180485

HRS DOCUMENTATION RECORD

Name of Site: Standard Chlorine Chemical Company, Inc.

EPA Region: 2

Date Prepared: April 2003

Street Address of Site: 1015-1035 Belleville Turnpike

City, County, State: Kearny, Hudson County, NJ 07032-4410

General Location in the State: Northern NJ

Topographic Map: Weehawken & Jersey City, NJ (Ref. 3)

Latitude: 40° 45' 00" North

Longitude: 74° 05 '50" West

Ref: 4

EPA ID No: NJD002175057

Scores

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

HRS DOCUMENTATION RECORD COVER SHEET

Name of Site: Standard Chlorine Chemical Company, Inc.
EPA ID No. NJD002175057

Contact Persons

Documentation Record and Site Investigation: Kristin Dobinson (212) 637-4328
U.S. Environmental Protection Agency
New York, NY

Pathways, Components, or Threats Not Scored

Elevated levels of hazardous substances are present in the soil, air, and groundwater at this facility, however, there is not enough documentation at this time to score these pathways. Additionally, there are no documented drinking water targets within the TDL, therefore, it was not included in the score for the surface water pathway.

WORKSHEET FOR COMPUTING HRS SITE SCORE

		S	S^2
1.	Ground Water Migration Pathway Score (S_{gw}) (from Table 3-1, line 13)	Not Scored	—
2a.	Surface Water Overland/Flood Migration Component (from Table 4-1, line 30)	100	
2b.	Ground Water to Surface Water Migration Component (from Table 4-25, line 28)	Not Scored	
2c.	Surface Water Migration Pathway Score (S_{sw} Enter the larger of lines 2a and 2b as the pathway score.	100	10,000
3.	Soil Exposure Pathway Score (S_s (from Table 5-1, line 22)	Not Scored	—
4.	Air Migration Pathway Score (S_a) (from Table 6-1, line 12)	Not Scored	—
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	

TABLE 4-1
SURFACE WATER OVERLAND/FLOOD MIGRATION COMPONENT SCORESHEET

Factor Categories and Factors	Maximum Value	Value Assigned
DRINKING WATER THREAT		
Likelihood of Release		
1. Observed Release	550	550
2. Potential to Release by Overland Flow		
2a. Containment	10	_
2b. Runoff	25	_
2c. Distance to Surface Water	25	_
2d. Potential to Release by Overland Flow (lines 2a x [2b + 2c])	500	_
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	_
7. Hazardous Waste Quantity	a	_
8. Waste Characteristics	100	_
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	_

Factor Categories and Factors	Maximum Value	Value Assigned
DRINKING WATER THREAT (Concluded)		
Drinking Water Threat Score		
13. Drinking Water Threat Score ([lines 5 x 8 x 12]/82,500, subject to a maximum of 100)	100	—
HUMAN FOOD CHAIN THREAT		
Likelihood of Release		
14. Likelihood of Release (same value as line 5)	550	550
Waste Characteristics		
15. Toxicity/Persistence/Bioaccumulation	a	$5x10^7$
16. Hazardous Waste Quantity	a	100
17. Waste Characteristics	1,000	180
Targets		
18. Food Chain Individual	50	45
19. Population		
19a. Level I Concentrations	b	—
19b. Level II Concentrations	b	0.03
19c. Potential Human Food Chain Contamination	b	—
19d. Population (lines 19a + 19b + 19c)	b	0.03
20. Targets (lines 18 + 19d)	b	45.03
Human Food Chain Threat Score		
21. Human Food Chain Threat Score ([lines 14 x 17 x 20]/82,500, subject to a maximum of 100)	100	54.036

Factor Categories and Factors	Maximum Value	Value Assigned
ENVIRONMENTAL THREAT		
Likelihood of Release		
22. Likelihood of Release (same value as line 5)	550	550
Waste Characteristics		
23. Ecosystem Toxicity/Persistence/ Bioaccumulation	a	$5x10^7$
24. Hazardous Waste Quantity	a	100
25. Waste Characteristics	1,000	180
Targets		
26. Sensitive Environments		
26a. Level I Concentrations	b	—
26b. Level II Concentrations	b	125
26c. Potential Contamination	b	—
26d. Sensitive Environments (lines 26a + 26b + 26c)	b	125
27. Targets (value from 26d)	b	125
Environmental Threat Score		
28. Environmental Threat Score ([lines 22 x 25 x 27]/82,500, subject to a maximum 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 maximum of 100)	100	100
SURFACE WATER OVERLAND/FLOOD MIGRATION COMPONENT SCORE		
30. Component Score (S_{of})[c], (highest score from line 29 for all watersheds evaluated, subject to a maximum of 100)	100	100

