Product sample	31, pp. 4-25, 6-9, Table 4-20, Figure 3-2; 32, pp. 5, 6; 75, pp. 2, 6, 12; 76, pp. 1 through 4, 12; 77, pp. 10, 19, 31; 78, p. 1; 79, pp. 2, 4
Cumene	Product (seep) sample	32, pp. 6, 7
Ethylbenzene	Product (seep) sample	31, pp. 4-25, 6-9, Table 5-20, Figure 3-2; 32, pp. 6, 7; 75, pp. 2, 6, 9, 12; 76, pp. 1 through 4, 9, 13; 77, pp. 11, 20; 78, p. 1; 79, p. 5
Tetrachloroethene	Product (seep) sample	32, pp. 6, 7
1,2,4-Trimethyl benzene	Product (seep) sample	32, pp. 6, 7

TABLE 1 (Continued)

HAZARDOUS SUBSTANCES ASSOCIATED WITH SOURCE 1

Hazardous Substance	Evidence	Reference
Volatile Organic Compounds (Continued)		
1,3,5-Trimethyl benzene	Product (seep) sample	32, pp. 6, 7
Xylene	Product (seep) sample	10, pp. 25, 27; 31, pp. 4-25, 6-9, Table 5-20; Figure 3-2 in Reference 31; 32, pp. 6, 7; 75, pp. 2, 6, 9; 76, pp. 1 through 4, 9, 13; 77, pp. 11, 20; 79, pp. 2, 5
Semivolatile Organic Compounds		
Benzo(a)pyrene	Product sample	78, pp. 1 through 4, 13; 79, p. 28
Chrysene	Product sample	78, pp 1 through 4, 13; 79, p. 28
Fluoranthene	Product sample	76, pp. 1 through 4, 9, 20; 77, p. 45; 78, pp. 1 through 4, 10; 79, p. 23
2-Methylnaphthalene	Product (seep) sample	31, pp. 4-25, 6-9, Table 5-20, Figure 3-2; 75, pp. 2, 6, 9, 19, 35, 44; 78, pp. 6, 11; 79, pp. 12, 17
Naphthalene	Product (seep) sample	31, pp. 4-25, 6-9, Table 5-20, Figure 3-2; 32, pp. 6, 7; 75, pp. 2, 6, 9; 76, pp. 1 through 4, 16, 19, 35, 44; 78, pp. 6, 9, 11; 79, pp. 12, 17, 22

Soil Samples - Source 1

1987 Investigation

In 1987, contaminated soil was identified in the area of Buildings 50 and 67 during a subsurface soil investigation (Ref. 10, p. 5). The source of the contaminated soil is the free-phase product. Soil samples were analyzed for priority pollutants and total petroleum hydrocarbons (Ref. 10, p. 6), revealing the presence of petroleum hydrocarbons, VOCs (xylene), SVOCs [pentachlorophenol, di-n-butyl phthalate, bis(2-ethylhexyl)phthalate)], cyanide, chromium, copper, and lead (Ref. 10, pp. 10 and 25 through 39).

Remedial Investigation

Hazardous substances associated with Source 1 were identified during numerous soil sampling investigations conducted in the area of the free-phase product ground water plume. The most recent investigation was a five-phase RI for the Lucas plant (Ref. 31, p. 3-3). The soil samples collected during the RI are used to characterize Source 1 because the soil contamination is a result of the ground water plume. The RI identifies Source 1 as AEC I/III (Ref. 31, p. 3-3 to 3-6). The RI report refers to AEC I/III when soil samples were collected from Source 1. Figure 3-2, in Reference 31, was used to identify soil sampling locations specifically associated with Source 1, free-phase product.

Soil samples were collected from Source 1 during three phases of the RI as described in the sections below.

<u>Phase I RI</u>

Soil samples were collected in the area of Source 1 (AEC I/III) (Ref. 31, p. 3-7) from August 1991 through January 1992, during a Phase I RI for the Lucas plant (Ref. 31, p. 3-3). The Phase I RI focused in the seep area (ground water plume in the area of Buildings 50 and 67) and Tank Farm A. Four test borings (TB-6, TB-7, B-13, and TB-14) were drilled in the area of the free-phase product identified near Building 67 (Ref. 31, Figure 3-2). Two soil samples were collected from each boring at 0 to 2 feet below the bgs and at the water table. The samples were analyzed for Priority Pollutant Volatile Organic Analysis plus 15-non target compounds (PP VOA+15), Priority Pollutant Base Neutral Analysis (PP BNA), lead, chromium, and barium. Two of the test borings were converted into monitoring wells. The monitoring wells, MW-13 and MW-14, were sampled and analyzed for PP VOA+15, PP BNA, lead, chromium, barium, and phenols (Ref. 31, p. 3-11). Free-phase product was identified in both MW-13 and MW-14 (Ref. 31, p. 4-18, Table 4-20). MW-14 is located adjacent to the storm sewer systems where free-phase product has been recovered. The storm system is known to leak product to the surrounding area (Ref. 31, pp. 1-5, 3-22, 3-23, Figure 3-2).

Six soil borings (TB-1 through TB-4, TB-11 [converted to MW-11], and 12 [converted to MW-12]) were installed in and around the free-phase product ground water plume in the area of former Tank Farm A. The soil borings were drilled to a depth of 10 to 20 feet bgs (Ref. 31, pp. 3-7, 3-8, Figure 3-2). Splitspoon samples were collected continuously until the water table was encountered. Two soil samples from each boring were collected and analyzed for PP VOA+15, PP BNA, lead, chromium, and barium. Samples were collected at 0 to 2 feet bgs and at the water table interface (Ref. 31, p. 3-8).

<u>Phase II RI</u>

Screening techniques were employed in the area of Source 1 to evaluate the presence or absence of sources, to identify hot spots, and to provide additional data concerning the subsurface from June 1993 and October 1993, during a Phase II RI for the Lucas plant. Soil borings were drilled in the free-phase areas near Buildings 50 and 67 and Tank Farm A and soil samples were collected at various depths (Ref. 31, pp. 3-3, 3-14, 3-15).

<u>Phase III RI</u>

During Phase III of the RI, from July 1995 through August 1995, soil samples were collected from Source 1 and 45 hand-augered borings were located throughout the seep area (seep near Buildings 50 and 67) to delineate the extent of free-phase product (Ref. 31, pp. 3-3, 3-18).

Analytical results for soil samples collected during the RI from Source 1 indicated the presence of the following hazardous substances: acetone; 2-butanone; 1,2-dichloroethene; ethylbenzene; 1,1,2,2-tetrachloroethane; tetrachloroethene; toluene; 1,1,2-trichloroethane; trichloroethene; xylene (total); benzo(a)anthracene; benzo(a)pyrene; benzo(b)fluoranthene; benzo(k)fluoranthene; chrysene; 2,4-dimethylphenol; fluoranthene; 2-methylnaphthalene; naphthalene; phenanthrene; pyrene; aluminum; arsenic; barium; cadmium; chromium; copper; iron; lead; magnesium; mercury; nickel; selenium; silver; vanadium; and zinc (Ref. 31, Table 4-5, Figure 3-2).

As documented in the RI report, the area of contaminated soil associated with Buildings 50 and 67 is estimated as 7,000 square feet (Ref. 31, pp. 5-4, 5-5, Figure 3-2). The RI also indicates that the estimated the volume of contaminated soil in the area of Tank Farm A is 9,000 cubic yards (Ref. 31, p. 5-3).

Provided below is a summary of the analyses for soil samples collected in Source 1 revealing the presence of contaminated soil in the vicinity of the product seep areas. The sampling locations are shown on Figure 3-2 in Reference 31. Soil samples collected from MW-12 are used to document background concentrations for shallow soil samples and are used as source samples for deeper soil samples. The soil in the shallow portion of MW-12 does not contain hazardous substances found in the free-phase product, Source 1. The free-phase product ground water plume has not contaminated the shallow soil at the location of MW-12. No other soil sampling location was identified that could be used to establish background concentrations for shallow soil. All the soil samples are collected from the Westphalia and Nixonton Urban land complex soil types (Ref. 31, Figure 2-10).

Source 1 Soil Sample: 013-B001 (The well log for MW-13 indicates that a flame ionization detector [FID] detected 1,000 [units not listed] units of VOCs [Ref. 31, Appendix C, p. 12]).

Location ID	MW-13	MW-12
Sample Type	Source - Soil	Background - Soil
Field Sample ID	013-B001	012-B001
Date Collected	10/28/1991	10/14/1991
Depth (ft bgs)	0.0-2.0	0.0-2.0
Reference	31, Table 4-5 (p. 1), p. 3-11, and Figure 3-2	31, Table 4-5 (p. 1), p. 3-11, and Figure 3-2
Location	E Bldg 67	NW Tank Farm A
Volatile Organic Compounds (mg/kg)		
Ethylbenzene	3.9	ND
Xylene (total)	9	ND
Semivolatile Organic Compounds (mg/kg)		
2,4-Dimethylphenol	4.1	ND
2-Methylnaphthalene	3.1	ND
Naphthalene	10	ND
Metals (mg/kg)		
Barium	37.5	10.6
Lead	27.5	6

Source 1 Soil Sample: 013-B002

Location ID	MW-13	MW-12
Sample Type	Source - Soil	Background - Soil
Field Sample ID	013-B002	012-B001
Date Collected	10/28/1991	10/14/1991
Depth (ft bgs)	2.0-4.0	0.0-2.0
Reference	31, Table 4-5 (p. 2, 16), p. 3-11, and Figure 3-2	31, Table 4-5 (p. 2, 15), p. 3-11, and Figure 3-2
Location	E Bldg 67	NW Tank Farm A
Volatile Organic Compounds (mg/kg)		
2-Butanone	22	ND
Ethylbenzene	61	ND
Xylene (total)	200	ND
Semivolatile Organic Compounds (mg/kg)		
2-Methylnaphthalene	10	ND
Naphthalene	42	ND

Metals (mg/kg)		
Barium	68.1	10.6
Lead	22.4	4.1

Source 1 Soil Sample: 014-B001

Location ID	MW-14	MW-12
Sample Type	Source - Soil	Background - Soil
Field Sample ID	014-B001	012-B001
Date Collected	10/281991	10/14/1991
Depth (ft bgs)	0.0-2.0	0.0-2.0
Reference	31, Table 4-5 (p. 1), p. 3-11, and Figure 3-2	31, Table 4-5 (p. 15), p. 3-11, and Figure 3-2
Location	N Bldg 67	NW Tank Farm A
Volatile Organic Compounds (mg/kg)		
2-Butanone	0.24	ND
Toluene	0.009	ND
Trichloroethene	0.01	ND
Metals (mg/kg)		
Barium	67.3	10.6
Lead	24.6	4.1

Source 1 Soil Sample: PS-01 (Background soil samples are not available; no other surface soil samples were collected. [Ref. 31, Appendix C, p. 577]).

Location ID	PS-01	
Sample Type	Source - Soil	
Field Sample ID	PS-01	
Date Collected	2/21/1996	
Depth (ft bgs)	Surface	
Reference	31, Table 4-5 (pp. 9, 16) and Figure 3-2	
Location	W Bldg 50	
Volatile Organic Compounds (mg/kg)		
Xylene	64	
Semivolatile Organic Compounds (mg/kg)		
Benzo(a)anthracene	1.4	J
Benzo(a)pyrene	1.5	J
Benzo(b)fluoranthene	1.2	J
Benzo(k)fluoranthene	1.3	J
Chrysene	1.6	J
Fluoranthene	2.6	J

Location ID	PS-01	
Sample Type	Source - Soil	
Field Sample ID	PS-01	
Date Collected	2/21/1996	
Depth (ft bgs)	Surface	
Reference	31, Table 4-5 (pp. 9, 16) and Figure 3-2	
Location	W Bldg 50	
2-Methylnaphthalene	6.8	J
Naphthalene	18	
Phenanthrene	2	J
Pyrene	2.3	J
Metals (mg/kg)		
Arsenic	29.3	
Barium	493	
Cadmium	0.44	
Chromium	200	
Lead	1180	
Mercury	0.29	
Nickel	3.9	
Selenium	0.38	
Vanadium	10.8	
Zinc	130	

Source 1 Soil Sample: 007-B001 (The soil boring log for TB-07 indicates that an organic vapor analyzer [OVA] detected 300 to 1,000 [units not provided] units of VOCs [Ref. 31, Appendix C, p. 237]).

Location ID	TB-07	MW-12
Sample Type	Source - Soil	Background - Soil
Field Sample ID	007-B001	012-B001
Date Collected	10/29/1991	10/14/1991
Depth (ft bgs)	0.0-3.0	0.0-2.0
Reference	31, Table 4-5 (p. 3), p. 3-11, and Figure 3-2	31, Table 4-5 (p. 2), p. 3-11, and Figure 3-2
Location	SE Bldg 67	NW Tank Farm A
Volatile Organic Compounds (mg/kg)		
Xylene (total)	0.028	ND

Source 1 Soil Sample: 007-B001 (The soil boring log for TB-08 indicates that an OVA detected 1,000 [units not provided] units of VOCs and the soil had a solvent odor [Ref. 31, Appendix C, p. 238]).

Location ID	TB-08	MW-12
Sample Type	Source - Soil	Background - Soil
Field Sample ID	007-B001	012-B001
Date Collected	10/22/1991	10/14/1991
Depth (ft bgs)	0.0-2.0	0.0-2.0
Reference	31, Table 4-5 (pp. 4, 11, 17), p. 3-11, and Figure 3-2	31, Table 4-5 (pp. 2, 9, 15), p. 3-7, and Figure 3-2
Location	E Bldg 67	NW Tank Farm A
Volatile Organic Compounds (mg/kg)		
Ethylbenzene	0.015	ND
Semivolatile Organic Compounds (mg/kg)		
2-Methylnaphthalene	1.7	ND
Naphthalene	4.6	ND
Metals (mg/kg)		
Barium	2,940	10.1
Chromium	90.7	7.7
Lead	2,070	4.1

Source 1 Soil Sample: 030-B001 (The soil boring log for TB-30 indicates that an OVA detected up to 1,000 [units not provided] units of VOCs [Ref. 31, Appendix C, p. 264]).

Location ID	TB-30	TB-37
Sample Type	Source - Soil	Background - Soil
Field Sample ID	030-B001	007-B001
Date Collected	7/7/1993	7/7/1993
Depth (ft bgs)	4.2-5.0	4.7-5.5
Reference	31, Table 4-5 (pp. 4, 11), p. 3-14, and Figure 3-2	31, Table 4-5 (pp. 5, 12), p. 3-14, and Figure 3-2
Location	E Bldg 67	SE Tank Farm A
Volatile Organic Compounds (mg/kg)		
Ethylbenzene	3.5	ND
Xylene	27	ND
Semivolatile Organic Compounds (mg/kg)		
2-Methylnaphthalene	48	ND
Naphthalene	180	0.049 J

Source 1 Soil Sample: 030-B001

Location ID	TB-30	SGW-236
Sample Type	Source - Soil	Background - Soil
Field Sample ID	030-B001	236-B002
Date Collected	7/7/1993	7/6/1993
Depth (ft bgs)	4.2-5.0	3.5-4.0
Reference	31, Table 4-5 (pp. 4, 11), p. 3-14, and Figure 3-2 A	31, Table 4-5 (p. 1), p. 3-14, and Figure 3-2
Location	SE Bldg 67	SE Tank A
Volatile Organic Compounds (mg/kg)		
Ethylbenzene	3.5	ND
Xylene (total)	27	ND
Semivolatile Organic Compounds (mg/kg)		
2-Methylnaphthalene	48	NA
Naphthalene	180	NA

Source 1 Soil Sample: 011-B001 (The soil boring log for MW-11 indicates that a FID detected up to 1,000 [units not provided] units of VOCs [Ref. 31, Appendix C, p. 6]).

Location ID	MW-11	MW-12
Sample Type	Source - Soil	Background - Soil
Field Sample ID	011-B001	012-B001
Date Collected	10/14/1991	10/14/1991
Depth (ft bgs)	0.0-2.0	0.0-2.0
Reference	31, Table 4-5 (p. 9), pp. 3-7, and Figure 3-2	31, Table 4-5 (p. 9), p. 3-7, and Figure 3-2
Location	SW Tank Farm A	NW Tank Farm A
Semivolatile Organic Compounds (mg/kg)		
2-Methylnaphthalene	0.37	ND
Naphthalene	1.6	ND

Source 1 Soil Sample: 012-B002 (The soil boring log for MW-12 indicates that the FID detected up to 800 [units not provided] units of VOCs [Ref. 31, Appendix C, p. 9]).

Location ID	MW-12	TB-6
Sample Type	Source - Soil	Background - Soil
Field Sample ID	012-B002	006-B002
Date Collected	10/14/1991	10/22/1991
Depth (ft bgs)	6.0-8.0	6.0-7.0
Reference	31, Table 4-5 (pp. 2, 9), pp. 3-7, and Figure 3-2	31, Table 4-5 (pp. 3, 10), and Figure 3-2
Location	NW Tank Farm A	S Corner Bldg 55
Volatile Organic Compounds (mg/kg)		
Ethylbenzene	19	ND
Xylene (total)	69	ND
Semivolatile Organic Compounds (mg/kg)		
2-Methylnaphthalene	8.4	ND
Naphthalene	39	ND

Source 1 Soil Sample: 001-B001 (The soil boring log for TB-01 indicates that an OVA detected up to 1,000 [units not provided] units of VOCs [Ref. 31, Appendix C, p. 230]).

Location ID	TB-01		MW-12
Sample Type	Soil		Soil
Field Sample ID	001-B001		012-B001
Date Collected	10/14/1991		10/14/1991
Depth (ft bgs)	0.0-2.0		0.0-2.0
Reference	31, Table 4-5 (p. 10), pp. 3-7, and Figure 3-2		31, Table 4-5 (p. 9), p. 3-7, and Figure 3-2
Location	NE Tank Farm A		NW Tank Farm A
Semivolatile Organic Compounds (mg/kg)			
Benzo(k)fluoranthene	0.42		ND
Chrysene	0.52		ND
Fluoranthene	1		ND
Naphthalene	0.55	J	ND
Phenanthrene	0.7		ND
Pyrene	0.81		ND

Source 1 Soil Sample: 001-B001

Location ID	TB-01	MW-12
Sample Type	Source - Soil	Background - Soil
Field Sample ID	001-B002	012-B001
Date Collected	10/14/1991	10/14/1991
Depth (ft bgs)	10.0-12.0	6.0-8.0
Reference	31, Table 4-5 (pp. 1), pp. 3-7 and Figure 3-2	31, Table 4-5 (pp. 2, 9), p. 3-7, and Figure 3-2
Location	NE Tank Farm A	NW Tank Farm A
Volatile Organic Compounds (mg/kg)		
Ethylbenzene	1,300	19
Toluene	24	ND
Xylene (total)	6,900	69

Source 1 Soil Sample: 002-B001 (The soil boring log for TB-02 indicates that an OVA detected up to 200 [units not provided] units of VOCs [Ref. 31, Appendix C, p. 232]).

Location ID	TB-02		MW-12
Sample Type	Source - Soil		Background - Soil
Field Sample ID	002-B001		012-B002
Date Collected	10/14/1991		10/14/1991
Depth (ft bgs)	0.0-2.0		0.0-2.0
Reference	31, Table 4-5 (1, 10), pp. 3-7, and Figure 3-2		31, Table 4-5 (pp. 2, 9), p. 3-7, and Figure 3-2
Location	Tank Farm A		NW Tank Farm A
Volatile Organic Compounds (mg/kg)			
Ethylbenzene	5.5		ND
Trichloroethene	0.55		ND
Xylene (total)	37		ND
Semivolatile Organic Compounds (mg/kg)			
2,4-Dimethylphenol	0.66		ND
2-Methylnaphthalene	0.072	J	ND
Benzo(a)anthracene	0.055	J	ND
Benzo(a)pyrene	0.038	J	ND
Benzo(b)fluoranthene	0.056	J	ND
Benzo(k)fluoranthene	0.038	J	ND
Chrysene	0.063	J	ND
Semivolatile Organic Compounds (mg/kg)			
Fluoranthene	0.12	J	ND
Naphthalene	0.053	J	ND

Location ID	TB-02		MW-12
Sample Type	Source - Soil		Background - Soil
Field Sample ID	002-B001		012-B002
Date Collected	10/14/1991		10/14/1991
Depth (ft bgs)	0.0-2.0		0.0-2.0
Reference	31, Table 4-5 (1, 10), pp. 3-7, and Figure 3-2		31, Table 4-5 (pp. 2, 9), p. 3-7, and Figure 3-2
Location	Tank Farm A		NW Tank Farm A
Phenanthrene	0.14	J	ND
Pyrene	0.1	J	ND

Source 1 Soil Sample: 002-B002

Location ID	TB-02	TB-06
Sample Type	Source - Soil	Background - Soil
Field Sample ID	002-B002	006-B002
Date Collected	10/14/1991	10/22/1991
Depth (ft bgs)	8.0-10.0	6.0-7.00
Reference	31, Table 4-5 (pp. 3, 10), pp. 3-7, and Figure 3-2	31, Table 4-5 (pp. 3, 10), pp. 3-7, 3-11 and Figure 3-2
Location	Tank Farm A	S Corner Bldg 55
Volatile Organic Compounds (mg/kg)		
Ethylbenzene	31	ND
Xylene	150	ND
Semivolatile Organic Compounds (mg/kg)		
2-Methylnaphthalene	7.5	ND
Naphthalene	25	ND

Source 1 Soil Sample: 003-B001 (The soil boring log for TB-03 indicates that an OVA detected up to 300 [units not provided] units of VOCs [Ref. 31, Appendix C, p. 233]).

Location ID	TB-03	MW-12
Sample Type	Source - Soil	Background - Soil
Field Sample ID	003-B001	012-B001
Date Collected	10/14/1991	10/14/1991
Depth (ft bgs)	0.0-2.0	0.0-2.0
Reference	31, Table 4-5 (pp. 3, 10), pp. 3-7, and Figure 3-2	31, Table 4-5 (pp. 2, 9), p. 3-7, and Figure 3-2
Location	Tank Farm A	NW Tank Farm A
Volatile Organic Compounds (mg/kg)		
Ethylbenzene	0.28	ND
Xylene	1.6	ND
Semivolatile Organic Compounds (mg/kg)		
2-Methylnaphthalene	0.39	ND

Source 1 Soil Sample: 003-B002

Location ID	TB-03	TB-06
Sample Type	Source - Soil	Background - Soil
Field Sample ID	003-B002	006-B002
Date Collected	10/14/1991	10/22/1991
Depth (ft bgs)	8.0-10.0	6.0-7.0
Reference	31, Table 4-5 (pp. 3, 10), pp. 3-7, and Figure 3-2	31, Table 4-5 (pp. 3, 10), pp. 3-7, 3-11 and Figure 3-2
Location	Tank Farm A	S Corner Bldg 55
Volatile Organic Compounds (mg/kg)		
Ethylbenzene	18	ND
Xylene	84	ND
Semivolatile Organic Compounds (mg/kg)		
2-Methylnaphthalene	15	ND
Naphthalene	72	ND

Source 1 Soil Sample: 004-B001 (The soil boring log for TB-04 indicates that an OVA detected up to 900 [units not provided] units of VOCs [Ref. 31, Appendix C, p. 234]).

Location ID	TB-04	MW-12
Sample Type	Source - Soil	Background - Soil
Field Sample ID	004-B001	012-B001
Date Collected	10/14/1991	10/14/1991
Depth (ft bgs)	0.0-2.0	0.0-2.0
Reference	31, Table 4-5 (p. 3), pp. 3-7, and Figure 3-2	31, Table 4-5 (p. 2), p. 3-7, and Figure 3-2
Location	Tank Farm A	NW Tank Farm A
Volatile Organic Compounds (mg/kg)		
Ethylbenzene	0.14	ND

Source 1 Soil Sample: 004-B002

Location ID	TB-04	TB-06
Sample Type	Source - Soil	Background - Soil
Field Sample ID	004-B002	006-B002
Date Collected	10/14/1991	10/22/1991
Depth (ft bgs)	8.0-10.0	6.0-7.00
Reference	31, Table 4-5 (pp. 3, 10), pp. 3-7, and Figure 3-2	31, Table 4-5 (pp. 3, 10), and Figure 3-2
Location	Tank Farm A	S Corner Bldg 55
Volatile Organic Compounds (mg/kg)		
Ethylbenzene	4.8	ND
Xylene	33	ND
Semivolatile Organic Compounds (mg/kg)		
2-Methylnaphthalene	18	ND
Naphthalene	92	ND

Source 1 Soil Sample: 001-B002 (The soil boring log for TB-11 (MW-11) indicates that an OVA detected up to 1,000 [units not provided] units of VOCs [Ref. 31, Appendix C, p. 6]).

Location ID	TB-11	TB-6
Sample Type	Source - Soil	Background - Soil
Field Sample ID	011-B002	006-B002
Date Collected	10/14/1991	10/22/1991
Depth (ft bgs)	8.0-10.0	6.0-7.0
Reference	31, Table 4-5 (pp. 4, 11), pp. 3-7, 3-8, and Figure 3-2	31, Table 4-5 (pp. 3, 10), and Figure 3-2
Location	MW-11, Tank Farm A	S Corner Bldg 55
Volatile Organic Compounds (mg/kg)		
Ethylbenzene	55	ND
Xylene (total)	560	ND
Semivolatile Organic Compounds (mg/kg)		
2-Methylnaphthalene	2.5	ND
Naphthalene	11	ND

Source 1 Soil Sample: 028-B001 (The soil boring log for TB-28 indicates that an OVA detected up to 1,000 [units not provided] units of VOCs [Ref. 31, Appendix C, p. 262]).

Location ID	TB-28	MW-20
Sample Type	Source - Soil	Background - Soil
Field Sample ID	028-B001	020-B101
Date Collected	7/6/1993	7/14/1993
Depth (ft bgs)	1.5-2.0	0.0-2.0
Reference	31, Table 4-5 (p. 4), p. 3-14, and Figure 3-2	31, Table 4-5 (p. 1), p. 3-15, and Figure 3-2
Location	N Tank Farm A	NW Bldg 55
Volatile Organic Compounds (mg/kg)		
1,1,2-Trichloroethane	0.014	ND

Source 1 Soil Sample: 029-B002 (The soil boring log for TB-29 indicates that an OVA detected up to 500 [units not provided] units of VOCs [Ref. 31, Appendix C, p. 263]).

Location ID	TB-29	SGW-236
Sample Type	Source - Soil	Background - Soil
Field Sample ID	029-B002	236-B002
Date Collected	7/7/1993	7/6/1993
Depth (ft bgs)	5.2-5.7	3.5-4.0
Reference	31, Table 4-5 (p. 4), p. 3-14, and Figure 3-2	31, Table 4-5 (p.1), p. 3-14, and Figure 3-2
Location	NW Tank Farm A	SE Tank Farm A
Volatile Organic Compounds (mg/kg)		
Acetone	0.066	ND

Source 1 Soil Sample: TB-54-10 (The soil boring log for TB-54 indicates that an FID detected up to 480 [units not provided] units of VOCs [Ref. 31, Appendix C, p. 314]).

Location ID	TB-54	TB-58	
Sample Type	Source - Soil	Background - Soil	
Field Sample ID	TB-54-10	TB-58-09	
Date Collected	9/30/1996	9/30/1996	
Depth (ft bgs)	10.0-10.5	9.0-9.5	
Reference	31, Table 4-5 (p. 7), p. 3-25, and Figure 3-2	31, Table 4-5 (p. 8), and Figure 3-2	
Location	E Tank Farm A	NW Tank Farm A	
Volatile Organic Compounds (mg/kg)			
Ethylbenzene	98	11	J
Xylene (total)	420	56	

Source 1 Soil Sample: TB-55-10.5 (The soil boring log for TB-55 indicates that an organic vapor monitor (OVM) detected up to 1,246 [units not provided] units of VOCs [Ref. 31, Appendix C, p. 316]).

Location ID	TB-55		TB-58	
Sample Type	Source - Soil		Background - Soil	
Field Sample ID	TB-55-10.5		TB-58-09	
Date Collected	9/30/1996		9/30/1996	
Depth (ft bgs)	10.5-11.0		9.0-9.5	
Reference	31, Table 4-5 (pp. 7, 13), p. 3-25, and Figure 3-2		31, Table 4-5 (pp. 8, 13), p. 3-25 and Figure 3-2	
Location	Tank Farm A		NW Tank Farm A	
Volatile Organic Compounds (mg/kg)				
Ethylbenzene	1,500		11	J
Xylene (total)	11,000	D	56	

Source 1 Soil Sample: TB-56-13 (The soil boring log for TB-56 indicates that a FID detected up to 920 [units not provided] units of VOCs [Ref. 31, Appendix C, p. 320]).

Location ID	TB-56	TB-58	
Sample Type	Source - Soil	Background - Soil	
Field Sample ID	TB-56-13	TB-58-09	
Date Collected	9/30/1996	9/30/1996	
Depth (ft bgs)	13.0-13.5	9.0-9.5	
Reference	31, Table 4-5 (pp. 7, 13), p. 3-25, and Figure 3-2	31, Table 4-5 (pp. 7, 13), p. 3-25 and Figure 3-2	
Location	E Tank Farm A	NW Tank Farm A	
Volatile Organic Compounds (mg/kg)			
Ethylbenzene	170	11	J
Xylene (total)	1,200	58	

Source 1 Soil Sample: TB-57-12.5 (The soil boring log for TB-57 indicates that a FID detected up to 4,200 [units not provided] units of VOCs [Ref. 31, Appendix C, p. 323]).

Location ID	TB-57	TB-58	
Sample Type	Source - Soil	Background - Soil	
Field Sample ID	TB-57-12.5	TB-58-09	
Date Collected	9/30/1996	9/30/1996	
Depth (ft bgs)	12.0-12.5	9.0-9.5	
Reference	31, Table 4-5 (p. 7), p. 3-25, and Figure 3-2	31, Table 4-5 (p. 8), and p. 3-25 Figure 3-2	
Location	E Tank Farm A	NW Tank Farm A	
Volatile Organic Compounds (mg/kg)			
Ethylbenzene	750	11	J
Xylene (total)	4,700	58	

Notes:

B	Boring
bgs	Below ground surface
Bldg	Building
D	Diluted
E	East
ft	Foot
ID	Identification
J	Estimated concentration
mg/kg	Milligrams per kilogram
MW	Monitoring well
N	North
NA	Not analyzed
ND	Not detected
NE	Northeast
NW	Northwest
PS	Point sample
S	South
SE	Southeast
SW	Surface water
TB	Test boring
W	West

2.4.2 Hazardous Waste Quantity

2.4.2.1.1 Hazardous Constituent Quantity

The information available is not sufficient to adequately support the evaluation of the hazardous constituent quantity for Source No. 1.

Sum (pounds): Unknown
Hazardous Constituent Quantity Value (C): Not available (NA)

2.4.2.1.2 Hazardous Waste Stream Quantity

The information available is not sufficient to adequately support the evaluation of the hazardous waste stream quantity for Source No. 1.

Sum (pounds): Unknown
Hazardous Waste Stream Quantity Value: NA

2.4.2.1.3 Volume

During the Phase III activities, free-phase product was measured for the mobile thickness of the product, the volume of recoverable product, and the recharge rates of the product (Ref. 31, p. 3-20). A bail-down test was conducted to identify the thickness of the product (Ref. 31, Appendix K, Tables E1 through E4). The bail-down test completed in WP-3 in the area of the Building 50 indicated that the thickness of the product in July 1995 as 0.33 foot and in August 1995 as 0.48 foot (Ref. 31, Figures 4-11 and 4-12). The bail-down test completed in the area of the Building 67 indicated that the thickness of the product in July 1995 at MW-21 as 2.21 feet, at MW-13R as 0.98 foot, and at WP-1 as 1.33 feet (Ref. 31, Figure 4-11). In August 1995 the thickness of product was recorded at MW-21 as 0.66 foot, at MW-13R as 1.28 feet, and at WP-1 as 1.33 feet (Ref. 31, Figure 4-12). The bail-down test completed in MW-11 in the area of the Tank Farm A identified the thickness of product as 1.47 feet in July 1995 and 0.45 foot in August 1995 (Ref. 31, Appendix K, Table E2, and Figures 4-11 and 4-12). The lateral extent of three separate product plumes in ground water are shown on Figures 4-11 and 4-12, Appendix K, Reference 31. The plumes are considered separate because of the absence of product in the monitoring wells located between the plumes (Ref. 31, p. 4-20). The total volume of the free-phase product cannot be estimated.

Dimension of source (yd^3 or gallons): Unknown, but greater than zero
Volume Assigned Value: Unknown, > 0

2.4.2.1.4 Area

The information available is not sufficient to adequately support the evaluation of the area or the area of observed contamination for Source No. 1.

Area of Source (ft^2): Not Scored
Area Assigned Value: Not Scored

2.4.2.1.5 Source Hazardous Waste Quantity Value

The source HWQ value for Source No. 1 is assigned a source HWQ value of greater than zero because the waste quantity associated with Source 1 has not been adequately documented; however, the presence of free-phase product in ground water has been documented.

Source Hazardous Waste Quantity Value: Unknown, but greater than zero

2.2 SOURCE CHARACTERIZATION

2.2.1 SOURCE IDENTIFICATION

Name of source: Areas of Contaminated Soil

Number of source: 2

Source Type: Contaminated Soil

This source includes three areas of contaminated soil. The areas of contaminated soil are combined as one source because they are of the same type, from the same operations, near each other, potentially from the same releases, contain the same type of contaminants, and were investigated as one source during an RI, as documented in the sections below.

Contaminated Soil: Pump House

The pump house transferred wastewater from the Lucas plant operations to the lagoon area (Ref. 31, p. 5-6). Lead contamination has been identified in the soil surrounding the former pump house (Ref. 31, pp. ES-2, 6-4).

In 1994, NJDEP advanced augers into the bank of Hilliards Creek adjacent to the pump house. Approximately 1 foot of paint sludge was observed when the augers were retrieved. The sludge tapered to a faint greenish color about 15 feet downstream of the pump house (Ref. 66, pp. 1, 2).

In 1999, a waste sample was collected adjacent to the pump house and was found to contain barium (14,400 parts per million [ppm]), lead (1,090 ppm), magnesium (7,340 ppm), and mercury (17.8 ppm) (Ref. 26, pp. 5, 8). An RI confirmed that lead-contaminated soil was associated with the pump house (Ref. 31, pp. ES-2, 3-27, 5-7, and 5-8).

Contaminated Soil: Northwest of Building 55

The RI for the Lucas plant identified contaminated soil northwest of Building 55, in the area of soil boring B-76 (Ref. 31, p. 5-5, Table 4-11, Figure 3-2). The contaminated soil may have resulted from operations in former Buildings 15 and 49, formerly located west of the Tank Farm A. Building 15 was used to store varnish in 440-, 960-, and 2,200-gallon ASTs. Building 49 was used to store varnish in 2,500- and 6,000-gallon tanks (Refs. 5; 60, p. 33). Soil may have become contaminated during transfer and temporary storage of materials near the tanks, which may have resulted in leaks and spills (Ref. 59, Appendix II, p. II55).

Other sources of the soil contamination are shown on an insurance map, dated April 16, 1964, including a solvent pump house formerly located northwest of Building 55 and leaks from raw materials stored in Building 55 (Refs. 5; 60, pp. 99, 100).

Contaminated Soil: Southeast Corned of Building 55

A soil boring (TB-06) was completed at the southeast corner of Building 55. Analytical results for soil samples collected from the boring indicated the presence of contaminated soil as documented in Section 2.4.1. The contamination at TB-06 is considered separate from the contaminated soil detected south of TB-06 in the area of free-phase product ground water plume because the plume does not exceed to sampling location TB-06 (Ref. 31, pp. 4-11 and 4-12).

Location of the source, with reference to a map of the site: The areas of contaminated soil are located on the northwest side of Building 55 in the area of test boring 76 (TB-76), on the southeast corner of Building 55, and in the area of the pump house located west of Building 67 (Ref. 31, Figures 2-2 and 3-2). The locations where soil sample analyses revealed the presence of contaminated soil and defined the area of Source 2 are shown on Figure 3-2 of Reference 31.

Containment:

Release to ground water: As documented in the section above, Source 2 is an area of contaminated soil. No liners, covers, or other containment features are associated with the source; therefore, a containment factor value of 10 is assigned to this source. Additionally, as documented in Section 4.2.1.5, there is evidence that hazardous substances have migrated from the source to ground water (Ref. 1, Table 3-2).

Release via overland migration and/or flood: As documented in the section above, Source 2 is an area of contaminated soil. No runoff control systems are associated with the source; therefore, a containment factor value of 10 is assigned to this source. Additionally, as documented in Section 4.1.2.1.1, there is evidence that hazardous materials have migrated from the source (Ref. 1, Table 4-2).

Gas release to air: The air migration pathway was not scored.

Particulate release to air: The air migration pathway was not scored.

2.4 WASTE CHARACTERISTICS

2.4.1 Hazardous Substances:

The hazardous substances associated with Source 2 were identified during numerous soil sampling investigations. The most recent investigation was a five-phase RI for the Lucas plant (Ref. 31, p. 3-3). The data from the RI are used to characterize Source 2. Figure 3-2, in Reference 31, was used to identify soil sampling locations specifically associated with Source 2. The soil samples were analyzed for Priority Pollutant Volatile Organic Analysis plus 15-non target compounds (PP VOA+15), Priority Pollutant Base Neutral Analysis (PP BNA), lead, chromium, and barium (Ref. 31, p. 3-11). During Phase IV of the RI for the Lucas plant, three soil borings were drilled around the pump house. Sludge and paint were observed in one of the borings, TB-73. A sample of the sludge and paint was collected from the boring (Ref. 31, p. 5-7). Additional investigations were conducted in the area of pump house to further delineate the extent of soil contamination (Ref. 31, pp. 3-26, 3-27). Three soil borings were hand augered in the area of the pump house (Ref. 31, pp. 3-3, 2-27). The borings were installed to delineate the extent of sludge and paint chips observed in a boring, TB-73, previously drilled in the area of the pump house (Ref. 31, p. 3-27).

The tables below provide a summary of hazardous substances detected in soil samples collected from Source 2 during numerous phases of the RI. The result for a background soil sample is listed to provide a reference concentration for the hazardous substances. Background soil sample selection is based on whether the background and source soil sample were collected within the same depth range, period of time, and whether the samples were analyzed for the same hazardous substances. All soil samples collected from 1990 to 1997 were analyzed by Weston Analytics Division, a New Jersey-certified laboratory. All samples collected from 1998 to 2000 were analyzed by Severn-Trent Laboratories (STL), a New Jersey-certified laboratory (Ref. 31, p. 3-37). Reference 111 provides a Quality Assurance Project Plan used by Sherwin-Williams' environmental consultant. The plan provides analytical methods, quantitation limits, and detection limits for some of the investigations conducted by Sherwin-Williams' (Ref. 111). It is likely that these same methods were used for analyzing the samples summarized in this section. Analytical data sheets from the laboratories are not available; however, the RI report that Sherwin-Williams prepared indicates that the analytical data are valid. The analytical results in the tables below are considered usable and of known quality (Ref. 31, p. 3-38). Table 3-1 of Reference 31 provides a summary of the analytical suite for the soil samples.

The locations of the soil samples are provided on Figure 3-2, in Reference 31, and are circled.

Contaminated soil southeast corner of Building 55:

Analytical results for a soil boring sample collected from the southeast corner of Building 55 indicated the presence of a number hazardous substances three times above the background concentrations. The soil sample does not contain the same hazardous substances as detected in the product samples and is therefore, considered a separate area of contamination, as documented below.

Source 2 Soil Sample:006-B001 (The soil boring log for TB-06 indicates that an OVA detected up to 700 [units not provided] units of VOCs [Ref. 31, Appendix C, p. 236]).

Location ID	TB-06	MW-12
Sample Type	Source - Soil	Background - Soil
Field Sample ID	006-B001	012-B001
Date Collected	10/22/1991	10/14/1991
Depth (ft bgs)	1.0-2.0	0.0-2.0
Reference	31, Table 4-5 (pp. 3, 17), and Figure 3-2	31, Table 4-5 (pp. 2 , 15), p. 3-11, and Figure 3-2
Location	SE Corner of Bldg 55	NW Tank Farm A
Volatile Organic Compounds (mg/kg)		
1,1,2,2-Tetrachloroethane	0.05	ND
Tetrachloroethene	0.019	ND
Total-1,2-dichloroethene	0.019	ND
Trichloroethene	0.071	ND
Metals (mg/kg)		
Lead	78.3	4.1

Contaminated Soil Associated with the Pump House

Provided below is a summary of analytical results for soil samples collected in the area of the pump house. The results indicate the presence of contaminated soil.

Source 2 Soil Sample: TB-73 (Red and white paint like fakes were observed in the soil boring [Ref. 31, Appendix C, p. 370]).

Location ID	TB-73	TB-95
Sample Type	Source - Soil	Background - Soil
Date Collected	1/15/1999	1/15/1999
Depth (ft bgs)	0.5-1.5	0.8-1.3
Reference	31, pp. 5-7, 5-8, Table 4-5 (p. 18), and Figure 3-2	31, pp. 5-7, 5-8, Table 4-5 (p. 19), and Figure 3-2
Location	W Pump House	Background SW Pump House
Metals (mg/kg)		
Antimony	5.4	1.6
Barium	14,500	841
Chromium	55.7	15.5
Cobalt	78.5	7.2
Copper	1,080	73
Lead	1,040	231
Magnesium	2,900	257
Mercury	25.2	1.8

Location ID	TB-73	TB-95
Sample Type	Source - Soil	Background - Soil
Date Collected	1/15/1999	1/15/1999
Depth (ft bgs)	0.5-1.5	0.8-1.3
Reference	31, pp. 5-7, 5-8, Table 4-5 (p. 18), and Figure 3-2	31, pp. 5-7, 5-8, Table 4-5 (p. 19), and Figure 3-2
Location	W Pump House	Background SW Pump House
Metals (mg/kg)		
Nickel	46.2	5.8
Zinc	3,240	564

Contaminated Soil Located Northwest of Building 55

Provided below is a summary of analytical results for soil samples collected in the area northwest of Building 55. The results indicate the presence of contaminated soil.

Source 2 Soil Sample: TB-176 [odors and staining observed in the sample (Ref. 31, p. 5-5)].

Location ID	B-76		B-75
Sample Type	Source - Soil		Background - Soil
Field Sample ID	B-176		B-75
Date Collected	4/16/1997		4/16/1997
Depth (ft bgs)	10.0-12.0		11.5-17.0
Reference	31, Tables 3-1, 4-5 (pp. 9, 15), and Figure 3-2		31, Tables 3-1, 4-5 (p. 15), and Figure 3-2
Location	NW Bldg 55		W Bldg 58
Semivolatile Organic Compounds (mg/kg)			
2-Methylnaphthalene	1.9	J	ND
Naphthalene	9.4	J	ND
Metals (mg/kg)			
Arsenic	4.2		ND
Barium	224		29.1
Beryllium	0.11		ND
Copper	197		1.1
Lead	401		8.5
Mercury	0.12		ND
Nickel	3.2		ND

Source 2 Soil Sample: B-76 [odors and staining observed in the sample (Ref. 31, p. 5-5)].

Location ID	B-76		B-78
Sample Type	Source - Soil		Background - Soil
Field Sample ID	B-76		B-78
Date Collected	4/16/1997		4/16/1997
Depth (ft bgs)	3.0-3.5		3.5-4.0
Reference	31, Table 4-5 (pp. 2, 9, 15), and Figure 3-2		31, Tables 3-1, 4-5 (pp. 2, 15), and Figure 3-2
Location	NW Bldg 55		150 ft S Bldg 67
Volatile Organic Compounds (mg/kg)			
Ethylbenzene	20		ND
Xylene (total)	8.8		ND
Semivolatile Organic Compounds (mg/kg)			
Naphthalene	8.3	J	NA
Metals (mg/kg)			
Barium	82.5		10.6
Cadmium	0.42		ND
Chromium	13.2		3.6
Copper	12.1		2.2
Lead	171		6
Mercury	0.08		ND
Nickel	2.2		ND
Zinc	62.1		6.7

Source 2 Soil Sample: 020-B001 (The soil boring log for MW-20 indicates that an OVA detected up to 110 [units not provided] units of VOCs [Ref. 31, Appendix C, p. 48]).

Location ID	MW-20	SGW-236
Sample Type	Source - Soil	Background - Soil
Field Sample ID	020-B001	236-B001
Date Collected	7/14/1993	7/06/1993
Depth (ft bgs)	1.5-2.0	1.5-2.0
Reference	31, Table 4-5 (p. 1), and Figure 3-2	31, Table 4-5 (p. 1), Figure 3-2, and p. 3-11
Location	NW Bldg 55	SE Tank Farm A
Volatile Organic Compounds (mg/kg)		
Ethylbenzene	24	0.76 J
Xylene	4.4	ND

Source 2 Soil Sample: TB-59-01 (The soil boring log for TB-59 indicates that the FID detected up to 110 [units not provided] units of VOCs [Ref. 31, Appendix C, p. 328]).

Location ID	TB-59	SGW-236
Sample Type	Source - Soil	Background - Soil
Field Sample ID	TB-59-01	236-B001
Date Collected	10/1/1996	7/06/1993
Depth (ft bgs)	1.5-2.0	1.5-2.0
Reference	31, Table 4-5 (p. 8), and Figure 3-2	31, Table 4-5 (p. 2), p. 3-11, and Figure 3-2
Location	NW Bldg 55	SE Tank Farm A
Volatile Organic Compounds (mg/kg)		
Ethylbenzene	7	0.76 J
Xylene	24	ND

Source 2 Soil Sample: TB-60-04 (No background soil samples were collected within the depth range of 4.0 to 4.5 feet bgs in 1996; therefore, the result for a background sample collected from 1993 is provided in the table below. The background concentrations are not critical for this sample because the hazardous substances detected in the source soil sample are not naturally occurring. A strong petroleum odor was detected in the soil boring. The soil boring log for TB-60 indicates that the FID detected up to 4,200 [units not provided] units of VOCs [Ref. 31, Appendix C, p. 330]).

Location ID	TB-60	TB-37
Sample Type	Source - Soil	Background - Soil
Field Sample ID	TB-60-04	007-B001
Date Collected	10/1/1996	7/06/1993
Depth (ft bgs)	4.0-4.5	4.7-5.5
Reference	31, Table 4-5 (p. 8), and Figure 3-2	31, Table 4-5 (p. 5), and Figure 3-2
Location	NW Bldg 55	SE Tank Farm A
Volatile Organic Compounds (mg/kg)		
Ethylbenzene	28	ND
Xylene	56	ND

Source Soil Sample: TB-61-04 (No background soil samples were collected within the depth range of 4.0 to 4.5 feet bgs in 1996; therefore, the result for a background sample collected from 1993 is provided in the table below. The background concentrations are not critical for this sample because the hazardous substances detected in the source soil sample are not naturally occurring. A petroleum odor was detected in the soil boring. The soil boring log for TB-61 indicates that the FID detected up to 3,000 [units not provided] units of VOCs [Ref. 31, Appendix C, p. 332]).

Location ID	TB-61	TB-37
Sample Type	Source - Soil	Background - Soil
Field Sample ID	TB-61-04	007-B001
Date Collected	10/1/1996	7/6/1993
Depth (ft bgs)	4.0-4.5	4.7-5.5
Reference	31, Table 4-5 (p. 8), and Figure 3-2	31, Table 4-5 (p. 5), and Figure 3-2
Location	NW Bldg 55	SE Tank Farm A
Volatile Organic Compounds (mg/kg)		
Ethylbenzene	27	ND
Xylene	170	ND

Notes:

B	Boring	N	North
bgs	Below ground surface	NA	Not analyzed
Bldg	Building	ND	Not detected
ft	Foot	NW	Northwest
HA	Hand auger	S	South
ID	Identification	SE	Southeast
J	Estimated concentration	SW	Surface water
mg/kg	Milligram per kilogram	TB	Test boring
MW	Monitoring well	W	West

2.4.2 Hazardous Waste Quantity

2.4.2.1.1 Hazardous Constituent Quantity

The information available is not sufficient to adequately support the evaluation of the hazardous constituent quantity for Source No. 2.

Sum (pounds): Unknown
Hazardous Constituent Quantity Value (C): Not available (NA)

2.4.2.1.2 Hazardous Waste Stream Quantity

The information available is not sufficient to adequately support the evaluation of the hazardous waste stream quantity for Source No. 2.

Sum (pounds): Unknown
Hazardous Waste Stream Quantity Value: NA

2.4.2.1.3 Volume

The information available is not sufficient to adequately support the determination of the volume hazardous waste quantity value for Source No. 2.

Dimension of source (yd^3 or gallons): 0
Volume Assigned Value: 0

2.4.2.1.4 Area

Since the volume of contaminated soil associated with Source 2 is not adequately estimated, the area of Source 2 is evaluated (Ref. 1, Section 2.4.2.1.3). The area of contaminated soil associated with Source 2 is difficult to document because numerous areas within the area are covered with buildings, parking lots, and roads. Numerous removal actions have been conducted in the area of Source 2; however, based on Section 2.4.1 for Source 2, contamination still remains in Source 2 (Refs. 18, pp. ES-1, 1-1, 1-2, 3-5, 4-1; 31, pp. 3-22, 3-23, 3-24, 5-3, 5-4, 5-5, and Figure 3-2). Therefore, the area of soil contamination for Source 2 is assigned the value of greater than zero.

Area of Source (ft^2): Unknown, > 0
Area Assigned Value: Unknown, > 0

2.4.2.1.5 Source Hazardous Waste Quantity Value

The source HWQ value for Source No. 2 is assigned a source HWQ value of greater than zero because the waste quantity associated with Source 2 has not been adequately documented; however, the presence of contaminated soil has been documented.