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

REFERENCES

Ref. No.	Description of the Reference
1.	U.S. Environmental Protection Agency (EPA). Hazard Ranking System, 40 CFR Part 300, Appendix A, 55 FR 51533. December 14, 1990. 165 pages.
2.	EPA. Superfund Chemical Data Matrix. June 1996. 9 pages.
3.	U.S. Geological Survey (USGS), Jersey City Quadrangle, Weehawken Quadrangle. 2 maps.
4.	EPA. Latitude and Longitude Calculation Worksheet. 3 pages.
5.	EPA, National Wetlands Inventory (NWI) map. March 2003. 1 map.
6.	Brown and Caldwell, Addendum to Volume IIA, Remedial Investigation (RI) Workplan, NJDEP Site Identification No. 116 (Standard Chlorine) Volume I -Report and Appendices A and C, for Chemical Land Holdings, Inc., July 2001. 293 pages.
7.	Dobinson, Kristin, EPA Region II, Photo log of Standard Chlorine Site Visit, 13 December, 2001. 9 pages.
8.	Weston, Remedial Investigation for the Standard Chlorine Chemical Company, Inc, and Standard Naphthalene Products Inc. Properties, for Standard Chlorine Chemical Company, Inc., May 1993. 229 pages.
9.	Environmental Resources Management (ERM), Focused Remedial Investigation (FRI) Report, for Standard Chlorine Chemical Company, Inc. and Standard Naphthalene Products Inc. Site, January 1997. 226 pages.
10.	Key Environmental, Supplemental Remedial Investigation Report, for Standard Chlorine Chemical Company, April 1999. 154 pages.
11.	E.C. Jordan Co., Phase II Dioxin Site Investigation-Final Report Standard Chlorine Chemical Company, for NJ Department of Environmental Protection, December 1985. 44 pages.
12.	Weston, Stage I Analysis Report for: Sampling and Analysis of Potentially Dioxin Contaminated Materials in Waste Lagoons, for Standard Chlorine Chemical Company, Inc., Volume I, September 1987. 43 pages.
13.	Weston, Stage II and III Analysis Report for: Sampling and Analysis of Potentially Dioxin Contaminated Materials in Waste Lagoons, for Standard Chlorine Chemical Company, Inc., May 1988. 30 pages.
14.	EPA Region 2 Superfund Contract Support Team, Sampling Report for Standard Chlorine Site, 2-3 October, 2002. 931 pages.
15.	Dobinson, Kristin, EPA Region II, Project Note to Standard Chlorine File, Subject: TOC Normalized Data, 26 March, 2003. 5 pages.
16.	Boyle, Susan B., NJ Department of Environmental Protection (NJDEP), Letter to Director R. Caspe of EPA Re: NPL Listing Request - Standard Chlorine Chemical Company, 04 December, 2001. 3 pages.

17. Workman, Robert, Enviro-Sciences, Inc., Letter to Maria Franco-Spera of NJDEP RE: Drum Storage Inventory at Standard Chlorine Chemical Company, 7 November, 2000. 14 pages.

18. NJ Department of Environmental Protection (NJDEP), Public Health Advisories and Guidance on Fish Consumption for Recreational Fishing : 2003 Fish Consumption Advisories for PCBs and Dioxin http://www.nj.gov/dep/dsr/pcb-dioxin-chart.htm Accessed on 25 March, 2003. 5 pages.

19. Dobinson, Kristin, EPA Region II, Project Note to Standard Chlorine File, Subject: Fish Consumption Advisories, 25 March, 2003. 1 page.

20. Dobinson, Kristin, EPA Region II, Project Note to Standard Chlorine File, Subject: Hackensack River Keeper, 01 March 2002. 1 page.

21. Dobinson, Kristin, EPA Region II, Project Note to Standard Chlorine File, Subject: Fishing in the Hackensack River at the Standard Chlorine Site, 19 February, 2003. 1 page.

22. US Fish and Wildlife Service, Southern New England-New York Bight Coastal Ecosystems Program, Regionally Significant Habitats and Habitat Complexes of the New York Bight Watershed, November 1996. 38 pages.

23. NJDEP, Administrative Consent Order In the Matter of Standard Chlorine Chemical Corporation, Kearny, NJ, 20 October, 1989. 22 pages.

24. Dobinson, Kristin, EPA Region II, Project Note to Standard Chlorine File, Subject: Estimated Mean Annual Flow for the Hackensack River, 18 March, 2003. 5 pages.

25. Mack, W.M., Lockheed Martin Services, Aerial Photographic Analysis of Standard Chlorine Chemical Corporation Site, for EPA Region 2, May 2002. 85 pages.

26. US EPA, Quick Reference Fact Sheet: Multi-Media Dioxin and Furan Analytical Service for Superfund (DLM01.4). EPA 540-F-02-007. September 2002. 4 pages.

27. EPA, 15-mile Target Distance Limit Map, March 2003. 1 map.

28. Dobinson, Kristin, EPA Region II, Photo log of Standard Chlorine Site Visit, 7 May, 2002. 15 pages.

SITE SUMMARY

The Standard Chlorine Chemical Company, Inc. (Standard Chlorine), site is located in an industrial area along the tidally-influenced Hackensack River in Kearny Township, New Jersey. The Standard Chlorine facility occupies approximately 25 acres in the Hackensack Meadowlands. Various forms of chemical manufacturing and/or processing have occurred at this facility since 1916 when the White Tar Company purchased lots on the eastern portion of the site. White Tar refined crude naphthalene at the site from 1916 to 1942, when Koppers Company, Inc. (Koppers) acquired the facility. Koppers processed approximately 11,000 tons per year of crude naphthalene and naphthalene oil and produced creosote disinfectants. In 1946, Koppers purchased adjacent property and opened the Tar Products Division - Meadows Plant, which included the storage and packaging of 1,4-dichlorobenzene moth preventatives and deodorizers in solid form (Ref. 6, pp. 1-1). The Thomas A. Edison Co., the Edison Storage Battery Co., and Emark Battery Corp. used acid and lead-lined acid equipment on site. Crown Rubber Products, Inc. and Keaton Rubber Co. were manufacturers of insulating raw rubber parts (Ref. 6, pp. 1-2). Tanatex Chemical Corp, a part of Sybron Chemicals, Inc. operated at the site between 1959 and 1962. Tanatex produced dye carriers involving the use of methylnaphthalenes, alkynated naphthalenes, chlorinated benzenes, and other common dye carrier solvents until the early 1960's (Ref. 6, pp. 1-2).

In 1962, part of the site was sold to Standard Chlorine and another part was sold to Standard Naphthalene Products, Inc. (SNP), a wholly owned subsidiary of Standard Chlorine. SNP processed liquid petroleum naphthalene at the site from 1963 to 1982 for the production of moth balls, flakes, and crystals From 1963 to 1993, Standard Chlorine carried out operations at this site under its own name and the name of Chloroben Corporation (Chloroben), a subsidiary of Standard Chlorine. Standard Chlorine manufactured moth crystals and flakes from dichlorobenzene isomers. Standard Chlorine separated dichlorobenzenes from 1963 to 1982. Standard Chlorine also separated and stored 1,2,4-trichlorobenzene from 1970 to 1980. After closing the dichlorobenzene operation in 1981, Standard Chlorine converted liquid naphthalene into mothballs, flakes and chips. This operation was discontinued in mid-1982 (Ref. 6, pp. 1-2). For a period extending until 30 April, 1993, Chloroben operated a batch formulation and blending operation at the site producing various solvents and inorganic chemicals for use in cleaning drains, sewers, and septic tanks (Ref. 6, pp. 1-2 - 1-3).

In 1989, an Administrative Consent Order (ACO) was entered into between the New Jersey Department of Environmental Protection (NJDEP) and Standard Chlorine. The ACO required Standard Chlorine to plan and implement several interim remedial measures (IRMs), a remedial investigation of the site, and an evaluation and selection of a remedial action (Ref. 16; 23).

Several potential source areas exist at the Standard Chlorine site. The primary areas of concern include contaminated soils and two lagoons located on the eastern portion of the facility property (Ref. 8, pp.5-2 - 5-3, 5-7 - 5-8, 5-17, 5-21- 5-24). These areas appear to ultimately drain into the Hackensack River via three probable points of entry: a drainage pipe along the northern property boundary, a drainage ditch that runs along the southern property boundary, and overland runoff that flows directly from the facility property to the river (Ref.8, pp. 5-24 - 5-25; Ref. 11, pp.10-11). Tanks and drums containing (or at one time contained) various site-related hazardous substances, such as dioxin and asbestos, also are present at the facility (Ref. 8, pp.3-4; 16; 17).