Source Hazardous Waste Quantity Value: Unknown, but greater than zero

SOURCE DESCRIPTION

2.2 SOURCE CHARACTERIZATION

Source Number: 3

Source Description: Lagoons

Source Type: Backfilled surface impoundment

Source 3 includes five backfilled surface impoundments and an associated pipeline and drainage channel. Between 1950 and 1977, wastewater generated from the paint manufacturing process was discharged into five impoundments for treatment and disposal. The lagoons were located south of the facility. Wastewater was discharged by gravity from the manufacturing plant to a lift station and subsequently pumped to a 27,000-gallon concrete holding basin. Alum was added to the wastewater, and then the wastewater was fed by gravity from the basin to Lagoon 1 for coagulation and settling. The wastewater was then transferred to Lagoons 2, 3, and 4 for biological treatment. A holding basin was also used in the wastewater treatment system (Refs. 6, pp. 2-3, 2-4, and Figure 2-4; 31, p. 2-5). Tank washout from the latex system and Sher-dye was disposed of in the lagoons (the sanitary waste system on Lucas plant) (Ref. 70, pp. 9, 11).

Aerial photographs from 1940 show two open storage areas along a railroad spur. This area appears to be the location of the lagoons (Ref. 7, pp. 4, 5). Aerial photographs from 1951 show three impoundments in the area of the lagoons. An open storage area is located north of the lagoons (Ref. 7, pp. 6, 7, 10, 11). The 1961 aerial photographs indicate that one of the three lagoons (impoundments) was divided into four separate lagoons, for a total of six lagoons. Several piles of light-toned mounded material were observed near one of the lagoons (impoundment one) (Ref. 7, p. 8). Aerial photographs from 1973 show the presence of a pipeline extending from the north bank of one of the lagoons (impoundment one) to a drainage channel (Hilliards Creek) that runs through the center of the Lucas plant. An outfall from the western bank of the lagoon area toward a drainage channel (Hilliards Creek) is visible (Ref. 7, pp. 10, 11). Aerial photographs from 1975 show the presence of leachate scars on the downslope of one of the lagoons. The lagoons are no longer visible in 1984 aerial photographs (Ref. 7, p. 13).

In 1975, one of the settling lagoons overflowed into Hilliards Creek (Ref. 59, Appendix X, p. X6).

On July 31, 1975, and September 16, 1975, NJDEP inspectors noted foul solvents odors emanating from monitoring wells in the area of the lagoons, and one of the lagoons was observed to be leaking its contents into Hilliards Creek (Ref. 32, p. 3).

On May 5, 1976, NJDEP inspectors observed that a feed pipe used for transport of raw materials in the facility had ruptured causing an oil discharge to the primary settling lagoon and Hilliards Creek (Ref. 32, p. 3).

In 1976, NJDEP directed Sherwin-Williams to conduct a subsurface investigation in the former lagoon area (AEC IV) (Ref. 31, pp. 3-1, 3-33). Approximate depths (from an average existing ground surface) were as follows:

Lagoon 1 = 5 feet
Lagoon 2 = 15 feet
Lagoon 3 = 8 feet
Lagoon 4 = 12 feet
Holding Basin = 10 feet

Depths are documented in Reference 31 (pp. 3-33, 3-34). According to the RI report, a sludge pit was located in the area of the lagoons. The depth of the sludge pit was 20 feet (Ref. 31, pp. 3-33, 3-34). Sludge was encountered at the base of the lagoons at depths of 2 to 5 feet in the lagoons and the base of the holding basin at a depth of 3 feet. Twenty-eight soil borings were drilled in the lagoon area (Ref. 31, p. 3-34). A review of Figure 2-4 in Reference 6 indicates that the four impoundments, a holding basin (the fifth surface impoundment), and a sludge disposal area were associated with the four surface impoundments. The sludge pit, as referred to in the RI, may be the sludge disposal area shown on Figure 2-4 in Reference 6.

On August 17, 1978, NJDEP issued an administrative order to Sherwin-Williams to remove sludge in the area of the lagoons and to monitor ground water. The order was based on findings that Sherwin-Williams operated unlined wastewater treatment lagoons and stored sludge without NJDEP approval or authorization. NJDEP concluded that the lagoons allowed inadequately treated wastewater to percolate into the ground water (Ref. 57, pp. 1, 2, 3).

In 1979, a subsurface investigation was conducted in the area of the lagoons, or Site 2 as referenced in reference documentation (Ref. 41, Plates 2, 6, and 7, p. 10). The report documenting the investigation indicated that the lagoon area included the following: a holding pond (150 by 180 feet), ponds 1 and 2 (60 by 80 feet each), pond 3 (40 by 40 feet), and pond 4 (100 by 150 feet). (A sludge disposal pond, 40 by 150 feet, was also located adjacent to the lagoons. However, its waste (dried sludge) was included in another NPL site, the US Avenue Burn site and not included in the waste quantity for this site [Ref. 41, pp. 10, 14, Plate 6].) According to the report, industrial waste including paint sludge and raw sewage was emptied into the holding pond, where primary sedimentation took place. A pump suctioned material from the holding pond to pond 1. From pond 1, the fluid was transferred by gravity to pond 2, then to pond 3, and finally to pond 4. Dried sludge was excavated from ponds 1, 2, 3, and 4 then disposed of in the sludge holding pond. The report does not identify the location where pond 4 discharges (Refs. 41, p 11; 8, p. 3). Analytical results for soil borings indicated the presence of dried paint in the holding pond, ponds 1, 2, 3, and 4, and in the sludge disposal pond. (The waste quantity associated with the sludge disposal pond is evaluated as part of a separate site, US Avenue Burn Site.) Drainage from the lagoon area was noted to be toward the west, the location of Hilliards Creek (Refs. 41, p. 14; 9).

In 1979, a total of 8,096 cubic yards of sludge was removed from the lagoon area. After the sludge was visibly removed, the lagoons were filled in with clean fill. The removal was considered complete when all the visually identifiable sludge and contaminated soils were removed (Refs. 31, pp. 3-33 and 3-34; 42, p. 4). Since the removal action was based on visually removing the waste associated with Source 3, it cannot be documented that all the contamination associated with Source 3 has been removed. No confirmatory samples were collected. Available data, provided in Section 4.0 of this documentation record, indicate that

Source 3 released hazardous substances to ground water and surface water. The contamination associated with the releases to ground water and surface water has not been addressed. Since no confirmatory samples were collected to document that all contamination associated with Source 3 was removed and releases to ground water and surface water from Source 3 have not been addressed, the removal action completed in the Source 3 is not considered a qualifying removal action (Refs. 82; 83).
In 1993, a site inspection (SI) report completed by NJDEP indicated that memorandums by Sherwin-Williams described a breach of the lagoon system (Ref. 59, p. 3).

Location of the source, with reference to a map of the site: Figure 2-4, in Reference 6, shows the location of the four backfilled surface impoundments (also referred to as lagoons and ponds in reference documentation) and the holding basin, fifth backfilled surface impoundment. Source 3 is located on the southeastern portion of the former Lucas plant, on the south side of Foster Avenue and on the east side of Hilliards Creek (see Figure 2-4 in Reference 6).

Containment:

Release to ground water: The lagoons were unlined (Ref. 57, pp. 1, 2, 3); therefore, a containment factor value of 10 is assigned to this source. Additionally, as documented in the section above, there is evidence that hazardous substances migrated from the source (Ref. 1, Table 3-2).

Release via overland migration and/or flood: Migration of hazardous substances from the source area has been documented; therefore, a containment factor value of 10 is assigned to this source (Ref. 59, Appendix X, p. X6). Additionally, as documented in the section above, no surface water runoff control system was associated with Source 3 (Ref. 1, Table 4-2).

Gas release to air: The air migration pathway was not scored.

Particulate release to air: The air migration pathway was not scored.

2.4 WASTE CHARACTERISTICS

2.4.1 Hazardous Substances:

In 1977, wastewater sludge samples were analyzed for disposal purposes. The leachate analysis revealed the presence of lead, 0.16 mg/L (Ref. 19, pp. 1, 3). The paint sludge was classified as special waste (Refs. 23; 24). In 1977, analysis of spent iron residue from the wastewater treatment plant revealed 0.007 mg/L of arsenic and 0.25 mg/L of lead in the leachate (Ref. 22, pp. 1, 2). In 1978, analysis of a paint sludge sample revealed 0.08 percent by weight of lead (Ref. 20, pp. 1, 2). In April 1978, analysis of a wastewater sludge sample revealed the presence of arsenic at 0.7 mg/kg (Ref. 25, pp. 1, 2). In March 1978, analysis of leachate from paint sludge revealed 0.015 mg/L of lead (Ref. 21, p. 1).

Soil samples were collected from the approximate center of each lagoon (referred to as ponds in reference documentation) (Ref. 31, p. 3-36) in November 1996, during Phase IV of the RI for the Lucas plant (Ref. 31, p. 3-3). Analysis of a soil sample collected from the lagoons revealed the presence of 11 mg/kg of pentachlorophenol, 4.5 mg/kg of arsenic, and 0.08 mg/kg of mercury (Ref. 31, Table 4-7 [p. 2], Figure 3-2). The Table 2 summarizes the hazardous substances detected in soil boring samples collected from the lagoons during Phase IV of the RI for the Lucas plant. The soil samples were collected during the RI to confirm whether the 1979 remediation was effective. One sample was collected from the approximate center or each lagoon and the disposal area. Samples SS-P1, SS-P2, SS-P3, and SS-P4 were collected from the former lagoons. Sample SS-HP was collected from the former holding pond. The samples were collected immediately below the base of the former features or the fill material to evaluate whether natural soils were contaminated by the operations of the lagoons and ponds (Ref. 31, p. 3-36). No appropriate background soil sample was identified for comparison to results for soil samples collected from the lagoons.

All soil samples collected during the RI from 1990 to 1997 were analyzed by Weston Analytics Division, a New Jersey-certified laboratory. All samples collected from 1998 to 2000 were analyzed by STL, a New Jersey-certified laboratory (Ref. 31, p. 3-37). The analytical results in the tables below are considered usable and of known quality (Ref. 31, p. 3-38). Table 3-1 of Reference 31 provides a summary of the analytical suite for the soil samples. The detection limits were not provided in the RI report.

TABLE 2

SUMMARY OF WASTE SAMPLES ASSOCIATED WITH LAGOONS

Sample type	**Hazardous Substance**	**Concentration**	**Date**	**Reference**
Wastewater Sludge	lead	0.16 mg/L	1977	Ref. 19, p. 1, 3
Leachate	arsenic	0.007 mg/L	1977	Ref. 22, pp. 1, 2
	lead	0.25 mg/L	1977	Ref. 22, p. 1, 2
Paint Sludge	lead	008 % by weight	1978	Ref. 20, pp. 1, 2
Wastewater Sludge	arsenic	0.7 mg/kg	1978	Ref. 25, pp. 1, 2

Sample type	**Hazardous Substance**	**Concentration**	**Date**	**Reference**
Leachate/Paint Sludge	lead	0.015 mg/L	1978	Ref. 21, p. 1

SUMMARY OF HAZARDOUS SUBSTANCES DETECTED IN SOIL SAMPLES COLLECTED FROM SOURCE 3

Site ID	Holding Pond	Lagoon 1	Lagoon 2	Lagoon 3	Lagoon 4
Location ID	SS-HP	SS-P1	SS-P2	SS-P3	SS-P4
Field Sample ID	SS-HP	SS-P1	SS-P2	SS-P3	SS-P4
Date Collected	4/17/1997	4/17/1997	4/17/1997	4/17/1997	4/17/1997
Depth (ft bgs)	10.0-12.0	10.0-12.0	10.0-12.0	10.0-12.0	10.0-12.0
Reference	31, p. 3-36, Table 4-7 [pp. 1, 2, 3]	31, p. 3-36, Table 4-7 [pp. 1, 2, 3]	31, p. 3-36, Table 4-7 [pp. 1, 2, 3]	31, p. 3-36, Table 4-7 [pp. 1, 2, 3]	31, p. 3-36, Table 4-7 [pp. 1, 2, 3]
Volatile Organic Compounds (mg/kg)					
2-Butanone	0.029	0.018 J	0.023	0.014	0.029
Carbon Disulfide	ND	0.012 J	0.018	0.004 J	0.063
Ethylbenzene	0.039	0.19	0.014	0.005 J	ND
Xylenes (total)	0.26	0.93	0.071	0.012	0.004 J
Semivolatile Organic Compounds (mg/kg)					
Benzoic Acid	ND	0.051 J	0.12 J	ND	3.4
Pentachlorophenol	11	0.31 J	13	0.11 J	0.055 J
Metals (mg/kg)					
Arsenic	3.4	ND	ND	ND	ND
Barium	5.5	13.1	2.8	6.2	4.5
Cadmium	ND	ND	ND	ND	ND
Chromium	6.6	7.2	8.6	6.9	8.1
Copper	1.3	2.7	1.9	17.1	1.2
Lead	4.1	7	4.9	10	5
Mercury	0.03	0.06	0.04	0.02	0.04
Nickel	ND	2.0	2.4	2.1	5.7
Zinc	4.2	8.4	30.4	34.9	39.7

Notes:
HP Holding pond
ID Identification
mg/kg Milligram per kilogram
ND Not detected
P Pond
SS Soil sample

2.4.2 Hazardous Waste Quantity

2.4.2.1.1 Hazardous Constituent Quantity

The information available is not sufficient to adequately support the evaluation of the hazardous constituent quantity for Source No. 3.

Sum (pounds): Unknown
Hazardous Constituent Quantity Value (C): Not available (NA)

2.4.2.1.2 Hazardous Waste Stream Quantity

The information available is not sufficient to adequately support the evaluation of the hazardous waste stream quantity for Source No. 3.

Sum (pounds): Unknown
Hazardous Waste Stream Quantity Value: NA

2.4.2.1.3 Volume

In 1979, a total of 8,096 cubic yards of sludge was removed from the lagoon area. After the sludge was visibly removed, the lagoons were filled with clean fill. The removal was considered complete when all the visually identifiable sludge and contaminated soils were removed (Refs. 31, p. 3-34; 42, p. 4). Analytical results for soil samples collected during a latter investigation, after the removal, indicate that residual contamination remains in the soil underlying the lagoons. The hazardous waste quantity associated with the lagoon area cannot be quantified.

Dimension of source (yd^3 or gallons): 0
Volume Assigned Value: 0

2.4.2.1.4 Area

In 1979, a subsurface investigation was conducted in the area of the lagoons, or Site 2 as referenced in reference documentation (Ref. 41, Plates 2, 6, and 7, p. 10). The report documenting the investigation indicated that the lagoon area included the following: a holding pond (150 by 180 feet), ponds 1 and 2 (60 by 80 feet each), pond 3 (40 by 40 feet), and pond 4 (100 by 150 feet). (The sludge disposal pond, 40 by 150 feet, was also identified, but the waste quantity associated with that source was evaluated as part of a separate site, the US Avenue Burn site [Ref. 41, pp. 10, 14, Plate 6].) The area associated with the lagoon area is estimated to be 26,200 sq ft to 32,200 sq ft. Since the Source 3 area cannot be adequately confirmed, the area of Source 3 is assigned the value of greater than 0.

Area of Source (ft^2): Unknown, > 0
Area Assigned Value: Unknown, >0

2.4.2.1.5 Source Hazardous Waste Quantity Value

The source HWQ value for Source No. 3 is assigned a value of greater than zero because the waste quantity associated with Source 3 has not been adequately documented; however, the presence of contaminated soil has been documented.

Source Hazardous Waste Quantity Value: Unknown, but greater than zero

SOURCE DESCRIPTION

2.2 SOURCE CHARACTERIZATION

<u>Source Number</u>: 4

<u>Source Description</u>: Contaminated Soil Associated with Tank Farm B

<u>Source Type</u>: Contaminated Soil

Source 4 is an area of contaminated soil identified through sampling in the area of Tank Farm B (Refs. 31, Table 4-3, Figure 3-2; 59, Appendix II, pp. II31, II32). The presence of contaminated soil in the area of Tank Farm B, as documented in Section 2.4.1, indicates that product leaked and spilled from the tank farm. Tank Farm B is located in the southern section of the plant on the south side of Foster Avenue and on the west bank of Hilliards Creek (See Reference 6, Figure 2-4). Raw materials were stored in ASTs and USTs in the area of Tank Farm B. Seventeen tanks were associated with Tank Farm B (Refs. 31, Table 2-2; 6, Figure 2-4). Materials stored in the tanks included isobutyl alcohol, C.P. acetone, methyl amyl acetate, isopropyl acetate, xylene, lacquer solvent, toluene, toluene-based solvent blend, methyl ethyl ketone, ethyl acetate, isopropanol, solvent, methyl isobutyl ketone, solvent blend, and aromatic naphtha (Refs. 5; 31, Table 2-2).

All ASTs and USTs were dismantled and removed from the property in June 1981, after the Lucas plant was sold to Scarborough (Ref. 31, p. 2-4).

The soil sample analytical data generated from an RI in the area of Tank Farm B revealed the presence of numerous hazardous substances in the area of Tank Farm B, including: acetone; 2-butanone; 2-hexanone; chloroform; ethylbenzene; toluene; 1,1,1-trichloroethane; trichloroethene; xylenes; benzo(a)anthracene; benzo(a)pyrene; benzo(b)fluoranthene; benzo(k)fluoranthene; chrysene; di-n-butyl phthalate; fluoranthene; phenanthrene; pyrene; aluminum; antimony; arsenic; barium; chromium; cobalt; lead; magnesium; mercury; zinc; and cyanide (Refs. 31, Table 4-3, Figure 3-2; 59, Appendix II, pp. II31, II32).

<u>Location of the source, with reference to a map of the site</u>: As shown on Figure 2-4, in Reference 6, Tank Farm B was located on the west side of Hilliards Creek and on the south side of Foster Avenue, just west of Building 50 (Refs. 6, Figure 2-4; 31, Figure 3-2).

Containment:

Release to ground water: As documented in the section above, Source 4 is an area of contaminated soil. No containment structures are associated with the source; therefore, a containment factor value of 10 is assigned to this source (Ref. 1, Table 3-2).

Release via overland migration and/or flood: As documented in the section above, Source 4 is an area of contaminated soil. No containment structures are associated with the source; therefore, a containment factor value of 10 is assigned to this source (Ref. 1, Table 4-2).

Gas release to air: The air migration pathway was not scored.

Particulate release to air: The air migration pathway was not scored.

2.4 WASTE CHARACTERISTICS

2.4.1 Hazardous Substances:

Liquid hazardous substances were stored in the tanks in the area of Tank Farm B. The contents of the tanks are summarized in Table 2-2 of Reference 31. The presence of contaminated soil in the area of Tank Farm B, as documented below, indicates that product leaked and spilled from the tank farm.

Four soil borings (TB-5, MW-16, MW-17, and MW-18) were installed in the vicinity of former Tank Farm B (Ref. 31, pp. 3-1, 3-31) from August 1991 through January 1992, during Phase I of the RI (Ref. 31, p. 3-3). The soil samples were analyzed for PP VOA+15, PP BNA, lead, barium, and chromium (Ref. 31, p. 3-31).

Additional soil borings (TB-91 through TB-93) were installed to delineate the extent of subsurface xylene contamination in the area from July 1998 through January 2000, during Phase V of the RI (Ref. 31, pp. 3-3, 3-33). Two samples were collected from each boring and sent for analysis of VOCs (Ref. 31, p. 3-33). A summary of soil samples collected from Source 4 during two phases of the RI is provided in the tables below. The result for a background soil sample is listed when available to provide a reference concentration for the hazardous substances. Background soil samples were selected based on whether the background and source soil sample were collected within the same depth range and same period of time and whether the samples were analyzed for the same hazardous substances. All soil samples collected from 1990 to 1997 were analyzed by Weston Analytics Division, a New Jersey-certified laboratory. All samples collected from 1998 to 2000 were analyzed by STL, a New Jersey-certified laboratory (Ref. 31, p. 3-37). The analytical results in the tables below are considered usable and of known quality (Ref. 31, p. 3-38). Table 3-1 of Reference 31 provides a summary of the analytical suite for the soil samples. No background soil samples could be identified for the source soil samples collected in 1993 and 1996.

Soil boring samples collected from MW-14 are used as background sampling locations for shallow soil intervals. The deeper soil intervals in MW-14 is contaminated with hazardous substances associated with the free-phase product ground water plume in the area of Buildings 55 and 67 as documented in Section 2.4.1 for Source 1.

Source 4 Soil Sample: 016-B001

Location ID	MW-16	MW-12
Sample Type	Source - Soil	Background - soil
Field Sample ID	016-B001	012-B001
Date Collected	10/18/1991	10/14/1991
Depth (ft bgs)	0.0-2.0	0.0-2.0
Reference	31, Table 4-3 (p. 1), and Figure 3-2	31, Table 4-5 (p. 2), p. 3-11, and Figure 3-2
Location	Tank Farm B	S Bldg 55
Volatile Organic Compounds (mg/kg)		
Chloroform	0.02	ND
Toluene	0.013	ND
Trichloroethane	0.006	ND
Trichloroethene	0.069	ND

Source 4 Soil Sample: 017-B001

Location ID	MW-17	MW-14
Sample Type	Source - Soil	Background - Soil
Field Sample ID	017-B001	014-B002
Date Collected	10/18/1991	10/28/1991
Depth (ft bgs)	2.0-4.0	2.0-4.0
Reference	31, Table 4-3 (pp. 1, 5), and Figure 3-2	31, Table 4-5 (pp. 2, 16), and Figure 3-2
Location	S Tank Farm B	N Bldg 67
Volatile Organic Compounds (mg/kg)		
Chloroform	0.046	ND
Toluene	0.013	ND
Trichloroethane	0.017	ND
Trichloroethene	0.17	0.003 J
Xylenes	0.017	ND
Metals (mg/kg)		
Barium	165	9.1
Chromium	21.2	2.2
Lead	634	2.1

Source 4 Soil Sample: 017-B002

Location ID	MW-17	TB-37
Sample Type	Source - Soil	Background - Soil
Field Sample ID	017-B002	007-B002
Date Collected	10/18/1991	10/29/1991
Depth (ft bgs)	4.0-6.0	3.0-6.0
Reference	31, Table 4-3 (p. 1), and Figure 3-2	31, Table 4-5 (p. 5), and Figure 3-2
Location	S Tank Farm B	S Tank Farm A
Volatile Organic Compounds (mg/kg)		
Chloroform	0.022	ND
Toluene	0.016	ND
Trichloroethane	0.011	ND
Trichloroethene	0.06	ND
Xylenes	0.01	ND

Source 4 Soil Sample: 018-B001

Location ID	MW-18	MW-12
Sample Type	Source - Soil	Background - Soil
Field Sample ID	018-B001	012-B001
Date Collected	10/18/1991	10/14/1991
Depth (ft bgs)	0.0-2.0	0.0-2.0
Reference	31, Table 4-3 (p. 1), and Figure 3-2	31, Table 4-5 (p. 2), p. 3-11, and Figure 3-2
Location	S Tank Farm B	S Bldg 55
Volatile Organic Compounds (mg/kg)		
Chloroform	0.035	ND
Toluene	0.011	ND
Trichloroethane	0.013	ND
Trichloroethene	0.13	ND

Source 4 Soil Sample: 018-B002

Location ID	MW-18	MW-12
Sample Type	Source - Soil	Background - Soil
Field Sample ID	018-B002	012-B002
Date Collected	10/18/1991	10/14/1991
Depth (ft bgs)	6.0-8.0	6.0-8.0
Reference	31, Table 4-3 (pp. 3, 5), and Figure 3-2	31, Table 4-5 (pp. 9, 15), and Figure 3-2
Location	Tank Farm B	S Bldg 55
Semivolatile Organic Compounds (mg/kg)		
Benzo(b)fluoranthene	0.37	ND
Fluoranthene	0.38	ND
Pyrene	0.41	ND
Metals (mg/kg)		
Barium	379	2
Chromium	39.2	4.7
Lead	660	1.8

Source 4 Soil Sample: 005-B001

Location ID	TB-05	TB-37
Sample Type	Source - Soil	Background - Soil
Field Sample ID	005-B001	007-B002
Date Collected	10/18/1991	10/29/1991
Depth (ft bgs)	4.0-6.0	3.0-6.0
Reference	31, Table 4-3 (p. 1), and Figure 3-2	31, Table 4-5 (p. 5), and Figure 3-2
Location	Tank Farm B	S Tank Farm A
Volatile Organic Compounds (mg/kg)		
Chloroform	0.024	ND
Ethylbenzene	0.01	ND
Toluene	0.024	ND
Trichloroethane	0.009	ND
Trichloroethene	0.082	ND
Xylenes	0.092	ND

Source 4 Soil Sample: 005-B002

Location ID	TB-05	MW-12
Sample Type	Source - Soil	Background - Soil
Field Sample ID	005-B002	012-B002
Date Collected	10/18/1991	10/14/1991
Depth (ft bgs)	6.0-8.0	6.0-8.0
Reference	31, Table 4-3 (p. 1), and Figure 3-2	31, Table 4-5 (p. 2), and Figure 3-2
Location	Tank Farm B	NW Tank Farm A
Volatile Organic Compounds (mg/kg)		
Chloroform	0.01	ND
Toluene	0.025	ND
Trichloroethane	0.003 J	ND
Trichloroethene	0.035	ND

Source 4 Soil Sample: 005-B102

Location ID	TB-05	MW-12
Sample Type	Source - Soil	Background - Soil
Field Sample ID	005-B102	012-B002
Date Collected	10/18/1991	10/14/1991
Depth (ft bgs)	6.0-8.0	6.0-8.0
Reference	31, Table 4-3 (p. 1), and Figure 3-2	31, Table 4-5 (p. 1), and Figure 3-2
Location	Tank Farm B	NW Tank Farm A
Volatile Organic Compounds (mg/kg)		
2-Butanone	0.027	ND
Chloroform	0.018	ND
Ethylbenzene	0.037	ND
Toluene	0.027	ND
Trichloroethane	ND	ND
Trichloroethene	0.06	ND
Xylenes	0.46	ND

Source 4 Soil Sample: 032-B001

Location ID	TB-32	SGW-278
Sample Type	Source - Soil	Background - Soil
Field Sample ID	032-B001	278-B001
Date Collected	7/8/1993	7/8/1993
Depth (ft bgs)	4.5-5.0	4.5-5.2
Reference	31, Table 4-3 (pp. 2, 5, 7), and Figure 3-2	31, Table 4-3 (pp. 1, 5, 7) and Figure 3-2
Location	Tank Farm B	NW Tank Farm B
Volatile Organic Compounds (mg/kg)		
Acetone	0.07	ND
Metals (mg/kg)		
Arsenic	9.7	1.2
Chromium	68.9	10.1
Cobalt	1.6	ND
Lead	859	ND
Magnesium	284	77
Mercury	0.59	ND
Zinc	611	2.6
Cyanide	2.8	NA

Notes:

Bldg	Building	NA	Not analyzed
ft bgs	Feet below ground surface	ND	Not detected
ID	Identification	NW	Northwest
mg/kg	Milligram per kilogram	S	South
MW	Monitoring well	TB	Test boring
N	North		

No soil samples were collected in 1996 and 1999 that could be used as background for the 1996 and 1999 soil source samples listed in the tables below. No background concentration is provided. Therefore, only concentrations of hazardous substances that are not naturally occurring and associated with operations at the Lucas plant are listed in the tables below and used to characterize Source 4.

Source 4 Soil Sample: TB-67-01

Location ID	TB-67
Sample Type	Source - Soil
Field Sample ID	TB-67-01
Date Collected	10/1/1996
Depth (ft bgs)	1.5-2.0
Reference	31, Table 4-3 (pp. 2, 6), and Figure 3-2
Location	Tank Farm B
Volatile Organic Compounds (mg/kg)	
Ethylbenzene	19
Toluene	63
Xylenes	370
Metals (mg/kg)	
Lead	1,070

Source 4 Soil Sample: TB-69-01

Location ID	TB-69
Sample Type	Source - Soil
Field Sample ID	TB-69-01
Date Collected	10/1/1996
Depth (ft bgs)	1.5-2.0
Reference	31, Table 4-3 (p. 4), and Figure 3-2
Location	Tank Farm B
Semivolatile Organic Compounds (mg/kg)	
Benzo(a)anthracene	0.46
Benzo(a)pyrene	0.45
Benzo(b)fluoranthene	0.44
Benzo(k)fluoranthene	0.39
Chrysene	0.49
Di-n-butyl Phthalate	0.82
Fluoranthene	0.85
Phenanthrene	0.64
Pyrene	0.86

Source 4 Soil Sample: TB-69-5.5

Location ID	TB-69
Sample Type	Source - Soil
Field Sample ID	TB-69-5.5
Date Collected	10/1/1996
Depth (ft bgs)	4.0-4.5
Reference	31, Table 4-3 (p. 6), and Figure 3-2
Location	Tank Farm B
Metals (mg/kg)	
Lead	398

Source 4 Soil Sample: TB-91A

Location ID	TB91
Sample Type	Source - Soil
Field Sample ID	TB-91A
Date Collected	2/5/1999
Depth (ft bgs)	3.5-4.0
Reference	31, Table 4-3 (p. 2), and Figure 3-2
Location	Tank Farm B
Volatile Organic Compounds (mg/kg)	
2-Butanone	0.46
Acetone	0.34
Ethylbenzene	0.13
Toluene	0.71
Xylenes	0.80

Source 4 Soil Sample: TB-91B

Location ID	TB91
Sample Type	Source - Soil
Field Sample ID	TB-91B
Date Collected	2/5/1999
Depth (ft bgs)	4.8-5.0
Reference	31, Table 4-3 (p. 2), and Figure 3-2
Location	Tank Farm B
Volatile Organic Compounds (mg/kg)	
2-Butanone	0.14
2-Hexanone	0.069
Acetone	0.14
Ethylbenzene	1.2
Toluene	1.9
Xylenes	5.8

Source 4 Soil Sample: TB-92A

Location ID	TB-92
Sample Type	Source - Soil
Field Sample ID	TB-92A
Date Collected	2/5/1999
Depth (ft bgs)	3.5-4.0
Reference	31, Table 4-3 (p. 2), and Figure 3-2
Location	Tank Farm B
Volatile Organic Compounds (mg/kg)	
2-Butanone	0.19
Acetone	0.14
Xylenes	0.59

Source 4 Soil Sample: TB-92B

Location ID	TB-92
Sample Type	Source - Soil
Field Sample ID	TB-92B
Date Collected	2/5/1999
Depth (ft bgs)	5.0-5.5
Reference	31, Table 4-3, (p. 2) and Figure 3-2
Location	Tank Farm B
Volatile Organic Compounds (mg/kg)	
2-Butanone	0.14
Acetone	0.12
Toluene	0.12
Xylenes	0.18

Source 4 Soil Sample: TB-93A

Location ID	TB-93
Sample Type	Source - Soil
Field Sample ID	TB-93A
Date Collected	2/5/1999
Depth (ft bgs)	1.5-2.0
Reference	31, Table 4-3 (p. 2), and Figure 3-2
Location	Tank Farm B
Volatile Organic Compounds (mg/kg)	
2-Butanone	0.13
Acetone	0.11

Source 4 Soil Sample: TB-93B

Location ID	TB-93
Sample Type	Source - Soil
Field Sample ID	TB-93B
Date Collected	2/5/1999
Depth (ft bgs)	4.5-5.0
Reference	31, Table 4-3 (p. 2), and Figure 3-2
Location	Tank Farm B
Volatile Organic Compounds (mg/kg)	
2-Butanone	0.19
Acetone	0.21

Notes:

ft bgs	Feet below ground surface
ID	Identification
mg/kg	Milligram per kilogram
TB	Test boring

2.4.2 Hazardous Waste Quantity

2.4.2.1.1 Hazardous Constituent Quantity

The information available is not sufficient to adequately support the evaluation of the hazardous constituent quantity for Source No. 4.

Sum (pounds): Unknown
Hazardous Constituent Quantity Value (C): Not available (NA)

2.4.2.1.2 Hazardous Waste Stream Quantity

The information available is not sufficient to adequately support the evaluation of the hazardous waste stream quantity for Source No. 4.

Sum (pounds): Unknown
Hazardous Waste Stream Quantity Value: NA

2.4.2.1.3 Volume

The information available is not sufficient to adequately support the determination of the volume hazardous waste quantity value for Source No. 4.

Dimension of source (yd^3 or gallons): 0
Volume Assigned Value: 0

2.4.2.1.4 Area

The information available is not sufficient to adequately support the determination of the area hazardous waste quantity value for Source No. 4. However, the area hazardous waste quantity is considered to be greater than zero, but unknown because contaminated soil remains in Source 4 as documented in Section 2.4.1.

Area of Source (ft^2): Unknown, > 0
Area Assigned Value: Unknown, > 0

2.4.2.1.5 Source Hazardous Waste Quantity Value

The source HWQ value for Source No. 4 is assigned a value of greater than zero because the waste quantity associated with Source 4 has not been adequately documented; however, the presence of contaminated soil has been documented.

Source Hazardous Waste Quantity Value: Unknown, but greater than zero

SUMMARY OF SOURCE EVALUATED

SHERWIN-WILLIAMS/HILLIARDS CREEK

Source No.	Source Hazardous Waste Quantity Value	Ground Water	Surface Water	Air Gas	Air Particulate
1	>0	10	10	Not scored	Not scored
2	>0	10	10	Not scored	Not scored
3	>0	10	10	Not scored	Not scored
4	>0	10	10	Not scored	Not scored

Total Source Hazardous Waste Quantity Value: >0
Site Hazardous Waste Quantity Factor Value: 100 (Level II Wetland)
(Ref. 1 [Table 2-6], Section 2.4.2.2)

Other Sources:

Numerous structures are shown on a 1964 insurance map that are potential areas of contaminated soil, including (1) the soil underlying the empty and dirty drum storage area on the southern portion of the Lucas plant, east of Hilliards Creek; (2) the soil underlying a solvent railroad and truck tanker unloading station in the southern section of the Lucas plant, on the east side of Hilliards Creek, and west of the empty and dirty drum storage area, and north of current Building 67; (3) soil underlying Building 67 (formerly Building 36) used to store unknown materials, located on the southern portion of the facility, east of Hilliards Creek; (4) soil underlying the former location of a sewage treatment plant; (5) soil underlying piping associated with the Building 67 that runs from east to west across the facility and extends from Building 67 and crosses under Foster Avenue to the north and eastern portions of the former Lucas plant; (5) soil underlying former Building 56, where drums of finished stock were stored; (6) soil underlying Building 57 used to store pigments, located on the northwest portion of the former Lucas plant, on the east side of Gibbsboro-Clementon Road; (7) soil underlying the 22,000-gallon fuel oil tank, former coal storage bin, latex storage tanks, and drum storage area formerly located on the north side of Foster Avenue in the areas of former Buildings 37 and 52; (8) soil underlying Building 52, used for mixing lacquers, and Building 53, used for storing laquer and filling cans with solvent; (9) soil underlying the former railroad that ran from Foster Avenue, north to numerous locations on the former Lucas plant; (10) soil underlying former Building 39 where paint products were stored and mixed; (11) soil underlying Buildings 7-1, 7-2, 29, and 58, which were used to store cans of paint and finished stock (Refs. 4; 5; 60, pp. 66, 67, 68, 96). Sampling investigations of many of these potential source areas have not been conducted.

Aerial photographs from 1961 show two open storage areas in the northeastern corner of the Lucas plant (Ref. 7, p. 8). This area is referred to as the vacant lot in RI documents.

The 1984 aerial photographs show drums stacked around buildings in the northern portion of the Lucas plant and open storage areas in the north and central portions of the plant (Ref. 7, p. 13).

Lacquer storage tanks were located at an unidentified location on the Lucas plant, and the soil underlying the tanks may be contaminated (Ref. 13, p. 7).

Septic systems located on the plant are also potential sources of soil contamination (Ref. 31, pp. 3-17, 4-28, 4-29, 4-30, Table 4-21, Figure 3-2).

Surface runoff from the northern section of the former Lucas plant flowed to Silver Lake. The bottom sediments of Silver Lake were periodically excavated to maintain the volume of water in the lake for water power and purity. The sediments were removed from the plant area and spread on nearby fields (Ref. 60, pp. 56, 57). Since potential areas of soil contamination were located on the northern section of the plant, as evidenced by historical maps, the sediments in Silver Lake may have been contaminated and may have contaminated nearby fields (Refs. 4; 5).

Gasoline Station

A gasoline station is located on the northeastern section of the former Lucas plant. Free-phase product was observed in the area of the former gasoline station. Analytical results for a product sample indicated benzene, ethylbenzene, xylene, naphthalene, and 2-methyl naphthalene (Ref. 31, pp. ES-6, 3-30).

Twelve soil samples (TB-39 through TB-48, TB-52, and TB-53) were collected from the area of the former gasoline station from July 1995 through August 1995, during Phase III of the RI for the Lucas plant (Ref. 31, pp. 3-3, 3-18). The soil samples were collected within the vadose zone and were biased toward intervals that exhibited elevated field screening results (Ref. 31, p. 3-18). Analytical for soil samples collected during the RI did not identify a significant area of soil contamination in the area of the gasoline station; however, ground water contamination in the area was identified (Ref. 31, Table 4-11, Figure 3-2).

Test pits were excavated on the gasoline station property to identify the USTs and the waste oil pit reportedly located on the property on July 11 and 12, 1995, during Phase III of the RI for the Lucas plant. Two steel USTs were located and uncovered. The tanks were observed to be corroded, and holes were visible in the tanks. The waste oil pit was not uncovered during the excavation (Ref. 31, p. 3-21).

The plume identified in the area of gas station was determined to be limited to a small area on the northwest side of the former gas station building and to be separate from the plumes identified in the areas of Buildings 50 and 67 and former Tank Farm A (Ref. 31, Figures 4-11 and 4-12).

Lead-Contaminated Soil Surrounding Hilliards Creek

Soil samples were collected from 16 transects set across Hilliards Creek between Clementon-Gibbsboro Road and Hilliard Road (T1 through T15 and T17) (Ref. 51, pp. 5, 8) between December 1999 and January 2000. As shown on Reference 97, Hilliards Creek is located downgradient of the former Lucas plant and received surface water runoff from the plant during and before its operation (see Reference 6,

Figure 2-4 and Reference 31, Figure 3-2) (Ref. 31, pp. 2-9, 2-17). The soil samples were collected to evaluate whether periodic flooding transported contaminated sediments from Hilliards Creek to the flood plain of Hilliards Creek. A soil sample was collected from the north and south banks of Hilliards Creek at each transect location. The transects were spaced 200 feet apart. Soil samples were collected at 30-foot intervals along each transect. The soil samples collected from the banks of Hilliards Creek were collected from within the 100-year flood plain. Additional soil samples were collected as needed to complete the horizontal and vertical delineation of lead contamination, and four soil boring samples were collected from the southern berm of the manmade pond located off Gibbsboro-Clementon Road (Ref. 51, pp. 5, 8).

All samples were analyzed for lead (Ref. 51, p. 5). Approximately 25 percent of all samples were analyzed for TAL metals plus cyanide, 5 percent for TCLP metals (including copper and zinc), 5 percent for TCLP VOCs and BNA analyses (Ref. 51, p. 6). All samples were collected in accordance with the November 1999 work plan for the Hilliard's Creek Site, Gibbsboro, New Jersey, and the December 1999 work plan addendum (Refs. 51, p. 4; 68; 69). The results from the analysis of the soil samples were validated according to Region II Contract Laboratory Program (CLP) data validation protocols (Ref. 51, p. 20). The analytical laboratory used CLP statement of work (SOW) ILM04.0 for the analysis of lead and TAL metals (Ref. 68, Table 2).

No background soil sample was collected. However, a transect (T17) was placed across Nicholson Branch, a tributary of Hilliards Creek. The transect was used to collect surface and subsurface soil from the two banks of Nicholson Branch (Ref. 51, pp. 5, 8, and Figure 4). The samples collected from transect 17 are used to establish background levels for lead in soil located within the Hilliards Creek flood plain. Analytical results for soil samples indicating concentrations of lead above three times the background concentration are provided in the Tables 3 and 4. The background soil samples were analyzed for lead only. Therefore, lead is the only metal evaluated. As documented in Tables 3 and 4, analytical results for soil samples collected from the banks or flood plains of Hilliards Creek indicated the presence of lead-contaminated soil.

TABLE 3

SURFACE SOIL SAMPLES COLLECTED FROM THE FLOOD PLAIN OF HILLIARDS CREEK (0 to 0.5 ft bgs)

Location ID	T17E	T17W	T01N	T01N15	T01S	T02N	T02N15	T02N30	T02S
Field Sample ID	SS-T17E-0.0-0.5	SS-T17W-0.0-0.5	SS-T01N-0.0-0.5	SS-T01N15-0.0-0.5	SS-T01S-0.0-0.5	SS-T02N-0.0-0.5	SS-T02N15-0.0-0.5	SS-T02N30-0.0-0.5	SS-T02S-0.0-0.5
Date Collected	12/13/1999	12/13/1999	12/3/1999	12/28/1999	12/3/1999	12/3/1999	12/28/1999	12/28/1999	12/3/1999
Depth (ft bgs)	0.0-0.5	0.0-0.5	0.0-0.5	0.0-0.5	0.0-0.5	0.0-0.5	0.0-0.5	0.0-0.5	0.0-0.5
Sample Type	Background	Background	Source	Source	Source	Source	Source	Source	Source
Reference	51, Table 4-c, p. 14, Figure 4	51, Table 4-c, p. 14, Figure 4	51, Table 4-c, p. 4, Figure 4	51, Table 4-c, p. 4, Figure 4	51, Table 4-c, p. 4, Figure 4	51, Table 4-c, p. 5, Figure 4	51, Table 4-c, p. 5, Figure 4	51, Table 4-c, p. 5, Figure 4	51, Table 4-c, p. 5, Figure 4
Metals (mg/kg)									
Lead	124	49.8	524	420	1,030	1,490	1,070	733	1,370

Notes:

bgs	Below ground surface
E	East
ft	Foot
ID	Identification
mg/kg	Milligram per kilogram
N	North
T	Transect
S	South
SS	Surface soil
W	West

TABLE 3 (Continued)

SURFACE SOIL SAMPLES COLLECTED FROM THE FLOOD PLAIN OF HILLIARDS CREEK (0 to 0.5 ft bgs)

Location ID	T17E	T17W	T02S15	T02S30	T06N	T06S	T07N	T07S	T08N
Field Sample ID	SS-T17E-0.0-005	SS-T17W-0.0-005	SS-T02S15-0.0-0.5	SS-T02S30-0.0-0.5	SS-T06N-0.0-0.5	SS-T06S-0.0-0.5	SS-T07N-0.0-0.5	SS-T07S-0.0-0.5	SS-T08N-0.0-0.5
Date Collected	12/13/1999	12/13/1999	12/3/1999	12/3/1999	12/8/1999	12/8/1999	12/8/1999	12/8/1999	12/8/1999
Depth (ft bgs)	0.0-0.5	0.0-0.5	0.0-0.5	0.0-0.5	0.0-0.5	0.0-0.5	0.0-0.5	0.0-0.5	0.0-0.5
Sample Type	Background	Background	Source	Source	Source	Source	Source	Source	Source
Reference	51, Table 4-c, p. 14, Figure 4	51, Table 4-c, p. 14, Figure 4	51, Table 4-c, p. 5, Figure 4	51, Table 4-c, p. 6, Figure 4	51, Table 4-c, p. 8, Figure 4	51, Table 4-c, p. 8, Figure 4	51, Table 4-c, p. 8, Figure 4	51, Table 4-c, p. 8, Figure 4	51, Table 4-c, p. 8, Figure 4
Metals (mg/kg)									
Lead	124	49.8	718	460	4,660	3,460	2,330	2,020	2,810

Notes:

bgs	Below ground surface
E	East
ft	Foot
ID	Identification
mg/kg	Milligram per kilogram
N	North
T	Transect
S	South
SS	Surface soil
W	West

TABLE 3 (Continued)

SURFACE SOIL SAMPLES COLLECTED FROM THE FLOOD PLAIN OF HILLIARDS CREEK (0.0 to 0.5 ft bgs)

Location ID	T17E	T17W	T08S	T09S	T11S	T13S	T14S
Field Sample ID	SS-T17E-0.0-005	SS-T17W-0.0-005	SS-T08S-0.0-0.5	SS-T09S-0.0-0.5	SS-T11S-0.0-0.5	SS-T13S-0.0-0.5	SS-T14S-0.0-0.5
Date Collected	12/13/1999	12/13/1999	12/8/1999	12/10/1999	12/10/1999	12/10/1999	12/10/1999
Depth (ft bgs)	0.0-0.5	0.0-0.5	0.0-0.5	0.0-0.5	0.0-0.5	0.0-0.5	0.0-0.5
Sample Type	Background	Background	Source	Source	Source	Source	Source
Reference	51, Table 4-c, p. 14, Figure 4	51, Table 4-c, p. 14, Figure 4	51, Table 4-c, p. 8, Figure 4	51, Table 4-c, p. 10, Figure 4	51, Table 4-c, p. 11, Figure 4	51, Table 4-c, p. 12, Figure 4	51, Table 4-c, p. 13, Figure 4
Metals (mg/kg)							
Lead	124	49.8	7,530	1,660	409	508	513

Notes:

bgs	Below ground surface
E	East
ft	Foot
ID	Identification
mg/kg	Milligram per kilogram
N	North
T	Transect
S	South
SS	Surface soil
W	West

TABLE 4

SUBSURFACE SOIL SAMPLES COLLECTED FROM THE FLOOD PLAIN OF HILLIARDS CREEK (1.5 to 2.0 ft bgs)

Location ID	T17E	T01N	T01S	T01S15	T02N	T02N15	T02N30	T02S	T02S15	T02S30
Field Sample ID	SS-T17E-1.5-2.0	SS-T01N-1.5-2.0	SS-T01S-1.5-2.0	SS-T01S15--1.5-2.0	SS-T02N-1.5-2.0	SS-T02N15-1.5-2.0	SS-T02N30-1.5-2.0	SS-T02S-1.5-2.0	SS-T02S15-1.5-2.0	SS-T02S30-1.5-2.0
Date Collected	12/13/1999	12/3/1999	12/3/1999	12/28/1999	12/3/1999	12/28/1999	12/28/1999	12/3/1999	12/3/1999	12/3/1999
Depth (ft bgs)	1.5-2.0	1.5-2.0	1.5-2.0	1.5-2.0	1.5-2.0	1.5-2.0	1.5-2.0	1.5-2.0	1.5-2.0	1.5-2.0
Sample Type	Background	Source	Source	Source	Source	Source	Source	Source	Source	Source
Reference	51, Table 4-c, p. 14, Figure 4	51, Table 4-c, p. 4, Figure 4	51, Table 4-c, p. 4, Figure 4	51, Table 4-c, p. 14, Figure 4	51, Table 4-c, p. 5, Figure 4	51, Table 4-c, p. 5, Figure 4	51, Table 4-c, p. 5, Figure 4	51, Table 4-c, p. 5, Figure 4	51, Table 4-c, p. 6, Figure 4	51, Table 4-c, p. 6, Figure 4
Metals (mg/kg)										
Lead	6	5,720	898	184	5,290	4,430	121	1,080	24,300	916

Notes:

bgs Below ground surface
E East
ft Foot
ID Identification
mg/kg Milligram per kilogram
N North
T Transect
S South
SS Surface soil
W West

TABLE 4 (Continued)

SUBSURFACE SOIL SAMPLES COLLECTED FROM THE FLOOD PLAIN OF HILLIARDS CREEK (1.5 to 2.0 ft bgs)

Location ID	T17E	T04S	T06N	T06S	T07N	T07S	T08N	T08S	T11N	T12N
Field Sample ID	SS-T17E-1.5-2.0	SS-T04S-1.5-2.0	SS-T06N-1.5-2.0	SS-T06S-1.5-2.0	SS-T07N-1.5-2.0	SS-T07S-1.5-2.0	SS-T08N-1.5-2.0	SS-T08S-1.5-2.0	SS-T11N-1.5-2.0	SS-T12N-0.0-0.5
Date Collected	12/13/1999	12/3/1999	12/8/1999	12/8/1999	12/8/1999	12/8/1999	12/8/1999	12/8/1999	12/10/1999	12/10/1999
Source Type	Background	Source	Source	Source	Source	Source	Source	Source	Source	Source
Depth (ft bgs)	1.5-2.0	1.5-2.0	1.5-2.0	1.5-2.0	1.5-2.0	1.5-2.	1.5-2.0	1.5-2.0	1.5-2.0	1.5-2.0
Reference	51, Table 4-c, p. 14, Figure 4	51, Table 4-c, p. 7, Figure 4	51, Table 4-c, p. 8, Figure 4	51, Table 4-c, p. 8, Figure 4	51, Table 4-c, p. 8, Figure 4	51, Table 4-c, p. 9, Figure 4	51, Table 4-c, p. 9, Figure 4	51, Table 4-c, p. 9, Figure 4	51, Table 4-c, p. 11, Figure 4	51, Table 4-c, p. 12, Figure 4
Metals (mg/kg)										
Lead	6	220	108	56	3,140	3,820	589	16,300	593	2,950

Notes:

bgs Below ground surface
E East
ft Foot
ID Identification
mg/kg Milligram per kilogram
N North
T Transect
S South
SS Surface soil
W West

TABLE 4 (Continued)

SUBSURFACE SOIL SAMPLES COLLECTED FROM THE FLOOD PLAIN OF HILLIARDS CREEK (1.5 to 2.0 ft bgs)

Location ID	T17E	T12N	T13N	T13N15	T13S	T14N	T14N15	T14N30	T14S
Field Sample ID	SS-T17E-1.5-2.0	SS-T12N-0.0-0.5	SS-T13N-1.5-2.0	SS-T13N15-1.5-2.0	SS-T13S-1.5-2.0	SS-T14N-1.5-2.0	SS-T14N15-1.5-2.0	SS-T14N30-1.5-2.0	SS-T14S-1.5-2.0
Date Collected	12/13/1999	12/10/1999	12/9/1999	12/28/1999	12/10/1999	12/9/1999	12/28/1999	12/28/1999	12/10/1999
Depth (ft bgs)	1.5-2.0	1.5-2.0	1.5-2.0	1.5-2.0	1.5-2.0	1.5-2.0	1.5-2.0	1.5-2.0	1.5-2.0
Source Type	Background	Source	Source	Source	Source	Source	Source	Source	Source
Reference	51, Table 4-c, p. 14, Figure 4	51, Table 4-c, p. 12, Figure 4	51, Table 4-c, p. 12, Figure 4	51, Table 4-c, p. 12, Figure 4	51, Table 4-c, p. 13, Figure 4	51, Table 4-c, p. 13, Figure 4	51, Table 4-c, p. 13, Figure 4	51, Table 4-c, p. 13, Figure 4	51, Table 4-c, p. 13, Figure 4
Metals (mg/kg)									
Lead	6	2,950	4,330	604	61	562	144	1,330	61

Notes:

bgs	Below ground surface
E	East
ft	Foot
ID	Identification
mg/kg	Milligram per kilogram
N	North
T	Transect
S	South
SS	Surface soil
W	West

Lead-Contaminated Soil at 165 Kirkwood Road

Analytical results for soil samples collected as part of the ACO indicated the presence of lead in surface and subsurface (1 to 6.5 feet bgs) soil on a residential property at 165 Kirkwood Road (Refs. 50, p. 1-2; 51, Appendix A). In April 2000, composite samples were collected from 165 Kirkwood Roadand analyzed for TCLP metals, VOCs, and SVOCs (Refs. 30, p. 1; 51, Table 1, pp. 24, 25, Appendix A). The leachate from the samples contained arsenic (up to 1,190 µg/L), barium (up to 1,740 µg/L), cadmium (up to 42.3 µg/L), chromium (up to 59.1 µg/L), and lead (up to 53,000 µg/L) (Ref. 30, pp. 16, 18, 20, 22, 24, 26, 28, 30, 99, 101, 103, 105, 107, 119, 121, 123, 125, 127, 135, 137 through 149, 181, 182, 183, 185, 186, 188, 190, 191, 192, 194, 195, 196). No VOCs or SVOCs were detected in the samples. Analytical results for soil samples indicated high concentrations of lead in surface and subsurface soil (1.0 to 6.5 feet bgs) (Ref. 51, Table 4 and Appendix A).

Also in April 2000, soil samples were collected from 165 Kirkwood Road to complete the delineation of lead-contaminated soil (Ref. 51, p. 6). The property was divided into grids representing no more than 20 cubic yards each. Four borings were completed in each of these grids and samples were collected at intervals of 0 to 6 inches, 12 to 18 inches, and 24 to 30 inches. The four samples from each interval were composited on an equal-weight basis and analyzed for total lead. In total, 413 soil samples were collected during the April 2000 sampling event. The results of the April 2000 investigation indicated that lead was present at 165 Kirkwood Road at levels ranging from non-detect to 38,800 mg/kg (Ref. 51, p. 7 and Table 4). The address 165 Kirkwood Road is located on the flood plain of Hilliards Creek (Ref. 51, Table 4-b). Hilliards Creek bisects the backyard the property (Ref. 50, p. 1-2). Lead-contaminated soil at this location may be caused by releases from the Lucas plant to Hilliards Creek and the subsequent flooding of 165 Kirkwood Road by Hilliards Creek.

In September and November 2001, surface and subsurface soil samples were collected at 165 Kirkwood Road to complete delineation of lead contamination identified during earlier sampling events. Soil borings were drilled up to 10 feet bgs. Subsurface soil samples were collected at 1-foot intervals ranging from 0 to 10 feet bgs. The uppermost 6 inches of each interval were collected for analysis (Ref. 51, pp. 13, 14, 19, 23). In October 2003, an interim removal action was completed at 165 Kirkwood Road: the top 6 inches of soil were excavated from the property and disposed of (Ref. 50, pp. ES-1, 2-3). Lead-contaminated soil may remain on the property (Ref. 51, Table 4 and Appendix A) since only the top 6 inches of soil were removed from the property and results for soil samples below this depth indicated concentrations of lead greater than 400 mg/kg.

4.0 SURFACE WATER MIGRATION PATHWAY

4.1 OVERLAND/FLOOD MIGRATION COMPONENT

4.1.1 GENERAL CONSIDERATIONS

4.1.1.1 DEFINITION OF HAZARDOUS SUBSTANCE MIGRATION PATH FOR OVERLAND/FLOOD COMPONENT

Surface water runoff from the northernmost portion of the Lucas plant discharges directly into Silver Lake (Ref. 31, p. 2-9). Silver Lake discharges into Hilliards Creek through an underground culvert that crosses under the parking lot located between the lake and Foster Avenue (Refs. 6, Figure 2-4; 31, p. 2-17). The north-central portion of the Lucas plant, including portions of Source 2 (contaminated soil northwest and southeast of Building 55) and the entire area of Source 4, is occupied by buildings and paved areas. Runoff generated in the area between Silver Lake and Foster Avenue enters a network of catch basins and storm sewers, which discharge into Hilliards Creek, immediately south of Foster Avenue (Ref. 31, p. 2-9). From this point, Hilliards Creek continues to flow in the southwest direction, past Buildings 50 and 67 and the locations of the surface water impoundments (Source 3), approximately 1,000 feet to Gibbsboro-Clementon Road, under Gibbsboro-Clementon Road, then past a residential pond located on the north bank of Hilliards Creek. Hilliards Creek continues in the southwesterly direction and converges with an unnamed tributary of Bridgewood Lake approximately 800 feet west of Gibbsboro-Clementon Road. The creek continues approximately 0.85 mile to Kirkwood Lake (Refs. 31, Figures 2-2, 2-4, and 3-2; and 9). Kirkwood Lake continues in the westerly direction for approximately 4,224 feet to empty into the Cooper River. Cooper River continues in the northwest direction to complete the 15-mile downstream target distance limit (TDL). The TDL is documented on Reference 98. Surface features, such as buildings, are shown in Reference 31, Figures 2-2, 2-4, and 3-2.

Surface water runoff from the southern portion of the Lucas plant, including portions of Source 2 (contaminated soil associated with the pump house) and Sources 1 and 3 flow to Hilliards Creek (Ref. 31, Figures 2-4 and 3-2, p. 2-9). Free-phase product, Source 1, has been observed entering Hilliards Creek at the point where the storm sewer north of Building 67 discharges into Hilliards Creek (Refs. 31, Figure 3-2; 18, pp. 2-2, 2-3, Figure 3-1; 48, p. 2-3, Figures 2-1 and 2-4). Aerial photographs from 1973 show the presence of a pipeline extending from the north bank of one of the surface impoundments (impoundment one) associated with Source 3 to a drainage channel (Hilliards Creek) that runs through the center of the Lucas plant. An outfall also was observed extending from the western bank of the impoundment area toward the drainage channel (Hilliards Creek) (Ref. 7, p. 10).

Historically, surface water runoff from the Lucas plant followed the contours of the land and entered a storm sewer system that discharged into Hilliards Creek (Refs. 6, Figure 2-4; 18, pp. 2-2, 2-3, 3-2; 31, p. 2-9; 73, pp. 2, 4). The 1981 United States Geological Survey (USGS) topographic map of Clementon, New Jersey does not show Hilliards Creek from Foster Avenue to Gibbsboro-Clementon Road (Ref. 9). Observations made by personnel studying the Sherwin-Williams/Hilliards Creek area indicate that the creek is perennial in this section (Ref. 80). Therefore, the probable point of entry (PPE) into surface water, Hilliards Creek, is the point at which the storm sewer empties into Hilliards Creek because free-phase product (Source 1) contained in the storm sewer has been observed to discharge into Hilliards Creek. Free-phase product has been observed discharging into the sewer and then entering the creek at this point. This is the location where the storm sewer north of Building 67 discharges into the creek at sampling location SGW-292 (Refs. 31,

Figure 2-3; 10, pp. 1, 2; 31, p. 3-3; 32, p. 5; 36; 37; 48, p. 2-3; 65, pp. 1, 2, 3; 72, pp. 2, 4; 73, pp. 2, 4). The overland flow distance from Source 1 on the Lucas plant property to perennial surface water is zero since free-phase product (Source 1) was observed discharging directly into Hilliards Creek (Refs. 8, pp. 2-2, 2-3, 3-2; 18, pp. 2-2, 2-3, 3-2; 31, p. 2-9; 48, p. 2-3 9;73, pp. 2, 4) (Ref. 31, Figures 2-4 and 3-2). This PPE to surface water is shown on Reference 97 as PPE-1.

The PPE from Source 2 is at sampling location TB-73 collected adjacent to the pump house and to Hilliards Creek (Ref. 31, Figure 3-2) and is shown in Reference 97 as PPE-2. The most downstream PPE to surface water is the point at which Source 3, former impoundments, discharged into Hilliards Creek, as shown on Reference 7, page. 10. Aerial photographs from 1973 show the presence of a pipeline extending from the north bank of one of the surface impoundments (impoundment one) associated with Source 3 to a drainage channel (Hilliards Creek) that runs through the center of the Lucas plant. An outfall also was observed extending from the western bank of the impoundment area toward the drainage channel (Hilliards Creek) (Ref. 7, p. 10). The overland flow distance is estimated to be 333 feet as measured along the pipe line shown on Reference 7, page 11. The PPE for Source 3 is the point at which the drainage ditch discharges into Hilliards Creek, shown as PPE-3 on Reference 97. The PPE to Hilliards Creek from Source 4 (Former Tank Farm B) is adjacent to sampling location MW-14 (Ref. 31, Figure 3-2) as shown on Reference 98 as PPE-4.

4.1.1.2 Target Distance Limit

Surface water from PPE-4, the most upstream PPE, flows into Hilliards Creek and travels approximately 1.3 miles west to Kirkwood Lake. Kirkwood Lake continues in a westerly direction for approximately 4,224 feet then empties into the Cooper River. The Cooper River continues in a northwesterly direction to complete the 15-mile surface water downstream TDL. The TDL is documented on Reference 98.

Surface water from PPE-3, the most downstream PPE, flows into Hilliards Creek and flows approximately 1.2 miles west to Kirkwood Lake. Kirkwood Lake continues in a westerly direction for approximately 4,224 feet then empties into the Cooper River. The Cooper River continues in a northwesterly direction to complete the 15-mile surface water downstream TDL. The TDL is documented on Reference 98.

4.1.2.1 LIKELIHOOD OF RELEASE

Numerous investigations have been conducted in Hilliards Creek to determine whether the Lucas plant released hazardous substances to the creek. Only analytical data from the most recent investigations are used to document an observed release to surface water from the Lucas plant by chemical analysis. However, summaries of previous investigations, presented in the attribution section, provide additional documentation of releases to Hilliards Creek.

4.1.2.1.1 Observed Release

An observed release to Hilliards Creek by both direct observation and chemical analysis is documented in the sections below.

Direct Observation

The free-phase product (Source 1) in the area of Buildings 50 and 67 was initially identified in 1983 when a seep of an oily substance was observed in the parking lot between former Buildings 50 and 67 (also known as the Academy Paints Building). The seep (Buildings 50 and 67 seep) is the surface expression of the free-phase product in ground water in the area of Buildings 50 and 67 (Source 1). The seep flowed overland to a storm water catch basin in the parking lot, through the storm sewer, and then discharged through rip rap into Hilliards Creek (Refs. 32, p. 5; 65, pp. 1, 2, 3). The seep was observed on many occasions during construction of the new office complex that now occupies the Lucas plant (Ref. 65, p. 1).

On February 7, 1985, and March 6, 1987, New Jersey Department of Environmental Protection (NJDEP) personnel collected an aqueous sample of Building 50 and 67 seep (Source 1) while it was discharging into Hilliards Creek (Ref. 32, pp. 5, 6, 7). The exact location of the sample is not provided in reference documentation. Analytical results for the seep sample indicated the presence of the following hazardous substances (Refs. 6, Figure 2-4; 10, pp. 1, 2, 25 to 39; 31, pp. 3-2, 3-3 and Figures 2-2 and 3-2; Ref. 32, pp. 5, 6, 7).

Hazardous Substance	**Concentration (February 7, 1987)**	**Concentration (March 6, 1987)**
benzene	700 ppb	18,000 ppb
1,2,4-trimethylbenzene,	280 ppb	
1,3,5-trimethylbenzene,	220 ppb	3,490 ppb
naphthalene,	130 ppb	
xylenes,	180 ppb	
ethylbenzene,	76 ppb	7,380 ppb
cumene,	40 ppb	1,280 ppb
tetrachloroethene		7,605 ppb
toluene		7,750 ppb
sec-butylbenzene		3,025 ppb
n-propylbenzene		1,580 ppb
1,2,3-trimethylbenzene		5,900 ppb
p-xylene		1,170 ppb
m-xylene		7,530 ppb

On February 19, 1988, and again on February 25, 1988, NJDEP observed the Building 50 and 67 seep (Source 1) discharging into Hilliards Creek (Refs. 36; 37).

In 1989, NJDEP submitted a sample of the Building 50 and 67 seep to an analytical laboratory for comparison to known petroleum and solvent products. Results of the comparison indicated that constituents in the seep sample were most similar to a mixture of solvents and to 627 solvent (a solvent), Varsol 18 (an oil), and mineral spirits (a solvent), which were used at the Lucas plant (Refs. 63, pp. 1, 2; 31, Table 2-2).

On April 9, 2002, free-phase product (Source 1) from an on-site free-phase product recovery system was observed in the storm water drain north of Building 67. The storm drain discharges into Hilliards Creek. Product was pumped out of the storm water drain, and additional measures were taken to prevent further releases to the drain and Hilliards Creek (Refs. 48, p. 2-3; 72, pp. 2, 4; 73, pp. 2, 4).

Chemical Analysis - 2004

From December 6 through December 9, 2004, Tetra Tech collected sediment and surface water samples from Hilliards Creek and wetlands adjacent to Hilliards Creek. Background surface water and sediment samples also were collected from Cooper River, Cedar Lake, and an unnamed tributary of Cedar Lake. Background wetland sediment samples were collected from Linden Lake (Ref. 84, Table 1, and Figure 2). Tetra Tech collected the surface water and sediment samples beginning at the sample location closest to the point where Hilliards Creek discharges into Kirkwood Lake (Ref. 84, p. 5, Figure 1). Surface water samples were collected before the sediment sample at each sample location by submerging the sample container in the creek. At each location, Tetra Tech collected three 40-milliliter vials pre-preserved with hydrochloric acid for target compound list (TCL) volatile organic compound (VOC) analysis; four 1-liter amber bottles preserved with ice for TCL semivolatile organic compounds (SVOC), pesticide, and polychlorinated biphenyls (PCB) analyses; one 1-liter polyethylene bottle for hardness analyses; and one 1-liter polyethylene bottle for dissolved TAL metals and cyanide analyses. The aqueous samples collected for dissolved TAL metals analysis were filtered and then preserved with nitric acid to a pH of less than 2 prior to sample shipment (Ref. 84, p. 14).

Tetra Tech collected grab sediment samples for TCL VOC analysis and placed samples directly in the sample jars. Water was decanted from sediment samples collected for total organic carbon (TOC), grain size, TAL metals, TCL SVOC, pesticide, and PCB analysis prior to placing the sample in a sample container. Tetra Tech used these techniques for the collection of all sediment samples (Ref. 84, p. 14).

The TCL organic samples were packaged and shipped to Ceimic Corporation in Narragansett, Rhode Island for analysis. The samples collected for dissolved TAL metals analysis were packaged and shipped to ChemTech Consulting Group (CHEMED) in Mountainside, New Jersey for analysis. All samples were sent for analysis under the U.S. Environmental Protection Agency (EPA) Contract Laboratory Program (CLP) Case No. 33650. A summary of the sample analysis and analytical methods is provided in Table 5 (Ref. 84, p. 14).

TABLE 5

ANALYTICAL PARAMETERS AND METHODS

Matrix	Analysis	Analytical Method
Sediment	TAL Metals	CLP SOW ILM05.3 ICPAES + Hg
Sediment	TOC	American Society of Agronomy 3rd ed., Ch. 34
Sediment	pH	9045
Sediment	Grain size	ASTM D422
Sediment	TCL VOCs	CLP SOW OLM04.3
Sediment	TCL SVOCs	CLP SOW OLM04.3
Aqueous	Dissolved TAL Metals	CLP SOW ILM05.3 ICPAES + Hg

Matrix	Analysis	Analytical Method
Aqueous	TOC	9060A
Aqueous	pH	150.1/9040C
Aqueous	TCL VOCs	CLP SOW OLM04.3
Aqueous	TCL SVOCs	CLP SOW OLM04.3
Aqueous	Hardness (Mn, Ca)	130.1

Notes:

ASTM	American Society for Testing and Materials
Ca	Calcium
CLP	Contract Laboratory Program
Hg	Mercury
ICPAES	Inductively coupled plasma/atomic emission spectroscopy
ILM	Inorganic low to medium
Mn	Manganese
OLM	Organic low to medium
SOW	Statement of work
SVOC	Semivolatile organic compound
TAL	Target analyte list
TCL	Target compound list
TOC	Total organic carbon
VOC	Volatile organic compound

Sediment and surface water samples analyzed for TCL and TAL constituents were analyzed under the EPA CLP (Ref. 84, p. 14). All analytical results were validated in accordance with EPA Region 2 "Evaluation of Metals Data for the CLP Program," and "CLP Organic Data Review and Preliminary Review" (Refs. 85, p. 15; 86, Standard Operating Procedure Number HW-2).

The locations of the background and release surface water and sediment samples and concentrations of hazardous substances detected in the samples are provided in the sections below. As documented in Tables 5, 6, and 10, the background and release samples are considered to be comparable because they were collected within the same time frame, analyzed using the same methods, are located within the same type of environment (creek or wetland), and have the same composition (see Tables 7, 8, and 9 for concentrations).

2004 Background Sampling Locations

During the Tetra Tech 2004 investigation of Hilliards Creek, Hilliards Creek background surface water and sediment samples were collected from locations outside of areas known to be contaminated by lead as indicated by previous investigations. The background locations were selected based on the similarity of surface water, drainage area, and wetland and soil type (Ref. 85, p. 8). A summary of the background sampling locations is provided in Table 6. The background sampling locations are provided in Reference 84, Figure 2.

TABLE 6

BACKGROUND SEDIMENT
AND SURFACE WATER SAMPLING LOCATIONS
2004 Hilliards CREEK INVESTIGATION

Sample ID	Date	Time	Depth	Sampling Location	Reference
Sediment Samples					
HC-BSD-1	12/09/04	9:00	0 - 2 inches	Wetland area on the northern side of Linden Lake, about 3,000 feet upstream of the confluence of Cooper River and Hilliards Creek.	84, p. 10, Figure 2, Appendix B, p. 17
HC-BSD-2	12/09/04	9:45	0 - 2 inches	Wetland area on the south side of Linden Lake, about 3,500 feet upstream from the confluence of Cooper River and Hilliards Creek.	84, p. 10, Figure 2, Appendix B, p. 18
HC-BSD-3	12/09/04	10:30	0 - 2 inches	Cooper River, about 1,500 feet upstream from the confluence of Cooper River and Hilliards Creek.	84, p. 10, Figure 2, Appendix B, p. 18
HC-BSD-7	12/09/04	12:40	0 - 2 inches	Northeast bank of Oles Lake below the water line. Oles Lake is located 1.5 miles northeast of the Lucas plant property and south of Cedar Lake.	84, p. 10, Figure 2, Appendix B, p. 19
HC-BSD-8	12/09/04	12:50	0 - 2 inches	From bottom of an unnamed tributary of Oles Lake.	84, p. 10, Figure 2, Appendix B, p. 20
Surface Water Samples					
HC-BSW-1	12/09/04	9:00	Surface	Wetland area on the northern side of Linden Lake, about 3,000 feet upstream of the confluence of Cooper River and Hilliards Creek.	84, p. 12, Figure 2, Appendix B, p. 17
HC-BSW-2	12/09/04	9:45	Surface	Wetland area on the south side of Linden Lake, about 3,500 feet upstream from the confluence of Cooper River and Hilliards Creek.	84, p. 12, Figure 2, Appendix B, p. 18
HC-BSW-3	12/09/04	10:30	Surface	Cooper River, about 1,500 feet upstream from the confluence of Cooper River and Hilliards Creek.	84, p. 12, Figure 2, Appendix B, p. 18

TABLE 6 (Continued)

BACKGROUND SEDIMENT AND SURFACE WATER SAMPLING LOCATIONS 2004 HILLIARDS CREEK INVESTIGATION

Sample ID	Date	Time	Depth	Sampling Location	Reference
Surface Water Samples (Continued)					
HC-BSW-5	12/09/04	11:55	Surface	About 600 feet east of Haddonfield Road, in an unnamed tributary draining Clement Lake, at Clement Lake discharge to an unnamed tributary.	84, p. 12, Figure 2, Appendix B, p. 19
HC-BSW-6	12/09/04	12:30	Surface	In Oles Lake, taken from the west bank.	84, p. 12, Figure 2, Appendix B, p. 19
HC-BSW-7	12/09/04	12:40	Surface	Northeast bank of Oles Lake below the water line. Oles Lake is located 1.5 miles northeast of the Lucas plant property and south of Cedar Lake.	84, p. 12, Figure 2, Appendix B, p. 19
HC-BSW-8	12/09/04	12:50	Surface	From bottom of an unnamed tributary of Oles Lake, north of Oles Lake.	84, p. 12, Figure 2, Appendix B, p. 19

Notes:

BSD	Background sediment	HC	Hilliards Creek
BSW	Background surface water	ID	Identification

2004 Background Concentrations:

The concentrations of hazardous substances detected in the background surface water and sediment samples are provided in the Tables 7, 8, and 9. As shown in Reference 84, Figure 2, two background sediment and surface water samples were collected from wetlands, two sediment and four surface water samples were collected from tributaries, and one sediment and one surface water sample were collected from a lake (Ref. 84, Figure 2). The highest concentrations of arsenic, lead, and SVOCs detected in the background samples are used to establish the background arsenic, lead, and SVOCs concentrations for the Hilliards Creek and wetland release samples. The wetland sediment sample used to establish background concentrations for arsenic, lead, and SVOCs is HC-BSD-2 (Tables 7 and 8; Ref. 1, Table 2-3).

The TOC values are presented in Table 7. The TOC values in background sediment samples can be compared to release sediment sample TOC values to determine whether the background and release samples have relatively the same amount of carbon.

TABLE 7

INORGANIC CONCENTRATIONS - 2004 BACKGROUND SEDIMENT SAMPLES

Sample Identification		HC-BSD-1		HC-BSD-2		HC-BSD-3		HC-BSD-7		HC-BSD-8	
CLP Sample Number		MB5797		MB5798		MB5799		MB57A3		MB57A4	
Location		Wetland		Wetland		Creek		Lake		Creek	
Reference		86, p. 87; 87, p. 8; 94, p. 72		86, p. 88; 87, p. 8; 94, p. 73		86, p. 89; 87, p. 8; 94, p. 74		86, p. 91; 87, p. 8; 94, p. 76		86, p. 92; 87, p. 8; 94, p. 77	
	CRDL	Conc.	Q	Conc.	Q	Conc.	Q	Conc.	Q	Conc.	Q
Inorganic Compounds (mg/kg)											
Arsenic	3	4.3	J	7.2	J	6.8	J	1	J	0.47	J
Lead	2	58.9	J	183	J	93.2	J	12.2	J	2	J
Total Organic Carbon (mg/kg)	-	57,000	-	46,000	-	30,000	-	6,200	-	6,100	-

Notes:

-	Not applicable
BSD	Background sediment
Conc.	Concentration
CLP	Contract laboratory program
CRDL	Contract-required detection limit
HC	Hilliards Creek
J	Estimated value, the percent solids were less than 50 but greater than 10 (Ref. 86, p. N-4) or below the CRDLs (Ref. 86, pp. N-4 and N-5). These concentrations have no bias (Ref. 81).
mg/kg	Milligram per kilogram
Q	Data qualifier

TABLE 8

ORGANIC CONCENTRATIONS - BACKGROUND SEDIMENT

Sample Identification		HC-BSD-1		HC-BSD-2		HC-BSD-3		HC-BSD-7		HC-BSD-8	
CLP Sample Number		B5797		B5798		B5799		B57A3		B57A4	
Location		Wetland		Wetland		Creek		Lake		Creek	
Reference	**CRQL**	90, p. D-100; 87, p. 19		90, p. D-104; 87, p. 19		90, p. D-106; 87, p. 19		90, p. D-112; 87, p. 19		90, p. D-115; 87, p. 19	
		Conc.	**Q**	**Conc.**	**Q**	**Conc.**	**Q**	**Conc.**	**Q**	**Conc.**	**Q**
Organic Compounds (µg/kg)											
Benzo(a)anthracene	330	620	U	3000	U	1600	U	460	U	380	U
Benzo(a)pyrene	330	620	U	3000	U	1600	U	460	U	380	U
Benzo(b)fluoranthene	330	620	U	3000	U	1600	U	460	U	380	U
Benzo(g,h,i)perylene	330	620	U	3000	U	1600	U	460	U	380	U
Benzo(k)fluoranthene	330	620	U	3000	U	1600	U	460	U	380	U
Bis(2-ethylhexyl)phthalate	330	190	J	850	J	640	J	230	J	110	J
Chrysene	330	620	U	3000	U	1600	U	430	U	380	U
Fluoranthene	330	87	J	330	J	1600	U	51	J	380	J
Phenanthrene	330	620	U	3000	U	1600	U	430	U	380	U

Notes:

µg/kg	Microgram per kilogram
CLP	Contract laboratory program
Conc.	Concentration
CRQL	Contract-required quantitation limit
J	Estimated value, the percent solids were less than 50 but greater than 10 (Ref. 90, Attachment 1, p. 7 of 7) or below the CRQLs (Ref. 90, Attachment 1, p. 5 of 7). These concentrations have no bias (Ref. 81).
Q	Data qualifier
U	Not detected. The concentration provided is the adjusted CRQL based on dilutions and sample moisture (Ref. 90, p. 24).

Since all other concentrations are below CRQLs, the release concentrations need to exceed the CRQL to document an observed release (Ref. 1,Table 2-3)

TABLE 9

INORGANIC CONCENTRATIONS - BACKGROUND SURFACE WATER SAMPLES

Sample Identification		HC-BSW-1		HC-BSW-2		HC-BSW-3		HC-BSW-5		HC-BSW-6		HC-BSW-7		HC-BSW-8	
CLP Sample Number		MB57A5		MB57A6		MB57A7		MB57A9		MB57B0		MB57B1		MB57B2	
Location		Wetland		Wetland		Creek		Creek		Creek		Lake		Creek	
Reference		86, p. 149; 87, p.8		86, p. 58; 87, p. 8		89, p. 59; 87, p. 8		86, p. 61; 87, p. 8		86, p. 150; 87, p. 9		86, p. 151; 87, p. 9		86, p. 152; 87, p. 9	
	CRQL	**Conc.**	**Q**	**Conc.**	**Q**	**Conc.**	**Q**	**Conc.**	**Q**	**Conc.**	**Q**	**Conc.**	**Q**	**Conc.**	**Q**
Lead (µg/L)	10	10	U	10	U	10	U	10	U	10	U	10	U	10	U

Notes:
µg/L Microgram per liter
BSW Background surface water
CLP Contract laboratory program
Conc. Concentration
CRQL Contract-required quantitation limit
HC Hilliards Creek
Q Data qualifier
U Not detected above the detection limit. The reported value is the quantitation limit.
No release of organic compounds are documented for surface water; therefore, background surface water concentrations for organic compounds are not presented.

2004 Release Sampling Locations

During the Tetra Tech 2004 investigation of Hilliards Creek, surface water and sediment samples were collected from Hilliards Creek and wetlands of Hilliards Creek downstream of the Lucas plant (Ref. 84, p. 6). As documented in the section below, the samples contained concentrations of arsenic, lead, and SVOCs at concentrations exceeding three times the background concentration. A summary of the release sampling locations is provided in the Table 10. The release sampling locations are provided on Reference 97.

TABLE 10

LOCATION OF RELEASE SURFACE WATER AND SEDIMENT SAMPLES HILLIARDS CREEK

Sample ID	Date	Time	Depth	Sampling Location	Reference
Sediment Samples					
HC-SD-01	12/09/01	7:20	0 - 2 inches	Hilliards Creek, about 230 feet upstream of Gibbsboro-Clementon Road.	84, p. 6, Figure 1, Appendix B, p. 17
HC-SD-03	12/09/01	10:30	0-2 inches	Hilliards Creek, about 200 feet upstream of HC-SD-04.	84, p. 6, Figure 1, Appendix B, p. 18
HC-SD-04	12/08/04	18:45	0 - 2 inches	Hilliards Creek, about 250 feet downstream of Gibbsboro-Clementon Road.	84, p. 6, Figure 1, Appendix B, p. 16
HC-SD-05	12/08/04	16:45	0 - 2 inches	Hilliards Creek, about 250 feet upstream of HC-SD-06.	84, p. 6, Figure 1, Appendix B, p. 15
HC-SD-06	12/08/04	16:30	0 - 2 inches	Wetland area, on the north bank of Hilliards Creek, about 1,000 feet downstream of HC-SD-04.	84, p. 6, Figure 1, Appendix B, p. 15
HC-SD-08	12/08/04	12:20	0 - 2 inches	Hilliards Creek, about 270 feet downstream of HC-SD-06.	84, p. 7, Figure 1, Appendix B, p. 14
HC-SD-08-2	12/08/04	12:20	0 - 2 inches	Duplicate of HC-SD-08.	84, p. 7, Figure 1, Appendix B, p. 14
HC-SD-12	12/08/04	11:00	0 - 2 inches	Hilliards Creek, about 230 feet downstream of HC-SD-08.	84, p. 7, Figure 1, Appendix B, p. 13

TABLE 10 (Continued)

LOCATION OF RELEASE SEDIMENT SAMPLES
HILLIARDS CREEK

Sample ID	Date	Time	Depth	Sampling Location	Reference
Sediment Samples (Continued)					
HC-SD-13	12/08/04	10:30	0 - 2 inches	Hilliards Creek, about 120 feet downstream of HC-SD-12.	84, p. 7, Figure 1, Appendix B, p. 13
HC-SD-14	12/08/04	10:10	0 - 2 inches	Hilliards Creek, about 120 feet downstream of HC-SD-13.	84, p. 7, Figure 1 Appendix B, p. 13
HC-SD-15	12/08/04	9:50	0 - 2 inches	Hilliards Creek, about 120 feet downstream of HC-SD-14.	84, p. 7, Figure 1 Appendix B, p. 12
HC-SD-17	12/08/04	08:50	0 - 2 inches	Hilliards Creek, about 320 feet downstream of HC-SD-15.	84, p. 7, Figure 1, Appendix B, p. 10
HC-SD-18	12/08/04	08:50	0 - 2 inches	Hilliards Creek, about 150 feet downstream of HC-SD-17.	84, p. 7, Figure 1, Appendix B, p. 10
HC-SD-19	12/07/04	16:10	0 - 2 inches	Hilliards Creek, about 620 feet downstream of HC-SD-15.	84, p. 7, Figure 1, Appendix B, p. 10
HC-SD-20	12/07/04	16:25	0 - 2 inches	Hilliards Creek, about 150 feet downstream of HC-SD-19.	84, p. 7, Figure 1, Appendix B, p. 11
HC-SD-21	12/07/04	16:40	0 - 2 inches	Hilliards Creek, about 120 feet downstream of HC-SD-20.	84, p. 8, Figure 1, Appendix B, p. 11
HC-SD-22	12/07/04	15:00	0 - 2 inches	Hilliards Creek, about 200 feet downstream of HC-SD-21.	84, p. 8, Figure 1, Appendix B, p. 10
HC-SD-23	12/07/04	14:55	0 - 2 inches	Hilliards Creek, about 150 feet downstream of HC-SD-22.	84, p. 8, Figure 1, Appendix B, p. 10
HC-SD-25	12/07/04	13:45	0 - 2 inches	Hilliards Creek, about 275 feet downstream of HC-SD-23.	84, p. 8, Figure 1, Appendix B, p. 9

TABLE 10 (Continued)

LOCATION OF RELEASE SEDIMENT SAMPLES
HILLIARDS CREEK

Sample ID	Date	Time	Depth	Sampling Location	Reference
Sediment Samples (Continued)					
HC-SD-26	12/07/04	13:10	0 - 2 inches	Wetland area on the south bank of Hilliards Creek, about 150 feet downstream of HC-SD-25.	84, p. 8, Figure 1, Appendix B, p. 9
HC-SD-27	12/07/04	13:00	0 - 2 inches	Hilliards Creek, about 200 feet west of HC-SW/SD-31, from the south bank of creek.	84, p. 8, Figure 1, Appendix B, p. 8
HC-SD-28	12/07/04	10:30	0 - 2 inches	Wetland area adjacent to south bank of Hilliards Creek, about 270 feet downstream of HC-SD-25.	84, p. 8, Figure 1, Appendix B, p. 7
HC-SD-29	12/07/04	10:20	0 - 2 inches	Wetland area adjacent to south bank of Hilliards Creek, about 155 feet downstream of HC-SD-25.	84, p. 8, Figure 1, Appendix B, p. 7
HC-SD-31	12/07/04		0 - 2 inches	Hilliards Creek, about 400 feet downstream of HC-SD-29.	84, p. 8, Figure 1, Appendix B, p. 7
HC-SD-32	12/07/04	10:50	0 - 2 inches	Wetland area on north bank of Hilliards Creek, about 275 feet downstream of HC-SD-25.	84, p. 9, Figure 1, Appendix B, p. 7
HC-SD-33	12/07/04	8:40	0 - 2 inches	Wetland area on north bank of Hilliards Creek, about 540 feet downstream from HC-SD-27.	84, p. 9, Figure 1, Appendix B, p. 6
HC-SD-34	12/07/04	8:47	0 - 2 inches	Wetland area on north bank of Hilliards Creek, about 465 feet downstream of HC-SD-27.	84, p. 9, Figure 1, Appendix B, p. 6
HC-SD-35	12/06/04	15:10	0 - 2 inches	Hilliards Creek, about 200 feet downstream of HC-SD-33.	84, p. 9, Figure 1, Appendix B, p. 5
HC-SD-36	12/06/04	15:40	0 - 2 inches	Wetland area about 150 feet north of HC-SD-35, north of Nicholson Branch.	84, p. 9, Figure 1, Appendix B, p. 5

TABLE 10 (Continued)

LOCATION OF RELEASE SEDIMENT SAMPLES
HILLIARDS CREEK

Sample ID	Date	Time	Depth	Sampling Location	Reference
Sediment Samples (Continued)					
HC-SD-37	12/06/04	14:55	0 - 2 inches	Wetland area on the south bank of Hilliards Creek, about 100 feet south of HC-SD-35.	84, p. 9, Figure 1, Appendix B, p. 4
HC-SD-38	12/06/04	13:15	0 - 2 inches	North bank of Hilliards Creek below water line, about 200 feet downstream from HC-SD-35.	84, p. 9, Figure 1, Appendix B, p. 4
HC-SD-39	12/06/04	13:00	0 - 2 inches	Hilliards Creek, about 100 feet downstream from HC-SD-38.	84, p. 9, Figure 1, Appendix B, p. 4
HC-SD-40	12/06/04	10:45	0 - 2 inches	North bank of Hilliards Creek below water line, about 150 downstream of HC-SD-38.	84, p. 9, Figure 1, Appendix B, p. 2
HC-SD-41	12/06/04	9:50	0 - 2 inches	Wetland area on the north bank of Hilliards Creek, about 200 feet northwest of HC-SD-40.	84, p. 9, Figure 1, Appendix B, p. 1
HC-SD-43	12/06/04	9:00	0 - 2 inches	Wetland area on the north bank of Hilliards Creek, about 80 feet west of HC-SD-41, beside large metal duct.	84, p. 10, Figure 1, Appendix B, p. 1
HC-SD-44	12/06/04	11:35	0 - 2 inches	Wetland area between Cooper River and Hilliards Creek, about 250 feet upstream of the convergence of Hilliards Creek and Cooper River.	84, p. 10, Figure 1, Appendix B, p. 2
HC-SD-45	12/06/04	11:55	0 - 2 inches	Wetland area between Cooper River and Hilliards Creek, about 100 feet south from HC-SD-44.	84, p. 10, Figure 1, Appendix B, p. 3
HC-SD-46	12/06/04	12:05	0 - 2 inches	Wetland area south of Hilliards Creek, about 200 feet east of HC-SD-39.	84, p. 10, Figure 1, Appendix B, p. 3

TABLE 10 (Continued)

LOCATION OF RELEASE SEDIMENT SAMPLES
HILLIARDS CREEK

Sample ID	Date	Time	Depth	Sampling Location	Reference
Surface Water Samples					
HC-SD-48	12/06/04	10:50	0 - 2 inches	Wetland area on the north bank of Hilliards Creek, about 100 feet north of HC-SD-40.	84, p. 10, Figure 1, Appendix B, p. 2
HC-SW-08	12/08/04	12:05	Surface	Hilliards Creek, about 500 feet downstream of the convergence of Hilliards Creek and an unnamed tributary of Bridgewood Lake.	84, p. 11, Figure 1, Appendix B, p. 14
HC-SW-17	12/08/04	8:50	Surface	Hilliards Creek, about 1,600 feet downstream of ~~of~~ the convergence of Hilliards Creek and an unnamed tributary of Bridgewood Lake.	84, p. 11, Appendix B, p. 11
HC-SW-22	12/07/04	15:00	Surface	Hilliards Creek, about 200 feet downstream of HC-SD-21.	84, p. 11, Appendix B, p. 10
HC-SW-22-2	12/07/04	15:05	Surface	Duplicate of HC-SW-22.	84, p. 11, Appendix B, p. 10
HC-SW-23	12/07/04	14:55	Surface	Hilliards Creek, about 150 feet downstream of HC-SD-22.	84, p. 11, Appendix B, p. 9, 10
HC-SW-25	12/07/04	13:45	Surface	Hilliards Creek, about 275 feet downstream of HC-SD-23.	84, p. 11, Appendix B, p. 9
HC-SW-27	12/07/04	13:00	Surface	Hilliards Creek, about 200 feet west of HC-SW/SD-31, from the south bank of creek.	84, p. 11, Appendix B, p. 8
HC-SW-31	12/07/04	10:55	Surface	Hilliards Creek, about 200 feet west of HC-SD-25.	84, p. 11, Appendix B, p. 7, 8

TABLE 10 (Continued)
LOCATION OF RELEASE SEDIMENT SAMPLES
HILLIARDS CREEK

Sample ID	Date	Time	Depth	Sampling Location	Reference
Surface Water Samples (Continued)					
HC-SW-33	12/07/04	8:40	Surface	Wetland area on the north bank of Hilliards Creek, about 200 feet upstream from HC-SD-35.	84, p. 11, Appendix B, p. 6
HC-SW-34	12/07/04	8:47	Surface	Wetland area on the north bank of Hilliards Creek, about 100 feet north from HC-SD-33.	84, p. 11, Appendix B, p. 6
HC-SW-35	12/06/04	15:10	Surface	Hilliards Creek, about 200 feet upstream of HC-SD-46	84, p. 11, Appendix B, p. 5
HC-SW-39	12/06/04	13:00	Surface	Hilliards Creek, about 100 feet upstream from HC-SD-40.	84, p. 11, Appendix B, p. 4
HC-SW-41	12/06/04	9:50	Surface	Wetland area on the north bank of Hilliards Creek, about 200 feet northwest of HC-SD-40.	84, p. 11, Appendix B, p. 1

Notes:
HC Hilliards Creek
ID Identification
SD Sediment
SW Surface water

2004 Release Concentrations:

The concentrations of hazardous substances detected in sediment and surface water samples document an observed release Hilliards Creek are summarized in Tables 11 and 12, respectively. The sampling locations are shown on Reference 97. Concentration of the hazardous substance have a data qualifier of "J," estimated concentration, because the percent moisture was high (Ref. 86, pp. N-4 and N-5).

The highest concentrations of arsenic, lead, and SVOCs detected in the background samples are used to establish the background arsenic, lead, and SVOCs concentrations for the Hilliards Creek and wetland release samples. The wetland sediment sample used to establish background concentrations for arsenic, lead, and SVOCs is HC-BSD-2. The wetland background concentrations are arsenic 7.2 mg/kg × 3 = 21.6; lead 183 mg/kg × 3 = 549 mg/kg; and bis(2-ethylhexyl)phthalate 850 µg/kg × 3 = 2,550 µg/kg (no other SVOCs were detected in the background sample). The creek sediment sample used to establish background concentrations for arsenic, lead, and SVOCs is HC-BSD-3. The creek background concentrations are arsenic 6.8 mg/kg × 3 = 20.4; lead 93.2 mg/kg × 3 = 280 mg/kg; and bis(2-ethylhexyl)phthalate 640 µg/kg × 3 = 1,920 µg/kg (no other SVOCs were detected in the background sample) (Tables 7 and 8; Ref. 1, Table 2-3). To document an observed release, the concentration of the hazardous substances must be three times the background concentration and above the sample quantitation limit (SQL) if detected in the background or greater than or equal to the SQL if not detected in the background sample (Ref. 1, Table 2-3). The SQL for the release samples are provided in Reference 88. The TOC values are provided in Tables 11 and 12. The TOC values can be used to compare release and background sample TOC contents.

TABLE 11

CONCENTRATIONS OF HAZARDOUS SUBSTANCES DETECTED IN RELEASE SEDIMENT SAMPLES COLLECTED FROM HILLIARDS CREEK

Sample ID	Hazardous Substance	Conc.	Q	SQL*	Units	Reference
HC-SD-01	Arsenic	23.2	J	4.39	mg/kg	86, p. 110; 87, p. 3; 88, p. 1 91, p. D-70; 87, p. 12; 88, p. 3; 94, p. 9
	Lead	468	J	2.03	mg/kg	
	Benzo(a)anthracene	2,600	-	1,760	µg/kg	
	Benzo(a)pyrene	3,400	-	1,760	µg/kg	
	Benzo(b)fluoranthene	5,100	-	1,760	µg/kg	
	Benzo(g,h,i)perylene	3,000	-	1,760	µg/kg	
	Benzo(k)fluoranthene	1,900	-	1,760	µg/kg	
	Chrysene	3,600	-	1,760	µg/kg	
	Fluoranthene	6,200	J	1,760	µg/kg	
	Phenanthrene	3,100	-	1,760	µg/kg	
	Pyrene	6,400	-	1,760	µg/kg	
	Total organic carbon	4,200	-	-	mg/kg	
HC-SD-03	Arsenic	22.9	J	3.8	mg/kg	86, p. 113; 87, p. 3; 88, p. 1 91, p. D-79; 87, p. 12; 88, p. 3; 94, p. 12
	Fluoranthene	1,100	-	805	µg/kg	
	Total organic carbon	9,000	-	-	mg/kg	
HC-SD-04	Benzo(a)anthracene	2,100	-	857	µg/kg	91, p. D-82; 87, p. 12; 88, p. 3; 94, p. 13
	Benzo(a)pyrene	1,900	-	857	µg/kg	
	Benzo(b)fluoranthene	2,400	-	857	µg/kg	
	Benzo(g,h,i)perylene	1,100	-	857	µg/kg	
	Benzo(k)fluoranthene	920	-	857	µg/kg	
	Chrysene	2,000	-	857	µg/kg	
	Fluoranthene	4,700	-	857	µg/kg	
	Phenanthrene	2,600	-	857	µg/kg	
	Pyrene	4,300	-	857	µg/kg	
	Total organic carbon	8,600	-	-	mg/kg	

TABLE 11 (Continued)

CONCENTRATIONS OF HAZARDOUS SUBSTANCES DETECTED IN RELEASE SEDIMENT SAMPLES COLLECTED FROM HILLIARDS CREEK

Sample ID	Hazardous Substance	Conc.	Q	SQL*	Units	Reference
HC-SD-05	Arsenic	40.6	J	3.62	mg/kg	86, p. 115; 87, p. 3; 88, p. 1
	Lead	1,010	J	2.41	mg/kg	
HC-SD-06	Benzo(b)fluoranthene	410	-	402	µg/kg	91, p. D-88; 87, p. 12; 88, p. 3; 94, p. 15
	Pyrene	570	-	402	µg/kg	
	Total organic carbon	2,000	-	-	µg/kg	
HC-SD-08	Arsenic	580	J	15.31	mg/kg	86, p. 118; 87, p. 3; 88, p. 1; 90, p. D-73; 87, p. 12; 88, p. 3; 94, p. 17
	Lead	7,440	J	10.20	mg/kg	
	Benzo(b)fluoranthene	5,000	J	2,640	µg/kg	
	Chrysene	3,200	J	2,640	µg/kg	
	Fluoranthene	4,800	J	2,640	µg/kg	
	Pyrene	5,200	J	2,640	µg/kg	
	Total organic carbon	44,100	-	-	mg/kg	
HC-SD-08-2	Arsenic	506	J	11.45	mg/kg	86, p. 119; 87, p. 3; 88, p. 1; 90, p. D-76; 87, p. 12; 88, p. 3; 94, p. 18
	Lead	6,190	J	7.63	mg/kg	
	Benzo(b)fluoranthene	7,500	J	6,286	µg/kg	
	Fluoranthene	7,100	J	6,286	µg/kg	
	Pyrene	7,300	J	6,286	µg/kg	
	Total organic carbon	42,000	-	-	mg/kg	
HC-SD-12	Arsenic	150	J	19.11	mg/kg	86, p. 79; 87, p. 4; 88, p. 1; 94, p. 20
	Lead	5,910	J	12.74	mg/kg	
	Total organic carbon	38,000	-	-	mg/kg	
HC-SD-13	Arsenic	763	J	20.00	mg/kg	86, p. 80; 87, p. 4; 88, p. 1; 94, p. 21
	Lead	9,140	J	13.33	mg/kg	
	Total organic carbon	39,000	-	-	mg/kg	
HC-SD-14	Arsenic	1,110	J	19.11	mg/kg	86, p. 81; 87, p. 4; 88, p. 1; 94, p. 23
	Lead	6,350	J	12.74	mg/kg	
	Total organic carbon	49,000	-	-	mg/kg	
HC-SD-15	Arsenic	300	J	21.90	mg/kg	86, p. 82; 87, p. 4; 88, p. 1; 94, p. 23
	Lead	7,260	J	14.60	mg/kg	
	Total organic carbon	31,000	-	-	mg/kg	

TABLE 11 (Continued)

CONCENTRATIONS OF HAZARDOUS SUBSTANCES DETECTED IN RELEASE SEDIMENT SAMPLES COLLECTED FROM HILLIARDS CREEK

Sample ID	Hazardous Substance	Conc.	Q	SQL*	Units	Reference
HC-SD-17	Arsenic	211	J	8.67	mg/kg	86, p. 84; 87, p. 4; 88, p. 1; 94, p. 25
	Lead	2,650	J	5.78	mg/kg	
	Total organic carbon	25,000	-	-	mg/kg	
HC-SD-18	Arsenic	209	J	11.36	mg/kg	86, p. 85; 87, p. 4; 88, p. 1; 94, p. 26
	Lead	2,380	J	7.58	mg/kg	
	Total organic carbon	23,000	-	-	mg/kg	
HC-SD-19	Arsenic	244	J	13.45	mg/kg	86, p. 86; 87, p. 4; 88, p. 1; 94, p. 27
	Lead	2,640	J	8.97	mg/kg	
	Total organic carbon	25,000	-	-	mg/kg	
HC-SD-20	Arsenic	875	J	9.06	mg/kg	86, p. 20; 87, p. 5; 88, p. 1; 94, p. 28
	Lead	3,450	J	6.04	mg/kg	
	Total organic carbon	43,000	-	-	mg/kg	
HC-SD-21	Arsenic	374	J	11.03	mg/kg	86, p. 21; 87, p. 5; 88, p. 1; 94, p. 29
	Lead	3,000	J	7.353	mg/kg	
	Total organic carbon	46,000	-	-	mg/kg	
HC-SD-22	Arsenic	435	J	8.88	mg/kg	86, p. 22; 87, p. 5; 88, p. 1; 94, p. 31
	Lead	3,200	J	5.92	mg/kg	
	Total organic carbon	28,000	-	-	mg/kg	
HC-SD-23	Arsenic	108	J	6.1	mg/kg	86, p. 24; 87, p. 5; 88, p. 1; 94, p. 32
	Lead	1,470	J	4.08	mg/kg	
	Total organic carbon	34,000	-	-	mg/kg	
HC-SD-25	Arsenic	213	J	13.39	mg/kg	86, p. 120; 87, p. 5; 88, p. 1; 94, p. 34
	Lead	1,750	J	8.93	mg/kg	
	Total organic carbon	51,000	-	-	mg/kg	
HC-SD-26	Arsenic	180	J	7.96	mg/kg	86, p. 121; 87, p. 5; 88, p. 1; 94, p. 35
	Lead	2,270	J	5.30	mg/kg	
	Total organic carbon	25,000	-	-	mg/kg	
HC-SD-27	Arsenic	176	J	9.62	mg/kg	86, p. 122; 87, p. 5; 88, p. 1; 94, p. 36
	Lead	2,470	J	6.41	mg/kg	
	Total organic carbon	36,000	-	-	mg/kg	

TABLE 11 (Continued)

CONCENTRATIONS OF HAZARDOUS SUBSTANCES DETECTED IN RELEASE SEDIMENT SAMPLES COLLECTED FROM HILLIARDS CREEK

Sample ID	Hazardous Substance	Conc.	Q	SQL*	Units	Reference
HC-SD-28	Arsenic	311	J	6.62	mg/kg	86, p. 123; 87, p. 5; 88, p. 4 ; 94, p. 37
	Lead	2,920	J	4.41	mg/kg	
	Total organic carbon	28,000	-	-	mg/kg	
HC-SD-29	Arsenic	185	J	7.01	mg/kg	86, p. 124; 87, p. 5; 88, p. 2; 94, p. 38
	Lead	2,230	J	4.67	mg/kg	
	Total organic carbon	46,000	-	-	mg/kg	
HC-SD-31	Arsenic	256	J	10.14	mg/kg	86, p. 126; 87, p. 6; 88, p. 2; 94, p. 40
	Lead	3,060	J	6.76	mg/kg	
	Total organic carbon	41,000	-	-	mg/kg	
HC-SD-32	Arsenic	542	J	6.74	mg/kg	86, p. 127; 87, p. 6; 88, p. 2; 94, p. 41
	Lead	4,180	J	4.49	mg/kg	
	Total organic carbon	37,000	-	-	mg/kg	
HC-SD-33	Arsenic	449	J	6.98	mg/kg	86, p. 128; 87, p. 6; 88, p. 2; 94, p. 42
	Lead	4,290	J	4.65	mg/kg	
	Total organic carbon	27,000	-	-	mg/kg	
HC-SD-34	Arsenic	242	J	7.61	mg/kg	86, p. 129; 87, p. 6; 88, p. 2; 94, p. 43
	Lead	2,330	J	5.08	mg/kg	
	Total organic carbon	36,000	-	-	mg/kg	
HC-SD-35	Arsenic	360	J	8.57	mg/kg	86, p. 6; 87, p. 1; 88, p. 2; 94, p. 44
	Lead	4,090	J	5.71	mg/kg	
	Total organic carbon	35,000	-	-	mg/kg	
HC-SD-36	Arsenic	680	J	13.33	mg/kg	86, p. 7; 87, p. 1; 88, p. 2; 94, p. 45
	Lead	3,440	J	8.89	mg/kg	
	Total organic carbon	33,000	-	-	mg/kg	
HC-SD-37	Arsenic	161	J	7.87	mg/kg	86, p. 8; 87, p. 1; 88, p. 2; 94, p. 46
	Total organic carbon	46,000	-	-	mg/kg	
HC-SD-38	Arsenic	381	J	11.07	mg/kg	86, p. 10; 87, p. 1; 88, p. 2; 94, p. 48
	Lead	3,640	J	7.38	mg/kg	
	Total organic carbon	26,000	-	-	mg/kg	
HC-SD-39	Arsenic	322	J	10.27	mg/kg	86, p. 11; 87, p. 1; 88, p. 2; 94, p. 49
	Lead	3,830	J	6.85	mg/kg	
	Total organic carbon	25,000	-	-	mg/kg	
HC-SD-40	Arsenic	643	J	11.86	mg/kg	86, p. 12; 87, p. 1; 88, p. 2; 94, p. 50
	Lead	4,830	J	7.90	mg/kg	
	Total organic carbon	23,000	-	-	mg/kg	

TABLE 11 (Continued)

CONCENTRATIONS OF HAZARDOUS SUBSTANCES DETECTED IN RELEASE SEDIMENT SAMPLES COLLECTED FROM HILLIARDS CREEK

Sample ID	Hazardous Substance	Conc.	Q	SQL*	Units	Reference
HC-SD-41	Arsenic	108	J	14.02	mg/kg	86, p. 13; 88, p. 2; 94, p. 51
	Lead	1,900	J	9.35	mg/kg	
	Total organic carbon	35,000	-	-	mg/kg	
HC-SD-43	Benzo(a)anthracene	760	-	478	μg/kg	92, p. D-99; 88, p. 3; 94, p. 53
	Benzo(a)pyrene	720	-	478	μg/kg	
	Chrysene	810	-	478	μg/kg	
	Phenanthrene	600	-	478	μg/kg	
	Total organic carbon	34,000	-	-	mg/kg	
HC-SD-44	Arsenic	323	J	11.81	mg/kg	86, p. 16; 88, p. 2; 94, p. 54
	Lead	3,000	J	7.87	mg/kg	
	Total organic carbon	29,000	-	-	mg/kg	
HC-SD-45	Arsenic	630	J	16.76	mg/kg	86, p. 17; 88, p. 2; 94, p. 55
	Lead	5,220	J	11.17	mg/kg	
	Total organic carbon	38,000	-	-	mg/kg	
HC-SD-46	Arsenic	1,110	J	16.04	mg/kg	86, p. 18; 88, p. 2; 94, p. 56
	Lead	2,770	J	10.7	mg/kg	
	Total organic carbon	44,000	-	-	mg/kg	
HC-SD-48	Arsenic	349	J	12.10	mg/kg	86, p. 19; 88, p. 2; 94, p. 57
	Lead	2,820	J	8.07	mg/kg	
	Total organic carbon	29,000	-	-	mg/kg	

Notes:

--	Not applicable
*	See Reference 88
μg/kg	Microgram per kilogram
Conc.	Concentration
HC	Hilliards Creek
ID	Identification
J	Estimated concentration. The arsenic, lead, and SVOCs concentrations were "J" qualified because of the percent moisture was high (Refs. 86, pp. N-4 and N-5; 90, Attachment 1, p. 7 of 7). The concentrations are not adjusted due to the data qualifier because no bias is assigned to samples qualified because the percent moisture is high (Ref. 81).
mg/kg	Milligram per kilogram
Q	Data qualifier
SD	Sediment
SQL	Sample quantitation limit

TABLE 12

CONCENTRATIONS OF HAZARDOUS SUBSTANCES DETECTED IN RELEASE SURFACE WATER SAMPLES COLLECTED FROM HILLIARDS CREEK

Sample ID	Hazardous Substance	Conc. (μg/L)	CRQL (μg/L)	Reference
HC-SW-22	Lead	15.0	10	86, p. 48; 87, p. 6; 89, p. 1
HC-SW-34	Arsenic	30.1	10	86, p. 55; 87, p. 7; 89, p. 1
	Lead	29	10	
HC-SW-35	Lead	12.4	10	86, p. 42; 87, p. 2; 89, p. 1
HC-SW-39	Lead	24.1	10	86, p. 43; 87, p. 2; 89, p. 1

Notes:

μg/L Microgram per liter
Conc. Concentration
CRQL Contract-required quantitation limit
HC Hilliards Creek
ID Identification
SW Surface water

Chemical Analysis - 1998

In November 1998, 676 sediment samples, 42 soil samples, three waste samples, and eight aqueous samples were collected from Hilliards Creek between Foster Avenue and Hilliards Road and tributaries to Hilliards Creek to determine the extent of lead contamination within the creek and the creek's flood plain. Samples were collected from Hilliards Creek every 50 feet upstream from Hilliards Creek Road to Silver Lake, covering a total distance of approximately 4,600 feet. In total, 92 stream sampling points or 92 transects were established within Hilliards Creek. Three sets of samples were collected from each of the transects: one set of samples from the north bank, one set of samples from the south bank, and one set of samples from the center of the creek. Each set of samples consisted of two composite samples collected at depths of approximately 0 to 2 inches below ground surface (bgs) and 1 to 1.5 feet bgs. The samples collected from the center of Hilliards Creek are used to document an observed release to the creek. The sample identifier, SD, indicates that the sample was collected from the center of the creek. The last two numbers in the sample identification indicated the depth at which the sample was collected. For example, sample SD-60-0-2, indicates that the sample was collected at the center of the creek (SD), at transect location number 60, and at the depth of 0 to 2 inches bgs (Ref. 26, p. 1, Figure 1, Table 1).