The predominant hazardous substances associated with the lagoons and surrounding contaminated soils include: benzene, dichlorobenzenes, chlorobenzene, trichlorobenzenes, trimethylbenzene, naphthalene, and dioxin (TCDD). In addition, PCB-1260 was detected at 9300 milligrams per kilogram (mg/kg) in concrete chips taken from the vicinity of the former transformer, and at lesser concentrations (0.12 to 0.29 mg/kg) in soil samples collected directly beneath the concrete pavement (Ref. 10, pp. 39).

Data from sampling events conducted between 1992 and 2002 indicate that a release of site-related hazardous substances has occurred to the Hackensack River and adjacent wetlands. Dioxins, dichlorobenzenes, 1,2,4-trichlorobenzene, naphthalene, benzene, and chlorobenzene, as well as several other semivolatile and volatile organic compounds, were detected at varying levels in these samples. During the 2002 EPA sampling event, dioxin (2,3,7,8-TCDD) was detected at 96.1 nanograms per kilogram (ng/kg) in a sediment sample taken from the Hackensack River (Ref. 14, pp. 93, 821, 923). Surface water samples taken from the outfall at the point of

discharge to the Hackensack show concentrations of naphthalene at 45 µg/kg and 1,2,4-trichlorobenzene at 12 µg/kg (Ref. 14, pp. 8, 93, 644, 922). During the October 2002 EPA sampling event, a seep was observed entering the Hackensack River from the sediment southeast of the outfall where the southern drainage ditch confluences with the Hackensack River (Ref. 14, pp. 920). The seep was black in color with observed sediment (Ref. 14, pp. 920). Chemical analysis of the seep indicates the presence of 1,4-dichlorobenzene at 2 µg/kg (Ref. 14, pp. 542, 641, 920).

Historic records indicate that approximately 400 drums and seven plastic bags containing dioxin contaminated asbestos material previously removed from the distillation building had been stored in a "block" building in the lagoon area. In May 2000, the NJDEP directed Standard Chlorine to perform an inventory and evaluation of all drums, containers, aboveground tanks, etc that remained at the site which contained hazardous substances or hazardous waste. In August 2000, Standard Chlorine was directed to remove the drums containing dioxin contaminated asbestos material, to classify the contents of the drums containing tank bottoms and other material resulting from various site investigations, and to remove approximately 143 drums that were mostly empty or contained trash. Approximately 550 drums have been consolidated into six sea boxes and remain on site (Ref. 8, pp. 3-4; 16; 17).

In December 2001, NJDEP requested that EPA evaluate the Standard Chlorine site for listing on the National Priorities List due to the complex environmental issues present at the site and the inability of the responsible parties to address the issues. The NJDEP indicated that Standard Chlorine had not completed Remedial Investigation activities and was non-compliant with the terms of the 1989 ACO. While another ACO exists with Chemical Land Holdings (CLH), the scope of work is limited to chromium related issues and will not address the entire site. The NJDEP has terminated their ACO with Standard Chlorine (Ref. 16).

Warnings pertaining to the consumption of some fish (particularly crab) and a health advisory have been issued for the Hackensack River due to PCB and dioxin contamination, originating in part from the Standard Chlorine site (Ref. 18; 19). However, fishing still occurs along the river, and there is heavy recreational use of the river directly adjacent to the site (Ref. 20; 21). The site lies in the Hackensack Meadowlands which has been identified by the US Fish and Wildlife Service as a Significant Habitat Complex of the New York Bight Watershed at the request of the US EPA's New York - New Jersey Harbor Estuary Program, and is a habitat for some state or Federal designated endangered and/or threatened species (Ref. 22, pp. 26, 37; 27). Releases of site-related hazardous substances to ground water also have been documented since at least the early 1980s, and air releases pose a threat to a large population within 4 miles of the site (Ref. 23, pp.2-3; 8, pp. 1-7, 1-12 - 1-13; 11, pp.7).

2.2 SOURCE CHARACTERIZATION

2.2.1 SOURCE IDENTIFICATION

Name of source: Lagoons Number of source: 1

Source Type: Surface Impoundment

Description and Location of Source: Source 1 is a lagoon that encompasses an area of approximately 33,000 square feet and extends to an average depth of 6 feet below grade (Ref. 8, pp. 5-3). The lagoon is two contiguous units, designated as the east lagoon and west lagoon, containing a combined estimated volume of approximately 7,300 cubic yards of material. (Ref. 9, pp. 6; 23, pp. 1; 28, pp. 10). The lagoon bottom is at approximately 5 feet below mean sea level (msl) to 9 feet below msl and the base of the waste material is in contact with the water table (Ref. 10, pp. 10, Ref. 8, pp. 5-3). It is located on the eastern portion of the property, situated between the Hackensack River to the east, the Conrail right of way to the west, and the southern drainage ditch to the south (Ref. 9, pp. 18). The east lagoon is located approximately 25 feet from the Hackensack River (Ref. 23, pp. 1).