Soil samples also were collected on the north and south flood plains of Hilliards Creek at distances of 7 and 12 feet from the north and south bank of Hilliards Creek (Ref. 26, pp. 2, Figures 1 and 2, and Table 1, pp. 4 and 5).

Blue-stained material, believed to be paint, was observed in the sediments of Hilliards Creek and in soil adjacent to the creek (Ref. 26, Table 1, p. 5).

A sediment sample (N49A-10) collected from Hilliards Creek containing blue-stained material (paint) also contained arsenic (1,280 mg/kg) and lead (68,000 mg/kg) (Refs. 26, p. 5; 27, p. 9). Three waste samples collected from the banks of Hilliards Creek contained arsenic up to 759 mg/kg, and lead up to 65,000 mg/kg (Refs. 26, p. 5; 27, p. 11).

No background sample was collected during the sampling event. A sediment sample was collected from an unnamed tributary draining Bridgewood Lake, on the west side of Gibbsboro-Clementon Road (Ref. 26, Figure 1, p. 4). That sample, SD-60, is used to establish background concentrations of lead for the 1998 analytical data collected for Hilliards Creek. The concentrations of arsenic and lead detected in the background sample, as documented in Table 14, indicate that the sampling location was not impacted by activities on the Lucas plant. The background and release samples are considered to be comparable because they were collected within the same time frame, analyzed using the same methods, are located within the same type of environment (creek), receive drainage from similar areas, collected from the same depths, and are located within the same drainage basin (Refs. 9; 26).

All samples were analyzed for total lead using EPA Method 6010B (Ref. 28, p. 2). The detection limits are summarized in Reference 110.

Location of Background Samples - 1998

The location of the 1998 background samples is summarized in Table 13.

TABLE 13

BACKGROUND SEDIMENT
1998 HILLIARDS CREEK INVESTIGATION

Sample ID	Date	Time	Depth (bgs)	Sampling Location	Reference
SD-60-0-2	11/17/1998	14:14	0 - 2 inches	Center of unnamed tributary draining Bridgewood Lake. On the west side of Gibbsboro-Clementon Road.	26, Figure 1, p. 4; 28, p. 100078
SD-60-1-11.5	11/17/1998	14:16	1 - 1.5 feet	Center of unnamed tributary draining Bridgewood Lake. On the west side of Gibbsboro-Clementon Road.	26, Figure 1, p. 4; 28, p. 100078

Notes:
bgs below ground surface
ft foot
ID identification
SD sediment

Background Concentration 1998

The concentration of lead detected in the background sediment sample is summarized in the table below.

TABLE 14

1998 BACKGROUND SEDIMENT LEAD CONCENTRATION

Sample Identification	**SD-60-0-2**	**SD-60-1-1.5**
Percent Moisture	44.8	56.8
Sample Quantitation Limit	23.73	39.81
Reference	28, p. 15; 110	28, p. 15; 110
Lead	22.6	111

Locations of Release Samples 1998

A summary of the release sampling locations is provided in Table 15. The release sampling locations are provided on Figure 1 in Reference 26. The sampling locations on Figure 1 in Reference 26 identify each sampling location by the number used to designate the transect location. The distances measured from Foster Avenue, Gibbsboro-Clementon Road, and Hilliards Road to the sampling locations provided in Table 15 below are measured from the intersection of Hilliards Creek and the road along the contours of Hilliards Creek. Rather than straight line distances from the road to the sampling location. The samples were collected at 50-foot intervals (Ref. 26).

TABLE 15

**LOCATION OF 1998 RELEASE SEDIMENT SAMPLES
HILLIARDS CREEK**

Sample ID	Date	Time	Depth (bgs)	Sampling Location	Reference
SD-104-0-2	11/20/1998	14:39	2 inches	Center of Hilliards Creek, approximately 150 feet west of Foster Avenue	28, p. 100103
SD-103-1-1.5	11/20/1998	14:00	1 to 1.5 feet	Center of Hilliards Creek, approximately 200 feet west of Foster Avenue	28, p. 100102
SD-102-1-1.5	11/20/1998	14:20	1 to 1.5 feet	Center of Hilliards Creek, approximately 250 feet west of Foster Avenue	28, p. 100102
SD-101-0-2	11/20/1998	13:48	2 inches	Center of Hilliards Creek, approximately 300 feet west of Foster Avenue	28, p. 100101
SD-100-0-2	11/20/1998	13:41	1 to 1.5 feet	Center of Hilliards Creek, approximately 350 feet west of Foster Avenue	28, p. 100101
SD-97-1-1.5	11/20/1998	10:44	1 to 1.5 feet	Center of Hilliards Creek, approximately 500 feet west of Foster Avenue	28, p. 100099
SD-96-0-2	11/20/1998	10:05	2 inches	Center of Hilliards Creek, approximately 550 feet west of Foster Avenue	28, p. 100099
SD-95-0-2	11/20/1998	09:46	2 inches	Center of Hilliards Creek, approximately 600 feet west of Foster Avenue	28, p. 100098

TABLE 15 (Continued)

LOCATION OF 1998 RELEASE SEDIMENT SAMPLES
HILLIARDS CREEK

Sample ID	Date	Time	Depth (bgs)	Sampling Location	Reference
SD-95-1-1.5	11/20/1998	09:47	1 to 1.5 feet	Center of Hilliards Creek, approximately 600 feet west of Foster Avenue	28, p. 100098
SD-94-1-1.5	11/20/1998	09:37	1 to 1.5 feet	Center of Hilliards Creek, approximately 650 feet west of Foster Avenue	28, p. 100098
SD-93-1-1.5	11/20/1998	09:20	1 to 1.5 feet	Center of Hilliards Creek, approximately 700 feet west of Foster Avenue	28, p. 100098
SD-90-0-2	11/20/1998	08:25	2 inches	Center of Hilliards Creek, approximately 800 feet west of Foster Avenue	28, p. 100096
SD-88-0-2	11/19/1998	14:55	2 inches	Center of Hilliards Creek, approximately 300 feet east of Gibbsboro-Clementon Road	28, p. 100095
SD-88-1-1.5	11/19/1998	15:00	1 to 1.5 feet	Center of Hilliards Creek, approximately 300 feet east of Gibbsboro-Clementon Road	28, p. 100095
SD-87-0-2	11/19/1998	14:26	2 inches	Center of Hilliards Creek, approximately 250 feet east of Gibbsboro-Clementon Road	28, p. 100095
SD-86-0-2	11/19/1998	13:54	2 inches	Center of Hilliards Creek, approximately 200 feet east of Gibbsboro-Clementon Road	28, p. 100094
SD-86-1-1.5	11/19/1998	13:58	1 to 1.5 feet	Center of Hilliards Creek, approximately 200 feet east of Gibbsboro-Clementon Road	28, p. 100094

TABLE 15 (Continued)

**LOCATION OF 1998 RELEASE SEDIMENT SAMPLES
HILLIARDS CREEK**

Sample ID	Date	Time	Depth (bgs)	Sampling Location	Reference
SD-83-0-2	11/19/1998	Not listed	2 inches	Center of Hilliards Creek, approximately 50 feet east of Gibbsboro-Clementon Road	28, p. 100041
SD-83-1-1.5	11/19/1998	Not listed	1 to 1.5 feet	Center of Hilliards Creek, approximately 50 feet east of Gibbsboro-Clementon Road	28, p. 100041
SD-82-0-2	11/19/1998	11:19	2 inches	Center of Hilliards Creek, approximately 50 feet west of Gibbsboro-Clementon Road	28, p. 100094
SD-82-1-1.5	11/19/1998	11:22	1 to 1.5 feet	Center of Hilliards Creek, approximately 50 feet west of Gibbsboro-Clementon Road	28, p. 100094
SD-80-0-2	11/19/1998	10:18	2 inches	Center of Hilliards Creek, approximately 150 feet west of Gibbsboro-Clementon Road	28, p. 100093
SD-80-1-1.5	11/19/1998	10:21	1 to 1.5 feet	Center of Hilliards Creek, approximately 150 feet west of Gibbsboro-Clementon Road	28, p. 100093
SD-79-0-2	11/19/1998	11:07	2 inches	Center of Hilliards Creek, approximately 200 feet west of Gibbsboro-Clementon Road	28, p. 100093
SD-79-1-1.5	11/19/1998	11:08	1 to 1.5 feet	Center of Hilliards Creek, approximately 200 feet west of Gibbsboro-Clementon Road	28, p. 100093

TABLE 15 (Continued)

**LOCATION OF 1998 RELEASE SEDIMENT SAMPLES
HILLIARDS CREEK**

Sample ID	Date	Time	Depth (bgs)	Sampling Location	Reference
SD-78-0-2	11/19/1998	10:28	2 inches	Center of Hilliards Creek, approximately 250 feet west of Gibbsboro-Clementon Road	28, p. 100092
SD-78-1-1.5	11/19/1998	10:32	1 to 1.5 feet	Center of Hilliards Creek, approximately 250 feet west of Gibbsboro-Clementon Road	28, p. 100092
SD-77-1-1.5	11/19/1998	10:15	1 to 1.5 feet	Center of Hilliards Creek, approximately 300 feet west of Gibbsboro-Clementon Road	28, p. 100092
SD-76-0-2	11/19/1998	09:18	2 inches	Center of Hilliards Creek, approximately 350 feet west of Gibbsboro-Clementon Road	28, p. 100092
SD-76-1-1.5	11/19/1998	09:20	1 to 1.5 feet	Center of Hilliards Creek, approximately 350 feet west of Gibbsboro-Clementon Road	28, p. 100092
SD-75-0-2	11/19/1998	08:47	2 inches	Center of Hilliards Creek, approximately 400 feet west of Gibbsboro-Clementon Road	28, p. 100091
SD-74-0-2	11/19/1998	08:12	2 inches	Center of Hilliards Creek, approximately 450 feet west of Gibbsboro-Clementon Road	28, p. 100091
SD-74-1-1.5	11/19/1998	08:14	1 to 1.5 feet	Center of Hilliards Creek, approximately 450 feet west of Gibbsboro-Clementon Road	28, p. 100091

TABLE 15 (Continued)

**LOCATION OF 1998 RELEASE SEDIMENT SAMPLES
HILLIARDS CREEK**

Sample ID	Date	Time	Depth (bgs)	Sampling Location	Reference
SD-73-0-2	11/19/1998	09:21	2 inches	Center of Hilliards Creek, approximately 500 feet west of Gibbsboro-Clementon Road	28, p. 100091
SD-73-1-1.5	11/19/1998	09:27	1 to 1.5 feet	Center of Hilliards Creek, approximately 500 feet west of Gibbsboro-Clementon Road	28, p. 100091
SD-72-0-2	11/19/1998	08:46	2 inches	Center of Hilliards Creek, approximately 550 feet west of Gibbsboro-Clementon Road	28, p. 100090
SD-72-1-1.5	11/19/1998	08:50	1 to 1.5 feet	Center of Hilliards Creek, approximately 550 feet west of Gibbsboro-Clementon Road	28, p. 100090
SD-71-0-2	11/19/1998	08:17	2 inches	Center of Hilliards Creek, approximately 600 feet west of Gibbsboro-Clementon Road	28, p. 100090
SD-71-1-1.5	11/19/1998	08:20	1 to 1.5 feet	Center of Hilliards Creek, approximately 600 feet west of Gibbsboro-Clementon Road	28, p. 100090
SD-70-0-2	11/18/1998	15:11	2 inches	Center of Hilliards Creek, approximately 650 feet west of Gibbsboro-Clementon Road	28, p. 100089
SD-70-1-1.5	11/18/1998	15:21	1 to 1.5 feet	Center of Hilliards Creek, approximately 650 feet west of Gibbsboro-Clementon Road	28, p. 100089

TABLE 15 (Continued)

**LOCATION OF 1998 RELEASE SEDIMENT SAMPLES
HILLIARDS CREEK**

Sample ID	Date	Time	Depth (bgs)	Sampling Location	Reference
SD-65-0-2	11/17/1998	15:15	2 inches	Center of Hilliards Creek, approximately 700 feet west of Gibbsboro-Clementon Road	28, p. 100080
SD-65-1-1.5	11/17/1998	15:20	1 to 1.5 feet	Center of Hilliards Creek, approximately 700 feet west of Gibbsboro-Clementon Road	28, p. 100080
SD-64-0-2	11/17/1998	15:38	2 inches	Center of Hilliards Creek, approximately 750 feet west of Gibbsboro-Clementon Road	28, p. 100079
SD-63-0-2	11/17/1998	14:55	2 inches	Center of Hilliards Creek, approximately 800 feet west of Gibbsboro-Clementon Road	28, p. 100079
SD-62-0-2	11/17/1998	14:30	2 inches	Center of Hilliards Creek, approximately 850 feet west of Gibbsboro-Clementon Road	28, p. 100079
SD-61-0-2	11/17/1998	14:14	2 inches	Center of Hilliards Creek, approximately 900 feet west of Gibbsboro-Clementon Road	28, p. 100078
SD-49-0-2	11/16/1998	08:28	2 inches	Center of Hilliards Creek, approximately 1,000 feet west of Gibbsboro-Clementon Road	28, p. 100073
SD-48-0-2	11/13/1998	14:22	2 inches	Center of Hilliards Creek, approximately 1,050 feet west of Gibbsboro-Clementon Road	28, p. 100071

TABLE 15 (Continued)

LOCATION OF 1998 RELEASE SEDIMENT SAMPLES
HILLIARDS CREEK

Sample ID	Date	Time	Depth (bgs)	Sampling Location	Reference
SD-47-0-2	11/13/1998	14:10	2 inches	Center of Hilliards Creek, approximately 1,100 feet west of Gibbsboro-Clementon Road	28, p. 100071
SD-45-0-2	11/13/1998	10:16	2 inches	Center of Hilliards Creek, approximately 1,200 feet west of Gibbsboro-Clementon Road	28, p. 100070
SD-45-1-1.5	11/13/1998	10:30	1 to 1.5 feet	Center of Hilliards Creek, approximately 1,200 feet west of Gibbsboro-Clementon Road	28, p. 100070
SD-44-0-2	11/13/1998	10:05	2 inches	Center of Hilliards Creek, approximately 1,250 feet west of Gibbsboro-Clementon Road	28, p. 100068
SD-44-1-1.5	11/13/1998	10:02	1 to 1.5 feet	Center of Hilliards Creek, approximately 1,250 feet west of Gibbsboro-Clementon Road	28, p. 100069
SD-43-0-2	11/13/1998	09:30	2 inches	Center of Hilliards Creek, approximately 1,300 feet west of Gibbsboro-Clementon Road	28, p. 100068
SD-43-1-1. 5	11/13/1998	09:35	1 to 1.5 feet	Center of Hilliards Creek, approximately 1,300 feet west of Gibbsboro-Clementon Road	28, p. 100068
SD-42-0-2	11/13/1998	09:40	2 inches	Center of Hilliards Creek, approximately 1,350 feet west of Gibbsboro-Clementon Road	28, p. 100067

TABLE 15 (Continued)

**LOCATION OF 1998 RELEASE SEDIMENT SAMPLES
HILLIARDS CREEK**

Sample ID	Date	Time	Depth (bgs)	Sampling Location	Reference
SD-42-1-1.5	11/13/1998	09:42	1 to 1.5 feet	Center of Hilliards Creek, approximately 1,350 feet west of Gibbsboro-Clementon Road	28, p. 100067
SD-41-0-2	11/13/1998	08:58	2 inches	Center of Hilliards Creek, approximately 1,400 feet west of Gibbsboro-Clementon Road	28, p. 100067
SD-41-1-1.5	11/13/1998	09:00	1 to 1.5 feet	Center of Hilliards Creek, approximately 1,400 feet west of Gibbsboro-Clementon Road	28, p. 100067
SD-40-0-2	11/13/1998	08:40	2 inches	Center of Hilliards Creek, approximately 1,450 feet west of Gibbsboro-Clementon Road	28, p. 100067
SD-39-0-2	11/12/1998	08:25	2 inches	Center of Hilliards Creek, approximately 1,500 feet west of Gibbsboro-Clementon Road	28, p. 100065
SD-38-0-2	11/12/1998	14:40	2 inches	Center of Hilliards Creek, approximately 1,550 feet west of Gibbsboro-Clementon Road	28, p. 100065
SD-37-0-2	11/13/1998	14:21	2 inches	Center of Hilliards Creek, approximately 1,600 feet west of Gibbsboro-Clementon Road	28, p. 100066
SD-36-0-2	11/13/1998	13:54	2 inches	Center of Hilliards Creek, approximately 1,650 feet west of Gibbsboro-Clementon Road	28, p. 100066

TABLE 15 (Continued)

**LOCATION OF 1998 RELEASE SEDIMENT SAMPLES
HILLIARDS CREEK**

Sample ID	Date	Time	Depth (bgs)	Sampling Location	Reference
SD-35-0-2	11/13/1998	13:25	2 inches	Center of Hilliards Creek, approximately 1,700 feet west of Gibbsboro-Clementon Road	28, p. 100086
SD-35-1-1.5	11/13/1998	13:33	1 to 1.5 feet	Center of Hilliards Creek, approximately 1,700 feet west of Gibbsboro-Clementon Road	28, p. 100066
SD-34-0-2	11/13/1998	10:55	2 inches	Center of Hilliards Creek, approximately 1,750 feet west of Gibbsboro-Clementon Road	28, p. 100086
SD-34-1-1.5	11/13/1998	11:00	1 to 1.5 feet	Center of Hilliards Creek, approximately 1,750 feet west of Gibbsboro-Clementon Road	28, p. 100086
SD-33-0-2	11/13/1998	10:38	2 inches	Center of Hilliards Creek, approximately 1,800 feet west of Gibbsboro-Clementon Road	28, p. 100086
SD-32-0-2	11/12/1998	10:00	2 inches	Center of Hilliards Creek, approximately 1,850 feet west of Gibbsboro-Clementon Road	28, p. 100064
SD-31-0-2	11/12/1998	09:35	2 inches	Center of Hilliards Creek, approximately 1,900 feet west of Gibbsboro-Clementon Road	28, p. 100064
SD-30-0-2	11/12/1998	09:15	2 inches	Center of Hilliards Creek, approximately 1,950 feet west of Gibbsboro-Clementon Road	28, p. 100063

TABLE 15 (Continued)

LOCATION OF 1998 RELEASE SEDIMENT SAMPLES
HILLIARDS CREEK

Sample ID	Date	Time	Depth (bgs)	Sampling Location	Reference
SD-29-0-2	11/12/1998	08:40	2 inches	Center of Hilliards Creek, approximately 2,000 feet west of Gibbsboro-Clementon Road	28, p. 100063
SD-29-1-1.5	11/12/1998	08:43	1 to 1.5 feet	Center of Hilliards Creek, approximately 2,000 feet west of Gibbsboro-Clementon Road	28, p. 100063
SD-27-0-2	11/11/1998	16:30	2 inches	Center of Hilliards Creek, approximately 1,350 feet east of Hilliards Road	28, p. 100061
SD-26-0-2	11/11/1998	15:48	2 inches	Center of Hilliards Creek, approximately 1,300 feet east of Hilliards Road	28, p. 100061
SD-25-0-2	11/11/1998	14:30	2 inches	Center of Hilliards Creek, approximately 1,250 feet east of Hilliards Road	28, p. 100061
SD-24-0-2	11/11/1998	13:25	2 inches	Center of Hilliards Creek, approximately 1,200 feet east of Hilliards Road	28, p. 100061
SD-23-0-2	11/10/1998	14:40	2 inches	Center of Hilliards Creek, approximately 1,150 feet east of Hilliards Road	28, p. 100060
SD-22-1-1.5	11/11/1998	11:48	1 to 1.5 feet	Center of Hilliards Creek, approximately 1,100 feet east of Hilliards Road	28, p. 100059
SD-21-0-2	11/11/1998	11:20	2 inches	Center of Hilliards Creek, approximately 1,050 feet east of Hilliards Road	28, p. 100059
SD-20-0-2	11/11/1998	11:00	2 inches	Center of Hilliards Creek, approximately 1,000 feet east of Hilliards Road	28, p. 100058

TABLE 15 (Continued)

**LOCATION OF 1998 RELEASE SEDIMENT SAMPLES
HILLIARDS CREEK**

Sample ID	Date	Time	Depth (bgs)	Sampling Location	Reference
SD-20-1-1.5	11/11/1998	11:10	1 to 1.5 feet	Center of Hilliards Creek, approximately 1,000 feet east of Hilliards Road	28, p. 100058
SD-19-0-2	11/11/1998	10:45	2 inches	Center of Hilliards Creek, approximately 950 feet east of Hilliards Road	28, p. 100058
SD-19-1-1.5	11/11/1998	10:50	1 to 1.5 feet	Center of Hilliards Creek, approximately 950 feet east of Hilliards Road	28, p. 100058
SD-18-0-2	11/11/1998	09:45	2 inches	Center of Hilliards Creek, approximately 900 feet east of Hilliards Road	28, p. 100058
SD-16-0-2	11/11/1998	09:15	2 inches	Center of Hilliards Creek, approximately 800 feet east of Hilliards Road	28, p. 100057
SD-16-1-1.5	11/11/1998	09:19	1 to 1.5 feet	Center of Hilliards Creek, approximately 800 feet east of Hilliards Road	28, p. 100057
SD-15-0-2	11/11/1998	09:15	2 inches	Center of Hilliards Creek, approximately 750 feet east of Hilliards Road	28, p. 100057
SD-14-0-2	11/11/1998	09:10	2 inches	Center of Hilliards Creek, approximately 700 feet east of Hilliards Road	28, p. 100056
SD-14-1-1.5	11/11/1998	09:00	1 to 1.5 feet	Center of Hilliards Creek, approximately 700 feet east of Hilliards Road	28, p. 100056
SD-13-0-2	11/11/1998	08:45	2 inches	Center of Hilliards Creek, approximately 650 feet east of Hilliards Road	28, p. 100056

TABLE 15 (Continued)

**LOCATION OF 1998 RELEASE SEDIMENT SAMPLES
HILLIARDS CREEK**

Sample ID	Date	Time	Depth (bgs)	Sampling Location	Reference
SD-13-1-1.5	11/11/1998	08:47	1 to 1.5 feet	Center of Hilliards Creek, approximately 650 feet east of Hilliards Road	28, p. 100056
SD-12-0-2	11/11/1998	15:00	2 inches	Center of Hilliards Creek, approximately 600 feet east of Hilliards Road	28, p. 100055
SD-12-1-1.5	11/11/1998	15:30	1 to 1.5 feet	Center of Hilliards Creek, approximately 600 feet east of Hilliards Road	28, p. 100055
SD-11-0-2	11/11/1998	14:30	2 inches	Center of Hilliards Creek, approximately 550 feet east of Hilliards Road	28, p. 100054
SD-10-0-2	11/11/1998	14:20	2 inches	Center of Hilliards Creek, approximately 500 feet east of Hilliards Road	28, p. 100054
SD-09-0-2	11/11/1998	13:30	2 inches	Center of Hilliards Creek, approximately 450 feet east of Hilliards Road	28, p. 100054
SD-08-0-2	11/10/1998	13:00	2 inches	Center of Hilliards Creek, approximately 400 feet east of Hilliards Road	28, p. 100053
SD-08-1-1.5	11/10/1998	13:04	1 to 1.5 feet	Center of Hilliards Creek, approximately 400 feet east of Hilliards Road	28, p. 100053
SD-07-0-2	11/10/1998	11:45	2 inches	Center of Hilliards Creek, approximately 350 feet east of Hilliards Road	28, p. 100053
SD-07-1-1.5	11/10/1998	11:47	1 to 1.5 feet	Center of Hilliards Creek, approximately 350 feet east of Hilliards Road	28, p. 100053

TABLE 15 (Continued)

LOCATION OF 1998 RELEASE SEDIMENT SAMPLES
HILLIARDS CREEK

Sample ID	Date	Time	Depth (bgs)	Sampling Location	Reference
SD-06-0-2	11/10/1998	11:30	2 inches	Center of Hilliards Creek, approximately 300 feet east of Hilliards Road	28, p. 100052
SD-05-0-2	11/10/1998	11:08	2 inches	Center of Hilliards Creek, approximately 250 feet east of Hilliards Road	28, p. 100052
SD-05-1-1.5	11/10/1998	11:10	1 to 1.5 feet	Center of Hilliards Creek, approximately 250 feet east of Hilliards Road	28, p. 100052
SD-04-0-2	11/10/1998	10:47	2 inches	Center of Hilliards Creek, approximately 200 feet east of Hilliards Road	28, p. 100052
SD-03-0-2	11/10/1998	09:22	2 inches	Center of Hilliards Creek, approximately 150 feet east of Hilliards Road	28, p. 100051
SD-03-1-1.5	11/10/1998	09:25	1 to 1.5 feet	Center of Hilliards Creek, approximately 150 feet east of Hilliards Road	28, p. 100052
SD-02-0-2	11/10/1998	08:54	2 inches	Center of Hilliards Creek, approximately 100 feet east of Hilliards Road	28, p. 100051
SD-02-1-1.5	11/10/1998	08:55	1 to 1.5 feet	Center of Hilliards Creek, approximately 100 feet east of Hilliards Road	28, p. 100051
SD-01-0-2	11/10/1998	08:00	2 inches	Center of Hilliards Creek, approximately 50 feet east of Hilliards Road	28, p. 100051
SD-01-1-1.5	11/10/1998	08:00	1 to 1.5 feet	Center of Hilliards Creek, approximately 50 feet east of Hilliards Road	28, p. 100051

TABLE 15 (Continued)

LOCATION OF 1998 RELEASE SEDIMENT SAMPLES
HILLIARDS CREEK

Notes:

bgs	below ground surface
ID	Identification
SD	sediment

Release Concentrations 1998

The concentration of hazardous substances detected in Hilliards Creek sediment samples collected during the 1998 investigation documenting an observed release to Hilliards Creek are summarized in Table 16. All samples were analyzed for lead using EPA Method 6010B (Refs. 26, p. 1 and Table 1, p. 4; 28, p. 2). SQLs are summarized in Reference 110.

TABLE 16

CONCENTRATIONS OF LEAD DETECTED IN 1998 RELEASE SEDIMENT SAMPLES COLLECTED FROM HILLIARDS CREEK

Sample ID	Hazardous Substance	Conc. (mg/kg)	Percent Moisture	SQL (mg/kg)	Reference
SD-104-0-2	Lead	344	23.5	12.33	28, p. 24; 110, p. 1
SD-102-1-1.5	Lead	1,550	39	19.51	28, p. 24; 110, p. 1
SD-101-0-2	Lead	416	20.1	11.09	28, p. 24; 110, p. 1
SD-100-0-2	Lead	743	67.4	70.55	28, p. 23; 110, p. 1
SD-97-1-1.5	Lead	434	44.7	23.33	28, p. 23; 110, p. 1
SD-96-0-2	Lead	772	67.2	69.82	28, p. 23; 110, p. 1
SD-95-0-2	Lead	21,700	79.8	363.86	28, p. 22; 110, p. 1
SD-95-1-1.5	Lead	24,100	66	252.06	28, p. 22; 110, p. 1
SD-94-1-1.5	Lead	1,040	52.4	31.30	28, p. 22; 110, p. 1
SD-93-1-1.5	Lead	1,110	22.8	12.34	28, p. 22; 110, p. 1
SD-90-0-2	Lead	155	40.8	20.44	28, p. 21; 110, p. 1
SD-88-0-2	Lead	182	32.1	16.35	28, p. 21; 110, p. 1
SD-88-1-1.5	Lead	80,700	78.2	633.03	28, p. 21; 110, p. 1
SD-87-0-2	Lead	14,300	78	151.82	28, p. 21; 110, p. 1
SD-86-1-1.5	Lead	32,400	79.9	357.21	28, p. 21; 110, p. 1
SD-83-0-2	Lead	2,250	33.9	16.49	28, p. 20; 110, p. 1
SD-83-1-1.5	Lead	1,870	31.7	15.37	28, p. 20; 110, p. 1
SD-82-0-2	Lead	10,400	30.1	28.76	28, p. 20; 110, p. 1

TABLE 16 (Continued)

**CONCENTRATIONS OF LEAD DETECTED IN 1998
RELEASE SEDIMENT SAMPLES
COLLECTED FROM HILLIARDS CREEK**

Sample ID	Hazardous Substance	Conc. (mg/kg)	Percent Moisture	SQL (mg/kg)	Reference
SD-82-1-1.5	Lead	4,160	19.8	10.80	28, p. 20; 110, p. 1
SD-80-0-2	Lead	10,600	37.1	93.80	28, p. 19; 110, p. 1
SD-80-1-1.5	Lead	4,940	30.6	14.84	28, p. 19; 110, p. 1
SD-79-0-2	Lead	76.7	15.6	10.02	28, p. 19; 110, p. 1
SD-79-1-1.5	Lead	1,360	15.5	10.40	28, p. 19; 110, p. 1
SD-78-0-2	Lead	74.5	15.3	10.46	28, p. 19; 110, p. 1
SD-78-1-1.5	Lead	10,900	65.4	64.14	28, p. 19; 110, p. 1
SD-77-1-1.5	Lead	21,900	50.9	146.84	28, p. 19; 110, p. 1
SD-76-1-1.5	Lead	718	40.2	20.57	28, p. 19; 110, p. 1
SD-75-0-2	Lead	83.8	17.5	21.21	28, p. 18; 110, p. 1
SD-74-0-2	Lead	102	13	9.53	28, p. 18; 110, p. 1
SD-74-1-1.5	Lead	27,000	68.3	146.37	28, p. 18; 110, p. 1
SD-73-0-2	Lead	97.4	23	11.82	28, p. 18; 110, p. 1
SD-73-1-1.5	Lead	818	30.7	15.15	28, p. 18; 110, p. 1
SD-72-0-2	Lead	1,820	76	1,304.17	28, p. 18; 110, p. 2
SD-72-1-1.5	Lead	4,830	62.7	51.74	28, p. 18; 110, p. 2
SD-71-0-2	Lead	69.6	17.8	10.47	28, p. 18; 110, p. 2
SD-71-1-1.5	Lead	658	34.7	16.69	28, p. 18; 110, p. 2
SD-70-0-2	Lead	70,300	60.7	486.01	28, p. 17; 110, p. 2
SD-70-1-1.5	Lead	10,500	44.9	121.05	28, p. 17; 110, p. 2
SD-65-0-2	Lead	149	12.5	9.70	28, p. 16; 110, p. 2
SD-65-1-1.5	Lead	1,540	22.8	11.76	28, p. 16; 110, p. 2

TABLE 16 (Continued)

CONCENTRATIONS OF LEAD DETECTED IN 1998 RELEASE SEDIMENT SAMPLES COLLECTED FROM HILLIARDS CREEK

Sample ID	Hazardous Substance	Conc. (mg/kg)	Percent Moisture	SQL (mg/kg)	Reference
SD-64-0-2	Lead	373	13	9.62	28, p. 16; 110, p. 2
SD-63-0-2	Lead	708	59.1	41.81	28, p. 16; 110, p. 2
SD-62-0-2	Lead	406	16.6	10.78	28, p. 16; 110, p. 2
SD-61-0-2	Lead	16,300	79.5	178.54	28, p. 16; 110, p. 2
SD-49-0-2	Lead	909	28	13.89	28, p. 13; 110, p. 2
SD-48-0-2	Lead	1,120	30.3	14.78	28, p. 13; 110, p. 2
SD-47-0-2	Lead	483	20.1	11.75	28, p 13; 110, p. 2
SD-45-0-2	Lead	1,630	41.3	20.95	28, p. 13; 110, p. 2
SD-45-1-1.5	Lead	595	65.6	61.63	28, p. 12; 110, p. 2
SD-44-0-2	Lead	911	27.3	14.03	28, p. 12; 110, p. 2
SD-44-1-1.5	Lead	1,620	44.7	24.05	28, p. 12; 110, p. 2
SD-43-0-2	Lead	377	19.4	10.89	28, p. 12; 110, p. 2
SD-43-1-1.5	Lead	2,200	38.8	18.95	28, p. 12; 110, p. 2
SD-42-0-2	Lead	5,540	30.8	15.03	28, p. 12; 110, p. 2
SD-42-1-1.5	Lead	1,120	27.8	13.45	28, p. 12; 110, p. 2
SD-41-0-2	Lead	582	26.3	7.60	28, p. 12; 110, p. 2
SD-41-1-1.5	Lead	4,490	41	9.49	28, p. 12; 110, p. 2
SD-40-0-2	Lead	5,290	67.2	17.10	28, p. 12; 110, p. 2
SD-39-0-2	Lead	18,000	59.5	444.44	28, p. 11; 110, p. 2
SD-38-0-2	Lead	3,800	59.9	43.89	28, p. 11; 110, p. 2
SD-37-0-2	Lead	5,190	70.5	83.73	28, p. 11; 110, p. 2
SD-36-0-2	Lead	4,690	67.7	69.66	28, p. 11; 110, p. 2

TABLE 16 (Continued)

**CONCENTRATIONS OF LEAD DETECTED IN 1998
RELEASE SEDIMENT SAMPLES
COLLECTED FROM HILLIARDS CREEK**

Sample ID	Hazardous Substance	Conc. (mg/kg)	Percent Moisture	SQL (mg/kg)	Reference
SD-35-0-2	Lead	5,880	76.5	134.47	28, p. 10; 110, p. 2
SD-35-1-1.5	Lead	6,080	82.8	246.51	28, p. 10; 110, p. 2
SD-34-0-2	Lead	11,200	79.2	176.96	28, p. 10; 110, p. 2
SD-34-1-1.5	Lead	72,400	72.6	959.85	28, p. 10; 110, p. 2
SD-33-0-2	Lead	21,400	80	185.50	28, p. 10; 110, p. 2
SD-32-0-2	Lead	18,000	81.8	213.74	28, p. 10; 110, p. 3
SD-31-0-2	Lead	5,190	82.3	232.20	28, p. 10; 110, p. 3
SD-30-0-2	Lead	2,040	69.3	80.46	28, p. 9; 110, p. 3
SD-29-0-2	Lead	3,240	82.5	235.43	28, p. 9; 110, p. 3
SD-29-1-1.5	Lead	396	74.8	119.44	28, p. 9; 110, p. 3
SD-27-0-2	Lead	2,290	78.3	153.00	28, p. 9; 110, p. 3
SD-26-0-2	Lead	161	20.9	7.07	28, p. 9; 110, p. 3
SD-25-0-2	Lead	1,050	60	45.50	28, p. 8; 110, p. 3
SD-24-0-2	Lead	4,490	54.9	36.59	28, p. 8; 110, p. 3
SD-23-0-2	Lead	255	37.2	18.15	28, p. 8; 110, p. 3
SD-22-1-1.5	Lead	5,670	63.3	53.95	28, p. 8; 110, p. 3
SD-21-0-2	Lead	260	16.4	10.84	28, p. 8; 110, p. 3
SD-20-0-2	Lead	39,500	83.6	2,682.93	28, p. 7; 110, p. 3
SD-20-1-1.5	Lead	993	76.8	137.93	28, p. 7; 110, p. 3
SD-19-0-2	Lead	765	38.4	18.99	28, p. 7; 110, p. 3
SD-19-1-1.5	Lead	897	47.3	26.57	28, p. 7; 110, p. 3

TABLE 16 (Continued)

CONCENTRATIONS OF LEAD DETECTED IN 1998 RELEASE SEDIMENT SAMPLES COLLECTED FROM HILLIARDS CREEK

Sample ID	Hazardous Substance	Conc. (mg/kg)	Percent Moisture	SQL (mg/kg)	Reference
SD-18-0-2	Lead	2,230	74.2	108.53	28, p. 7; 110, p. 3
SD-16-0-2	Lead	1,540	56.1	37.13	28, p. 7; 110, p. 3
SD-16-1-1.5	Lead	2,780	68.7	72.20	28, p. 7; 110, p. 3
SD-15-0-2	Lead	266	27.1	13.57	28, p. 7; 110, p. 3
SD-14-0-2	Lead	26,800	82	231.67	28, p. 6; 110, p. 3
SD-14-1-1.5	Lead	66,800	84.1	2,798.74	28, p. 6; 110, p. 3
SD-13-0-2	Lead	964	81.2	212.23	28, p. 6; 110, p. 3
SD-13-1-1.5	Lead	5,400	83.4	260.84	28, p. 6; 110, p. 3
SD-12-0-2	Lead	6,120	69.3	78.83	28, p. 6; 110, p. 3
SD-12-1-1.5	Lead	434	56.9	40.37	28, p. 6; 110, p. 3
SD-11-0-2	Lead	241	36	17.50	28, p. 6; 110, p. 3
SD-09-0-2	Lead	385	51.3	30.80	28, p. 6; 110, p. 3
SD-08-0-2	Lead	18,100	84.8	324.34	28, p. 5; 110, p. 3
SD-08-1-1.5	Lead	2,450	77.5	148.00	28, p. 5; 110, p. 3
SD-07-0-2	Lead	9,920	84	276.25	28, p. 5; 110, p. 3
SD-07-1-1.5	Lead	3,310	80.7	197.41	28, p. 5; 110, p. 3
SD-05-0-2	Lead	78,300	89	5,900	28, p. 4; 110, p. 3
SD-05-1-1.5	Lead	59,200	89.3	6,242.99	28, p. 4; 110, p. 4
SD-04-0-2	Lead	6,780	86.1	388.49	28, p. 4; 110, p. 4
SD-03-0-2	Lead	3,640	76.3	128.27	28, p. 4; 110, p. 4
SD-03-1-1.5	Lead	1,030	59.4	43.35	28, p. 4; 110, p. 4

TABLE 16 (Continued)

**CONCENTRATIONS OF LEAD DETECTED IN 1998
RELEASE SEDIMENT SAMPLES
COLLECTED FROM HILLIARDS CREEK**

Sample ID	Hazardous Substance	Conc. (mg/kg)	Percent Moisture	SQL (mg/kg)	Reference
SD-02-0-2	Lead	7,660	63.3	54.50	28, p. 4; 110, p. 4
SD-02-1-1.5	Lead	8,810	71.1	87.20	28, p. 4; 110, p. 4

Notes:
Conc. Concentration
ID identification
mg/kg milligram per kilogram
SD sediment
SQL sample quantitation limit

Attribution:

The significant increase in concentrations of lead, arsenic, and SVOCs to Hilliards Creek is clearly attributable in part to historic and ongoing releases from the activities at the Sherwin-Williams/Hilliards Creek site. The history of the use of lead, arsenic, and SVOCs at the paint works is well documented. Although the operations that led to the historic releases most likely terminated by the 1980s, this does not mean the contamination documented downstream from the paint works area in Hilliards Creek did not at least in part originate from these operations. Further, at least part of the lead, arsenic, and SVOCs in Hilliards Creek is entering Hilliards Creek via ground water seeps flowing overland to the creek (perhaps via the Sherwin-Williams treatment system) or by direct discharge of ground water to the creek.

Besides the historic information linking lead and arsenic to the paint works operations, these substances are also associated with four sources evaluated at the site. In addition, numerous studies by both EPA and Sherwin-Williams have shown continuous increased contamination of these substances in Hilliards Creek downstream of the paint works area and the PPEs for the four site sources.

The 1998 investigation of Hilliards Creek documented the presence of lead in the sediments of Hilliards Creek from the Lucas plant property to Gibbsboro-Clementon Road and extending to Hilliards Road at concentrations three times the background amount, which indicated an observed release of lead to Hilliards Creek. (Lead was the only hazardous substance analyzed for during this investigation.) This includes a distance of approximately 4,600 feet (Ref. 26, p. 8). A 2004 Hilliards Creek investigation included the collection of sediment samples from Hilliards Creek between Gibbsboro-Clementon Road and Hilliard Road. The 2004 investigation documented a significant increase in lead concentrations to Hilliards Creek along this entire section, Gibbsboro-Clementon Road to Hilliards Road.

The Lucas plant, located at the headwaters of Hilliards Creek, was used to manufacture paints that contained lead (Refs. 9; 12; 6, Figure 2-4; 61, pp. 3, 4, 5, 6, 8, 12, 19, 22, 26, 30). Surface water runoff from the Lucas plant flowed to Hilliards Creek during the entire operational period of the Lucas plant (Refs. 3, 4, 5; 6, Figure 2-4; 18, pp. 2-2, 2-3, 3-2; 31, p. 2-9; 73, p. 2, 4). The wastewater lagoons (Source 3), used to treat and store lead-contaminated paint sludge, also discharged to Hilliards Creek (Refs. 7, pp. 10, 11; 8, p. 3; 19, pp. 1, 3; 20, pp. 1, 2; 21, p. 1; 25, pp. 1, 2; 41, p. 11). Lead was used extensively at the Lucas plant (Refs. 13, p. 3; 31, p. 2-3; 60, pp. 6, 8, 10, 12, 22, 26). The presence of lead within Hilliards Creek extending from the Lucas plant to Hilliards Road indicates that over time, from operations at the Lucas plant, lead has accumulated in the sediments of Hilliards Creek and its flood plain.

The 2004 Hilliards Creek investigation also documented a significant increase in arsenic concentrations to Hilliards Creek from Gibbsboro-Clementon Road to Hilliard Road. As documented in source section of this HRS documentation record, arsenic was detected in source samples at concentrations exceeding three times background. Arsenic is a common constituent in paint and a constituent of Paris green, a pigment manufactured at the Lucas plant (Refs. 12; 99, p. 1; 100, p. 1; 101, p. 2). Arsenic is also used in paint for the bottom of ships as was manufactured at the Lucas plant (Refs. 13, p. 10; 99, p. 3). As documented in the sections below, no other significant source of arsenic, other than the disposal areas used by Lucas plant, are located within the Hilliards Creek watershed.

Similarly SVOCs are associated with all four of the site sources, being found in soil samples and free product samples as discussed earlier in the source sections of this document.

The five sections below provide further information related to the attribution of arsenic and lead (as well as the SVOCs found in the observed releases by direct observation) in Hilliards Creek to the Lucas plant.

The first section provides information on the land use surrounding Hilliards Creek. This section contains both historical and recent information showing that the paint works area has been a main source of contamination to the creek. It also discusses other facilities and other proposed and final NPL sites in the watershed that might have contributed lead or arsenic to Hilliards Creek. However, releases from these facilities would negate that part of the significant increase in contaminant concentrations at least in part is due to the releases from the sources.

The second section describes investigations that have been conducted in Hilliards Creek to determine whether the paint works area released hazardous substances to the creek. Besides the analytical data from the most recent investigations used to document an observed release to surface water from the paint works area by chemical analysis, a summary of previous investigations is provided in the section below to provide additional documentation of releases to Hilliards Creek. These studies show that the lead and arsenic concentrations are significantly higher below the PPEs for this site and the contamination appears to be continuous from these PPEs downstream to Kirkwood Lake.

The third section describes documentation of historic releases from site activities to Hilliards Creek that have been observed over time. It clearly supports that the paint works area is historically a source of lead and arsenic releases.

The fourth section describes operations at the paint works area that may have released arsenic, lead, and SVOCs to Hilliards Creek and Hilliards Creek wetlands.

The fifth section describes ground water releases directly to surface water.

Land Use Surrounding Hilliards Creek

Historical aerial photography indicates that, west of Gibbsboro-Clementon Road, land use along the course of Hilliards Creek has changed over time. Historically, properties along that portion of the creek were used for farming, but were gradually abandoned and either subdivided for residential development or were acquired by the Borough of Gibbsboro under the Green Acres program. To the East of Gibbsboro-Clementon Road, Hilliard Creek is bordered by a cemetery, Lucas plant, and residential properties (Refs. 3; 4; 5; 6, p. 2-11).

The 1964 insurance map of the Lucas plant identified Hilliards Creek as a drainage ditch located between ASTs and a garage with a gasoline storage tank and pump. The map shows that Building 67 located east of Hilliards Creek was used as a warehouse, with a railroad and tanker truck solvent unloading station at its northern side and a sewage treatment plant and drum storage area to its southern side. This same map also shows the Lucas plant former wastewater lagoon located directly south of Building 67 and east of Hilliards Creek (Refs. 5; 6, p. 2-13).

The 1947 site map shows drainage from the above ground solvent storage tanks flowing in an eastern direction into Hilliards Creek. The maps indicated that the ground slopes to a small brook (Hilliards Creek). The map indicates a flood occurred in September 1940 that broke a dam wall and caused water to enter parts of the building to a depth of 4 to 5 feet (Refs. 3; 6, p. 2-12).

A historical report about Gibbsboro New Jersey provides historic information related to the land-use surrounding Hilliards Creek. In the 1800s, Gibbsboro was used mainly for farming (Ref. 17, p. D4) and a grist mill operated on Hilliards Creek (Refs. 17, pp. D7, D16; 60, p. 15). The Lucas plant began operating in the mid-1800s and houses were constructed in the area around Hilliards Creek (Ref. 17, pp. D10, D16). A railroad provided transportation of goods (Ref. 17, p. D11). The only manufacturing conducted in Gibbsboro in 1906 was done by the Lucas plant (Ref. 17, p. D-18). In 1924, Gibbsboro was a self-contained community of workers who for the most part were engaged in the production of Lucas Paint and Varnish Products (Ref. 17, p. D-18). In 1931 the Labrusca Vineyard and a concrete block manufacturer were located in Gibbsboro (Ref. 17, p. D-20). In 1960, the Labrusca Vineyards closed and 500 homes were constructed on the 100-acre parcel (Ref. 17, p. D-20). The Lucas plant was the major industry in Gibbsboro, New Jersey, from the 1800s to 1970s (Ref. 60, p. 6).

The date at which lead was no longer used at the Lucas plant has not been determined. During the 1940s and 1950s, paint manufacturers essentially discontinued the use of lead pigments in consumer paints and in 1954, a voluntary standard to remove lead pigment from consumer paints, was developed by the American Standards Association (Ref. 106). The lead contamination in Hilliards Creek is expected to have moved downstream from the plant, since the lead discharges from the plant ceased over 50 years ago. Additionally, discharge from the former lagoons (Source 3) containing lead-contaminated wastewater ceased in 1977, over 28 years ago (Ref. 31, p. 2-5). The concentrations of lead detected in Hilliards Creek, as documented earlier in this section, also indicate that the lead contamination from the Lucas plant has migrated downstream. For example, at sampling location HC-SD-45, lead was detected up to 5,220 mg/kg (Refs. 86, p. 17; 88, p. 2). The sampling location is about 6,600 feet downstream from PPE-4, the most upstream PPE (Ref. 97).

West of the site, on Kirkwood Lake, an ice harvesting company and gristmill operated in the early 1900s (Refs 9; 49, p. 2-1).

Other Possible Facilities and Off-Site Sources

A gun club is located on Bridgewood Lake (43, p. C-2-5). Bridgewood Lake flows to Hilliards Creek (Ref. 9). The gun club is a potential source of lead contamination from lead bullets. Releases from the gun club would not be a source of arsenic.

Academy Paints and Scotko Sign and Display, Inc. are facilities listed as RCRA facilities and are generators of hazardous waste (Refs. 31, p. 2-6; 59, Appendix II, p. II10). Both are tenants of the industrial park that replaced the Paint Works facility (Refs. 31, p. 2-6; 56, Appendix II9). Scotko Sign and Display, Inc. occupied Building 56 (Ref. 31, p. 2-7). Academy Paints manufactured paint (latex and oil based) from 1982 to 1989 in Building 67 (Refs. 67, p. 1; 31, p. 2-6). Academy Paints used the following materials: toluidine, ammonia 260, driers (solvents), ethylene glycol, flammable liquids, naphtha, paint, potassium chlorate, resin solution, mineral spirits, xylene, and ethylbenzene (Refs. 33, p. 9; 67, pp. 7, 8;). Two 5,000-gallon ASTs were located north of the Academy Works building, which stored solvents, alkyl resins, and mineral spirits. Fifty-five-gallon drums were located on the back of the building on a concrete pad as well as directly on the ground (Ref. 59, Appendix II, II10).

Several commercial and industrial operations are present in the immediate vicinity of the plant. A former gasoline service station, previously leased to CITGO and the Sun Oil Company, was located directly northeast of the intersection of Foster Avenue and US Avenue, east of the Lucas plant, within 120 feet of Building 55 (Ref. 31, p. 2-17 and Figure 3-2).

The former General Electric (GE) Company Aerospace Government Electronic Systems facility is located immediately to the north of the facility, at the intersection of Route 561 and US Avenue. When it was in operation, the facility was listed on the Toxic Release Inventory (TRI) as releasing to the air and disposing of 1,1,1-trichloroethane off site.

Additionally, numerous RCRA facilities are located in Gibbsboro but are not associated with significant releases of lead or arsenic (Ref. 31, p. 2-17).

Hazardous wastes sites identified within 1 mile of the Hilliards Creek site include the Shell gasoline service station and the Buzby landfill (Ref. 59, Appendix II, p. II8).

The concentrations of lead in Hilliards Creek may be partially attributable to surface runoff from nearby roads and parking lots and the former use of leaded fuels (Ref. 59, Appendix II, II56).

Land uses in the area of Hilliards Creek that may have contributed to the PAH contamination in Hilliards include wood burning, exhaust from automobiles and trucks, and runoff from asphalt roads (Refs. 9; 105, pp. 2, 3, 4).

If during further investigation releases from these above mentioned facilities or sources are found to be contributing significant contamination to Hilliards Creek, appropriate actions will be undertaken and, if appropriate, will be included as part of this site. However, they are not thought to be ongoing sources of lead or arsenic.

NPL and Proposed NPL Sites

Two hazardous waste sites are located a short distance from the Lucas plant, Route 561 Dump Site, and the US Avenue Burn Site (Ref. 41, p. 6). The US Avenue Burn Site is listed on the NPL and the Route 561 Dump Site has been proposed for listing on the NPL (Refs. 44, p. 1; 45, p. 2). The sites are described below. Locations of the sites are shown on Figure 2-1 of Reference 6.

US Avenue Burn Site

The US Avenue Burn site, a site listed on the NPL, was used and owned for waste management by the Lucas plant. The site was used for the disposal of wastes generated solely by the Lucas plant. The site is located approximately 500 feet southeast of Building 67 on the Lucas plant property on vacant land east of Bridgewood Lake in Gibbsboro, New Jersey. The site includes, but is not limited to, three sources: the Burn Area, the Burn Landfill, and the Railroad Track. The Burn Area portion of the site was previously used for disposal and burning of paint wastes from the Lucas plant. The Burn Landfill portion of the site was used for the disposal of sludge from the Lucas plant’s wastewater treatment system. The Railroad Track portion of the site was used to transport materials to and from the Lucas plant (Refs. 45, pp. 1, 2; 6, p. 2-6, Figure 2-1).

Hazardous substances detected in samples from the Landfill Area included barium, cadmium, lead, and zinc (Ref. 61, pp. 7, 8). Analytical results for soil samples from the Burn Area indicated antimony, arsenic, barium, cadmium, total chromium, copper, lead, and zinc (Ref. 61, p. 9). Contaminated soil is associated with the Railroad Track portion of the US Avenue Burn site. Hazardous substances detected in the soil include arsenic, barium, chromium, and lead (Ref. 61, p. 7).

White Sand Branch and Haney Run Brooke flow across the US Avenue Burn site into Bridgewood Lake, which discharges into Hilliards Creek downstream of the Lucas plant (Refs. 97; 6, Figure 2-1). The Burn Area source of the US Avenue Burn site is located in a wetland of White Sand Branch. The wetland is contaminated (Ref. 61, pp. 3, 6). During the investigations conducted at the site, the field crew observed the presence of discolored soils (green) along a section of the railroad track used to transport materials (Ref. 59, Appendix Z, p. Z1, Appendix FF, p. FF1).

Route 561 Dump Site

The Route 561 Dump Site, a site proposed for listing on the NPL, is located approximately 1,000 feet northeast of Building 55 on the Lucas plant property on a vacant parcel located on Route 561 near Milford/Kresson Road in Gibbsboro, New Jersey. The site was previously owned and used by the Lucas plant as a paint waste disposal area (Refs. 44, p. 1; 61, 3; 9; 6, p. 2-9). The Route 561 Dump site released paint wastes, arsenic, and lead into White Sand Branch, which eventually discharges into Bridgewood Lake (Refs. 9; 59, pp. 10, 11, 13, 17). White Sand Branch flows south through the Route 561 Dump Site and leaves the site through a culvert under Route 561 and continues southwest to Bridgewood Lake. Bridgewood Lake flows into an unnamed tributary that converges with Hilliards Creek downstream of the Lucas plant (Refs. 44, p. 1; 61, 3; 9; 6, p. 2-9). Analytical results for soil samples collected from the dump site indicated the presence of arsenic, barium, cadmium, and lead. Arsenic and lead were also detected in sediment samples from White Sand Branch (Ref. 61, pp. 6, 7).

<u>Investigations of Hilliards Creek</u>

This section describes investigations conducted of Hilliards Creek that were not used in the observed release to surface water section of this HRS documentation record.

Investigations of Hilliards Creek 1983 to 1991

On February 7, 1985, NJDEP personnel sampled Hilliards Creek and a seep (Source 1) discharging into Hilliards Creek (Ref. 32, p. 5). Analytical results for creek samples indicated the presence of benzene, ethylbenzene, 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, xylenes, and toluene (Ref. 32, p. 6).

In March 1987, NJDEP collected surface water samples from Hilliards Creek at the point where a seep (Source 1) discharged into the creek and upstream and downstream of the seep. The upstream surface water sample contained less then 5 micrograms per liter (µg/L) of lead and the surface water sample collected at the seep contained 450 µg/L of lead (Refs. 62, pp. 16, 63; 64, p. 10).

In 1991, two sediment samples were collected from Hilliards Creek near the seep, Source 1. Analytical results for the samples indicated the presence of numerous SVOCs (Ref. 59, Appendix II, II38).

Remedial Investigations - Hilliards Creek

From August 1991 through January 1992, during a Phase I RI for the Lucas plant (Ref. 31, p. 3-3), three sediment samples (001-SD01, 002-SD01, and 003-SD01) were collected from Hilliards Creek. No background sediment sample was collected in Hilliards Creek. Analytical results for the sediment samples indicated the presence of numerous SVOCs including acenaphthene, acenaphthylene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, carbazole, chrysene, di-n-octyl phthalate, dibenzo(a,h)anthracene, dibenzofuran, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, pentachlorophenol, phenanthrene, and pyrene. Numerous metals were also detected in the sediment samples (Ref. 31, Table 4-16). However, since metals are naturally occurring and no background sediment sample was collected, the significance of the metal concentrations can not be determined.

Three surface water samples (001-SW01, 002-SW01, and 003-SW01) were collected from Hilliards Creek during the Phase I RI. A background surface water sample (004-SW01) was collected from the northeastern-most point of Silver Lake, upgradient of sources on the Lucas plant property to provide data representing background conditions (Ref. 31, pp. 3-3, 3-12, 3-17). Hazardous substances detected in the Hilliards Creek surface water samples at concentrations greater than three times the background concentration (with the consideration of data qualifiers) or above the detection limit if not detected in the background sample include benzene, xylene, phenols, aluminum, arsenic, chromium, copper, lead, magnesium, manganese, vanadium, and zinc (Refs. 31, Table 5-8; 81).

From September 1996 through January 1997, during Phase IV of the RI, one sediment sample (SD-09) was collected in Hilliards Creek immediately adjacent to the former pump house, at Source 2 (Ref. 31, pp. 3-3, 3-26). The sediment sample contained the highest concentrations of polychlorinated aromatic hydrocarbons (PAHs), ranging from 1.7 to 31 mg/kg, of all the sediment samples collected during RI activities. These results indicate that the contaminated soil associated with the pump house has released PAHs to Hilliards Creek (Ref. 31, pp. 5-13, 6-8, Table 4-16).

November 1998 Soil and Sediment Investigation Hilliards Creek

In 1998, lead contamination in Hilliards Creek was identified when sediment samples were collected from the creek to establish reference (background) concentrations. One of the sediment samples collected from the creek contained 221,900 ppm of lead. That sample was collected adjacent to a trail in the Hilliards Creek Wildlife Refuge (Ref. 54, pp. 1, 5). To determine the source of the lead contamination, numerous investigations were conducted by EPA.

As documented in the Observed Release Section of this HRS documentation record, in December 1998, 676 sediment samples, 42 soil samples, three waste samples, and eight aqueous samples were collected from Hilliards Creek and tributaries to Hilliards Creek. Blue-stained material, believed to be paint, was observed in the sediments of Hilliards Creek and in soil adjacent to the creek (Ref. 26, Table 1, p. 5). The report documenting the November 1998 sampling event, concluded that significant concentrations of lead were in the sediments of Hilliards Creek and its tributaries, and in the soil surrounding the creek (Ref. 26, p. 6). One of the samples collected from the bank of the creek, which was noted as containing blue-stained material (believed to be paint), contained Resource Conservation and Recovery Act (RCRA) hazardous concentrations of lead (greater than 5 milligrams per liter) (Refs. 26, Table 1, pp. 5, 6; 27, p. 12). The NJDEP residential direct contact soil cleanup criteria (RDCSCC) of 400 ppm was exceeded in 437 of the sediment and soil samples (Ref. 26, p. 6). The concentrations of lead in the shallow and deep sediment samples did not vary significantly. The highest concentrations of lead were detected in sediments collected from the portion of Hilliards Creek within the property boundaries of Hilliards Creek Wildlife Refuge (Ref. 26, p. 7). Hilliards Creek Wildlife Refuge is located on the west side of Gibbsboro-Clementon Road, approximately 1,200 feet southwest of the Lucas plant (Ref. 97). During the investigation, analysts identified lead contamination in Hilliards Creek extending from Hilliards Road upstream to a distance of 4,600 feet (Ref. 26, p. 8).

During the November 1998 investigation, a sediment sample was collected from Hilliards Creek containing blue material or paint, and was analyzed for TAL metals. The following metals were detected in the sediment sample: aluminum (11,700 ppm), arsenic (1,280 ppm), chromium (29,300 ppm), iron (47,300 ppm), lead (68,000 ppm), and zinc (8,830 ppm). Analytical results for the sample (W-1) containing blue material collected from the bank of Hilliards Creek indicated aluminum (12,400 ppm), arsenic (759 ppm), barium (2,870 ppm), chromium (38,500 ppm), and lead (65,000 ppm) (Refs. 26, p. 7 and Table 1, p, 5; 27, p. 11). Two other samples containing blue-green stained material were collected from the flood plain of Hilliards Creek downstream of the Lucas plant. These samples contained barium (up to 14,400 ppm), lead (up to 1,090 ppm), magnesium (up to 7,340 ppm), and mercury (up to 17.8 ppm) (Refs. 26, pp. 5, 7, 8; 27, p. 11, Figure 2).

1999 Soil Investigation Hilliards Creek

In June 28, 1999, 155 soil samples were collected to define the extent of lead in the soil adjacent to Hilliards Creek. The samples were analyzed on site using X-ray Fluorescence (XRF). Sixteen samples were analyzed for TAL metals (Ref. 29, p. 2). Lead was detected in silt-rich soils in Hilliards Creek flood plain. Lead concentrations decreased to a nondetectable level in areas up slope from the flood plain. The highest lead concentrations were detected in samples containing blue-green clayey material (Ref. 29, p. 3).

1999 Health Consultation Hilliards Creek

In 1999, the Agency for Toxic Substances and Disease Registry (ATSDR) completed a health consultation for Hilliards Creek. ATSDR evaluated the analytical data collected in 1998 where lead was detected at 221,900 ppm in a sediment sample collected in the Hilliards Creek Wildlife Refuge. ATSDR concluded that an urgent health hazard exists to children and adults who use the refuge. The area where the sediment sample was collected was expected to be visited frequently because a trail in the refuge brought visitors to the sampling location (Ref. 55, pp 4, 8).

1999 Administrative Order of Consent Hilliards Creek

On September 30, 1999, the EPA Region 2, Regional Administrator and Sherwin-Williams signed an AOC for a removal action that required Sherwin-Williams to delineate the extent of contamination at accessible areas along Hilliards Creek; prevent direct contact with the contamination by use of engineering controls in accessible areas; obtain access; post signs where appropriate; and conduct site inspections on a quarterly basis (Refs. 49, P. 1-1; 50, pp. 1-1, 1-2; 51, pp. 1, 2, 22, 23). The removal action under the AOC also included sampling of Hilliards Creek and residential properties near Hilliards Creek to delineate the extent of lead-contaminated soil and the installation of a fence around lead-contaminated soil adjacent to Hilliards Creek (Ref. 51, pp. 9 through 14).

Between December 1999 and January 2000, sediment and soil samples were collected from 16 transects (T1 through T15 and T17) across Hilliards Creek between Gibbsboro-Clementon Road and Hilliards Road. The transects were spaced approximately 200 feet apart. Samples were collected at approximately 30-foot intervals along each transect from each bank of Hilliards Creek and from the center of Hilliards Creek. The surface soil samples collected from the banks of Hilliards Creek were collected from within the 100-year flood plain of Hilliards Creek. The flood plain samples were collected to determine whether periodic flooding transported contaminated sediments from Hilliards Creek to the flood plain of Hilliards Creek. Additional samples were collected as needed to complete the horizontal and vertical delineation of lead contamination, including four soil boring samples at various depths from the southern berm of the manmade pond located off of Gibbsboro-Clementon Road (Ref. 51, pp. 5, 8).

All samples were analyzed for lead (Ref. 51, p. 5). Approximately 25 percent of all samples were analyzed for TAL metals plus cyanide, five percent for TCLP metals (including copper and zinc), and five percent for TCLP VOC and BNA analyses. All sediment samples collected during the initial round of sampling were submitted for pH, TOC, and grain size analyses (Ref. 51, p. 6). All samples were collected in accordance with the November 1999 Work Plan for the Hilliards Creek Site, Gibbsboro, New Jersey and the December 1999 Work Plan Addendum (Refs. 51, p. 4; 68, 69).

No sediment sample designated to be background for all of Hilliards Creek was collected. However, a transect (T17) was placed across Nicholson Branch, a tributary of Hilliards Creek. The transect included the collection of surface and subsurface soil and sediment samples from the two flood plain banks and the center of Nicholson Branch (Ref. 51, pp. 5, 8, and Figure 4). Nicholson Branch is similar in size to Hilliards Creek, located within the same drainage area, and has similar soil/sediment types (Refs. 31, pp. 2-7 through 2-10; 6, Figure 2-7). The samples collected from transect 17 in Nicholson Branch are used to establish background lead levels in sediment located within Hilliards Creek. A summary of analytical results for sediment samples indicating concentrations of lead above three times the background concentration is provided in the Tables 17 and 18. The background samples were analyzed for lead only (Ref. 51, Table 4c, p. 14, Figure 4). Therefore, lead is the only metal evaluated.

TABLE 17

INORGANIC DATA SUMMARY - HILLIARDS CREEK SEDIMENT SAMPLES (0.0 TO 0.5 foot bgs) 1999 SHERWIN-WILLIAMS INVESTIGATION

Location ID	T17C	T01C	T02C	T03C	T03C2	T04C	T05C	T05C2	T08C	T09C
Field Sample ID	SS-T17C-0.0-005	SS-T01C-0.0-0.5	SS-T02C-0.0-0.5	SD-T03C-0.0-0.5	SD-T03C2-0.0-0.5	SD-T04C-0.0-0.5	SD-T05C-0.0-0.5	SD-T05C2-0.0-0.5	SD-T08C-0.0-0.5	SD-T09C-0.0-0.5
Date Collected	12/13/1999	12/03/199	12/3/1999	12/2/1999	12/2/1999	12/2/1999	12/2/1999	12/3/1999	12/8/1999	12/09/199
Sample Type	Background	Release	Release	Release	Release	Release	Release	Release	Release	Release
Location	Nicholson Branch	Hilliards Creek - West of Hilliard Road	Hilliards Creek - 100 feet west of Hilliard Road	Hilliards Creek wetland - 700 feet west of Hilliard Road	Hilliards Creek wetland - 700 feet west of Hilliard Road	Hilliards Creek wetland - 800 feet west of Hilliard Road	Hilliards Creek wetland - 825 feet west of Hilliard Road	Hilliards Creek - 700 feet west of Hilliard Road	Hilliards Creek - 1,200 feet west of Hilliard Road	North of the location where Hilliards Creek discharges into Kirkwood Lake
Reference	51, Table 4-c, p. 14, Figure 4	51, Table 4-f, p. 1, Figure 4	51, Tables 4-f, p. 5, Figure 4	51, Table 4-f, p. 6, Figure 4	51, Table 4-f, p. 6, Figure 4	51, Table 4-f, p. 6, Figure 4	51, Table 4-f, p. 7, Figure 4	51, Table 4-f, p. 7, Figure 4	51, Table 4-f, p. 9, Figure 4	51, Table 4-f, p. 10, Figure 4
Lead (mg/kg)	2.9	194	206	1,970	502	3,350	106	6,270	2,150	266

TABLE 17 (Continued)

**INORGANIC DATA SUMMARY - HILLIARDS CREEK
SEDIMENT SAMPLES (0.0 to 5.0 foot bgs)
1999 SHERWIN-WILLIAMS INVESTIGATION**

Location ID	T17C	T10C	T11C	T12C	T13C	T14C	T15C
Field Sample ID	SS-T17C-0.0-0.5	SD-T10C-0.0-0.5	SD-T11C-0.0-0.5	SD-T12C-0.0-0.5	SD-T13C-0.0-0.5	SD-T14C-0.0-0.5	SD-T15C-0.0-0.5
Date Collected	12/13/1999	12/9/1999	12/9/1999	12/9/1999	12/9/1999	12/9/1999	12/9/1999
Sample Type	Background	Release	Release	Release	Release	Release	Release
Location	Nicholson Branch	Where Hilliards Creek discharges into Kirkwood Lake	Kirkwood Lake, 200 feet west of the dam	Kirkwood Lake, 300 feet west of the dam	Kirkwood Lake, 400 feet west of the dam	Kirkwood Lake, 600 feet west of the dam	Hilliards Creek wetland, 200 feet southeast of the Kirkwood dam
Reference	51, Table 4-c, p. 14, Figure 4	51, Table 4-f, p. 10, Figure 4	51, Table 4-f, p. 11, Figure 4	51, Table 4-f, p. 11, Figure 4	51, Table 4-f, p. 12, Figure 4	51, Table 4-f, p. 13, Figure 4	51, Table 4-f, p. 13, Figure 4
Lead (mg/kg)	2.9	1,530	788	906	210	854	32

Notes:

bgs	Below ground surface
C	Center
ID	Identification
mg/kg	Milligram per kilogram
SD	Sediment
SS	Soil Sample
T	Transect

TABLE 18

INORGANIC DATA SUMMARY - HILLIARDS CREEK SEDIMENT SAMPLES (1.5 to 2.0 feet bgs) 1999 SHERWIN-WILLIAMS INVESTIGATION

Location ID	T17C	T02C	T03C	T03C2	T07C	T09C	T11C	T12C	T13C	T14C
Field Sample ID	SS-T17C-1.5-2.0	SS-T02C-1.5-2.0	SD-T03C-1.5-2.0	SD-T03C2-1.5-2.0	SD-T07C-1.5-2.0	SD-T09C-1.5-2.0	SD-T11C-1.5-2.0	SSD-T12C-1.5-2.0	SSD-T13C-1.5-2.0	SD-T14C-1.5-2.0
Date Collected	12/13/1999	12/3/1999	12/2/1999	12/2/1999	12/8/1999	12/09/199	12/17/1999	12/9/1999	12/9/1999	12/9/1999
Sample Type	Background	Release	Release	Release	Release	Release	Release	Release	Release	Release
Location	Nicholson Branch	Hilliards Creek - 100 ft west of Hilliards Road	Hilliards Creek wetland - 700 ft west of Hilliards Road	Hilliards Creek wetland - 800 ft west of Hilliards Road	Hilliards Creek wetland - 1,000 ft west of Hilliards Road	North of the location where Hilliards Creek discharges into Kirkwood Lake	Kirkwood Lake, 200 ft west of the dam	Kirkwood Lake, 300 ft west of the dam	Kirkwood Lake, 400 ft west of the dam	Kirkwood Lake, 600 ft west of the dam
Reference	51, Table 4-c, p. 14	51, Table 4-c, p. 5	51, Table 4-c, p. 6	51, Table 4-c, p. 6	51, Table 4-c, p. 8	51, Table 4-c, p. 10	51, Table 4-c, p. 11	51, Table 4-c, p. 11	51, Table 4-c, p. 12	51, Table 4-c, p. 13
Lead (mg/kg)	3.7	144	519	289	112	39.3	69.8	30.4	641	116

Notes:

bgs	Below ground surface	mg/kg	Milligram per kilogram
C	Center	SD	Sediment
ft	Foot	SS	Soil Sample
ID	Identification	T	Transect

Ten surface water samples also were collected from nine sampling locations where lead was detected at elevated concentrations as compared to background (Ref. 51, p. 6, Figure 5). The samples were analyzed for TAL metals (filtered and unfiltered), TOC, total dissolved solids (TDS), totals suspended solids, and hardness. The samples were collected from a depth of approximately 2 inches below the top of the water surface (Ref. 50, p. 6). No background surface water sample was collected (Ref. 51, Figure 5). To determine whether the concentrations of hazardous substances detected in the surface water samples are three times above the background concentration, surface water sample SW-09 collected from a tributary draining Bridgewood Lake is used to establish background concentrations (Ref. 51, Figure 5). The tributary does not receive surface water runoff from the Lucas plant, but does receive surface water runoff from two hazardous waste sites, US Avenue Burn Site and Route 561 Dump Site (Ref. 6, Figure 2-1). As summarized in Table 19, concentrations of arsenic and lead were detected at three times above the background concentration in surface water samples SW-07 and SW-08. Lead was detected in surface water sample SW-05 at concentrations three times the background concentration as documented in the table below. The hardness, TDS, TOC, and total suspended solids values are presented for water quality information and are not used to establish an observed release of these values.

TABLE 19

SURFACE WATER SAMPLES FROM HILLIARDS CREEK
1999 SHERWIN-WILLIAMS INVESTIGATION

Location ID	SW-09	SW-05	SW-07	SW-08
Date Collected	12/22/1999	12/22/1999	12/22/1999	12/22/1999
Reference	51, p. 6, Table 2-a, Table 2-b, Figure 5	51, p. 6, Table 2-a, Table 2-b, Figure 5	51, p. 6, Table 2-a, Table 2-b, Figure 5	51, p. 6, Table 2-a, Table 2-b, Figure 5
Sample Type	Background	Release	Release	Release
Hardness (mg/L)	33,100	42,900	59,200	60,400
Total Dissolved Solids (mg/L)	86	84	96	100
Total Organic Carbon (mg/L)	5.6	5.7	5.8	5.5
Total Suspended Solids (mg/L)	ND	ND	12	14
Metals (µg/L)				
Arsenic	ND	ND	4	20.4
Lead	8.1	24.7	646	700

Notes:
µg/L Microgram per liter
ID Identification
mg/L Milligram per liter
ND Not detected
SW Surface Water

In response to results of samples collected during investigations along Hilliards Creek, Sherwin-Williams fenced areas of the Hilliards Creek Wildlife Preserve and Hilliards Creek to limit access to lead-contaminated soil and sediment (Ref. 51, pp. 9, 10, 11).

June 2002 Investigation

In June 2002, Sherwin-Williams conducted a sampling investigation at Kirkwood Lake, the surface water into which Hilliards Creek discharges, and residential properties adjacent to Kirkwood Lake (Ref. 49, pp. 2-1, Figure 2, Table 1). The investigation identified arsenic and lead contamination in Kirkwood Lake and on one residential property (Ref. 49, pp. 3-7, 3-9, 3-10, 4-1, 4-2).

Historic Discharges into Hilliards Creek

Sherwin-Williams had a permit for discharging non-contact cooling water into Hilliards Creek from the Lucas plant under a NJDEP National Pollution Discharge Elimination System (NPDES) permit. The discharge ceased in August 1978 when the plant closed (Refs. 58; 59, p. 6).

A historic map of the Lucas plant indicates that hazardous substances stored and used in buildings on the plant property may have been released to Hilliards Creek. The maps indicated that Hilliards Creek originated at Silver Lake. Silver Lake discharged into an underground culvert that flowed under buildings located at the plant and finally to an open ditch, Hilliards Creek, on the east side of Foster Avenue. Building floor drains, a trench, a holding basin, and surface water run off from the plant were directed to the underground culvert that discharged into Hilliards Creek (Refs. 6, Figure 2-4; 60, pp. 16, 25, 28, 29, 62). Hazardous substances used and stored in buildings may have been released to Hilliards Creek through this pathway. As indicated by historic maps, numerous types of hazardous substances were used in the plant buildings (Refs. 6, Figure 2-4; 60).

There is also evidence that the surface impoundments (Source 3) leached their contents into Hilliards Creek (Ref. 32, p. 3). Aerial photographs taken in 1973 show the presence of a pipeline extending from the north bank of one of the surface impoundments (impoundment one) to a drainage channel (Hilliards Creek) that runs through the center of the Lucas plant. An outfall from the western bank of the impoundment area toward the drainage channel (Hilliards Creek) is visible (Ref. 7, p. 10).

On September 18, 1915, Building 39 was almost completely destroyed by fire (Ref. 60, p. 67). On February 21, 1940 and July 30, 1949, fires occurred at the facility (warehouse No. 36), which ignited thousands of gallons of drummed thinners, lacquer, and other flammable materials stored at the facility. During efforts to extinguish the fires, hazardous substances were released to soil, ground water, and surface water (Refs. 32, p. 3; 60, p. 68).

On May 5, 1976, NJDEP inspectors observed that a feed pipe used for the transport of raw materials had ruptured, causing an oil discharge to the primary settling lagoon (Source 3) and Hilliards Creek (Ref. 32, p. 3). The reference to the release does not indicate the exact type of the material discharged. This discharge may have released contaminants to Hilliards Creek.

In 1983, a seep (Source 1) was observed in the parking lot north of Building 67 between Buildings 67 and 50, flowing into Hilliards Creek (Refs. 32, p. 5; 65, pp. 1, 2, 3). The seep was observed on many occasions during the construction of the new office complex that now occupies the Lucas plant property. Two USTs, one for oil and another for solvent, were located in the area of the seep. There also was a loading pad for railroad cars in this area (Ref. 65, p. 1). The loading pad and the USTs may have been one of the sources of the seep. The seep flowed overland to a storm water catch basin in the parking lot and then discharged into Hilliards Creek (Refs. 32, p. 5; 65, pp. 1, 2, 3). Analytical results for a sample of the seep is presented in the waste characteristics section for Source 1 in this HRS documentation record.

On February 7, 1985, NJDEP personnel sampled Hilliards Creek and the seep (Source 1) discharging into Hilliards Creek (Ref. 32, p. 5). Analytical results for the seep sample indicated the presence of 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, naphthalene, xylenes, ethylbenzene, cumene, and tetrachloroethene (Ref. 32, pp. 6, 7). Analytical results for creek samples indicated the presence of benzene, ethylbenzene, 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, xylenes, and toluene (Ref. 32, p. 6).

On May 11, 1987, NJDEP personnel witnessed Paint Works's employees (persons employed by the Paint Works Corporate Associates I who purchased the Lucas plant from Sherwin-Williams) pumping hazardous substances into Hilliards Creek. On June 11, 1987, NJDEP personnel witnessed hazardous substances being discharged to Hilliards Creek through a ditch dug by Paint Works's employees. On June 4, 1987, NJDEP personnel observed Paint Works' fill in a section of Hilliards Creek with contaminated soils (Ref. 32, p. 8). The reference documentation for the above releases does not identify the hazardous substances released.

In 1994, during investigations at the US Avenue Burn Site, a NJDEP representative interviewed a resident of 25 US Avenue. The resident's interview indicated that Hilliards Creek was commonly known as the Paris Green ditch where the washout from the Paint Works facility ran different colors on different days (Ref. 59, Appendix BBB, pp. BBB3, BBB4). Another residence of Gibbsboro indicated that during the 1950s, he observed a rainbow sheen across Hilliards Creek and he soaked cattails in the material seeping into the creek in order to make torches (Ref. 64, p. 8).

On February 19, 1988 and February 25, 1988, NJDEP observed a seep (Source 1) discharging into Hilliards Creek (Refs. 36; 37). On several occasions in 2002, as documented in the source characterization section for Source 1, seeps were observed flowing into the Hilliards Creek at the point where the storm sewer north of Building 67 discharges into the creek (Refs. 72, pp. 2, 4; 73, pp. 2, 4). As documented in the source characterization section for Source 1 and Table 11, arsenic, lead, benzo(a)pyrene, bis(2-ethylhexyl)phthalate, and chrysene were detected in seep samples and in Hilliards Creek sediment samples at concentrations meeting the criteria for an observed release (Ref. 1, Table 2-3).

On March 30, 1989, NJDEP received a complaint of an illegal discharge of white paint solids into Hilliards Creek from Academy Paints and issued a notice of violation to Academy Paints (Refs. 34; 35).

On April 9, 2002, free-phase product from the seep (Source 1) was observed in the storm water system catch basin and inlet, in the rip-rap, and in Hilliards Creek (Ref. 48, p. 2-3). The product was characterized as waste petroleum distillates (Ref. 48, Appendix A). The free product was composed of benzene, ethylbenzene, xylene, naphthalene, and 2-methylnaphthalene (Ref. 31, p. 4-25).

Arsenic, lead, and SVOCs have been detected in soil samples collected from sources on the Lucas plant property (documented in the waste characterization section of this HRS documentation record), and surface water runoff from the sources are not contained (as documented in the source description section of this HRS documentation record). Surface water carried metals and SVOC-contaminated soil into Hilliards Creek as documented in Section 4.0 of this documentation record (Ref. 31, p. 6-9).

Additionally, lead and SVOCs have been detected in product samples collected from Source 1 (Refs. 76, pp. 12, 13, 19, 20; 77, p. 82). Product from Source 1 has been observed discharging into Hilliards Creek (Refs. 10, pp. 1, 2; 31, pp. 3-3, 3-22; 32, p. 5; 65, pp. 1, 2, 3; 36; 37).

Contaminant Sources Associated with Site Operations

Historic illustrations showing areas where white lead grinding operations were conducted do not show any air emission controls on the grinding equipment (Ref. 60, pp. 42, 43, 44, 45). During the grinding operations, lead would have been released to air and may have been deposited in Hilliards Creek and surrounding areas. Similarly, many operations shown in the historic illustrations like boiling and cooling varnish, mixing varnish, drum storage areas, latex storage, and solvent transport may have released lead and other hazardous substances (Ref. 5). Many of the historic illustrations show equipment on wooden floors or directly on the ground surface (Ref. 60, pp. 33, 35 through 41, 46, 51, 52, 53, 55). The historic descriptions of the buildings indicate that the buildings did not have containment structures and were not constructed to prevent spills from percolating into the underlying soil (Ref. 60, pp. 90, 91, 94 through 108).

Historic reports indicate that the varnish operation produced air emissions and the lacquer and paint operations produced highly toxic liquid waste. Arsenic wastewater produced from the color works was pumped to an open field outside Gibbsboro in the 1930s (Ref. 60, p. 69). Some of the residents recall that the field frequently caught fire (Ref. 60, pp. 69, 71). Residents also recall a time when Hilliards Creek would catch fire when solvents on its surface ignited (Ref. 60, p. 71). To resolve this problem, Sherwin-Williams added a scrubber to the alkyd plant stack and contained wastewater in pits behind old Number 36 platform (Ref. 60, p. 71).

Operations in the area of Tank Farm B (Source 4) are a probable cause of the soil contamination in this area. Hazardous substances may have leaked or released during the transportation of the tank contents by tank cars to the production facilities or from a system of pipes installed in 1911 to simplify the transportation process, former ASTs and USTs, an existing septic system, and historical use of process chemicals (loading and unloading) within the area (Refs. 59, Appendix II, p. II5; 60, p. 46). The area of Tank Farm B was referred to as oil hill (Ref. 60, p. 46). The tanks contained oils, mineral spirits, and xylene (Ref. 31, Table 2-2).

In September 1987 and February 1988, NJDEP determined that the analysis of seep (Source 1) samples indicated that the constituents in Source 1 were similar to the materials used and stored at the Sherwin-Williams facility (Ref. 38, pp. 1 through 3). The seeps (free-phase product) may have resulted from leaks from ASTs containing mineral spirits 66-2 and 802-15 alkyd resin, a pipe extending from the maintenance shop in Building 50, a former gasoline station, an existing septic system, or the handling of process chemicals during operations (Refs. 18, pp. 3-5, 4-1; 59 Appendix II, p. II5). A surface spill of motor oil also was indicated as a source of contamination (Ref. 18, pp. 3-5, 4-1).

Contaminated soil on the plant property may be due to the storage of raw materials in Buildings 55 and 58 and improper handling of materials during transfer, leaking transfer piping, leaking drums and tanks, spills during maintenance of pipes, spills during maintenance of pipes, pumps and tanks, spills during drum cleaning activities, discharge of wastes to surface impoundments, and leaks due to improper storage of drummed materials (Ref. 32, p. 9, Figure 2-2).

The reworking of the parking lot adjacent to Building 67 included the excavation of the cut-bank in the northeastern corner of the parking lot to provide an additional area for parking. This reworking allowed free-phase product and ground water to seep at the ground surface (Ref. 31, p. 6-3).

Analytical results for soil samples collected from the source areas indicated the presence of numerous SVOCs, including those SVOCs detected in the release to surface water and sediment samples collected from Hilliards Creek as documented in this section of the HRS documentation record (Refs. 31, Table 4-5; 78, p. 13). Surface water run off from the areas of contaminated soil, Sources 2, 3, and 4, would carry the contaminated soil to Hilliards Creek.

Ground Water Contaminant Releases to Surface Water

Locally, Hilliards Creek acts as a discharge zone for shallow ground water (Ref. 31, p. 4-2). Therefore, any shallow ground water contamination associated with the facility would eventually discharge into Hilliards Creek. As discussed in the observed release by direct observation via overland flow section earlier in this HRS Documentation Record and later in the Ground Water to Surface Water section of this HRS Documentation Record, the ground water is in direct contact with free product underneath the paint works area, and this free product and soils in the free product source area contain lead, arsenic, and SVOCs.

Similar types of wastes have been observed in the Route 561 Dump Site and in soil near Hilliards Creek and in sediments of Hilliards Creek including blue and bluish-green staining or blue and bluish-green stained soil and sediment (Ref. 59, Appendix Z, p. Z1; Appendix FF, p. FF1; Appendix GG, p. GG1).

In summary, lead, arsenic and several SVOCs are clearly associated with on-site sources. They are found in observed releases by direct observation. They are found in significantly higher concentrations downstream of the PPEs for the site sources, and historic documentation supports that these substances have been released to Hilliards Creek numerous times. Although there may be other sources in the Hilliard's Creek Watershed, it is clear that the significant increase in the release substances can be at least in part attributed to site releases.

Observed Release Hazardous Substances:

Arsenic
Benzo(a)anthracene
Benzo(b)pyrene
Benzo(b)fluoranthene
Benzo(g,h,i)perylene
Benzo(k)fluoranthene
Bis-2(ethylhexyl)phthalate
Chrysene
Fluoranthene
Lead
Phenanthrene

4.1.2.2 WASTE CHARACTERISTICS

4.1.2.2.1 Toxicity/Persistence

For each hazardous substance detected in a source with a containment value greater than zero, a toxicity factor value, a persistence factor value, and a combined toxicity/persistence factor value are assigned (Ref. 1, Section 4.1.2.2.1).

TABLE 20

TOXICITY/PERSISTENCE FACTOR VALUES
SHERWIN-WILLIAMS/HILLIARDS CREEK

Hazardous Substance	Source Number	Toxicity Factor Value	Persistence Factor Value*	Toxicity/ Persistence Factor Value	Reference
Acetone	1, 4	1	0.07	0.07	2, p. BI-1
Aluminum	1	0	1	0	2, p. BI-1
Antimony	2	10,000	1	10,000	2, p. BI-1
Arsenic	1, 2, 3, 4	10,000	1	10,000	2, p. BI-1
Barium	1, 2, 3, 4	10,000	1	10,000	2, p. BI-1
Benzene	1	1,000	0.4	400	2, p. BI-2
Benzo(a)anthracene	1, 4	1,000	1	1,000	2, p. BI-2
Benzo(a)pyrene	1, 4	10,000	1	10,000	2, p. BI-2
Benzoic acid	3	--	--	--	2, p. BI-2
Benzo(b)fluoranthene	1, 4	--	--	--	2, p. BI-2
Benzo(k)fluoranthene	1, 4	100	1	100	2, p. BI-2
Beryllium	2	10,000	1	10,000	2, p. BI-2
Bis (2-ethylhexyl) phthalate	1	100	1	100	2, p. BI-2
2-Butanone	1, 2, 4	--	--	--	2, p. BI-2
Cadmium	1, 2, 3	10,000	1	10,000	2, p. BI-2
Carbon disulfide	3	10	0.4	4	2, p. BI-3
4-Chloroaniline	1	--	--	--	2, p. BI-3
Chlorobenzene	1	100	0.0007	0.07	2, p. BI-3
Chloroform	4	100	0.4	40.0	2, p. BI-3
Chromium	1, 2, 3, 4	10,000	1	10,000	2, p. BI-3
Chrysene	1, 4	10	1	10	2, p. BI-3
Cobalt	2, 4	10	1	10	2, p. BI-3
Copper	1, 2, 3	0	1	0	2, p. BI-3
Cyanide	4	100	1	100	2, p. BI-4
1,2-Dichloroethene	1, 2	100	0.4	40	2, p. BI-4
2,4-Dimethylphenol	1	100	1	100	2, p. BI-5
Di-n-butyl phthalate	4	10	1	10	2, p. BI-4

TABLE 20 (Continued)

TOXICITY/PERSISTENCE FACTOR VALUES
SHERWIN-WILLIAMS/HILLIARDS CREEK

Hazardous Substance	Source Number	Toxicity Factor Value	Persistence Factor Value*	Toxicity/ Persistence Factor Value	Reference
Ethylbenzene	1, 2, 3, 4	10	$7x10^{-4}$	0.007	2, p. BI-6
Fluoranthene	1, 2	--	--	--	2, p. BI-6
2-Hexanone	4	--	--	--	2, p. BI-8
Iron	1	1	1	1	2, p. BI-8
Lead	1, 2, 3, 4	10,000	1	10,000	2, p. BI-8
Magnesium	1, 2, 4	--	--	--	2, p. BI-8
Manganese	1	10,000	1	10,000	2, p. BI-8
Mercury	1, 2, 3, 4	10,000	1	10,000	2, p. BI-8
2-Methylnaphthalene	1, 2	0	0.4	0	2, p. BI-9
Naphthalene	1, 2	1,000	0.4	400	2, p. BI-9
Nickel	1, 2, 3	10,000	1	10,000	2, p. BI-9
Pentachlorophenol	1, 3	100	1	100	2, p. BI-9
Phenanthrene	1, 4	0	0.4	0	2, p. BI-9
Pyrene	1, 4	100	1	100	2, p. BI-10
Selenium	1	100	1	100	2, p. BI-10
Silver	1	100	1	100	2, p. BI-10
Tetrachloroethene	1, 2	100	0.4	40	2, p. BI-10
Toluene	1, 4	10	0.07	0.7	2, p. BI-11
1,1,1-Trichloroethane	4	1	0.4	0.4	2, p. BI-11
1,1,2-Trichloroethane	1, 4	1,000	0.4	400	2, p. BI-11
Trichloroethene	1, 2, 4	10,000	0.4	4,000	2, p. BI, B2-1
1,2,4-Trimethylbenzene	1	--	--	--	2, p. BI-11
1,3,5-Trimethylbenzene	1	--	--	--	
Vanadium	1	100	1	100	2, p. BI-11
Xylene	1, 2, 3, 4	100	0.4	40	2, p. BI-12
Zinc	1, 2, 3, 4	10	1	10	2, p. BI-12

Notes:
* River persistence values are assigned.
– Not listed in the SCDM.

Toxicity/Persistence Factor Value: 10,000
(Ref. 1, Table 4-12)

4.1.2.2.2 Hazardous Waste Quantity

The source hazardous waste quantity (HWQ) values for each of the four sources is greater than zero. As documented in Section 4.1.4.3, wetlands are subject to Level I and II concentrations; therefore, a default value of 100 is assigned for the HWQ value (Ref. 1, Section 2.4.2.2, Table 2-6).

Hazardous Waste Quantity Factor Value: 100

4.1.2.2.3 Waste Characteristics Factor Category Value

The waste characteristics factor value is determined from the product of the toxicity/persistence and HWQ factor values, and is subject to a maximum product of 1×10^8 (Ref. 1, Table 2-7). Numerous hazardous substances listed in Table 20 have a toxicity/persistence value of 10,000 including benzo(a)pyrene, manganese, arsenic, lead, and mercury.

$$10{,}000 \times 100 = 1\times10^6$$

Toxicity/persistence factor value: 10,000
Waste characteristics product: 1×10^6
Waste Characteristics Factor Category Value: 32
(Ref. 1, Table 2-7)

4.1.3.2 WASTE CHARACTERISTICS

4.1.3.2.1 Toxicity/Persistence/Bioaccumulation

The toxicity, persistence, and bioaccumulation factor values associated with hazardous substances detected in the sources at the Sherwin-Williams/Hilliards Creek are summarized in Table 21.

TABLE 21

TOXICITY/PERSISTENCE/BIOACCUMULATION FACTOR VALUES SHERWIN-WILLIAMS/HILLIARDS CREEK

Hazardous Substance	Source Number	Toxicity/ Persistence Factor Value (Table 16)	Human Food Chain Bioaccumulation Value*	Toxicity/ Persistence/ Bioaccumulation Factor Value	Reference
Acetone	1, 4	0.07	0.5	0.035	2, p. BI-1
Aluminum	1	0	5,000	0	2, p. BI-1
Antimony	2	10,000	5	50,000	2, p. BI-1
Arsenic	1, 2, 3, 4	10,000	5	50,000	2, p. BI-1
Barium	1, 2, 3, 4	10,000	500	$5x10^6$	2, p. BI-1
Benzene	1	400	5,000	20,000	2, p. BI-2
Benzo(a)anthracene	1, 4	1,000	50,000	$5x10^7$	2, p. BI-2
Benzo(a)pyrene	1, 4	10,000	50,000	$5x10^8$	2, p. BI-2
Benzoic acid	3	--	--	--	2, p. BI-2
Benzo(b)fluoranthene	1, 4	--	--	--	2, p. BI-2
Benzo(k)fluoranthene	1, 4	100	50,000	$5x10^6$	2, p. BI-2
Beryllium	2	10,000	50	$5x10^5$	
Bis (2-ethyl hexyl) phthalate	1	100	50,000	$5x10^6$	2, p. BI-2
2-Butanone	1, 2, 4	--	--	--	2, p. BI-2
Cadmium	1, 2, 3	10,000	5,000	$5x10^7$	2, p. BI-2
Carbon disulfide	3	4	500	2,000	2, p. BI-2
4-Chloroaniline	1	--	--	--	2, p. BI-2
Chlorobenzene	1	0.07	50	3.5	2, p. BI-3
Chloroform	4	40	5	200	2, p. BI-3
Chromium	1, 2, 3, 4	10,000	500	$5x10^6$	2, p. BI-3
Chrysene	1, 4	10	5	50	2, p. BI-3
Cobalt	2, 4	10	5,000	50,000	2, p. BI-3
Copper	1, 2, 3	0	500	0	2, p. BI-3
Cyanide	4	0	0.5	50	2, p. BI-3
1,2-Dichloroethene	1, 2	40	50	2,000	2, p. BI-5
2,4-Dimethylphenol	1	100	500	$5x10^4$	2, p. BI-4
Di-n-butyl Phthalate	4	10	5,000	50,000	2, p. BI-5

TABLE 21 (Continued)

TOXICITY/PERSISTENCE/BIOACCUMULATION FACTOR VALUES SHERWIN-WILLIAMS/HILLIARDS CREEK

Hazardous Substance	Source Number	Toxicity/ Persistence Factor Value (Table 16)	Human Food Chain Bioaccumulation Value*	Toxicity/ Persistence/ Bioaccumulation Factor Value	Reference
Ethylbenzene	1, 2, 3, 4	0.7	50	3.5	2, p. BI-4
Fluoranthene	1, 4	--	--	--	2, p. BI-4
2-Hexanone	4	--	--	--	2, p. BI-7
Iron	1	1	5,000	5,000	2, p. BI-8
Lead	1, 2, 3, 4	10,000	5	50,000	2, p. BI-8
Magnesium	1, 2, 4	--	--	--	2, p. BI-8
Manganese	1	10,000	50,000	$5x10^8$	2, p. BI-8
Mercury	1, 2, 3, 4	10,000	50,000	$5x10^8$	2, p. BI-8
2-Methylnaphthalene	1, 2	0	50,000	0.0	2, p. BI-9
Naphthalene	1, 2	400	50,000	$2x10^6$	2, p. BI-9
Nickel	1, 2, 3	10,000	0.5	5,000	2, p. BI-9
Pentachlorophenol	1, 3	100	50,000	$5x10^6$	2, p. BI-9
Phenanthrene	1, 4	0	5,000	0.0	2, p. BI-9
Pyrene	1, 4	100	50,000	$5x10^6$	2, p. BI-9
Selenium	1	100	50	5,000	2, p. BI-10
Silver	1	100	50	5,000	2, p. BI-10
Tetrachloroethene	1, 2	40	50	2,000	2, p. BI-10
Toluene	1, 4	0.7	50	3.5	2, p. BI-11
1,1,1-Trichloroethane	4	0.4	5	2	2, p. BI-11
1,1,2-Trichloroethane	1, 4	400	50	20,000	2, p. BI-11
Trichloroethene	1, 2, 4	4,000	50	$2x10^5$	2, p. BI, B2-1
1,2,4-Trimethylbenzene	1	--	--	--	2, p. BI-11
1,3,5-Trimethylbenzene	1	--	--	--	2, p. BI-11
Vanadium	1	100	500	50,000	2, p. BI-11
Xylenes	2, 4	40	50	200	2, p. BI-12
Zinc	1, 2, 3, 4	10	5	50	2, p. BI-12

TABLE 21 (Continued)

**TOXICITY/PERSISTENCE/BIOACCUMULATION FACTOR VALUES
SHERWIN-WILLIAMS/HILLIARDS CREEK**

Notes:
* Fresh-water bioaccumulation values are assigned.
– Not Available.

Toxicity/Persistence/Bioaccumulation Factor Value: 5×10^8
(Ref. 1, Table 4-16)

4.1.3.2.2 Hazardous Waste Quantity

The source HWQ values for each of the four sources is greater than zero. As documented in Section 4.1.4.3, wetlands are subject to Level I and II concentrations; therefore, a minimum value of 100 is assigned for the HWQ value (Ref. 1, Section 2.4.2.2, Table 2-6).

Hazardous Waste Quantity Factor Value: 100

4.1.3.2.3 Waste Characteristics Factor Category Value

The waste characteristic factor value is the product of the highest toxicity/persistence factor value and HWQ value, multiplied by the highest bioaccumulation factor value for the same hazardous substance (Ref. 1, Section 4.1.3.2.3). The hazardous substances with the highest toxicity/persistence factor value and bioaccumulation factor value include benzo(a)pyrene, manganese, and mercury.

$$10{,}000 \times 100 = 1 \times 10^6$$

Toxicity/persistence factor value
X hazardous waste quantity factor value: 1×10^6

$$1 \times 10^6 \times 50{,}000 = 5 \times 10^{10}$$

(Toxicity/persistence X hazardous waste quantity)
X bioaccumulation potential factor value: 5×10^{10}

Waste Characteristics Factor Category Value: 320
(Ref. 1, Table 2-7)

4.1.3.3 HUMAN FOOD CHAIN THREAT - TARGETS

Actual Human Food Chain Contamination

Although aqueous and sediment samples document an observed release to the surface water migration pathway, actual food chain contamination is not scored because no fisheries are documented within the areas of the observed release (Ref. 1, Section 4.1.3.3).

4.1.3.3.1 Food Chain Individual

As documented in Section 4.1.2.1.1 of this HRS documentation record, an observed release of hazardous substances having a bioaccumulation factor value of 500 or greater is documented at the Hilliards Creek watershed and there is a fishery, Kirkwood Lake, within the 15-mile downstream TDL. The food chain individual factor is assigned a value of 20 (Refs. 1 [Section 4.1.3.3.1]; 52, p. 5).

Food Chain Individual Factor Value: 20
(Ref. 1 [Section 4.1.3.3.1])

4.1.3.3.2.3 Potential Human Food Chain Contamination

Kirkwood Lake is the only fishery identified within the 15-mile downstream TDL. The value for the potential human food chain contamination factor for Kirkwood Lake is assigned a value of greater than zero because information related to annual production of the lake has not been documented. However, since the lake is a fishery, the production value would be greater than zero (Ref. 52, p. 5).

Potential Human Food Chain Contamination Factor Value: >0
(Ref. 1 [Section 4.1.3.3.2.3])

4.1.4 ENVIRONMENTAL THREAT

4.1.4.2 Waste Characteristics

4.1.4.2.1 Ecosystem Toxicity/Persistence/Bioaccumulation

Table 22 presents the ecosystem toxicity/persistence/bioaccumulation factor values for hazardous substances detected in sources with a containment value greater than zero.

TABLE 22

**ECOSYSTEM TOXICITY/PERSISTENCE
FACTOR VALUES
SHERWIN- WILLIAMS/HILLIARDS CREEK**

Hazardous Substance	Source Number	Ecosystem Toxicity Value*	Persistence Value**	Ecosystem Toxicity/ Persistence Factor Value	Reference
Acetone	1, 4	100	0.07	7	2, p. BI-1
Aluminum	1	100	1.0	100	2, p. BI-1
Antimony	2	100	1.0	100	2, p. BI-1
Arsenic	1, 2, 3, 4	10	1.0	10	2, p. BI-1
Barium	1, 2, 3, 4	1	1.0	1	2, p. BI-1
Benzene	1	1,000	0.4	400	2, p. BI-2
Benzo(a)anthracene	1, 4	10,000	1.0	10,000	2, p. BI-2
Benzo(a)pyrene	1, 4	10,000	1.0	10,000	2, p. BI-2
Benzo(b)fluoranthene	1, 4	--	--	--	2, p. BI-2
Benzoic acid	3	--	--	--	2, p. BI-2
Benzo(k)fluoranthene	1, 4	0	1.0	0	2, p. BI-2
Beryllium	2	0	1.0	0	2, p. BI-2
Bis (2-ethylhexyl) phthalate	1	1,000	1.0	1,000	2, p. BI-2
2-Butanone	1, 2, 4	-	--	--	2, p. BI-2
Cadmium	1, 2, 3	10,000	1.0	10,000	2, p. BI-2
Carbon disulfide	3	100	0.4	40	2, p. BI-2
4-Chloroaniline	1	--	--	--	2, p. BI-3
Chlorobenzene	1	10,000	0.0007	7	2, p. BI-3
Chloroform	4	100	0.4	40	2, p. BI-3
Chromium	1, 2, 3, 4	10,000	1.0	10,000	2, p. BI-3
Chrysene	1, 4	1,000	1.0	1,000	2, p. BI-3
Cobalt	2, 4	0	1.0	0	2, p. BI-3
Copper	1, 2, 3	1,000	1.0	1,000	2, p. BI-3
Cyanide	4	1,000	1.0	1,000	2, p. BI-3

TABLE 22 (Continued)

ECOSYSTEMTOXICITY/PERSISTENCE
FACTOR VALUES
SHERWIN-WILLIAMS/HILLIARDS CREEK

Hazardous Substance	Source Number	Ecosystem Toxicity Value*	Persistence Value**	Ecosystem Toxicity/ Persistence Factor Value	Reference
1,2-Dichloroethene	1, 2	1	0.4	0.4	2, p. BI-5
2,4-Dimethylphenol	1	100	1.0	100	2, p. BI-4
Di-n-butyl phthalate	4	1,000	1.0	1,000	2, p. BI-5
Ethylbenzene	1, 2, 3, 4	100	0.0007	0.07	2, p. BI-4
Fluoranthene	1, 4	--	--	--	2, p. BI-4
2-Hexanone	4	--	--	--	2, p. BI-7
Iron	1	10	1.0	10	2, p. BI-8
Lead	1, 2, 3, 4	1,000	1.0	1,000	2, p. BI-8
Magnesium	1, 2, 4	--	--	--	2, p. BI-8
Manganese	1	0	1.0	0	2, p. BI-8
Mercury	1, 2, 3, 4	10,000	1.0	10,000	2, p. BI-8
2-Methylnaphthalene	1, 2	100	0.4	40	2, p. BI-8
Naphthalene	1, 2	1,000	0.4	400	2, p. BI-9
Nickel	1, 2, 3	100	1.0	100	2, p. BI-9
Pentachlorophenol	1, 3	100	1.0	100	2, p. BI-9
Phenanthrene	1, 4	10,000	0.4	4,000	2, p. BI-9
Pyrene	1, 4	10,000	1.0	10,000	2, p. BI-9
Selenium	1	1,000	1.0	1,000	2, p. BI-10
Silver	1	10,000	1.0	10,000	2, p. BI-10
Tetrachloroethene	1, 2	0	0.4	0	2, p. BI-10
Toluene	1, 4	100	0.1	7~~0~~	2, p. BI-11
1,1,1-Trichloroethane	4	10	0.4	4	2, p. BI-11
1,1,2-Trichloroethane	1, 4	100	0.4	40	2, p. BI-11
Trichloroethene	1, 2, 4	100	0.4	40	2, p. BI, B2-1
1,2,4-Trimethylbenzene	1	--	--	--	2, p. BI-11
1,3,5-Trimethylbenzene	1	--	--	--	2, p. BI-11
Vanadium	1, 4	0	1.0	0	2, p. BI-11
Xylenes	1, 2, 3, 4	100	0.4	40	2, p. BI-12
Zinc	1, 2, 3, 4	10	1.0	10	2, p. BI-12

TABLE 22 (Continued)

ECOSYSTEMTOXICITY/PERSISTENCE
FACTOR VALUES
SHERWIN-WILLIAMS/HILLIARDS CREEK

Notes:
* Fresh-water ecotoxicities are assigned.
** Persistence values for river.
– Not Available.

TABLE 23

ECOSYSTEM TOXICITY/PERSISTENCE/BIOACCUMULATION FACTOR VALUES SHERWIN-WILLIAMS/HILLIARDS CREEK

Hazardous Substance	Source Number	Ecosystem Toxicity/ Persistence Factor Value	Ecosystem Bioaccumulation Value *	Ecosystem Toxicity/ Persistence/ Bioaccumulation Value	Reference
Acetone	1, 4	7	0.5	3.5	2, p. BI-1
Aluminum	1	100	5~~0~~,000	$5x10^5$	2, p. BI-1
Antimony	2	100	5	500.0	2, p. BI-1
Arsenic	1, 2, 3, 4	10	5,000	$5x10^4$	2, p. BI-1
Barium	1, 2, 3, 4	1	500	500.0	2, p. BI-1
Benzene	1	400	5,000	$2x10^7$	2, p. BI-2
Benzo(a)anthracene	1, 4	10,000	50,000	$5x10^8$	2, p. BI-2
Benzo(a)pyrene	1, 4	10,000	50,000	$5x10^8$	2, p. BI-2
Benzo(b)fluoranthene	1, 4	--	--	--	2, p. BI-2
Benzoic acid	3	--	--	--	2, p. BI-2
Benzo(k)fluoranthene	1, 4	0	50,000	0.0	2, p. BI-2
Beryllium	2	0	50	0.0	2, p. BI-2
Bis (2-ethyl hexyl) phthalate	1	1,000	50,000	$5x10^7$	2, p. BI-2
2-Butanone	1, 2, 4	--	--	--	2, p. BI-2
Cadmium	1, 2, 3	10,000	50,000	$5x10^8$	2, p. BI-2
Carbon disulfide	3	40	500	$2x10^4$	2, p. BI-2
4-Chloroaniline	1	--	--	--	2, p. BI-3
Chlorobenzene	1	7	5,000	35,000.0	2, p. BI-3
Chloroform	4	40	500	$2x10^4$	2, p. BI-3
Chromium	1, 2, 3, 4	10,000	500	$5x10^6$	2, p. BI-3
Chrysene	1, 4	1,000	5,000	$5x10^6$	2, p. BI-3
Copper	1, 2, 3	1,000	5,000	$5x10^6$	2, p. BI-3
Cyanide	4	1,000	0.5	500.0	2, p. BI-3
1,2-Dichloroethene	1, 2	0.4	50	20.0	2, p. BI-5
2,4-Dimethylphenol	1	100	500	$5x10^4$	2, p. BI-4
Di-n-butyl phthalate	4	1,000	5,000	$5x10^6$	2, p. BI-4
Ethylbenzene	1, 2, 3, 4	0.07	50	3.5	2, p. BI-6
Fluoranthene	1, 4	--	--	--	2, p. BI-6
2-Hexanone	4	--	--	--	2, p. BI-8
Iron	1	10	5,000	$5x10^5$	2, p. BI-8

TABLE 23 (Continued)

ECOSYSTEM TOXICITY/PERSISTENCE/BIOACCUMULATION FACTOR VALUES SHERWIN-WILLIAMS/HILLIARDS CREEK

Hazardous Substance	Source Number	Ecosystem Toxicity/ Persistence Factor Value	Ecosystem Bioaccumulation Value *	Ecosystem Toxicity/ Persistence/ Bioaccumulation Value	Reference
Lead	1, 2, 3, 4	1,000	50,000	$5x10^7$	2, p. BI-8
Magnesium	1	--	--	--	2, p. BI-8
Manganese	1	0	50,000	0.0	2, p. BI-8
Mercury	1, 2, 3, 4	10,000	50,000	$5x10^8$	2, p. BI-8
2-Methylnaphthalene	1, 2	40	50,000	$2x10^6$	2, p. BI-8
Naphthalene	1, 2	400	50,000	$2x10^7$	2, p. BI-9
Nickel	1, 2, 3	100	500	$5x10^4$	2, p. BI-9
Pentachlorophenol	1, 3	100	50,000	$5x10^6$	2, p. BI-9
Phenanthrene	1, 4	4,000	50,000	$2x10^8$	2, p. BI-9
Pyrene	1, 4	10,000	50,000	$5x10^8$	2, p. BI-9
Selenium	1	1,000	500	$5x10^5$	2, p. BI-10
Silver	1	10,000	50	$5x10^5$	2, p. BI-10
Tetrachloroethene	1, 2	0	50	0	2, p. BI-10
Toluene	1, 4	7~~0~~	5,000	35,000	2, p. BI-11
1,1,1-Trichloroethane	4	4	5	20	2, p. BI-11
1,1,2-Trichloroethane	1, 4	40	50	2,000	2, p. BI-11
Trichloroethene	1, 2, 4	40	50	200	2, p. BI-11
1,2,4-Trimethylbenzene	1	--	--	--	2, p. BI-11
1,3,5-Trimethylbenzene	1	--	--	--	2, p. BI-11
Vanadium	1	0	500	0	2, p. BI-11
Xylenes	1, 2, 3, 4	40	50	2,000	2, p. BI-12
Zinc	1, 2, 3, 4	10	50,000	$5x10^4$	2, p. BI-12

Notes:
* Fresh-water environmental bioaccumulation values are assigned.
– Not Available.

Ecosystem Toxicity/Persistence/Bioaccumulation Potential Factor Value: 5×10^8

4.1.4.2.2 Hazardous Waste Quantity

The source HWQ values for each of the four sources is greater than zero. As documented in Section 4.1.4.3, wetlands are subject to Level I and II concentrations; therefore, a minimum value of 100 is assigned for the HWQ value (Ref. 1, Section 2.4.2.2, Table 2-6).

Hazardous Waste Quantity Factor Value = 100

4.1.4.2.3 Waste Characteristics Factor Category Value

The waste characteristics factor category value is determined by taking the product of the highest ecosystem toxicity/persistence factor value and the HWQ value and multiplying the product by the highest ecosystem bioaccumulation factor value (Ref. 1, Section 4.1.4.2.3). The hazardous substances with the highest values include benzo(a)anthracene; benzo(a)pyrene; cadmium; mercury; and pyrene.

$10{,}000 \times 100 = 1 \times 10^6$

Ecosystem toxicity/persistence factor value
× Hazardous waste quantity factor value: 1×10^6

1×10^6 x $50{,}000 = 5 \times 10^{10}$

(Ecosystem toxicity/persistence X hazardous waste quantity)
× ecosystem bioaccumulation potential factor value: 5×10^{10}

Waste Characteristics Factor Category Value: 320
(Ref. 1, Table 2-7)

4.1.4.3 ENVIRONMENTAL THREAT - TARGETS

Level I Concentrations

Actual environmental contamination has been documented in the wetland of Hilliards Creek and in Hilliards Creek, as documented in Section 4.1.1.1 of this documentation record. The sampling locations and wetland are shown on Reference 97. The wetland is identified on Reference 93, Wetland Inventory Map, and electronically transposed onto Reference 97 for clarity. The wetland is a palustrine forested broad-leaved deciduous and needle-leaved evergreen, and palustrine scrub/shrub and emergent wetland (Ref. 93). The Level I samples listed below are documented in an observed release to Hilliards Creek in Table 12 of this documentation record.

Sample ID: HC-SW-22
Sample Medium: Aqueous
Location: Hilliards Creek, approximately 4,389 feet downstream of the PPE-1.
References: 9; 84, Figure 1; 97

Sample ID: HC-SW-34
Sample Medium: Aqueous
Location: Hilliards Creek, approximately 5,800 feet downstream of the PPE-1.
References: 9; 84, Figure 1; 97

Sample ID: HC-SW-35
Sample Medium: Aqueous
Location: Hilliards Creek, approximately 6,100 feet downstream of the PPE-1.
References: 9; 84, Figure 1; 97

Sample ID: HC-SW-39
Sample Medium: Aqueous
Location: Hilliards Creek, approximately 6,500 feet downstream of the PPE-1.
References: 9; 84, Figure 1; 97

The concentrations of hazardous substances detected in surface water samples documenting an observed release to surface water and the corresponding benchmark are listed in Table 24. The concentrations of hazardous substances detected in the samples are documented in Table 12. The environmental benchmarks are EPA's ambient water quality criteria (AWQC), as presented in National Recommended Water Quality Criteria: 2002 (EPA-822-R-02-047) (Ref. 1, Table 4-22). To use the AWQC, the criteria are adjusted in relation to the hardness of the aqueous sample. Reference 95 provides the AWQC for each aqueous sample adjusted for the sample-specific hardness values (Refs. 2, p. 28; 95). The AWQC provide criteria maximum concentrations (CMC) and criteria continuous concentrations (CCC) (Ref. 2, pp. BII-1, BII-8). Therefore, CMC and CCC for each aqueous sample are calculated to determine the sample-specific CMC and CCC with consideration of the hardness value for the sample. The CCC is the chronic benchmark and is used to determine actual contamination in accordance with Reference 1, Table 4-22.

TABLE 24

BENCHMARK CONCENTRATIONS - LEVEL I SENSITIVE ENVIRONMENTS

Sample ID	Hazardous Substance	Hazardous Substance Concentration (µg/L)*	Benchmark Concentration (µg/L) (Refs. 2, p. BII-8; 95)	Benchmark (Refs. 2; 95)
HC-SW-22	Lead	15	1.02	AWQC - CCC
HC-SW-34	Lead	29	2.8	AWQC - CCC
HC-SW-35	Lead	12.4	1.12	AWQC - CCC
HC-SW-39	Lead	24.1	6.43	AWQC - CCC

Notes:
* The concentration cited represents dissolved metals because the surface water samples were filtered (Ref. 84, p. 6).
µg/L Microgram per liter
AWQC Ambient Water Quality Criteria
HC Hilliards Creek
CCC Criteria Continuous Concentration
SW Surface water

Most Distant Level I Sample

Sample ID: HC-SW-39 (aqueous sample)
Sample Medium: Aqueous
Location: Hilliards Creek, approximately 5,708 feet downstream of the PPE -3.
References: 9; 84, Figure 1; 97

Level II Concentrations

The locations of the Level II wetland sediment sampling locations outside of the area of Level I wetland concentrations is documented below (Ref. 1, Section 4.1.4.3.1.2).

Sample ID: HC-SD-41
Sample Medium: Sediment
Location: Wetland between Cooper River and Hilliards Creek, approximately 389 feet downstream of HC-SW-39.
References: 9; 84, Figure 1; 97

Sample ID: HC-SD-43
Sample Medium: Sediment
Location: Wetland adjacent to Hilliards Creek, approximately 6,900 feet downstream of the PPE-3.
References: 9; 84, Figure 1; 97

Sample ID: HC-SD-44
Sample Medium: Sediment
Location: Wetland adjacent to Hilliards Creek, approximately 6,600 feet downstream of the PPE-3.
References: 9; 84, Figure 1; 97

Sample ID: HC-SD-45
Sample Medium: Sediment
Location: Wetland adjacent to Hilliards Creek, approximately 6,600 feet downstream of the PPE-3.
References: 9; 84, Figure 1; 97

Sample ID: HC-SD-46
Sample Medium: Sediment
Location: Wetland adjacent to Hilliards Creek, approximately 6,200 feet downstream of the PPE-3.
References: 9; 84, Figure 1; 97

Sample ID: HC-SD-48
Sample Medium: Sediment
Location: Wetland adjacent to Hilliards Creek, approximately 6,500 feet downstream of the PPE-3.
References: 9; 84, Figure 1; 97

Most Distant Level II Sample

Sample ID: HC-SD-43 (sediment sample)
Sample Medium: Sediment
Location: Hilliards Creek, approximate 389 feet downstream of the HC-SW-39.
Reference: 9; 84, Figure 1; 97

4.1.4.3.1 Sensitive Environments

4.1.4.3.1.1 Level I Concentrations

Sensitive Environments

Sensitive environments other than wetland have not been identified within the 15-mile downstream target distance.

Wetlands

The wetland areas were identified from Reference 93, Wetland Inventory Map. The wetland is a palustrine forested broad-leaved deciduous and needle-leaved evergreen, and palustrine scrub/shrub and emergent wetland (Ref. 93). The sampling locations identified in the Level I Concentrations section above are within this wetland (Ref. 97). The wetlands subject to Level I concentrations are those wetlands located between PPE-1 and the most distance downstream Level I sampling location (HC-SW-39) (Ref. 1, Section 4.1.1.2).

The total length of wetlands from PPE-1 to the most downstream sampling location (HC-SW-39) containing Level I concentrations is estimated to be 5,708 feet (Refs. 93; 97). Since wetlands are located on both sides of Hilliards Creek, the total length of wetlands subject to Level I concentrations is two times 5,708 feet or 11,416 feet or 2.16 miles (Ref. 1, Section 4.1.4.3.1.1). The wetland frontage is summarized in Table 25.

TABLE 25

LEVEL I WETLAND FRONTAGE

Wetland	Wetland Frontage	Reference
Palustrine emergent, palustrine forested, palustrine scrub/shrub	2.16 mile	93; 97

Total Level I Wetland Frontage: 2.16 mi.

The wetland ratings value for 2.16 miles is obtained from Reference 1, Table 4-24 and is 75.

Level I Wetland Value: 75
(Ref. 1, Table 4-24)

For wetlands subject to Level I concentrations, the wetland value (75) is multiplied by 10 (Ref. 1, Section 4.1.4.3.1.1).

Level I Concentrations Factor Value: 750 (Ref. 1, Section 4.1.4.3.1.1)

4.1.4.3.1 Sensitive Environments

4.1.4.3.1.2 Level II Concentrations

Sensitive Environments

Sensitive environments other than wetlands have not been identified within the 15-mile downstream target distance.

Wetlands

The wetland length subject to Level II concentrations is located between surface water sampling location HC-SW-39 (most distance Level I concentration) and sediment sampling location HC-SD-43, the most distant Level II sediment sampling location. That length is estimated to be 778 feet or 0.15 mile as measured on Reference 97 (Refs. 93; 97) and includes the length of wetlands on both the north and south banks of Hilliards Creek (Ref. 1, Section 4.1.4.3.1.1). The Level II wetland frontage is summarized in Table 26.

TABLE 26

LEVEL II WETLAND FRONTAGE

Wetland	Wetland Frontage	Reference
Palustrine emergent, palustrine forested, palustrine scrub/shrub	0.15 mile	93; 97

Total Level I Wetland Frontage: 0.15 mile

The wetland ratings value for 0.15 mile of wetland frontage is obtained from Ref. 1, Table 4-24 and is 25.

Level II Wetland Value: 25
(Ref. 1, Table 4-24)

Level II Concentrations Factor Value: 25 (Ref. 1, Section 4.1.4.3.1.2)

4.1.4.3.1.3 Potential Contamination

Sensitive Environments

Sensitive environments potentially exposed to contaminants from the Sherwin-Williams/Hilliards Creek are not evaluated because the presence of sensitive environments other than wetlands subject to Level I and II concentrations have not been identified.

Potential Contamination Factor Value (SP): NE

4.2 GROUND WATER TO SURFACE WATER MIGRATION

The ground water to surface water migration component is included to evaluate the threats that result from migration of hazardous substances from a source to surface water via ground water (Ref. 1, Section 4.2).

4.2.1 General Considerations

4.2.1.1 Eligible Surface Water

Surface water eligible for evaluation in the ground water to surface water migration pathway includes those surface waters within 1 mile of the sources. Additionally, no aquifer discontinuity can be located between the sources and the surface waters, and the top of the uppermost aquifer must be at or above the bottom of the surface water (Ref. 1, Section 4.2.1.1). Eligible surface water bodies include Hilliards Creek, Silver Lake, White Sand Branch, Haney Run Brooke, and Bridgewood Lake (Ref. 9). The threats posed to Silver Lake, White Sand Branch, Haney Run Brooke, and Bridgewood Lake are not evaluated. Only the threats posed to Hilliards Creek are evaluated because the Hilliards Creek migration pathway yields the highest ground water to surface water migration score. An observed release to Hilliards Creek can be documented and fisheries and actual contamination of wetlands are associated with the migration pathway, as documented in the sections below (Refs. 9; 31, Figures 2-2 and 3-2). Evaluation of the other eligible surface water bodies does not change the site score. Hilliards Creek, as documented in Section 4.0 of this HRS documentation record, is the primary surface water body threatened by releases from the Lucas plant. Available documentation indicates that a release of lead to Bridgewood Lake may have occurred from the plant. However, background samples were not collected to document background conditions. Additionally Bridgewood Lake is not a fishery and the wetlands associated with the lake do not meet the minimum frontage requirements of 0.1 mile for HRS evaluation. As a result, the target value for Bridgewood Lake is very low.

Free-phase product in ground water and ground water seeps enter a storm sewer north of Building 67 when the water table is high, indicating that there is no aquifer discontinuity and that the top of the uppermost aquifer is at or above the bottom of Hilliards Creek (Refs. 6, p. 3-47; 18, p. 2-3). Locally, Hilliards Creek acts as a discharge zone for the shallow aquifer (Ref. 31, pp. 4-2, 6-2).

4.2.1.2 Hazardous Substance Migration Path for Ground Water to Surface Water

The ground water to surface water migration pathway is restricted to the ground water segment in the uppermost aquifer between the source and nearby surface water bodies. The surface water in-water segment begins at the PPE from the uppermost aquifer to the surface water. The location of the PPE is the point of the surface water that yields the shortest straight-line distance, within the aquifer boundary, from the sources with a containment factor value of greater then 0 to surface water. As documented in the source section of this HRS documentation record, the four sources evaluated have a containment factor value of greater than 0. The shortest distance from Source 1 to Hilliards Creek is the point at which the storm sewer north of Building 67 discharges into Hilliards Creek, the same location as PPE-1 evaluated in the overland component of the surface migration pathway (Refs. 10, pp. 1, 2, 3; 31, p. 3-4; 32, pp. 5, 6; 65, pp. 1, 2, 3; 97). Source 1 includes the sampling location MW-14 (see Section 2.4 of this documentation record for Source 1). The shortest straight-line distance from Source 1 to Hilliards Creek is measured from MW-14. The shortest distance to surface water from Source 2 is measured from the location of the contaminated soil sample (TB-73) adjacent to the pump house, which is located adjacent to Hilliards Creek (Ref. 31, Figure 3-2) and is shown in Reference 97 as PPE-3. The shortest straight line distance from Source 3 to Hilliards Creek is obtained by traveling the distance from the lagoons along the pipeline that extends from the lagoons into a drainage channel (Hilliards Creek), the same location as PPE-2 evaluated in the overland component of the surface migration pathway (Ref. 97). The pipeline makes the shortest straight line distance to surface water from Source 3 (Ref. 7, pp. 10, 11). The shortest straight-line distance from Source 4, Former Tank Farm B, to Hilliards Creek is obtained from measuring at sampling location MW-17(Ref. 31, Figure 3-2) as shown on Reference 98 as PPE-4. A summary of the PPEs is presented in the table below and illustrated on Reference 98.

TABLE 27
SUMMARY OF GROUND WATER TO SURFACE WATER
PROBABLE POINTS OF ENTRY

Source Number	PPE Number	Location of Shortest Distance Measurement
1	1	Measured from sampling location MW-14 (see Reference 31, Figure 3-2)
2	2	Measured from sampling location TB-73 (see Reference 31, Figure 3-2)
3	3	Measured from the western bank of the lagoons, along the pipeline, to Hilliards Creek as shown in aerial photographs (See Reference 7, pp. 10, 11)
4	4	Measured from sampling location MW-17 (see Reference 31, Figure 3-2)

Notes:
MW Monitoring well
PPE Probable point of entry
TB Test boring

4.2.2.1.1 Observed Release to Ground Water

In this section, an observed release to the uppermost aquifer is established as specified in Section 3.1.1 of Reference 1.

Regional Geology

The Lucas plant is located within the Atlantic Coastal Plain Physiographic Province. The Atlantic Coastal Plain geology within Camden County is characterized by unconsolidated and semiconsolidated sediments of Cretaceous through Quaternary ages consisting of alternating sand, silts, and clays. The sediments dip gently to the southeast and thicken from approximately 40 feet at the Delaware River to over 2,900 feet at the Camden-Atlantic County boundary. Below these unconsolidated sediments is pre-Cretaceous-age bedrock (Ref. 109, pp. 1, 9).

The Lucas plant is underlain by Pleistocene age sands of the Pennsauken Formation. The Pennsauken Formation outcrops in irregular patches in Gibbsboro and ranges in thickness from a few feet to approximately 30 feet. The Pennsauken Formation consists of medium- to coarse-grained quartzose sand, gravel, and clay (Refs. 109, pp. 82, 83, 84; 31, p. 2-11, Appendix C).

The Kirkwood Formation underlies the Pennsauken Formation. The Kirkwood Formation consists of sand, silt, and clay and reaches a thickness of approximately 80 feet in the vicinity of the Lucas plant (Refs. 109, pp. 82, 83, 84; 31, p. 2-11).

Regional Hydrogeology

The major freshwater aquifers in Camden County are sands and gravel of Cretaceous and Tertiary ages. The Pennsauken and Kirkwood Formations are not typically used for potable water supply in Camden County. The sands of the Pennsauken Formation and the upper section of the Kirkwood Formation form the shallow subsurface of the Lucas plant and sources areas. These formations are approximately 20 to 30 feet thick in the area of the plant and source areas and are generally hydraulically connected and form an unconfined (water table) aquifer (Refs. 109, pp. 1, 9, 10, 22, 84; 31, p. 2-12 and Appendix C).

Aquifer Description

Ground water underlying the Lucas plant and sources at the plant occurs in two distinct zones: the shallow zone (30 to 40 feet thick) and a deeper zone (total thickness unknown). The two zones are separated by a silt unit (Ref. 31, p. 4-2). However, since releases of hazardous substances have been documented in both zones, the two zones exchange water and are therefore interconnected and considered one aquifer, the shallow aquifer (Refs. 1, Section 3.0.1; 31, pp. ES-1, ES-2, 5-8, 6-2, 6-6). The shallow aquifer is the aquifer evaluated.

Shallow Aquifer (Stratum Name: Pennsauken and Kirkwood Formation)

The shallow aquifer is composed of reworked native soils, silty sand, and silt and is approximately 40 feet thick (Ref. 31, p. 4-1). The saturated thickness of this aquifer is approximately 30 to 40 feet. Depth to ground water is between 1 to 15 feet bgs. Ground water elevations indicate that the shallow zone flows from the northeast to the southwest towards Hilliards Creek (Ref. 31, p. 4-2, Figure 4-7). Locally, Hilliards Creek acts as a discharge zone for the shallow aquifer (Ref. 31, p. 4-2).

Free-phase product, composed of benzene, ethylbenzene, xylene, naphthalene, and 2-methyl naphthalene, has been identified in the shallow aquifer (Ref. 31, p. ES-6).

Direct Observation

Free-phase product has been identified at nine monitoring locations: MW-11, MW-13, MW-21, MW-26, MW-27, WP-1, WP-3, WP-12, and WP-14. The estimated thickness of the free-phase product is between 0.22 and 0.42 foot (Ref. 31, p. 4-18). The presence of free-phase product in the monitoring wells documents hazardous substances in direct contact with the ground water. Hazardous substances associated with the free-phase product include 2-methylnaphthalene 4-chloroaniline, naphthalene, chlorobenzene , ethylbenzene, xylene, benzene, benz(a)pyrene, chrysene, fluoranthene, naphthalene, cumene, tetrachlorothylene, 1,2, 4-trimethylbenzene, 1,3,5-trimethylbenzene, aluminum, arsenic, barium, chromium, copper, iron, lead, magnesium, manganese, and zinc (Ref. 31, pp. 3-3, 3-15, 3-17, Figure 3-2, Table 4-20; Ref.. 32, pp. 6, 7; Ref. 77, pp. 1, 2, 75, 76; Ref. 78, pp. 1 through 4, 13, 15, 16; Ref. 79, p. 28). See Section 2.2.1 for additional information.

During sampling events from June 1993 through October 1993, three well points (WP-1, WP-2, and WP-3) were installed to delineate the free-phase product ground water plume detected in MW-13 (Ref. 31, pp. 3-3, 3-15). Samples of free-phase product were collected from the MW-11 (located on the southern end of Tank Farm A) and MW-13 (located east of Building 67) (Ref. 31, p. 3-17, Figure 3-2). Analytical results for the product sample collected from MW-11 on August 6, 1993 indicated the presence of 2-methylnaphthalene (360 milligrams per liter [mg/L]), 4-chloroaniline (320 mg/L), naphthalene (930 mg/L), chlorobenzene (100 mg/L), ethylbenzene (at an estimated concentration of 520 mg/L), and xylene (at 4,600 mg/L) (Ref. 31, Table 4-20). The product sample collected from MW-13 on August 6, 1993 contained 2-methylnaphthalene (1,800 mg/L), naphthalene (6,200 mg/L), benzene (at 110 mg/L), ethylbenzene (1,200 mg/L), and xylene (2,100 mg/L) (Ref. 31, Table 4-20).

During sampling events from July 1995 through August 1995, 45 hand-augered borings were located throughout the seep area to attempt to delineate the extent of free-phase product through photoionization detector (PID) field screening and visual observation. No samples were collected from these locations (Ref. 31, pp. 3-3, 3-18). Additional monitoring wells were installed, and two rounds of ground water samples were collected (Ref. 31, p. 3-19). On July 14, 1995, samples of the free-phase product were collected from the MW-11 (located on the southern end of Tank Farm A), MW-13 (located east of Building 67), and MW-21 (southeast of Building 67) (Ref. 31, p. 3-17, Figure 3-2). Anaytical results for the product sample collected from MW-11 indicated the presence of naphthalene (at an estimated concentration of 600 mg/L), ethylbenzene (66 mg/L), and xylene (2,500 mg/L). The product sample collected from MW-13 contained naphthalene (at 3,200 mg/L), benzene (at 570 mg/L), ethylbenzene (at 1,400 mg/L), and xylene (at 7,500 mg/L). Analytical results for the product sample collected from MW-26 indicated 2-methylnaphthalene (at an estimated concentration of 460 mg/L), naphthalene (1,600 mg/L), and xylene (420 mg/L) (Ref. 31, Table 4-20).

On April 10, 2002, samples of the free-phase product were collected and analyzed for VOCs, petroleum products, and fingerprinted (Ref. 75, pp. 2, 4, 5). The concentrations of hazardous substances detected in the product samples are in the units of micrograms per kilogram (µg/kg) indicating that the samples were analyzed as a solid. Analytical results for the samples indicated the presence of benzene (up to 240,000 µg/kg), ethylbenzene (up to 4,600,000 µg/kg), xylene (up to 26,000,000 µg/kg), naphthalene (up to 1,800,000 µg/kg), 2-methylnaphthalene (up to an estimated concentration of 400,000 µg/kg), and numerous TICs (Ref. 75, pp. 6, 7, 8).

Chemical Analysis

Aquifer being evaluated: Shallow Aquifer

An observed release to ground water is documented by ground water samples collected from monitoring wells located on the Lucas plant during RI activities. The background ground water samples are selected based on whether the background and release ground water samples were collected within the same screened interval and period of time, and whether the samples were analyzed for the same hazardous substances. All ground water samples collected during the RI from 1990 to 1997 were analyzed by Weston Analytics Division, a New Jersey-certified laboratory. All samples collected from 1998 to 2000 were analyzed by Severn-Trent Laboratories (STL), a New Jersey-certified laboratory (Ref. 31, p. 3-37). Reference 111 provides a Quality Assurance Project Plan used by Sherwin-Williams' environmental consultant. The plan provides analytical methods, quantitation limits, and detection limits for some of the investigations conducted by Sherwin-Williams' (Ref. 111). It is likely that these same methods were used for analyzing the samples summarized in this section. Analytical data sheets from the laboratories and detection limits are not provided in the RI; however, the RI report states that the analytical data are valid. The analytical results used to document an observed release to ground water are considered usable and of known quality (Ref. 31, p. 3-38). Table 3-1 of Reference 31 provides a summary of the analytical suite for the ground water samples. The tables presenting the analytical results in the RI report provide only concentrations detected (Ref. 31, Tables 4-9, 4-11, 4-14). Tables 4-9, 4-11, and 4-14 of Reference 31 provide a summary of the hazardous substances detected in ground water samples. When concentrations of metals are reported in Tables 4-9, 4-11, and 4-14 of Reference 31 as soluble, the reported concentration is for dissolved metal. The dissolved metals concentrations are not used to document an observed release to ground water.

Background Concentrations:

Ground water investigations conducted at the Lucas plant have determined that the free-phase product plume in the shallow aquifer is limited to the east of Hilliards Creek (Ref. 31, p. ES-4). The RI activities determined, based on ground water elevations, the shallow aquifer flows from the northeast to the southwest towards Hilliards Creek (Ref. 31, p. 4-2, Figure 4-7) and is divided into a shallow and deep zone (Ref. 31, p. 4-2). Therefore, background well selection is based on whether the wells are screened within the same relative depth of the shallow aquifer. The RI activities did not establish a location of a background well. Therefore, wells installed on the Lucas Plant were reviewed to identify potential background well sampling locations. The RI activities included the installation of monitoring wells at biased locations or locations where contamination was expected to be located based site use history or previous sampling activities. Therefore, the majority of the monitoring wells located on the Lucas plant were installed in areas of potential contamination. No monitoring well located outside the influence of potential sources of contamination on the Lucas plant was identified that could be used to establish background concentrations for the shallow zone of aquifer on the east side of Hilliards Creek. The analytical data for ground water samples collected from monitoring well (MW) 14, indicate that the ground water contamination from the Lucas plant has not contaminated the ground water at MW-14. Although MW-14 is located on the Lucas plant in areas of known contamination, the well is used to establish background concentrations for the shallow zone of the aquifer on the east side of Hilliards Creek because analytical data indicate that operations at the Lucas plant have not released hazardous substances to the well, as documented in the sections below. MW-14 is located north of Building 67 (Ref. 31, Figure 3-2). Ground water samples were collected from MW-14 during four separate sampling activities (Ref. 31, Table 3-1, p. 3). As documented in the section below, during each sampling activity, no significant concentrations of hazardous substances were detected in the ground water samples.

MW-20 is also used to establish background SVOC and VOC concentrations for the shallow zone of the aquifer on the east side of Hilliards Creek for the 1993 sampling activity. The monitoring well is screened in the shallow zone of the aquifer and is located on the northwest side of Building 55 (Ref. 31, Table 4-1, p. 2 and Figure 3-2). The ground water samples collected from MW-20 were analyzed for SVOCs and VOCs (Ref. 31, Table 3-1). MW-28, located northeast of the Lucas plant, is also used to establish background concentrations for the shallow zone of the aquifer on the east side of Hilliards Creek (Ref. 31, Figure 3-2). MW-28 is screened in the shallow portion of the aquifer (Ref. 31, Table 4-1, p. 2). Ground water samples were collected from the well in 1993 and analyzed for SVOCs and VOCs and in 1995 and analyzed for inorganic compounds (Ref. 31, Table 3-1).

Other background ground water samples for the shallow zone of the aquifer were collected from 47 Hydropunch™ sampling locations (SGW-200 sample identification sequence), excluding SGW-278, SGW-280, and SGW-300, for screening analyses. Thirty-nine shallow ground water-screening samples were collected from the Hydropunch™ locations and analyzed for BTEX. Analytical data for the SGW sampling locations SGW-200; SGW-204; SGW- 210; and SGW-286 are presented to illustrate that the BTEX compounds detected in the shallow zone of the aquifer on the east side of Hilliards Creek are not migrating from a source northeast of the Lucas plant (ground water flows from the northeast to the southwest) (Ref. 31, p. 4-7, Figure 4-7). The Lucas plant is the only potential source of the BTEX ground water contamination.

MW-16 is used to establish background concentrations for shallow zone of the aquifer on the west side of Hilliards Creek and is located in the area of Tank Farm B (Ref. 31, Table 3-1, p. 2, and Figure 3-2). Although Tank Farm B (Source 4) is a potential source of ground water contamination, analytical results for samples collected from MW-16 have not indicated significant concentrations of hazardous substances (Ref. 31, Table 4-9). The only contaminant detected in ground water samples collected from MW-16 at significant concentrations is lead, up to 10 µg/L. This may reflect ground water contamination from Tank Farm B (Ref. 31, Table 4-9).

Two monitoring wells are used to establish background concentrations for the deep zone of the aquifer, MW-32 and MW-34 (Ref. 31, Table 3-1, p. 2). MW-32 is located on the east side of Hilliards Creek in the eastern section of the Lucas plant, near the gasoline station, upgradient of the source areas. MW-34 is located on the east side of Hilliards Creek in the far northeastern portion of the Lucas plant upgradient of source areas. Monitoring well locations are shown in Reference 31, Figure 3-2.

Based on similar screened intervals, dates of collection, analytical and collection procedures, and analytical parameters, the samples collected from MW-14, MW-16, MW-20, MW-28, MW-32, and MW-34 are considered to be adequate background samples. Ground water samples collected from Hydropunch™ background sampling locations are presented to illustrate that no source of BTEX contamination is located northeast of the Lucas plant. Although the ground water samples were collected for screening purposes only and were not collected from completed monitoring wells, presentation of these background concentrations provides additional evidence that the Lucas plant is the source of BTEX contamination in groundwater.

There are numerous instances where analytical results from the analysis of the samples are not provided in the RI summary of detections tables. For example, in the years 1999 and 2000, ground water samples were collected from MW-32 and analyzed for VOCs and SVOCs (Ref. 31, Table 3-1). Analytical results for samples collected on those dates are not provided in the summary of detections tables presented in the RI (Ref. 31, Table 4-11). It is likely that the results were not recorded because no hazardous substances were detected in the ground water samples collected on those dates.

No background ground water sample analytical results were identified in the RI for years 1999 and 2000. Therefore, data for ground water samples collected from the date closest to the years 1999 and 2000 are used to establish background concentrations. In many cases, background ground water samples were collected a year or more before the release ground water sample was collected. Although the background samples used were collected up to a year or more before the release ground water samples, the background samples used are considered adequate because the hazardous substances detected in the release ground water samples are not naturally occurring, are established as being present in the shallow aquifer underlying the Lucas plant, and are at least partially attributable to the Lucas plant.

The construction details for the background monitoring wells are summarized in Table 28. As shown in Table 28, MW-32 and MW-34 are screened at a greater depths than MW-14, MW-16, MW-20, and MW-28. MW-14, MW-20, and MW-28 are used to establish background conditions for the shallow zone of the aquifer located on the east side of Hilliards Creek. MW-16 is used to establish background conditions for the shallow zone of the aquifer on the west side of Hilliards Creek. MW-32 and MW-34 are used to establish background conditions for the deep zone of the aquifer on the east side of Hilliards Creek. Background ground water samples are compared to release ground water samples collected from monitoring wells screened within the same relative interval. Ground water samples collected from Hydropunch™ sampling locations SWG-200; SWG-204; SWG-210; SWG-212; and SWG-286 are used to illustrate that no BTEX source is located northeast of the plant on east side of Hilliards Creek. No construction information for Hydropunch™ wells is available (Ref. 31, p. 3-14).

TABLE 28

BACKGROUND MONITORING WELL CONSTRUCTION DETAILS

Monitoring Well ID	Depth (ft msl)	Screened Interval (ft msl)	Reference
MW-14	74.28	85.28-74.28	31, Appendix C, p. 21
MW-16	78.60	88.60-78.60	31, Appendix C, p. 25
MW-20	58.19	68.19 - 58.19	31, Appendix C, p. 52
MW-28	84.57	104.57 - 84.57	31, Table 4-1, p. 2
MW-32	25.13	30.13 - 25.13	31, Appendix C, p. 117
MW-34	17.21	27.1 - 17.21	31, Appendix C, p. 137
SGW-200	shallow	NA	31, p. 3-14
SGW-204	shallow	NA	31, p. 3-14
SGW-210	shallow	NA	31, pp. 3-14
SGW-212	shallow	NA	31, pp. 3-14
SGW-286	shallow	NA	31, pp. 3-14

Notes:

ft Foot
ID Identification
MW Monitoring well
msl Mean sea level
NA Not Available
SGW These samples are not used for documenting background or release concentrations. They are used to show background concentrations for other shallow ground water monitoring (SGW) locations that are presented in the release sample tables. The SGW locations are presented to illustrate that BTEX are not migrating from northeast of the Lucas plant.

Table 29 summarizes the analytical parameters for ground water samples collected from MW-14; MW-16; MW-20; MW-28; MW-32; MW-34; SGW-200; SGW-204; SGW-210; SGW-212; and SGW-286. The reference documentation does not describe the analytical methods used to analyze the ground water samples or the detection limits (Ref. 31, Table 3-1, pp. 4, 8). Table 29 presents the analytical parameters exactly as they appear in Reference 31, Table 3-1. Table 3-1 of Reference 31 indicates that ground water samples collected from MW-34 were analyzed for VOCs on February 3, 1999; March, 24, 1999; and January 14, 2000. However, the VOC analytical results for MW-34 are not provided in the summary of detections tables in the RI report (Ref. 31, Table 4-11). Because the summary of VOC detections for MW-34 is missing from the RI, MW-32 is used to establish background concentrations for VOCs in ground water collected from within the same relative screened interval and dates. Because Table 4-11 of Reference 31 provides only a summary of detections, it is likely that no VOCs were detected in ground water samples collected from MW-34 and therefore, no analytical results were provided in Table 4-11 of Reference 31 for MW-34.

The rational or purpose for selecting the locations of the monitoring wells used to establish background conditions for the Lucas plant is not provided in the RI. The text of the RI does not discuss MW-32 and MW-34. However, the RI does discuss the purpose for some of the monitoring well locations. The RI indicates that from August 1991 through January 1992, during Phase I of the RI (Ref. 31, p. 3-3), MW-14 was installed in the ground water seep area to define ground water flow direction and to monitor ground water conditions (Ref. 31, pp. 3-1, 3-11). Ground water samples were collected from MW-14 and analyzed for PP VOA+15, PP base neutral acids (BNA), phenols, lead, barium, and chromium (Ref. 31, p. 3-31). A list of PP VOA and BNAs is provided in Reference 96. During Phase II of the RI a ground water sample was collected from MW-14 and analyzed for lead (Ref. 31, p. 3-17). According to the RI, ground water samples were collected from MW-28 for the purpose of characterizing specific water qualify parameters required for remedial design options (Ref. 31, p. 3-19). The RI also indicates that MW-16 was installed in the vicinity of the former Tank Farm B during Phase I of the RI (Ref. 31, pp. 3-1, 3-3, 3-31). Ground water samples were collected from MW-16 and analyzed for PP VOA+15, PP base neutral acids (BNA), phenols, lead, barium, and chromium (Ref. 31, p. 3-31). From June 1993 through October 1993, during Phase II of the RI (Ref. 31, p. 3-3), ground water samples were collected from MW-16 and analyzed for VOC+10, SVOC+20, and lead (Ref. 31, p. 3-32). From July 1998 through January 2000, during Phase V of the RI (Ref. 31, p. 3-3), ground water samples were collected from MW-16 to confirm the presence of PCP based on previous analytical results (Ref. 31, p. 3-33). MW-20 was installed at greater depths in the water table aquifer (Ref. 31, p. 3-15).

The concentrations of hazardous substances detected in ground water samples collected from MW-14; MW-16; MW-20; MW-28; MW-32; MW-34; SGW-200; SGW-204; SGW-210; SGW-212; and SGW-286 are summarized in Table 30. In many cases, hazardous substances listed in Table 30 do not appear in the summary of detections tables (Ref. 31, Tables 4-9, 4-11, and 4-14) used to prepare Table 30. Since the hazardous substance is not detected, the hazardous substance is not listed in the summary of detections tables. Not all hazardous substances analyzed for are listed in the summary of detections tables presented in the RI (Ref. 31, Tables 4-9, 4-11, and 4-14). In some cases, no analytical results are presented in the tables indicating the none of substances analyzed for were detected. In many cases, a blank space appears in the cell of the summary of detections tables. A blank cell indicates that the hazardous substance was not detected. The detection limit followed by the laboratory data qualifier is not used to denote "not detected," as is most commonly practiced. The analytical results for the analysis of ground water collected from MW-28 on August 5, 1993 for SVOCs and VOCs, on September 9, 1993 for VOC, and July 14, 1995 for metals are provided in Table 3-11 (Ref. 31, Table 3-1, p. 3 and Table 4-11, pp. 7, 20, 26). Because analytical results are not provided in the summary table, no concentrations of hazardous substances were detected in the ground water samples. The summary table only provides a summary of detections.

TABLE 29

SUMMARY OF SAMPLING AND ANALYSIS FOR BACKGROUND MONITORING WELLS

Sample ID	Collection Date	Parameters	Reference
Ground Water Samples from MW-14 (shallow well)			
014-M003	08/04/1991	Metals Semivolatiles Volatiles	31, Table 3-1 (p. 3)
014-M001	12/04/1991	Metals Semivolatiles Volatiles	31, Table 3-1 (p. 3)
014-M002	01/01/1992	Metals Semivolatiles Volatiles	31, Table 3-1 (p. 3)
014-M004	09/10/1993	Metals Semivolatiles Volatiles	31, Table 3-1 (p. 3)
MW14-GW4	11/11/1996	Metals	31, Table 3-1 (p. 3)
Ground Water Samples from MW-16 (shallow well)			
016-M001	12/5/1991	Metals Semivolatiles Volatiles	31, pp. 3-31, 3-32, Table 3-1 (p. 8)
016-M002	01/07/1992	Metals Semivolatiles Volatiles	31, pp. 3-31, 3-32, Table 3-1 (p. 8)
016-M003	08/05/1993	Metals Semivolatiles Volatiles	31, pp. 3-31, 3-32, Table 3-1 (p. 8)
016-M004	09/08/1993	Metals Semivolatiles Volatiles	31, pp. 3-31, 3-32, Table 3-1 (p. 8)

TABLE 29 (Continued)

SUMMARY OF SAMPLING AND ANALYSIS FOR BACKGROUND MONITORING WELLS

Sample ID	Collection Date	Parameters	Reference
016-M203	08/05/1993	Semivolatiles Volatiles	31, pp. 3-31, 3-32, Table 3-1 (p. 8)
Ground Water Samples from MW-20 (shallow well)			
020-M003	08/09/1993	Semivolatiles Volatiles	31, Table 3-1 (p. 3)
020-M004	09/08/1993	Semivolatiles Volatiles	31, Table 3-1 (p. 3)
Ground Water Samples from MW-28 (shallow well)			
028-M003	08/05/1993	Semivolatiles Volatiles	31, Table 3-1 (p. 4)
028-M004	09/09/1993	Semivolatiles Volatiles	31, Table 3-1 (p. 4)
028-M005	07/14/1995	Inorganics	31, Table 3-1 (p. 4)
Ground Water Samples from MW-32 (deep well)			
MW32-GW4	11/05/1996	Inorganics Metals Semivolatiles Volatiles	31, Table 3-1 (p. 4)
GW5-MW32	01/22/1997	Inorganics Metals Semivolatiles Volatiles	31, Table 3-1 (p. 4)
MW-32	02/04/1999	Inorganics Metals Semivolatiles Volatiles	31, Table 3-1 (p. 4)

TABLE 29 (Continued)

SUMMARY OF SAMPLING AND ANALYSIS FOR BACKGROUND MONITORING WELLS

Sample ID	Collection Date	Parameters	Reference
Ground Water Samples from MW-32 (deep well) (Continued)			
MW-32	1/14/2000	Inorganics Metals Semivolatiles Volatiles	31, Table 3-1 (p. 4)
Ground Water Samples from MW-34 (deep well)			
MW-34	2/3/1999	Inorganics Metals Semivolatiles Volatiles	31, Table 3-1 (p. 4)
MW-34	3/24/1999	Inorganics Metals Semivolatiles Volatiles	31, Table 3-11 (p. 4)
MW-34	1/14/2000	Inorganics Metals Semivolatiles Volatiles	31, Table 3-11 (p. 4)
Hydropunch™ ground water samples (shallow ground water)			
SGW-200	06/22/1993	BTEX (benzene, toluene, ethyl benzene, xylene)	31, Table 3-11 (p. 2)
SGW-204	06/22/1993	BTEX	31, Table 3-11 (p. 2)
SGW-210	06/22/1993	BTEX	31, Table 3-11 (p. 2)
SGW-212	06/22/1993	BTEX	31, Table 3-11 (p. 2)
SGW-286	06/22/1993	BTEX	31, Table 3-11 (p. 2)

TABLE 29 (Continued)

SUMMARY OF SAMPLING AND ANALYSIS FOR BACKGROUND MONITORING WELLS

Notes:

BTEX	benzene, toluene, ethylbenzene, and xylene
GW	Ground water
ID	Identification
MW	Monitoring well
SGW	Shallow ground water

TABLE 30

BACKGROUND CONCENTRATIONS

MW ID Field Sample ID	Hazardous Substance	Conc. (µg/L)	Q	Detection Limits (µg/L)	Date	Reference
MW-14 (014-M003)	**Volatile Organic Compounds**				08/04 /1991	31, Table 4-11 (pp. 4, 16, 25); 112, pp. 2, 3, 4, 5
	Acetone	12	B	10		
	2-Butanone	ND		10		
	Benzene	3 (4.94)*	J	10		
	Carbon disulfide	ND		10		
	Chlorobenzene	ND		10		
	Chloroform	ND		10		
	1,1-Dichloroethane	ND		10		
	Ethylbenzene	ND		10		
	Methylene chloride	26	B	10		
	Styrene	ND		10		
	Toluene	ND		10		
	Total 1,2-dichloroethene	5 (50)*	J	10		
	Vinyl chloride	ND		10		
	Xylene (total)	ND		10		
	Semivolatile Organic Compounds					
	Acenaphthene	ND		10		
	Benzoic acid	ND		50		
	2-Chloronaphthalene	ND		10		
	Cresol	ND		10		
	Dibenzofuran	ND		10		
	2,4-Dimethylphenol	ND		10		
	Fluorene	ND		10		
	4-Methylphenol	ND		10		
	2-Methylnaphthalene	ND		10		
	Naphthalene	ND		10		
	4-Nitrophenol	ND		25		
	Pentachlorophenol	ND		25		
	Phenol	ND		10		
	2,4,5-Trichlorophenol	ND		25		
	Metals					

TABLE 30 (Continued)

BACKGROUND CONCENTRATIONS

MW ID Field Sample ID	Hazardous Substance	Conc. (µg/L)	Q	Detection Limits (µg/L)	Date	Reference
	Lead	2.4		3		
MW-14 (014-M001)	**Volatile Organic Compounds**				12/04 /1991	31, Table 4-11 (pp. 4, 16, 25); 112, pp. 2, 3, 4, 5
	Acetone	12	B	10		
	2-Butanone	ND		10		
	Benzene	3 (4.94)*	J	10		
	Carbon disulfide	ND		10		
	Chlorobenzene	ND		10		
	Chloroform	ND		10		
	1,1-Dichloroethane	ND		10		
	Ethylbenzene	ND		10		
	Methylene chloride	26	B	10		
	Styrene	ND		10		
	Toluene	ND		10		
	Total-1,2-dichloroethene	5 (50)*	J	10		
	Vinyl chloride	ND		10		
	Xylene (total)	ND		10		
	Semivolatile Organic Compounds					
	Acenaphthene	ND		10		
	Benzoic acid	ND		50		
	2-Chloronaphthalene	ND		10		
	Cresol	ND		10		
	Dibenzofuran	ND		10		
	2,4-Dimethylphenol	ND		10		
	Fluorene	ND		10		
	4-Methylphenol	ND		10		
	2-Methylnaphthalene	ND		10		
	Naphthalene	ND		10		
	4-Nitrophenol	ND		25		
	Pentachlorophenol	ND		25		
	Phenol	ND		10		
	2,4,5-Trichlorophenol	ND		25		

TABLE 30 (Continued)

BACKGROUND CONCENTRATIONS

MW ID Field Sample ID	Hazardous Substance	Conc. (µg/L)	Q	Detection Limits (µg/L)	Date	Reference
	Metals					
	Lead	2.4		3		
MW-14 (014-M002)	**Volatile Organic Compounds**				01/08 /1992	31, Table 4-11 (pp. 4, 16, 25); 112, pp. 2, 3, 4, 5
	Acetone	47	B	10		
	2-Butanone	ND		10		
	Benzene	3 (4.94)*	J	10		
	Carbon disulfide	ND		10		
	Chlorobenzene	ND		10		
	Chloroform	ND		10		
	1,1-Dichloroethane	ND		10		
	Ethylbenzene	ND		10		
	Methylene chloride	27		10		
	Styrene	ND		10		
	Toluene	ND		10		
	Total 1,2-dichloroethene	5 (50)*	J	10		
	Vinyl chloride	ND		10		
	Xylene (total)	ND		10		
	Semivolatile Organic Compounds					
	Acenaphthene	ND		10		
	Benzoic acid	ND		50		
	2-Chloronaphthalene	ND		10		
	Cresol	ND		10		
	Dibenzofuran	ND		10		
	2,4-Dimethylphenol	ND		10		
	Fluorene	ND		10		
	4-Methylphenol	ND		10		
	2-Methylnaphthalene	ND		10		
	Naphthalene	ND		10		
	4-Nitrophenol	ND		25		
	Pentachlorophenol	ND		25		
	Phenol	ND		10		

TABLE 30 (Continued)

BACKGROUND CONCENTRATIONS

MW ID Field Sample ID	**Hazardous Substance**	**Conc. (µg/L)**	**Q**	Detection Limits (µg/L)	**Date**	**Reference**
	2,4,5-Trichlorophenol	ND		25		
	Metals					
	Lead	ND		3		
MW-14 (014-M004)	**Volatile Organic Compounds**				09/10 /1993	31, Table 4-11 (pp. 4, 16, 25); 112, pp. 2, 3, 4, 5
	Acetone	20	B	10		
	2-Butanone	ND		10		
	Benzene	ND		10		
	Carbon disulfide	ND		10		
	Chlorobenzene	ND		10		
	Chloroform	ND		10		
	1,1-Dichloroethane	ND		10		
	Ethylbenzene	ND		10		
	Methylene chloride	11	B	10		
	Styrene	ND		10		
	Toluene	ND		10		
	Total 1,2-dichloroethene	5 (50)*	J	10		
	Vinyl chloride	ND		10		
	Xylene (total)	ND		10		
	Semivolatile Organic Compounds					
	Acenaphthene	ND		10		
	Benzoic acid	ND		50		
	2-Chloronaphthalene	ND		10		
	Cresol	ND		10		
	Dibenzofuran	ND		10		
	2,4-Dimethylphenol	ND		10		
	Fluorene	ND		10		
	4-Methylphenol	ND		10		
	2-Methylnaphthalene	ND		10		
	Naphthalene	ND		10		
	4-Nitrophenol	ND		25		
	Pentachlorophenol	ND		25		

TABLE 30 (Continued)

BACKGROUND CONCENTRATIONS

MW ID Field Sample ID	Hazardous Substance	Conc. (µg/L)	Q	Detection Limits (µg/L)	Date	Reference
	Phenol	ND		10		
	2,4,5-Trichlorophenol	ND		25		
	Metals					
	Lead	4.4		3		
MW-16 016-M001	**Volatile Organic Compounds**				12/05 /1991	31, pp. 3-31, Table 3-1 (p. 8), Table 4-9 (pp. 1, 3, 5); 112, pp. 2, 3, 4, 5
	Acetone	14	B	10		
	2-Butanone	ND		10		
	Benzene	ND		10		
	Carbon disulfide	ND		10		
	Chlorobenzene	ND		10		
	Chloroform	ND		10		
	1,1-Dichloroethane	ND		10		
	Ethylbenzene	ND		10		
	Methylene chloride	12	B	10		
	Styrene	ND		10		
	Toluene	ND		10		
	Total-1,2-dichloroethene	ND		10		
	Vinyl chloride	ND		10		
	Xylene (total)	ND		10		
	Semivolatile Organic Compounds					
	Acenaphthene	ND		10		
	Benzoic acid	ND		50		
	2-Chloronaphthalene	ND		10		
	Cresol	ND		10		
	Dibenzofuran	ND		10		
	2,4-Dimethylphenol	ND		10		
	Fluorene	ND		10		
	4-Methylphenol	ND		10		
	2-Methylnaphthalene	ND		10		
	Naphthalene	ND		10		
	4-Nitrophenol	ND		25		

TABLE 30 (Continued)

BACKGROUND CONCENTRATIONS

MW ID Field Sample ID	**Hazardous Substance**	**Conc. (µg/L)**	**Q**	Detection Limits (µg/L)	**Date**	**Reference**
	Pentachlorophenol	ND		25		
	Phenol	ND		10		
	2,4,5-Trichlorophenol	ND		25		
	Metals					
	Lead	10		3		
MW-16 016-M002	**Volatile Organic Compounds**				01/07 /1992	31, pp. 3-31, Table 3-1 (p. 8), Table 4-9 (pp. 1, 3, 5); 112, pp. 2, 3, 5
	Acetone	ND		10		
	2-Butanone	ND		10		
	Benzene	ND		10		
	Carbon disulfide	ND		10		
	Chlorobenzene	ND		10		
	Chloroform	ND		10		
	1,1-Dichloroethane	ND		10		
	Ethylbenzene	ND		10		
	Methylene chloride	8		10		
	Styrene	ND		10		
	Toluene	ND		10		
	Total-1,2-dichloroethene	ND		10		
	Vinyl chloride	ND		10		
	Xylene (total)	ND		10		
	Semivolatile Organic Compounds					
	Acenaphthene	ND		10		
	Benzoic acid	ND		50		
	2-Chloronaphthalene	ND		10		
	Cresol	ND		10		
	Dibenzofuran	ND		10		
	2,4-Dimethylphenol	ND		10		
	Fluorene	ND		10		
	4-Methylphenol	ND		10		
	2-Methylnaphthalene	ND		10		
	Naphthalene	ND		10		

TABLE 30 (Continued)

BACKGROUND CONCENTRATIONS

MW ID Field Sample ID	Hazardous Substance	Conc. (µg/L)	Q	Detection Limits (µg/L)	Date	Reference
	4-Nitrophenol	ND		25		
	Pentachlorophenol	2 (20.24)*	J	25		
	Phenol	ND		10		
	2,4,5-Trichlorophenol	ND		25		
	Metals					
	Lead	3		3		
MW-16 016-M003	**Volatile Organic Compounds**				08/05 /1993	31, pp. 3-32, Table 3-1 (p. 8), Table 4-9 (pp. 1, 3, 5); 112, pp. 1, 2, 3, 4, 5
	Acetone	ND		10		
	2-Butanone	ND		10		
	Benzene	ND		10		
	Carbon disulfide	ND		10		
	1,1-Dichloroethane	ND		10		
	Ethylbenzene	ND		10		
	Methylene chloride	ND		10		
	Styrene	ND		10		
	Toluene	ND		10		
	Total-1,2-dichloroethene	ND		10		
	Vinyl chloride	ND		10		
	Xylene (total)	ND		10		
	Semivolatile Organic Compounds					
	Acenaphthene	ND		10		
	Benzoic acid	ND		50		
	2-Chloronaphthalene	ND		10		
	Dibenzofuran	ND		10		
	2,4-Dimethylphenol	ND		10		
	Fluorene	ND		10		
	2-Methylnaphthalene	ND		10		
	4-Methylphenol	ND		10		
	Naphthalene	ND		10		
	4-Nitrophenol	ND		25		
	Pentachlorophenol	ND		25		

TABLE 30 (Continued)

BACKGROUND CONCENTRATIONS

MW ID Field Sample ID	Hazardous Substance	Conc. (μg/L)	Q	Detection Limits (μg/L)	Date	Reference
	Phenol	ND		10		
	2,4,5-Trichlorophenol	ND		25		
	Metals					
	Lead	5		3		
MW-20 (020-M003)	**Volatile Organic Compounds**				08/09 /1993	31, Table 4-11 (p. 5); 112, pp. 2, 3, 4, 5
	Acetone	14	B	10		
	2-Butanone	ND		10		
	Benzene	2 (3.28)*	J	10		
	Carbon disulfide	ND		10		
	Chlorobenzene	ND		10		
	Chloroform	ND		10		
	1,1-Dichloroethane	ND		10		
	Ethylbenzene	ND		10		
	Methylene chloride	ND		10		
	Styrene	ND		10		
	Toluene	ND		10		
	Total-1,2-dichloroethene	8 (80)*	J	10		
	Vinyl chloride	ND		10		
	Xylene (total)	ND		10		
	Semivolatile Organic Compounds					
	Acenaphthene	ND		10		
	Benzoic acid	ND		50		
	2-Chloronaphthalene	ND		10		
	Cresol	ND		10		
	Dibenzofuran	ND		10		
	2,4-Dimethylphenol	ND		10		
	Fluorene	ND		10		
	4-Methylphenol	ND		10		
	2-Methylnaphthalene	ND		10		
	Naphthalene	ND		10		
	4-Nitrophenol	ND		25		

TABLE 30 (Continued)

BACKGROUND CONCENTRATIONS

MW ID Field Sample ID	Hazardous Substance	Conc. (µg/L)	Q	Detection Limits (µg/L)	Date	Reference
	Pentachlorophenol	ND		25		
	Phenol	ND		10		
	2,4,5-Trichlorophenol	ND		25		
MW-20 (020-M004)	**Volatile Organic Compounds**				09/08 /1993	31, Table 4-11 (p. 5); 112, pp. 2, 3, 4, 5
	Acetone	12	B	10		
	2-Butanone	ND		10		
	Benzene	4 (6.56)*	J	10		
	Carbon disulfide	ND		10		
	Chlorobenzene	ND		10		
	Chloroform	ND		10		
	1,1-Dichloroethane	ND		10		
	Ethylbenzene	3 (30)*	J	10		
	Methylene chloride	ND		10		
	Styrene	ND		10		
	Toluene	ND		10		
	Total-1,2-dichloroethene	3 (30)*	J	10		
	Vinyl chloride	ND		10		
	Xylene (total)	ND		10		
	Semivolatile Organic Compounds					
	Acenaphthene	ND		10		
	Benzoic acid	ND		50		
	2-Chloronaphthalene	ND		10		
	Cresol	ND		10		
	Dibenzofuran	ND		10		
	2,4-Dimethylphenol	ND		10		
	Fluorene	ND		10		
	4-Methylphenol	ND		10		
	2-Methylnaphthalene	ND		10		
	Naphthalene	ND		10		
	4-Nitrophenol	ND		25		
	Pentachlorophenol	ND		25		

TABLE 30 (Continued)

BACKGROUND CONCENTRATIONS

MW ID Field Sample ID	**Hazardous Substance**	**Conc. (µg/L)**	**Q**	Detection Limits (µg/L)	**Date**	**Reference**
	Phenol	ND		10		
	2,4,5-Trichlorophenol	ND		25		
MW-28 (028-M003)	**Volatile Organic Compounds**				08/05 /1993	31, Table 3-1 (p. 4), Table 4-11 (pp. 7, 20) See comments in the notes at the end the of the table.; 112, pp. 1, 2, 3, 4, 5
	Acetone	ND		10		
	2-Butanone	ND		10		
	Benzene	ND		10		
	Carbon disulfide	ND		10		
	Chlorobenzene	ND		10		
	Chloroform	ND		10		
	1,1-Dichloroethane	ND		10		
	Ethylbenzene	ND		10		
	Methylene chloride	ND		10		
	Styrene	ND		10		
	Toluene	ND		10		
	Total-1,2-dichloroethene	ND		10		
	Vinyl chloride	ND		10		
	Xylene (total)	ND		10		
	Semivolatile Organic Compounds					
	Acenaphthene	ND		10		
	Benzoic acid	ND		50		
	2-Chloronaphthalene	ND		10		
	Cresol	ND		10		
	Dibenzofuran	ND		10		
	2,4-Dimethylphenol	ND		10		
	Fluorene	ND		10		
	2-Methylphenol	ND		10		
	2-Methylnaphthalene	ND		10		
	Naphthalene	ND		10		
	Pentachlorophenol	ND		25		
	Phenol	ND		10		
	2,4,5-Trichlorophenol	ND		25		

TABLE 30 (Continued)

BACKGROUND CONCENTRATIONS

MW ID Field Sample ID	Hazardous Substance	Conc. (μg/L)	Q	Detection Limits (μg/L)	Date	Reference
MW-28 (028-M004)	**Volatile Organic Compounds**				09/09 /1993	31, Table 3-1 (p.4), Table 4-11 (pp. 7, 20) See comments in the notes at the end the of the table.; 112, pp. 1, 2, 3, 4, 5
	Acetone	ND		10		
	2-Butanone	ND		10		
	Benzene	ND		10		
	Carbon disulfide	ND		10		
	Chlorobenzene	ND		10		
	Chloroform	ND		10		
	1,1-Dichloroethane	ND		10		
	Ethylbenzene	ND		10		
	Methylene chloride	ND		10		
	Styrene	ND		10		
	Toluene	ND		10		
	Total-1,2-dichloroethene	ND		10		
	Vinyl chloride	ND		10		
	Xylene (total)	ND		10		
	Semivolatile Organic Compounds					
	Acenaphthene	ND		10		
	Benzoic acid	ND		50		
	2-Chloronaphthalene	ND		10		
	Cresol	ND		10		
	Dibenzofuran	ND		10		
	2,4-Dimethylphenol	ND		10		
	Fluorene	ND		10		
	4-Methylphenol	ND		10		
	2-Methylnaphthalene	ND		10		
	Naphthalene	ND		10		
	4-Nitrophenol	ND		25		
	Pentachlorophenol	ND		25		
	Phenol	ND		10		
	2,4,5-Trichlorophenol	ND		25		

TABLE 30 (Continued)

BACKGROUND CONCENTRATIONS

MW ID Field Sample ID	Hazardous Substance	Conc. (µg/L)	Q	Detection Limits (µg/L)	Date	Reference
MW-28 028-M005	**Metals**				07/14/1995	31, Table 3-11 (p. 4) and Table 4-11 (p. 26) See comments in the notes at the end the of the table.; 112, p. 5
	Lead	ND		3		
MW-32 MW32-GW4	**Volatile Organic Compounds**				11/05/1996	31,Table 4-11 (pp. 8, 19); 112, pp., 2, 3, 4, 5
	Acetone	0.3	BJ	10		
	2-Butanone	ND		10		
	Benzene	ND		10		
	Carbon disulfide	ND		10		
	1,1-Dichloroethane	ND		10		
	Ethylbenzene	ND		10		
	Methylene chloride	0.6	BJ	10		
	Styrene	ND		10		
	Toluene	ND		10		
	Total 1,2-dichloroethene	ND		10		
	Vinyl chloride	ND		10		
	Xylene	ND		10		
	Semivolatile Organic Compounds					
	Acenaphthene	ND		10		
	Benzoic acid	ND		50		
	2-Chloronaphthalene	ND		10		
	Cresol	ND		10		
	Dibenzofuran	ND		10		
	2,4-Dimethylphenol	ND		10		
	Fluorene	ND		10		
	2-Methylnaphthalene	ND		10		
	4-Methylphenol	ND		10		
	Naphthalene	ND		10		

TABLE 30 (Continued)

BACKGROUND CONCENTRATIONS

MW ID Field Sample ID	**Hazardous Substance**	**Conc. (µg/L)**	**Q**	Detection Limits (µg/L)	**Date**	**Reference**
	Pentachlorophenol	ND		25		
	Phenol	ND		10		
	2,4,5-Trichlorophenol	ND		25		
MW-32 GW5-MW32	**Volatile Organic Compounds**				01/22 /1997	31, Table 4-11 (p. 8); 112, pp. 2, 3, 4, 5
	Acetone	22		10		
	2-Butanone	ND		10		
	Benzene	ND		10		
	Benzoic Acid			50		
	Carbon disulfide	ND		10		
	Cresol (ortho)			10		
	1,1-Dichloroethane	ND		10		
	Ethylbenzene	ND		10		
	Methylene chloride	1	BJ	10		
	Styrene	ND		10		
	Toluene	ND		10		
	Total-1,2-dichloroethene	ND		10		
	Trichloroethene			10		
	Vinyl chloride	ND		10		
	Xylene (total)	ND		10		
MW-32 MW-32	**Semivolatile Organic Compounds**				01/14 /2000	31 Table 4-11 (p. 19); 112, pp. 2, 3, 4, 5
	Acenaphthene	ND		10		
	Benzoic acid	ND		50		
	2-Chloronaphthalene	ND		10		
	Cresol	ND		10		
	Dibenzofuran	ND		10		
	2,4-Dimethylphenol	ND		10		
	Fluorene	ND		10		
	2-Methylphenol	ND		10		
	Naphthalene	ND		10		
	Pentachlorophenol	ND		25		
	Phenol	ND		10		

TABLE 30 (Continued)

BACKGROUND CONCENTRATIONS

MW ID Field Sample ID	Hazardous Substance	Conc. (µg/L)	Q	Detection Limits (µg/L)	Date	Reference
	2,4,5-Trichlorophenol	ND		25		
MW-34 MW-34	**Semivolatile Organic Compounds**				02/03 /1999	31 Table 4-11 (p. 19); 112, pp. 2, 3, 4, 5
	Acenaphthene	ND		10		
	Benzoic acid	ND		50		
	2-Chloronaphthalene	ND		10		
	Cresol	ND		10		
	Dibenzofuran	ND		10		
	2,4-Dimethylphenol	ND		10		
	Fluorene	ND		10		
	4-Methylphenol	ND		10		
	2-Methylnaphthalene	ND		10		
	Naphthalene	ND		10		
	Pentachlorophenol	ND		25		
	Phenol	ND		10		
MW-34 MW-34	**Semivolatile Organic Compounds**				03/24 /1999	31, Table 4-11 (p. 19); 112, pp. 2, 3, 4, 5
	Acenaphthene	ND		10		
	Benzoic acid	ND		50		
	2-Chlorophenol	ND		10		
	Cresol	ND		10		
	Dibenzofuran	ND		10		
	2,4-Dimethylphenol	ND		10		
	Fluorene	ND		10		
	4-Methylphenol	ND		10		
	2-Methylnaphthalene	ND		10		
	Naphthalene	ND		10		
	Pentachlorophenol	ND		25		
	Phenol	ND		10		
	Vinyl Chloride	ND		10		

TABLE 30 (Continued)

BACKGROUND CONCENTRATIONS

MW ID Field Sample ID	Hazardous Substance	Conc. (µg/L)	Q	Detection Limits (µg/L)	Date	Reference
SGW-200	**BTEX**				06/22 /1993	3, Table 4-11 (p. 10); 112, pp. 2, 3, 4, 5
	Benzene	ND		10		
	Toluene	ND		10		
	Ethyl benzene	ND		10		
	Xylene	1.2		10		
SGW-204	**BTEX**				06/22 /1993	3, Table 4-11 (p. 10); 112, p. 2
	Benzene	0.16 (0.26)*	J	10		
	Toluene	ND		10		
	Ethyl benzene	ND		10		
	Xylene	1.2		10		
SGW-210	**BTEX**				06/22 /1993	3, Table 4-11 (p. 11); 112, pp. 2
	Benzene	0.36 (0.59)	J	10		
	Toluene	ND		10		
	Ethyl benzene	ND		10		
	Xylene	0.48 (4.8)*	J	10		
SGW-212	**BTEX**				06/23 /1993	3, Table 4-11 (p. 11) No BTEX detected. Therefore, analytical results are not presented in Table 4-11; 112, pp. 2
	Benzene	ND		10		
	Toluene	ND		10		
	Ethyl benzene	ND		10		
	Xylene	ND		10		
SGW-286	**BTEX**				06/29 /1993	3, Table 4-11 (p. 13); 112, pp. 2
	Benzene	0.15 (0.25)*	J	10		
	Toluene	1.7		10		
	Ethyl benzene	0.45 (4.5)*	J	10		

TABLE 30 (Continued)

BACKGROUND CONCENTRATIONS

MW ID Field Sample ID	Hazardous Substance	Conc. (μg/L)	Q	Detection Limits (μg/L)	Date	Reference
	Xylene	3.3		10		

Notes:

()	Adjusted concentration	ID	Identification
B	Detected in the laboratory blank	J	Estimated concentration
BTEX	Benzene, toluene, ethylbenzene, xylene	MW	Monitoring well
Conc.	Concentration	S	Shallow
μg/L	Microgram per liter		
GW	Ground Water		
Q	Data qualifier		

Notes (Continued):

*Adjusted concentration: The benzene, 1,2-dichloroethene (total), and pentachlorophenol concentrations qualified with a "J" data qualifier are adjusted in accordance with Reference 81. The reason for the "J" qualifiers is unknown; therefore, the samples are conservatively adjusted to reflect an unknown bias. The concentration is adjusted by multiplying the concentration by the appropriate adjustment factor (Ref. 81, Exhibit 2). The adjustment factor for benzene is 1.64, 1,2-dichloroethene (total) is 10, and pentachlorophenol is 10.12 (Ref. 81, p. 15).

No analytical results are presented in Table 4-11 for ground water samples collected from MW-28 on August 5, 1993 for VOC and SVOC analysis; on September 9, 1993 for VOC analysis; and on July 14, 1995 for inorganic analysis because Table 4-11 provides a summary of detections. Therefore, these substances were not reported (Ref. 31, Table 3-1, p. 4).

Release Samples:

Numerous monitoring wells were installed at the Lucas plant in the areas of the sources during the RI (see Reference 31, Figure 3-2). The construction details and locations of the monitoring wells used to document an observed release to ground water are summarized in Table 31. The construction details were obtained from borehole logs in Appendix C of Reference 31. In some instances, borehole logs are not provided in reference documentation. However, Table 4-1 in Reference 31 provides the screened interval for the monitoring wells in feet below mean sea level (msl). Concentrations of hazardous substances detected in the release ground water samples are summarized in Table 32.

TABLE 31

RELEASE MONITORING WELL CONSTRUCTION DETAILS

MW ID	Location	Depth (ft msl)	Screened Interval (ft msl)	Reference
MW-1*	South of shed and east of Tank Farm A	79.80	99.80 - 79.80	31, p. 3-8, Table 4-1, p. 1 and Appendix C, p.230
MW-2	Northwest of Lagoon Area	79.80	99.80 - 79.80	31, Table 4-1, p. 1, Appendix C, p. 5
MW-3*	South of Building 67	70.69	80.69 - 70.69	31, Table 4-1, p. 1
MW-4*	Southeast portion of Lagoon Area	67.88	77.88 - 67.88	31, Table 4-1, p. 1
MW-6	North of the Lagoon Area	78.10	82.10 - 78.10	31, Table 4-1, p. 1
MW-11	Tank Farm A	82.68	92.68 - 82.68	31, Appendix C, p. 8
MW-12	Northwest of Tank Farm A	82.07	92.07 - 82.07	31, Appendix C, p. 11
MW-13	West of Building 67	76	86 - 76	31, Appendix C, p. 14
MW-15	Northwest of Building 55	78.24	88.24 - 78.24	31, Appendix C, p. 24
MW-18	South of Tank Farm B	76.63	86.63 - 76.63	31, Table 4-1, p. 2
MW-19	Northwest of Tank Farm A	65.84	75.84 - 65.84	31, Appendix C, p. 47
MW-21	Southeast of Building 67	76.85	86.85 - 76.85	31, Appendix C, p. 56
MW-22	Southeast of Building 67	55.66	65.66 - 55.66	31, Appendix C, p. 63
MW-23	South of Lagoon area	73.65	83.65 - 73.65	31, Appendix C, p. 66
MW-24	Northeast of Building 58	84.87	94.87 - 84.87	31, Appendix C, p. 69

TABLE 31 (Continued)

RELEASE MONITORING WELL CONSTRUCTION DETAILS

MW ID	Location	Depth (ft msl)	Screened Interval (ft msl)	Reference
MW-25	Northeast of shed and Tank Farm A	85.09	95.09 - 85.09	31, Appendix C, p. 73
MW-30	Northwest of Tank Farm A	37.91	42.91- 37.91	31, Appendix C, p. 95
MW-33	Southeast of Building 67	35.42	40.42 - 35.42	31, Appendix C, p. 127
MW-35	Southeast of Building 55	17.53	27.53 - 17.53	31, Appendix C, p. 147
MW-36	Northeast of Lagoon Area	14.19	25.19 - 14.19	31, Appendix C, p. 163
MW-41*	South of Lagoon Area	9.83	19.83 - 9.83	31, p. 3-29, Table 4-1, p. 6

Notes:
ft Foot
ID Identification
msl Below mean sea level
MW Monitoring well
* The borehole logs for MW-1, MW-3, MW-4, and MW-41 were not in the reference documentation. However, Table 4-1 of Reference 31 summarizes the screened interval for the monitoring wells.

Release Concentrations

The concentrations of hazardous substances meeting the criteria for documenting an observed release to ground water are summarized in Table 32.

TABLE 32

RELEASE GROUND WATER SAMPLE CONCENTRATIONS OF HAZARDOUS SUBSTANCES

MW ID Field Sample ID	Hazardous Substance	Conc. (µg/L)	Q	Adjusted Conc. (µg/L)	Detection Limit (µg/L)	Date	Reference
MW-1 001-M001 (Background: MW-14, 014-M001)	**Volatile Organic Compounds**					12/03/1991	31, Table 4-11, pp. 3, 15; 112 pp. 1, 2, 3, 4, 5
	Ethylbenzene	250	J	25	10		
	Xylene	1,800	-	-	10		
	Semi-Volatile Organic Compounds						
	Naphthalene	1,900	-	-	10		
MW-1 001-M002 (Background: MW-14, 014-M002)	**Volatile Organic Compounds**					01/07/1992	31, Table 4-11, pp. 3, 15; 112 pp. 1, 2, 3, 4, 5
	Ethylbenzene	410	-	-	10		
	Total 1,2-dichloroethene	630	-	-	10		
	Xylene	2,300	-	-	10		
	Semivolatile Organic Compounds						
	2-Methylnaphthalene	810	-	-	10		
	Naphthalene	5,200	-	-	10		
MW-1 001-M003 (Background: MW-14, 014-M004; MW-20, 020-M003; MW-28, 028-M003)	**Volatile Organic Compounds**					08/05/1993	31, Table 4-11, pp. 3, 15; 112 pp. 1 , 2, 3, 4, 5
	Total 1,2-dichloroethene	410	J	174	10		
	Ethylbenzene	240	J	24	10		
	Xylene	950	J	45	10		
	Semivolatile Organic Compounds						
	2-Methylnaphthalene	35	-	-	10		
	Naphthalene	1,100	-	-	10		
MW-1 001-M004 (Background: MW-14, 014-M004; MW-20, 020-M004; MW-28, 028-M004)	**Volatile Organic Compounds**					09/09/1993	31, Table 4-11, pp. 3, 15; 112 pp. 1, 2, 3, 4, 5
	Ethylbenzene	240	-	-	10		
	Total 1,2-dichloroethene	490	-	-	10		
	Xylene	830	-	-	10		
	Semivolatile Organic Compounds						
	2-Methylnaphthalene	72	-	-	10		
	Naphthalene	670	-	-	10		

TABLE 32 (Continued)

RELEASE GROUND WATER SAMPLE CONCENTRATIONS OF HAZARDOUS SUBSTANCES

MW ID Field Sample ID	Hazardous Substance	Conc. (µg/L)	Q	Adjusted Conc. (µg/L)	Detection Limit (µg/L)	Date	Reference
MW-2 002-M001 (Background: MW-14, 014-M001)	**Volatile Organic Compounds**					12/04/1991	31, Table 4-14, p. 1; 112 pp. 1, 2, 3, 4, 5
	Carbon disulfide	16	-	-	10		
	Ethylbenzene	35	-	-	10		
	Xylene	170	-	-	10		
MW-2 002-M002 (Background: MW-14, 014-M002)	**Volatile Organic Compounds**					01/07/1992	31, Table 4-14, p. 1; 112 pp. 1, 2, 3, 4, 5
	Carbon disulfide	10	-	-	10		
	Ethyl benzene	7	-	-	10		
	Xylene	10	-	-	10		
MW-2 002-M003 (Background: MW-14, 014-M004; MW-20, 020-M004; MW-28, 028-M004)	**Volatile Organic Compounds**					09/23/1993	31, Table 4-14, pp. 1, 4; 112 pp. 1, 2, 3, 4, 5
	Xylene	140	-	-	10		
	Semivolatile Organic Compounds						
	2-Chloronaphthalene	28	-	-	10		
	4-Methylphenol	10	-	-	10		
	Phenol	17	-	-	10		
MW-2 002-M004 (Background: MW-14, 014-M004; MW-20, 020-M004; MW-28, 028-M004)	**Semivolatile Organic Compounds**					10/07/1993	31, Table 4-14, p. 4; 112 pp. 1, 2, 3, 4, 5
	Phenol	13	-	-	10		
MW-3 003-M004 (Background: MW-14, 014-M002)	**Metals**					01/08/1992	31, Table 4-14, p. 7; 112, p. 5
	Lead	5.1	-	-	3		
MW-3 003-M004 (Background: MW-14, 014-M004)	**Metals**					10/07/1993	31, Table 4-14, p. 7; 112, p. 5
	Lead	25	-	-	3		

TABLE 32 (Continued)

RELEASE GROUND WATER SAMPLE CONCENTRATIONS OF HAZARDOUS SUBSTANCES

MW ID Field Sample ID	Hazardous Substance	Conc. (µg/L)	Q	Adjusted Conc. (µg/L)	Detection Limit (µg/L)	Date	Reference
MW-4 004-M203[1] (Background: MW-14, 014-M004)	**Volatile Organic Compounds**					08/04/1993	31, Table 4-14, p. 2
	2-Butanone	12	-	-	10		
MW-4 004-M003 (Background: MW-14, 014-M004)	**Metals**					09/23/1993	31, Table 4-14, p. 8; 112, p. 5
	Lead	22	-	-	3		
MW-4 004-M004 (Background: MW-14, 014-M004)	**Metals**					10/07/1993	31, Table 4-14, p. 8; 112, p. 5
	Lead	23	-	-	3		
MW-6 006-M004 (Background: MW-14, 014-M004)	**Metals**					10/07/1993	31, Table 4-14, p. 9; 112, p. 5
	Lead	41	-	-	3		
MW-11 011-M001 (Background: MW-14, 014-M001)	**Volatile Organic Compounds**					12/03/1991	31, Table 4-11, pp. 3, 16; 112 pp. 1, 2, 3, 4, 5
	Benzene	120	-	-	10		
	Ethylbenzene	270	-	-	10		
	Total 1,2-dichloroethene	46	-	-	10		
	Xylene	810	-	-	10		
	Semivolatile Organic Compounds						
	Naphthalene	350	-	-	10		
MW-11 011-M002 (Background: MW-14, 014-M002)	**Volatile Organic Compounds**					01/07/1992	31, Table 4-11, p. 3; 112 pp. 1, 2, 3, 4, 5
	Ethylbenzene	500	-	-	10		
	Total 1,2-dichloroethene	110	-	-	10		
	Xylene	2,100	-	-	10		

TABLE 32 (Continued)

RELEASE GROUND WATER SAMPLE CONCENTRATIONS OF HAZARDOUS SUBSTANCES

MW ID Field Sample ID	Hazardous Substance	Conc. (µg/L)	Q	Adjusted Conc. (µg/L)	Detection Limit (µg/L)	Date	Reference
MW-12 012-M001 (Background: MW-14, 014-M001)	**Volatile Organic Compounds**					12/03/1991	31, Table 4-11, p. 3; 112 pp. 1, 2, 3, 4, 5
	Benzene	370	-	-	10		
	Ethylbenzene	790	-	-	10		
	Xylene	3,400	-	-	10		
MW-12 012-M002 (Background: MW-14, 014-M002)	**Volatile Organic Compounds**					01/07/1992	31, Table 4-11, pp. 3, 16; 112 pp. 1, 2, 3, 4, 5
	Benzene	270	-	-	10		
	Ethylbenzene	870	-	-	10		
	Xylene	3,400	-	-	10		
	Semivolatile Organic Compounds						
	Naphthalene	290	-	-	10		
MW-12 012-M003 (Background: MW-14, 014-M004; MW-20, 020-M003; MW-28, 028-M003)	**Volatile Organic Compounds**					08/05/1993	31, Table 4-11, pp. 3, 16; 112 pp. 1, 2, 3, 4, 5
	Benzene	610	-	-	10		
	Ethylbenzene	1,400	-	-	10		
	Toluene	10	-	-	10		
	Xylene	670	-	-	10		
	Semivolatile Organic Compounds						
	2,4-Dimethylphenol	46	-	-	10		
MW-12 012-M003	Naphthalene	75	-	-	10	08/05/1993	31, Table 4-11, pp. 3, 16; 112 pp. 1, 2, 3, 4, 5
	Phenol	10	-	-	10		
MW-12 MW12-GW4 (Background: MW-14, 014-M004; MW-32, MW32-GW4)*	**Volatile Organic Compounds**					11/05/1996	31, Table 4-11, p. 4; 112 pp. 1, 2, 3, 4, 5
	Benzene	540	-	-	10		
	Ethylbenzene	540	-	-	10		
	Toluene	130	-	-	10		
	Vinyl chloride	210	-	-	10		
	Xylene	750	-	-	10		

TABLE 32 (Continued)

RELEASE GROUND WATER SAMPLE CONCENTRATIONS OF HAZARDOUS SUBSTANCES

MW ID Field Sample ID	Hazardous Substance	Conc. (µg/L)	Q	Adjusted Conc. (µg/L)	Detection Limit (µg/L)	Date	Reference
MW-13 013-M001 (Background: MW-14, 014-M001)	**Volatile Organic Compounds**					12/04/1991	31, Table 4-11, pp. 4, 16; 112 pp. 1, 2, 3, 4, 5
	Acetone	9,500	-	-	10		
	Benzene	1,800	-	-	10		
	2-Butanone	110	-	-	10		
	Ethylbenzene	1,500	-	-			
	Xylene	10,000	-	-	10		
	Semivolatile Organic Compounds						
	2-Methylnaphthalene	120	-	-	10		
	Naphthalene	800	-	-	10		
MW-13 013-M002 (Background: MW-14, 014-M002)	**Volatile Organic Compounds**					01/08/1992	31, Table 4-11, pp. 4, 16; 112 pp. 1, 2, 3, 4, 5
	Benzene	3,200	-	-	10		
	Ethylbenzene	2,700	-	-	10		
	Methylene chloride	1,600	-	-	10		
	Styrene	660	-	-	10		
	Xylene	12,000	-	-	10		
	Semivolatile Organic Compounds						
	Naphthalene	1,800	-	-			
MW-15 015-M001 (Background: MW-14, 014-M001)	**Volatile Organic Compounds**					12/04/1991 12/04/1991	31, Table 4-11, pp. 4, 17; 112 pp. 1, 2, 3, 4, 5
	Benzene	350	-	-	10		
	Ethylbenzene	510	-	-	10		
	Vinyl chloride	53	-	-	10		
	Xylene	54	-	-	10		
	Semivolatile Organic Compounds						
	Naphthalene	59	-	-	10		

TABLE 32 (Continued)

RELEASE GROUND WATER SAMPLE CONCENTRATIONS OF HAZARDOUS SUBSTANCES

MW ID Field Sample ID	Hazardous Substance	Conc. (µg/L)	Q	Adjusted Conc. (µg/L)	Detection Limit (µg/L)	Date	Reference
MW-15 015-M002 (Background: MW-14, 014-M002)	**Volatile Organic Compounds**					01/08/1992	31, Table 4-11, pp. 4, 17; 112 pp. 1, 2, 3, 4, 5
	Benzene	220	-	-	10		
	Ethylbenzene	390	-	-	10		
	Semivolatile Organic Compounds						
	Naphthalene	66	-	-	10		
MW-15 015-M003 (Background: MW-14, MW14-M004; MW-20, 020-M003; MW-28, 028-M003)	**Volatile Organic Compounds**					08/05/1993	31, Table 4-11, pp. 4, 17; 112 pp. 1, 2, 3, 4, 5
	Benzene	130	-	-	10		
	2-Butanone	10	-	-	10		
	Ethylbenzene	160	-	-	10		
	Toluene	10	-	-	10		
	Vinyl chloride	100	-	-	10		
	Xylene	14	-	-	10		
	Semivolatile Organic Compounds						
	Naphthalene	43	-	-	10		
MW-15 015-M004 (Background: MW-14, 014-M004; MW-20, 020-M004; MW-28, 028-M004)	**Volatile Organic Compounds**					09/10/1993	31, Table 4-11, pp. 5, 17; 112 pp. 1, 2, 3, 4, 5
	Benzene	74	-	-	10		
	Ethylbenzene	140	-	-	10		
	Total 1,2-dichloroethene	62	-	-	10		
	Vinyl chloride	18	-	-	10		
MW-15 MW15-GW4 (Background Sample: MW-14, 014-M004; MW-32, MW32-GW4)*	**Volatile Organic Compounds**					11/06/1996	31, Table 4-11, p. 5; 112 pp. 1, 2, 3, 4, 5
	Benzene	100	-	-	10		
	Ethylbenzene	120	-	-	10		
	Toluene	5	-	-	10		
	Vinyl chloride	39	-	-	10		
	Xylene	15	-	-	10		
MW-18 018-M001 (Background: MW-16, MW16-M001)	**Metals**					12/05/1991	31, Table 4-9, p. 5; 112, p. 5
	Lead	30	-	-	3		

TABLE 32 (Continued)

RELEASE GROUND WATER SAMPLE CONCENTRATIONS OF HAZARDOUS SUBSTANCES

MW ID Field Sample ID	Hazardous Substance	Conc. (µg/L)	Q	Adjusted Conc. (µg/L)	Detection Limit (µg/L)	Date	Reference
MW-18 018-M002 (Background: MW-16, MW16-M002)	**Metals**					01/07/1992	31, Table 4-9, p. 6; 112, p. 5
	Lead	50	-	-	3		
MW-18 018-M003 (Background: MW-16, MW16-M003)	**Metals**					08/05/1993	31, Table 4-9, p. 6; 112, p. 5
	Lead	240	-	-	3		
MW-18 018-M004 (Background: MW-16, MW16-M004)	**Metals**					09/08/1993	31, Table 4-9, p. 6; 112, p. 5
	Lead	180	-	-	3		
MW-19 012-M004 (Background: MW-14, 014-M004; MW-20, 020-M004; MW-28, 028-M004)	**Volatile Organic Compounds**					09/09/1993	31, Table 4-11, pp. 5, 17; 112 pp. 1, 2, 3, 4, 5
	Benzene	260	-	-	10		
	Ethylbenzene	790	-	-	10		
	Toluene	300	-	-	10		
	Xylene	2,500	-	-	10		
	Semivolatile Organic Compounds						
	2-Methylnaphthalene	13	-	-	10		
	2,4-Dimethylphenol	11	-	-	10		
	Naphthalene	120	-	-	10		
MW-19 019-M003 (Background: MW-14, 014-M004; MW-20, 020-M003; MW-28, 028-M003)	**Volatile Organic Compounds**					08/09/1993	31, Table 4-11, p. 5; 112 pp. 1, 2, 3 4, 5
	Benzene	270	-	-	10		
	Ethylbenzene	750	-	-	10		
	Toluene	310	-	-	10		
	Xylene	2,000	-	-	10		

TABLE 32 (Continued)

RELEASE GROUND WATER SAMPLE CONCENTRATIONS OF HAZARDOUS SUBSTANCES

MW ID Field Sample ID	Hazardous Substance	Conc. (µg/L)	Q	Adjusted Conc. (µg/L)	Detection Limit (µg/L)	Date	Reference
MW-19 019-M004 (Background: MW-14, 014-M004; MW-20, 020-M004; MW-28, 028-M004)	**Volatile Organic Compounds**					09/09/1993	31, Table 4-11, pp. 5, 19; 112 pp. 1, 2, 3, 4, 5
	Benzene	480	-	-	10		
	Ethylbenzene	1,800	-	-	10		
	Xylene	1,400	-	-	10		
	Semivolatile Organic Compounds						
	2,4-Dimethylphenol	44	-	-	10		
	2-Methylnaphthalene	11	-	-	10		
	Naphthalene	120	-	-	10		
MW-21 021-M001 (Background: MW-14, 014-M004; MW-20, MW20-M003; MW-28, MW28-M003)	**Volatile Organic Compounds**					08/04/1993	31, Table 4-11, pp. 5, 17; 112 pp. 1, 2, 3, 4, 5
	Benzene	71	-	-	10		
	Ethylbenzene	37	-	-	10		
	Xylene	150	-	-	10		
	Semivolatile Organic Compounds						
	2,4-Dimethylphenol	11	-	-	10		
	2-Methylnaphthalene	28	-	-	10		
	Naphthalene	360	-	-	10		
MW-21 021-M004 (Background: MW-14, 014-M004; MW-20, 020-M004; MW-28, 028-M004)	**Volatile Organic Compounds**					09/08/1993	31, Table 4-11, pp. 5, 17; 112 pp. 1, 2, 3, 4, 5
	Benzene	86	-	-	10		
	Ethylbenzene	38	-	-	10		
	Xylene	240	-	-	10		
	Semivolatile Organic Compounds						
	Naphthalene	130	-	-	10		
MW-22 022-M003 (Background: MW-14, 014-M004; MW-20, 020-M003; MW-28, 028-M003)	**Volatile Organic Compounds**					08/09/1993	31, Table 4-11, p. 5; 112 pp. 1, 2, 3, 4, 5
	Benzene	45	-	-	10		

TABLE 32 (Continued)

RELEASE GROUND WATER SAMPLE CONCENTRATIONS OF HAZARDOUS SUBSTANCES

MW ID Field Sample ID	Hazardous Substance	Conc. (µg/L)	Q	Adjusted Conc. (µg/L)	Detection Limit (µg/L)	Date	Reference
MW-22 022-M004 (Background: MW-14, 014-M004; MW-20, 020-M004; MW-28, 028-M004)	**Volatile Organic Compounds**					09/08/1993	31, Table 4-11, p. 6; 112 pp. 1, 2, 3, 4, 5
	Benzene	51	-	-	10		
	1,2-dichloroethane	61	-	-	10		
MW-23 023-M001 (Background: MW-14, 014-M004; MW-20, 020-M004; MW-28, 028-M004)	**Volatile Organic Compounds**					09/23/1993	31, Table 4-14, pp. 1, 4; 112 pp. 1, 2, 3, 4, 5
	Carbon disulfide	23	-	-	10		
	Xylene	120	-	-	10		
	Semivolatile Organic Compounds						
	4-Methylphenol	10	-	-	10		
	Pentachlorophenol	1,400	-	-	25		
MW-23 023-M004 (Background: MW-14, 014-M004; MW-20, 020-M004; MW-28, 028-M004)	**Semivolatile Organic Compounds**					10/23/1993	31, Table 4-14, p. 4; 112 pp. 1, 2, 3, 4, 5
	2,4-Dichlorophenol	11	-	-	10		
	Pentachlorophenol	1,900	-	-	25		
MW-23 MW-101[1] (Background: MW-34, MW-34)*	**Semivolatile Organic Compounds**					02/04/1999	31, Table 4-14, p. 4; 112 pp. 1, 2, 3, 4, 5
	Pentachlorophenol	94	-	-	25		
MW-23 MW-23 (Background: MW-32, MW-34)*	**Semivolatile Organic Compounds**					02/04/1999	31, Table 4-14, p. 4
	Pentachlorophenol	110	-	-	25		
MW-23 MW-23 (Background: MW-32, MW-34)*	**Semivolatile Organic Compounds**					02/15/2000	31, Table 4-14, p. 4; 112 pp. 1, 2, 3, 4, 5
	Pentachlorophenol	69	-	-	25		

TABLE 32 (Continued)

RELEASE GROUND WATER SAMPLE CONCENTRATIONS OF HAZARDOUS SUBSTANCES

MW ID Field Sample ID	Hazardous Substance	Conc. (µg/L)	Q	Adjusted Conc. (µg/L)	Detection Limit (µg/L)	Date	Reference
MW-23 MW-23-GW4 (Background: MW-32, MW32-GW4)*	**Semivolatile Organic Compounds**					11/07/1996	31, Table 4-14, p. 4
	Benzoic acid	1,700	D	-	50		
MW-24 024-M003 (Background: MW-14, 014-M004; MW-20, 020-M004; MW-28, 028-M004)	**Volatile Organic Compounds**					08/05/1993	31, Table 4-11, pp. 6, 18; 112 pp. 1, 2, 3, 4, 5
	Benzene	74	-	-	10		
	Ethylbenzene	77	-	-	10		
	Styrene	330	-	-	10		
	Toluene	300	-	-	10		
	Xylene	1,200	-	-	10		
	Semivolatile Organic Compounds						
	Acenaphthene	84	-	-	10		
	Dibenzofuran	68	-	-	10		
	Fluorene	38	-	-	10		
	2-Methylnaphthalene	410	-	-	10		
	Naphthalene	1,500	-	-	10		
	4-Nitrophenol	72	-	-	25		
MW-24 024-M004 (Background: MW-14, 014-M004; MW-20, 020-M004; MW-28, 028-M004)	**Volatile Organic Compounds**					09/09/1993	31, Table 4-14, pp. 6, 18; 112 pp. 1, 2, 3, 4, 5
	Benzene	130	-	-	10		
	Ethylbenzene	77	-	-	10		
	Styrene	370	-	-	10		
	Toluene	340	-	-	10		
	Xylene	1,300	-	-	10		
	Semivolatile Organic Compounds						
	Acenaphthene	32	-	-	10		
	Dibenzofuran	28	-	-	10		
	Fluorene	15	-	-	10		
	2-Methylnaphthalene	190	-	-	10		
	Naphthalene	1,100	-	-	10		

TABLE 32 (Continued)

RELEASE GROUND WATER SAMPLE CONCENTRATIONS OF HAZARDOUS SUBSTANCES

MW ID Field Sample ID	Hazardous Substance	Conc. (µg/L)	Q	Adjusted Conc. (µg/L)	Detection Limit (µg/L)	Date	Reference
MW-24 024-M104 (Background: MW-14, 014-M004; MW-20, 020-M004; MW-28, 028-M004)	**Volatile Organic Compounds**					09/09/1993	31, Table 4-11, pp. 6, 18; 112 pp. 1, 2, 3, 4, 5
	Benzene	130	-	-	10		
	Toluene	320	-	-	10		
	Xylene	1,200	-	-	10		
	Semivolatile Organic Compounds						
	Acenaphthene	30	-	-	10		
	Dibenzofuran	26	-	-	10		
	Fluorene	14	-	-	10		
	2-Methylnaphthalene	170	-	-	10		
	Naphthalene	770	-	-	10		
MW-25 025-M003 (Background: MW-14, 016-M004; MW-20, 020-M003; MW-28, 028-M003)	**Volatile Organic Compounds**					08/05/1993	31, Table 4-14, pp. 6, 18; 112 pp. 1, 2, 3, 4, 5
	1,1-Dichloroethane	13	-	-	10		
	Semivolatile Organic Compounds						
	Pentachlorophenol	180	-	-	25		
MW-25 025-M004 (Background Sample: MW-14, 014-M004; MW-20, 020-M004; MW-28, 028-M004)	**Volatile Organic Compounds**					09/09/1993	31, Table 4-11, p. 6; 112 pp. 1, 2, 3, 4, 5
	1,1-Dichloroethane	14	-	-	10		
MW-30 GW5-MW30 (Background: MW-32, GW5-MW32)	**Volatile Organic Compounds**					01/22/1997	31, Table 4-11, pp. 7, 19; 112 pp. 1, 2, 3, 4, 5
	Acetone	850	-	-	10		
	Benzene	5,000	-	-	10		
	Toluene	330	-	-	10		
	Total 1,2-dichloroethene	120	-	-	10		
	Xylene	48	-	-	10		
	Semivolatile Organic Compounds						
	Benzoic acid	10,000	-	-	50		
	Cresol (ortho)	61	-	-	10		

TABLE 32 (Continued)

RELEASE GROUND WATER SAMPLE CONCENTRATIONS OF HAZARDOUS SUBSTANCES

MW ID Field Sample ID	Hazardous Substance	Conc. (µg/L)	Q	Adjusted Conc. (µg/L)	Detection Limit (µg/L)	Date	Reference
	4-Methylphenol	220	-	-	10		
	Phenol	530	-	-	10		
MW-30 GW5-MW53[1] (Background: MW-32, GW5-MW32)	**Volatile Organic Compounds**					01/22/1997	31, Table 4-11, pp. 7, 19; 112 pp. 1, 2, 3, 4, 5
	Benzene	5,400	-	-	10		
	Toluene	390	-	-	10		
	Total 1,2-dichloroethene	130	-	-	10		
	Xylene	53	-	-	10		
	Semivolatile Organic Compounds						
	Benzoic acid	15,000	-	-	50		
	Cresol (ortho)	63	-	-	10		
	4-Methylphenol	210	-	-	10		
	Phenol	750	-	-	10		
MW-30 MW-30 (Background: MW-32, MW-34)	**Volatile Organic Compounds**					02/03/1999	31, Table 4-11, pp. 7, 19; 112 pp. 1, 2, 3, 4, 5
	Acetone	540	-	-	10		
	Benzene	5,000	-	-	10		
	Toluene	380	-	-	10		
	Total 1,2-dichloroethene	79	-	-	10		
	Xylene	28	-	-	10		
	Semivolatile Organic Compounds						
	Benzoic acid	12,000	-	-	50		
	Cresol (ortho)	47	-	-	10		
	4-Methylphenol	190	-	-	10		
	Phenol	610	-	-	10		

TABLE 32 (Continued)

RELEASE GROUND WATER SAMPLE CONCENTRATIONS OF HAZARDOUS SUBSTANCES

MW ID Field Sample ID	Hazardous Substance	Conc. (μg/L)	Q	Adjusted Conc. (μg/L)	Detection Limit (μg/L)	Date	Reference
MW-30 MW-30-GW4 (Background: MW-32, MW32-GW4)	**Volatile Organic Compounds**					11/05/1996	31, Table 4-11, pp. 8, 19; 112 pp. 1, 2, 3, 4, 5
	Benzene	4,900	-	-	10		
	Toluene	270	-	-	10		
	Semivolatile Organic Compounds						
	Benzoic acid	10,000	-	-	50		
	4-Methylphenol	120	J	12	10		
	Phenol	430	J	122	10		
MW-30 MW50-GW4[1] MW-30-GW4 (Background: MW-32, MW32-GW-4)	**Volatile Organic Compounds**					11/05/1996	31, Table 4-11 p. 8; 112 pp. 1, 2, 3, 4, 5
	Benzene	5,500	-	-	10		
	Phenol	420	J	119	10		
	Toluene	300	-	-	10		
	Total 1,2-dichloroethene	120	J	12	10		
	Semivolatile Organic Compounds						
	Benzoic acid	9,400	-	-	50		
	4-Methylphenol	110	J	11	10		
MW-33 MW-33-GW4 (Background: MW-32, MW32-GW4)	**Volatile Organic Compounds**					11/06/1996	31, Table 4-11, p. 8; 112 pp. 1, 2, 3, 4, 5
	Benzene	430	D	-	10		
	Total 1,2-dichloroethene	32	-	-	10		
	Semivolatile Organic Compounds						
	Phenol	10	-	-	10		
MW-33 GW5-MW33 (Background: MW-32, GW5-MW32)	**Volatile Organic Compounds**					01/22/1997	31, Table 4-11, p. 8; 112 pp. 1, 2, 3, 4, 5
	Acetone	6	-	-	10		
	Benzene	570	-	-	10		
	Xylene	30	-	-	10		

TABLE 32 (Continued)

RELEASE GROUND WATER SAMPLE CONCENTRATIONS OF HAZARDOUS SUBSTANCES

MW ID Field Sample ID	Hazardous Substance	Conc. (µg/L)	Q	Adjusted Conc. (µg/L)	Detection Limit (µg/L)	Date	Reference
MW-33 MW-13 (Background: MW-32)	**Volatile Organic Compounds**					02/05/1999	31, Table 4-11, p. 8; 112 pp. 1, 2, 3, 4, 5
	Benzene	420	-	-	10		
MW-33 MW-33 (Background: MW-32)	**Volatile Organic Compounds**					01/13/2000	31, Table 4-11, p. 8; 112 pp. 1, 2, 3, 4, 5
	Benzene	570	-	-	10		
MW-35 MW-100[1] (Background: MW-32, MW-34)	**Volatile Organic Compounds**					02/03/1999	31, Table 4-11, p. 9; 112 pp. 1, 2, 3, 4, 5
	Benzene	80	-	-	10		
	Ethylbenzene	18	-	-	10		
	Xylene	49	-	-	10		
MW-35 MW-35 (Background: MW-32, MW-34)	**Volatile Organic Compounds**					02/03/1999	31, Table 4-11, p. 9; 112 pp. 1, 2, 3, 4, 5
	Benzene	78	-	-	10		
	Ethylbenzene	18	-	-	10		
	Xylene	49	-	-	10		
MW-35 MW-35 (Background: MW-32, MW-34)	**Volatile Organic Compounds**					03/24/1999	31, Table 4-11, p. 9; 112 pp. 1, 2, 3, 4, 5
	Benzene	96	-	-	10		
	Ethylbenzene	16	-	-	10		
	Xylene	38	-	-	10		
MW-35 MW-35 (Background: MW-32, MW-34)	**Volatile Organic Compounds**					01/14/2000	31, Table 4-11, p. 9; 112 pp. 1, 2, 3, 4, 5
	Ethylbenzene	10	-	-	10		
	Xylene	11	-	-	10		

TABLE 32 (Continued)

RELEASE GROUND WATER SAMPLE CONCENTRATIONS OF HAZARDOUS SUBSTANCES

MW ID Field Sample ID	Hazardous Substance	Conc. (µg/L)	Q	Adjusted Conc. (µg/L)	Detection Limit (µg/L)	Date	Reference
MW-35 MW-35D[1] (Background: MW-32, MW-34)	**Volatile Organic Compounds**					01/14/2000	31, Table 4-11, p. 9; 112 pp. 1, 2, 3, 4, 5
	Benzene	100	-	-	10		
MW-36 MW-36 (Background Sample: MW-32, MW-34)	**Volatile Organic Compounds**					02/03/1999	31, Table 4-11, p. 9; 112 pp. 1, 2, 3, 4, 5
	Benzene	150	-	-	10		
MW-36 MW-36 (Background: MW-32, MW-34)	**Volatile Organic Compounds**					03/24/1999	31, Table 4-11, p. 9; 112 pp. 1, 2, 3, 4, 5
	Benzene	73	-	-	10		
MW-36 MW-36 (Background: MW-32, MW-34)	**Volatile Organic Compounds**					01/13/2000	31, Table 4-11, p. 9; 112 pp. 1, 2, 3, 4, 5
	Benzene	140	-	-	10		
MW-36 MW-36DUP[1] (Background: MW-32, MW-34)	**Volatile Organic Compounds**					03/24/1999	31, Table 4-11, p. 9; 112 pp. 1, 2, 3, 4, 5
	Benzene	68	-	-	10		
MW-41 MW-41-12/8/99 (Background: MW-32, MW-34)	**Volatile Organic Compounds**					12/08/1999	31, Table 4-11, pp. 10, 23; 112 pp. 1, 2, 3, 4, 5
	Benzene	720	-	-	10		
	Semivolatile Organic Compounds						
	Phenol	110	-	-			

TABLE 32 (Continued)

RELEASE GROUND WATER SAMPLE CONCENTRATIONS OF HAZARDOUS SUBSTANCES

MW ID Field Sample ID	Hazardous Substance	Conc. (µg/L)	Q	Adjusted Conc. (µg/L)	Detection Limit (µg/L)	Date	Reference
MW-41 MW-41 (Background: MW-32, MW-34)	**Volatile Organic Compounds**				10	01/13/2000	31, Table 4-11, pp. 10, 22; 112 pp. 1, 2, 3, 4, 5
	Benzene	900	-	-	10		
	Semivolatile Organic Compounds						
	Phenol	36	-	-	10		

Notes:

[1]	Duplicate sample
µg/L	Microgram per liter
–	Not applicable
Conc.	Concentration
D	Diluted
GW	Ground water
ID	Identification
J	Estimated value
MW	Monitoring well
Q	Data qualifier
*	On some sampling dates, background shallow ground water samples were not collected from the aquifer. Therefore, the deep background ground water samples are used to establish background concentrations.

Notes (Continued):

Adjusted concentrations - Concentrations with the data qualifier J, estimated value, are divided by the adjustment factor value in Reference 81. The reason the data were J qualified is not known. Therefore, the bias was considered high. For release concentrations that have a high bias, the concentration is divided by the adjustment factor (Ref. 81, Exhibit 3). The adjustment factors used include ethylbenzene (10), total 1,2-dichloroethene (10), xylene (10), 4-methylphenol (10), and phenol (3.53) (Ref. 81, pp. 11, 12).

Attribution:

The hazardous substances detected in the release ground waters samples are attributable to sources located on the Lucas plant (see Section 2.4 of this documentation record) and to operations conducted at the Lucas plant as documented in the introduction section and attribution section (Section 4.0) of this documentation record.

Lead was used extensively at the Lucas plant (Refs. 13, p. 3; 31, p. 2-3; 60, pp. 6, 8, 10, 12, 22, 26). The presence of lead within ground water and in Hilliards Creek extending from the Lucas plant to Hilliards Road indicates that over time operations at the Lucas plant have released lead to ground water and surface water. As documented in Section 4.0 of this HRS documentation record, other than waste disposal areas used by the Lucas plant, no other significant sources of lead have been identified in the Hilliards Creek watershed. Potential sources of ground water contamination in the area surrounding the Lucas plant are discussed in the attribution and land use surrounding Hilliards Creek sections (see Section 4.0).

Lead has been detected in soil samples collected from sources on the Lucas plant property, as documented in the waste characterization section (Section 2.4) of this HRS documentation record, and ground water and surface water sediment and aqueous samples at concentrations exceeding three times the background concentration (see Sections 4.1.2.1.1 and 4.2.2.1.1 of this HRS documentation record).

Additionally, lead has been detected in product samples collected from the ground water underlying Source 1 (Refs. 76, pp. 12, 13, 19, 20; 77, p. 82). The product has been observed to discharge into Hilliards Creek (Refs. 10, pp. 1, 2; 31, pp. 3-3, 3-22; 32, p. 5; 65, pp. 1, 2, 3; 36; 37).

Analytical results for free-phase product samples collected from Source 1 indicated the presence of 2-methylnaphthalene; 4-chloroaniline; naphthalene; benzene; chlorobenzene; ethylbenzene; and xylene (Ref. 31, Table 4-20 and Section 2.4.1 of this HRS documentation for Source 1). These same hazardous substances were detected in the observed release samples as documented in Section 4.2 of this HRS documentation record.

Many of the hazardous substances detected in the observe release to ground water samples were also detected in source samples including acetone (Sources 1, 2, and 4); benzene (Source 1); benzoic acid (Source 3); 2-butanone (Sources 1 and 2); carbon disulfide (Sources 1 and 3); chlorobenzene (Source 1); chloroform (Source 4); 1,2-dichloroethene (Sources 1 and 2); 2,4-dimethylphenol (Source 1); ethylbenzene (Sources 1, 2, 3, and 4); lead (Sources 1, 2, 3, and 4); 2-methylnapthalene (Source 1); naphthalene (Sources 1 and 2); pentachlorophenol (Source 3); toluene (Sources 1 and 4); and xylene (Sources 1, 2, and 4). Refer to Section 2.4.1 of this HRS documentation record for the source sample documentation and Section 4.2 of this HRS documentation record for the ground water sample documentation.

Some of the hazardous substances detected in the ground water observed release samples were not detected in the source samples including acenaphthene; 2-chloronaphthalene; cresol; dibenzofuran; 1,1-dichloroethane; fluorene; 2-methylnaphthalene; 4-methyl phenol; phenol; styrene; tetrachloroethylene; total 1,2-dichloroethene; 2,4,5-trichlorophenol; and vinyl chloride. However, many of these hazardous substances can be attributed to operations conducted at the Lucas plant. PAHs, such as acenaphthene and fluorene are common constituents of petroleum products such as was used at the Lucas plant (Refs. 10, p. 9; 105, pp. 2, 4). Cresols are used in paint (Ref. 107, p. 75). 1,2-Dichloroethane is used for varnish and finish removers

(Ref. 108, p. 51). There is no record of the use of the following hazardous substances at the Lucas plant: 2-chloronaphthalene; dibenzofuran; 2-methylnaphthalene; 4-methyl phenol; phenol; styrene; tetrachloroethylene; total 1,2,-dichloroethene; 2,3,4-trichlorophenol; and vinyl chloride. Therefore, these hazardous substances are not used in the observed release to ground water.

Hazardous Substances Attributable to the Site and Documented in the Observed Release to Ground Water and Surface Water:

Lead

4.2.2.2 WASTE CHARACTERISTICS

4.2.2.2.1 Toxicity/Persistence

For each hazardous substance detected in a ground water sample meeting the criteria for an observed release and in a source with a containment value of greater than zero, a toxicity, a mobility, persistence factor, and a combined toxicity/mobility/persistence factor value are assigned (Ref. 1, Section 4.2.2.2.1).

TABLE 33

TOXICITY/MOBILITY/PERSISTENCE FACTOR VALUES SHERWIN-WILLIAMS/HILLIARDS CREEK

Hazardous Substance	Source Number	Toxicity Factor Value	Mobility Factor Value**	Persistence Factor Value*	Toxicity/ Persistence/ Mobility Factor Value	Reference
Acetone	1, 4	1	1.0	0.1	0.07	2, p. BI-1
Aluminum	1	0	1.0	1.0	0.0	2, p. BI-1
Antimony	2	10,000	$1x10^{-2}$	1.0	100.0	2, p. BI-1
Arsenic	1, 2, 3, 4	10,000	$1x10^{-2}$	1.0	100.0	2, p. BI-1
Barium	1, 2, 3, 4	10,000	$1x10^{-2}$	1.0	100.0	2, p. BI-1
Benzene	1	1,000	1.0	0.4	400.0	2, p. BI-2
Benzo(a)anthracene	1, 4	1,000	$2x10^{-9}$	1.0	$2x10^{-6}$	2, p. BI-2
Benzo(a)pyrene	1, 4	10,000	$2x10^{-9}$	1.0	$2x10^{-5}$	2, p. BI-2
Benzoic Acid	3	--	--	--	--	2, p. BI-2
Benzo(b)fluoranthene	1, 4	--	--	--	--	2, p. BI-2
Benzo(k)fluoranthene	1, 4	100	$2x10^{-9}$	1.0	$2x10^{-7}$	2, p. BI-2
Beryllium	2	10,000	$1x10^{-2}$	1.0	100.0	2, p. BI-2
Bis(2-ethylhexyl) phthalate	1	100	$2x10^{-7}$	1.0	$2x10^{-5}$	2, p. BI-2
2-Butanone	1, 2, 4	--	--	--	--	2, p. BI-2
Cadmium	1, 2, 3	10,000	$1x10^{-2}$	1.0	100.0	2, p. BI-2
Carbon disulfide	3	10	1.0	0.4	4.0	2, p. BI-3
4-Chloroaniline	1	--	--	--	--	2, p. BI-3
Chlorobenzene	1	100	1.0	0.0007	0.1	2, p. BI-3
Chloroform	4	100	1.0	0.4	40.0	2, p. BI-3
Chromium	1, 2, 3, 4	10,000	$1x10^{-2}$	1.0	100.0	2, p. BI-3
Chrysene	1, 4	10	$2x10^{-9}$	1.0	$2x10^{-8}$	2, p. BI-3
Cobalt	2, 4	10	$1x10^{-2}$	1.0	0.1	2, p. BI-3
Copper	1, 2, 3	0	$1x10^{-2}$	1.0	0	2, p. BI-3
Cyanide	4	100	1.0	1.0	100.0	2, p. BI-4
1,2-Dichloroethene	1, 2	100	1.0	0.4	40.0	2, p. BI-5
2,4-Dimethylphenol	1	100	1.0	1.0	100.0	2, p. BI-5
Di-n-butyl-phthalate	4	10	1.0	1.0	10.0	2, p. BI-4

TABLE 33

TOXICITY/MOBILITY/PERSISTENCE FACTOR VALUES SHERWIN-WILLIAMS/HILLIARDS CREEK

Hazardous Substance	Source Number	Toxicity Factor Value	Mobility Factor Value**	Persistence Factor Value*	Toxicity/ Persistence/ Mobility Factor Value	Reference
Ethylbenzene	1, 2, 3, 4	10	1.0	$7x10^{-4}$	$7x10^{-3}$	2, p. BI-6
Fluoranthene	1, 4	--	--	--	--	2, p. BI-6
2-Hexanone	4	--	--	--	--	2, p. BI-8
Iron	1	1	$1x10^{-2}$	1.0	$1x10^{-2}$	2, p. BI-8
Lead	1, 2, 3, 4	10,000	1.0	1.0	10,000.0	2, p. BI-8
Magnesium	1, 2, 4	--	--	--	--	2, p. BI-8
Manganese	1	10,000	$1x10^{-2}$	1.0	100.0	2, p. BI-8
Mercury	1, 2, 3, 4	10,000	$1x10^{-2}$	1.0	100.0	2, p. BI-8
2-Methylnaphthalene	1, 2	0	1.0	0.4	0.0	2, p. BI-9
Naphthalene	1, 2	1,000	1.0	0.4	400.0	2, p. BI-9
Nickel	1, 2, 3	10,000	$1x10^{-2}$	1.0	100.0	2, p. BI-9
Pentachlorophenol	1, 3	100	1.0	1.0	100.0	2, p. BI-9
Phenanthrene	1, 4	0	$1x10^{-5}$	0.4	0.0	2, p. BI-9
Pyrene	1, 4	100	$2x10^{-5}$	1.0	$2x10^{-3}$	2, p. BI-10
Selenium	1	100	1.0	1.0	100.0	2, p. BI-10
Silver	1	100	1.0	1.0	100.0	2, p. BI-10
Tetrachloroethene	1, 2	100	1.0	0.4	40.0	2, p. BI-10
Toluene	1, 4	10	1.0	7×10^{-2}	0.7	2, p. BI-11
1,1,1-Trichloroethane	4	1	1.0	0.4	0.4	2, p. BI-11
1,1,2-Trichloroethane	1, 4	1,000	1.0	0.4	400.0	2, p. BI-11
Trichloroethene	1, 2, 4	10,000	1.0	0.4	4,000.0	2, pp. BI, B2-1
1,2,4-Trimethylbenzene	1	--	--	--	--	2, p. BI-11
1,3,5-Trimethylbenzene	1	--	--	--	--	2, p. BI-11
Vanadium	1	100	$1x10^{-2}$	1.0	1.0	2, p. BI-11
Xylene	1, 2, 3, 4	100	1.0	0.4	40.0	2, p. BI-12
Zinc	1, 2, 3, 4	10	$1x10^{-2}$	1.0	0.1	2, p. BI-12

Notes:
* River persistence values are assigned.
** Mobility factor values are 1 for hazardous substances for which an observed release to ground water has been documented. All hazardous substances are assumed to be deposited as a solid.
– Not listed in the SCDM.

Toxicity/Mobility/Persistence Factor Value: 10,000 (Ref. 1, Table 4-26)

4.2.2.2.2 Hazardous Waste Quantity

The source hazardous waste quantity (HWQ) values for each of the four sources is greater than zero. As documented in Section 4.1.4.3, wetlands are subject to Level I and II concentrations; therefore, a default value of 100 is assigned for the HWQ factor value (Ref. 1, Section 2.4.2.2, Table 2-6).

Hazardous Waste Quantity Factor Value: 100

4.2.2.2.3 Waste Characteristics Factor Category Value

The waste characteristics factor value is determined from the product of the toxicity/mobility/persistence value for lead and nickel (10,000) and HWQ factor values, and is subject to a maximum product of 1×10^8 (Ref. 1, Table 2-7).

$$10{,}000 \times 100 = 1\times10^6$$

Toxicity/Persistence Factor Value: 10,000
Waste Characteristics Product: 1×10^6
Waste Characteristics Factor Category Value: 32
(Ref. 1, Table 2-7)

4.2.3.2 WASTE CHARACTERISTICS

4.2.3.2.1 Toxicity/Mobility/Persistence/Bioaccumulation

The toxicity, mobility, persistence, and bioaccumulation factor values associated with hazardous substances detected in the sources at the Sherwin-Williams/Hilliards Creek are summarized in Table 34.

TABLE 34

TOXICITY/MOBILITY/PERSISTENCE/BIOACCUMULATION FACTOR VALUES SHERWIN-WILLIAMS/HILLIARDS CREEK

Hazardous Substance	Source Number	Toxicity/ Mobility/ Persistence Factor Value (Table 33)	Human Food Chain Bioaccumulation Value*	Toxicity/ Persistence/ Mobility/ Bioaccumulation Factor Value	Reference
Acetone	1, 4	0.07	0.5	0.035	2, p. BI-1
Aluminum	1	0.0	50.0	0.0	2, p. BI-1
Antimony	2	100.0	5.0	500.0	2, p. BI-1
Arsenic	1, 2, 3, 4	100.0	5.0	500.0	2, p. BI-1
Barium	1, 2, 3, 4	100.0	500.0	50,000.0	2, p. BI-1
Benzene	1	400.0	5,000.0	2×10^{6}	2, p. BI-2
Benzo(a)anthracene	1, 4	2×10^{-6}	50,000.0	0.1	2, p. BI-2
Benzo(a)pyrene	1, 4	2×10^{-5}	50,000.0	1.0	2, p. BI-2
Benzoic acid	3	--	--	--	2, p. BI-2
Benzo(b)fluoranthene	1, 4	--	--	--	2, p. BI-2
Benzo(k)fluoranthene	1, 4	$2x10^{-7}$	50,000.0	0.01	2, p. BI-2
Beryllium	2	100.0	50.0	5,000.0	2, p. BI-2
Bis (2-ethylhexyl) phthalate	1	2×10^{-5}	50,000.0	1.0	2, p. BI-2
2-Butanone	1, 2, 4	--	--	--	2, p. BI-2
Cadmium	1, 2, 3	100.0	5,000.0	5×10^{5}	2, p. BI-2
Carbon disulfide	3	4.0	500.0	2,000.0	2, p. BI-2
4-Chloroaniline	1	--	--	--	2, p. BI-3
Chlorobenzene	1	0.07	50.0	3.5	2, p. BI-3
Chloroform	4	40.0	5.0	200.0	2, p. BI-3
Chromium	1, 2, 3, 4	100.0	500.0	50,000.0	2, p. BI-3
Chrysene	1, 4	2×10^{-8}	5.0	1×10^{-7}	2, p. BI-3
Cobalt	2, 4	0.1	5,000.0	500.0	2, p. BI-3
Copper	1, 2, 3	0	500.0	0	2, p. BI-3
Cyanide	4	100.0	0.5	50.0	2, p. BI-3
1,2-Dichloroethene	1, 2	40.0	50.0	2,000.0	2, p. BI-5
2,4-Dimethylphenol	1	100.0	500.0	50,000.0	2, p. BI-5
Di-n-butyl phthalate	4	10.0	5,000.0	50,000.0	2, p. BI-5

TABLE 34 (Continued)

TOXICITY/MOBILITY/PERSISTENCE/BIOACCUMULATION FACTOR VALUES SHERWIN-WILLIAMS/HILLIARDS CREEK

Hazardous Substance	Source Number	Toxicity/ Mobility/ Persistence Factor Value (Table 33)	Human Food Chain Bioaccumulation Value*	Toxicity/ Persistence/ Mobility/ Bioaccumulation Factor Value	Reference
Ethylbenzene	1, 2, 3, 4	0.007	50.0	0.35	2, p. BI-4
Fluoranthene	1, 4	--	--	--	2, p. BI-6
2-Hexanone	4	--	--	--	2, p. BI-8
Iron	1	0.01	5,000.0	50.0	2, p. BI-8
Lead	1, 2, 3, 4	10,000.0	5.0	50,000.0	2, p. BI-8
Magnesium	1, 2, 4	--	--	--	2, p. BI-8
Manganese	1	100.0	50,000.0	5×10^{6}	2, p. BI-8
Mercury	1, 2, 3, 4	100.0	50,000.0	5×10^{6}	2, p. BI-8
2-Methylnaphthalene	1, 2	0.0	50,000.0	0.0	2, p. BI-9
Naphthalene	1, 2	400.0	50,000.0	2×10^{7}	2, p. BI-9
Nickel	1, 2, 3	100.0	0.5	50.0	2, p. BI-9
Pentachlorophenol	1, 3	100.0	50,000.0	5×10^{6}	2, p. BI-9
Phenanthrene	1, 4	0.0	5,000.0	0.0	2, p. BI-9
Pyrene	1, 4	2×10^{-3}	50,000.0	500.0	2, p. BI-9
Selenium	1	100.0	50.0	5,000.0	2, p. BI-10
Silver	1	100.0	50.0	5,000.0	2, p. BI-10
Tetrachlorothene	1, 2	40.0	50.0	2,000.0	2, p. BI-10
Toluene	1, 4	0.7	50.0	200.0	2, p. BI-11
1,1,1-Trichloroethane	4	0.4	5.0	2.0	2, p. BI-11
1,1,2-Trichloroethane	1, 4	400.0	50.0	2,000.0	2, p. BI-11
Trichloroethene	1, 2, 4	4,000.0	50.0	2×10^{5}	2, p. BI, B2-1
1,2,4-Trimethylbenzene	1	--	--	--	2, p. BI-11
1,3,5-Trimethylbenzene	1	--	--	--	2, p. BI-11
Vanadium	1	1.0	500.0	500.0	2, p. BI-11
Xylenes	1, 2, 3, 4	40.0	50.0	2,000.0	2, p. BI-12
Zinc	1, 2, 3, 4	0.1	5.0	0.5	2, p. BI-12

Notes:
* Fresh-water bioaccumulation values are assigned.
– Not listed in the SCDM.

Toxicity/Mobility/Persistence/Bioaccumulation Factor Value: 2×10^{7}
(Ref. 1, Table 4-26)

4.2.3.2.2 Hazardous Waste Quantity

The source HWQ values for each of the four sources is greater than zero. As documented in Section 4.1.4.3, wetlands are subject to Level I and II concentrations; therefore, a default value of 100 is assigned for the HWQ factor value (Ref. 1, Section 2.4.2.2, Table 2-6).

Hazardous Waste Quantity Factor Value: 100

4.2.3.2.3 Waste Characteristics Factor Category Value

The waste characteristic factor category value is the product of the highest toxicity/mobility/persistence factor value for naphthalene (400) and HWQ factor value, multiplied by the highest bioaccumulation factor value 50,000 for naphthalene(Ref. 1, Section 4.2.3.2.3).

$400 \times 100 = 40,000$

Toxicity/persistence factor value
$\times$ hazardous waste quantity factor value: 1×10^5

$40,000 \times 50,000 = 2 \times 10^9$

(Toxicity/persistence $\times$ hazardous waste quantity)
$\times$ bioaccumulation potential factor value: 2×10^9

Waste Characteristics Factor Category Value: 180
(Ref. 1, Table 2-7)

4.2.3.3 HUMAN FOOD CHAIN THREAT - TARGETS

<u>**Actual Human Food Chain Contamination**</u>

Although aqueous and sediment samples document an observed release to the Hilliards Creek, actual food chain contamination is not scored because no fisheries are documented within the areas of the observed release (Ref. 1, Section 4.2.3.3).

4.2.3.3.1 Food Chain Individual

No hazardous substance having a bioaccumulation factor value of greater than 500 was detected in both the observe release to ground water and in the observed release to surface water. Lead was the only hazardous substance detected in both the observed release to surface water and ground water migration pathways. The food chain individual factor is assigned a value of 0 (Ref. 1, Section 4.1.3.3.1).

Food Chain Individual Factor Value: 0
(Ref. 1 [Section 4.1.3.3.1])

4.2.4 ENVIRONMENTAL THREAT

4.2.4.2 Waste Characteristics

4.2.4.2.1 Ecosystem Toxicity/Mobility/Persistence/Bioaccumulation

The ecosystem toxicity/mobility/persistence/bioaccumulation factor values for hazardous substances detected in sources with a containment value greater than zero are summarized in Tables 35 and 36.

TABLE 35

ECOSYSTEM TOXICITY/MOBILITY/PERSISTENCE FACTOR VALUES SHERWIN-WILLIAMS/HILLIARDS CREEK

Hazardous Substance	Source Number	Ecosystem Toxicity Value*	Mobility Value**	Persistence Value***	Ecosystem Toxicity/ Persistence Factor Value	Reference
Acetone	1, 4	100	1.0	0.1	7.0	2, p. BI-1
Aluminum	1	100	1.0	1.0	100	2, p. BI-1
Antimony	2	100	1×10^{-2}	1.0	1.0	2, p. BI-1
Arsenic	1, 2, 3, 4	10	1×10^{-2}	1.0	0.1	2, p. BI-1
Barium	1, 2, 3, 4	1	1×10^{-2}	1.0	0.1	2, p. BI-1
Benzene	1	1,000	1.0	0.4	400.0	2, p. BI-2
Benzo(a)anthracene	1, 4	10,000	2×10^{-9}	1.0	2×10^{-5}	2, p. BI-2
Benzo(a)pyrene	1, 4	10,000	2×10^{-9}	1.0	2×10^{-5}	2, p. BI-2
Benzoic acid	3	--	--	--	--	2, p. BI-2
Benzo(b)fluoranthene	1, 4	--	--	--	--	2, p. BI-2
Benzo(k)fluoranthene	1, 4	0	1×10^{-4}	1.0	0.0	2, p. BI-2
Beryllium	2	0	1×10^{-2}	1.0	0.0	2, p. BI-2
Bis(2-ethylhexyl)phthalate	1	1,000	2×10^{-7}	1.0	2×10^{-4}	2, p. BI-2
2-Butanone	1, 2, 4	-	-	-	-	2, p. BI-2
Cadmium	1, 2, 3	10,000	1×10^{-2}	1.0	100	2, p. BI-2
Carbon disulfide	3	100	1.0	0.4	40	2, p. BI-2
Chlorobenzene	1	10,000	1.0	0.0007	7.0	2, p. BI-2
Chloroform	4	100	1.0	0.40	40	2, p. BI-3
Chromium	1, 2, 3, 4	10,000	1×10^{-2}	1.0	100	2, p. BI-3
Chrysene	1, 4	1,000	2×10^{-9}	1.0	2×10^{-6}	2, p. BI-3
Cobalt	2, 4	0	1×10^{-2}	1.0	0.0	2, p. BI-3
Copper	1, 2, 3	1,000	1×10^{-2}	1.0	10	2, p. BI-3
Cyanide	4	1,000	1.0	1.0	1,000	2, p. BI-3
1,2-Dichloroethene	1, 2	1	1×10^{-2}	0.4	4×10^{-3}	2, p. BI-4
2,4-Dimethylphenol	1	100	1×10^{-2}	0.4	0.4	2, p. BI-4
Di-n-butyl phthalate	4	1,000	2×10^{-5}	1.0	2×10^{-2}	2, p. BI-5

TABLE 35 (Continued)

ECOSYSTEM TOXICITY/MOBILITY/PERSISTENCE FACTOR VALUES SHERWIN-WILLIAMS/HILLIARDS CREEK

Hazardous Substance	Source Number	Ecosystem Toxicity Value*	Mobility Value**	Persistence Value***	Ecosystem Toxicity/ Persistence Factor Value	Reference
Ethylbenzene	1, 2, 3, 4	100	1×10^{-2}	0.0007	0.07	2, p. BI-6
Fluoranthene	1, 4	--	--	--	--	2, p. BI-6
2-Hexanone	4	--	--	--	--	2, p. BI-8
Iron	1	10	1×10^{-2}	1.0	0.1	2, p. BI-8
Lead	1, 2, 3, 4	1,000	1.0	1.0	1,000	2, p. BI-8
Manganese	1	0	1×10^{-2}	1.0	0.0	2, p. BI-8
Mercury	1, 2, 3, 4	10,000	1×10^{-2}	1.0	100	2, p. BI-8
2-Methylnaphthalene	1, 2	100	2×10^{-3}	0.4	0.1	2, p. BI-8
Naphthalene	1, 2	1,000	1.0	0.4	400	2, p. BI-9
Nickel	1, 2, 3	100	1×10^{-2}	0.4	0.4	2, p. BI-9
Pentachlorophenol	1, 3	100	1.0	1.0	100	2, p. BI-9
Phenanthrene	1, 4	10,000	2×10^{-5}	0.04	0.1	2, p. BI-9
Pyrene	1, 4	10,000	2×10^{-5}	1.0	0.2	2, p. BI-9
Selenium	1	1,000	1.0	1.0	1,000	2, p. BI-10
Tetrachloroethene	1, 2	0	1.0	0.40	0.0	2, p. BI-10
Toluene	1, 4	100	1.0	0.07	7.0	2, p. BI-11
1,1,2-Trichloroethane	1, 4	100	1.0	0.4	40	2, p. BI-11
Trichloroethene	1, 2, 4	100	1.0	0.4	40	2, p. BI, B2-1
1,2,4-Trimethylbenzene	1	--	--	--	--	2, p. BI-11
1,3,5-Trimethylbenzene	1	--	--	--	--	2, p. BI-11
Vanadium	1	0	1×10^{-2}	1.0	0.0	2, p. BI-11
Xylenes	1, 2, 3, 4	100	1.0	0.4	40	2, p. BI-12
Zinc	1, 2, 3, 4	10	1.0	0.4	4.0	2, p. BI-12

Notes:
* Fresh water ecotoxicities are assigned.
** Mobility factor value of 1 assigned to those hazardous substances for which an observed release to ground water is documented.
*** Persistence values for river.
– Not listed in the SCDM.

TABLE 36

ECOSYSTEM TOXICITY/MOBILITY/PERSISTENCE AND BIOACCUMULATION FACTOR VALUES SHERWIN-WILLIAMS/HILLIARDS CREEK

Hazardous Substance	Source Number	Ecosystem Toxicity/ Mobility/ Persistence Factor Value (Table 35)	Bioaccumulation Factor Value*	Ecosystem Toxicity/ Persistence/ Bioaccumulation Factor Value	Reference
Acetone	1, 4	7.0	0.5	3.5	2, p. BI-1
Aluminum	1	100	5,000	$5x10^{5}$	2, p. BI-1
Antimony	2	1.0	5	5	2, p. BI-1
Arsenic	1, 2, 3, 4	0.1	5,000	500	2, p. BI-1
Barium	1, 2, 3, 4	0.1	500	50	2, p. BI-1
Benzene	1	400	5,000	$2x10^{6}$	2, p. BI-2
Benzo(a)anthracene	1, 4	2×10^{-5}	50,000	1.0	2, p. BI-2
Benzo(a)pyrene	1, 4	2×10^{-5}	50,000	1.0	2, p. BI-2
Benzoic acid	3	--	--	--	2, p. BI-2
Benzo(b)fluoranthene	1, 4	--	--	--	2, p. BI-2
Benzo(k)fluoranthene	1, 4	0.0	50,000	0.0	2, p. BI-2
Beryllium	2	0.0	50	0.0	2, p. BI-2
Bis(2-ethylhexyl) phthalate	1	2×10^{-4}	50,000	10	2, p. BI-2
2-Butanone	1, 2, 4	-	-	-	2, p. BI-2
Cadmium	1, 2, 3	100	50,000	5×10^{6}	2, p. BI-2
Carbon disulfide	3	40	500	50,000	2, p. BI-2
Chlorobenzene	1	7	5,000	35,000	2, p. BI-3
Chloroform	4	40	500	20,000	2, p. BI-3
Chromium	1, 2, 3, 4	100	500	50,000	2, p. BI-3
Chrysene	1, 4	2×10^{-6}	5,000	0.01	2, p. BI-3
Cobalt	2, 4	0.0	5,000	0.0	2, p. BI-3
Copper	1, 2, 3	10	50,000	$5x10^{5}$	2, p. BI-3
Cyanide	4	1,000	0.5	500	2, p. BI-3
1,2-Dichloroethene	1, 2	0.004	50	0.2	2, p. BI-5
2,4-Dimethylphenol	1	0.4	500	200	2, p. BI-4
Di-n-butyl phthalate	4	2×10^{-2}	5,000	100	2, p. BI-5
Ethylbenzene	1, 2, 3, 4	0.07	50	0.35	2, p. BI-4
Fluoranthene	1, 4	--	--	--	2, p. BI-6
2-Hexanone	4	--	--	--	2, p. BI-8
Iron	1	0.1	5,000	500	2, p. BI-8

TABLE 36 (Continued)

ECOSYSTEM TOXICITY/PERSISTENCE FACTOR VALUES SHERWIN-WILLIAMS/HILLIARDS CREEK

Hazardous Substance	Source Number	Ecosystem Toxicity/ Mobility/ Persistence Factor Value (Table 35)	Bioaccumulation Factor Value*	Ecosystem Toxicity/ Persistence/ Bioaccumulation Factor Value	Reference
Lead	1, 2, 3, 4	1,000	50,000	5×10^7	2, p. BI-8
Magnesium	1, 2, 4	--	--	--	2, p. BI-8
Manganese	1	0.0	50,000	0.0	2, p. BI-8
Mercury	1, 2, 3, 4	100	50,000	5×10^6	2, p. BI-8
2-Methylnaphthalene	1, 2	0.1	50,000	4,000	2, p. BI-8
Naphthalene	1, 2	400	50,000	2×10^7	2, p. BI-9
Nickel	1, 2, 3	0.4	500	200.0	2, p. BI-9
Pentachlorophenol	1, 3	100	50,000	5×10^6	2, p. BI-9
Phenanthrene	1, 4	0.1	50,000	5,000	2, p. BI-9
Pyrene	1, 4	0.2	50,000	25,000	2, p. BI-9
Selenium	1	1,000	500	$5x10^5$	2, p. BI-10
Silver	1	10,000	50	$5x10^5$	2, p. BI-10
Tetrachloroethene	1, 2	0.0	50	0.0	2, p. BI-11
Toluene	1, 4	7.0	5,000	35,000	2, p. BI-11
1,1,1-Trichloroethane	4	0.4	5	2	2, p. BI-11
1,1,2-Trichloroethane	1, 4	40	50	2,000	2, p. BI-11
Trichloroethene	1, 2, 4	40	50	2,000	2, p. BI, B2-1
1,2,4-Trichloromethylbenzene	1	--	--	--	2, p. BI-11
1,3,5-Trichloromethylbenzene	1	--	--	--	2, p. BI-11
Vanadium	1	0.0	500	0.0	2, p. BI-11
Xylenes	1, 2, 3, 4	40	50	2,000	2, p. BI-12
Zinc	1, 2, 3, 4	4.0	50,000	2×10^5	2, p. BI-12

Notes:
* Fresh-water bioaccumulation factor values are assigned.
– Not listed in the SCDM.

Ecosystem Toxicity/Mobility/Persistence/Bioaccumulation Potential Factor Value: 5×10^7

4.2.4.2.2 Hazardous Waste Quantity

The source HWQ values for each of the four sources is greater than zero. As documented in Section 4.1.4.3, wetlands are subject to Level I and II concentrations; therefore, a default value of 100 is assigned for the HWQ value (Ref. 1, Section 2.4.2.2, Table 2-6).

Hazardous Waste Quantity Factor Value: 100

4.2.4.2.3 Waste Characteristics Factor Category Value

The waste characteristics factor category value is determined by taking the product of the highest ecosystem toxicity/mobility/persistence factor value for lead and the HWQ value and multiplying the product by the highest ecosystem bioaccumulation factor value for lead (Ref. 1, Section 4.1.4.2.3).

$1{,}000 \times 100 = 100{,}000$

Ecosystem toxicity/persistence factor value
× Hazardous waste quantity factor value: 100,000

$100{,}000 \text{ x } 50{,}000 = 5 \times 10^{9}$

(Ecosystem toxicity/persistence X hazardous waste quantity)
× ecosystem bioaccumulation potential factor value: 5×10^{9}

Waste Characteristics Factor Category Value: 180
(Ref. 1, Table 2-7)

4.2.4.3 ENVIRONMENTAL THREAT - TARGETS

Level I Concentrations

The Level I concentrations for ground water to surface water migration component are the same concentrations documented in Section 4.1.4.3 for the surface water overland flow component. Lead was documented in both an observed release to ground water and to surface water as documented in Section 4.0 of this documentation record (Ref. 1, Section 4.2.1.3 and Section 4.2.1.4). Because the surface water sampling locations documenting Level I concentrations and the PPE to surface water from overland flow and ground water are the same, the Level I targets are the same. See Section 4.1.4.3 for the Level I concentrations.

4.2.4.3.1 Sensitive Environments

4.2.4.3.1.1 Level I Concentrations

Sensitive Environments

Sensitive environments other than wetlands have not been identified within the 15-mile downstream target distance.

Wetlands

The wetland areas were identified from Reference 93, Wetland Inventory Map. The wetland is a palustrine forested broad-leaved deciduous and needle-leaved evergreen, and palustrine scrub/shrub and emergent wetland (Ref. 93). The sampling locations identified in the Level I Concentrations section above are within this wetland (Ref. 97). The wetlands subject to Level I concentrations are those wetlands located between PPE-1 and the most distance downstream Level I sampling location (HC-SW-39) (Ref. 1, Section 4.1.1.2).

The total length of wetlands from PPE-1 to the most downstream sampling location (HC-SW-39) containing Level I concentrations is estimated to be 5,708 feet (Refs. 93; 97). Since wetlands are located on both sides of Hilliards Creek, the total length of wetlands subject to Level I concentrations is two times 5,708 feet or 11,416 feet or 2.16 miles (Ref. 1, Section 4.1.4.3.1.1). The wetland frontage is summarized in Table 25.
The wetland frontage is summarized in Table 37.

TABLE 37

LEVEL I WETLAND FRONTAGE

Wetland	Wetland Frontage	Reference
Palustrine emergent, palustrine forested, palustrine scrub/shrub	2.16 mile	93; 97

Total Level I Wetland Frontage: 2.16 mi.

The wetland ratings value for 2.16 miles is obtained from Reference 1, Table 4-24 and is 78.

Level I Wetland Value: 50
(Ref. 1, Table 4-24)

For wetlands subject to Level I concentrations, the wetland value (75) is multiplied by 10 (Ref. 1, Section 4.1.4.3.1.1).

Level I Concentrations Factor Value: 750 (Ref. 1, Section 4.1.4.3.1.1)

4.2.4.3.1 Sensitive Environments

4.2.4.3.1.1 Level II Concentrations

Sensitive Environments

Sensitive environments other than wetlands have been not been identified within the 15-mile downstream target distance.

Wetlands

The wetland length subject to Level II concentrations is located between surface water sampling location HC-SW-39 (most distance Level I concentration) and sediment sampling location HC-SD-43, the most distant Level II sediment sampling location. That length is estimated to be 778 feet or 0.15 mile as measured on Ref. 97 (Refs. 93; 97) and includes the length of wetlands on both the north and south banks of Hilliards Creek (Ref. 1, Section 4.1.4.3.1.1). The Level II wetland frontage is summarized in Table 38.

TABLE 38

LEVEL II WETLAND FRONTAGE

Wetland	Wetland Frontage	Reference
Palustrine emergent, palustrine forested, palustrine scrub/shrub	0.15 mile	93; 97

Total Level I Wetland Frontage: 0.15 mile

The wetland ratings value for 0.15 mile of wetland frontage is obtained from Reference 1, Table 4-24 and is 25.

Level II Wetland Value: 25
(Ref. 1, Table 4-24)
Level II Concentrations Factor Value: 25 (Ref. 1, Section 4.1..4.3.1.2)

4.2.4.3.1.3 Potential Contamination

Sensitive Environments

Sensitive environments potentially exposed to contaminants from the Sherwin-Williams/Hilliards Creek are not evaluated because the presence of sensitive environments other then wetlands subject to Level I and II concentrations have not been identified.

Potential Contamination Factor Value (SP): Not evaluated