Residual wastes associated with the lagoon include sludge and viscous oils. The sludge is typically black and viscous, with a significant solids content. The oils, where observed, appear as free-phase liquids or DNAPL. Although two physically distinct layers of waste sludge were detected in the lagoons, the constituents detected in the sludge samples from both layers were fairly consistent. The chemical composition of the sludge has been identified from the analyses of four sludge samples collected as part of the Weston Remedial Investigation (RI) Report. The lagoons consist of two major layers of materials: 1-3 feet of white to brown material with bladed crystals, silt and fine sand; the lower layer consists of 3-4 feet of black tar material (Ref. 8, pp. 5-3). Samples were taken from each layer in the east (ELS1, ELS2) and west (WLS1, WLS2) sides of the lagoons (Ref. 8, fig.5-1). The most common VOCs present within the lagoon sludges include ethylbenzene, benzene, methylene chloride, and toluene (Ref. 9, pp. 25; Ref. 6 Table116-04, pp.1,4; 8, table 5-1). The most common SVOCs present within the lagoon sludges include naphthalene,1,2-dichlorobenzene, 1,3-dichlorobenzene, and 1,4-dichlorobenzene (Ref. 9, pp. 25; 6 Table116-04, pp. 10, 13; 8, table 5-1). The major constituent in each of the samples was naphthalene which accounted for between 30 and almost 99 percent of the sample content (Ref. 8, pp. 5-8).

In February and March 1987, a "Stage I" dioxin sampling event was conducted (Ref. 6, pp.2-2; 12; 23, pp.4). Samples were collected at four depths at a total of 20 locations (sample locations A through T). The first two shallow samples were analyzed and the two deeper core samples were archived to be analyzed for dioxin if the shallow samples revealed contamination (Ref. 12, pp. 19; 23, pp.4). The results of the re-analyzed samples are referred to as Stages II and III (Ref. 6, pp.2-2; 12, pp. 19; 13, pp. 11-12). These samples were taken in the lagoon area and show contamination of 2,3,7,8-TCDD (Ref. 6, pp. 2-3, fig. 116-2.8; 12, pp. 8-9, 21, 24; 13, pp. 13, 14-15, 24, 25).

2.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE

Standard Chlorine operations at the site included manufacturing of moth crystals and flakes from dichlorobenzene. Standard Chlorine separated dichlorobenzenes at the site from 1963 to 1982. Standard Chlorine also separated and stored 1,2,4-trichlorobenzene at the site from 1970 to 1980. SNP processed liquid petroleum naphthalene at the site from 1963 until 1982. Raw materials were transported to the site by rail and tank truck for processing. Chloroben Chemical Corporation (Chloroben), a subsidiary of Standard Chlorine, operated a batch formulation and blending operation at the site for various drain cleaners known as "Chloroben". From 1963 until 1981, Chloroben products were made from 1,2-dichlorobenzene, after which they were produced from hydrochloric acid, sulfuric acid, and methyl benzoate (Ref. 23, pp.2; 6, pp. 1-2 - 1-3).

A New Jersey Department of Environmental Protection (NJDEP) Selected Substances Report dated August 1980 indicates that Standard Chlorine disposed of an estimated 12,000 lb/yr of waste from the processing of 1,2,4-trichlorobenzene into the lagoon system between 1975 and 1979 (Ref. 23, pp. 2; 6, pp. 1-7). Also listed as substances present at the site include 1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, 1,2,4-trichlorobenzene, and naphthalene (Ref. 23, pp. 2).

An NJDEP inspection of the site on 23 June 1982 reported that the lagoon system was reported by Standard Chlorine to have been used for waste disposal by Koppers, a former property owner (Ref. 8, pp. 1-8).

In 1985, NJDEP conducted the Phase II Dioxin Investigation, which identified 23 sites in New Jersey suspected of contamination with halogenated dibenzo-p-dioxins, specifically 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD, or dioxin). The Standard Chlorine site was included in the investigation because Standard Chlorine once produced and stored two dioxin related compounds at the site, 1,2,4-trichlorobenzene and 1,2-dichlorobenzene. Results from this sampling event prompted a more in-depth dioxin investigation by Standard Chlorine (Ref. 11,pp. 1, 7; 23, pp.3).

Historical aerial photos indicate piping had existed to allow discharge into the lagoons. The piping appears to originate from the building areas directly north of the lagoons (Ref. 25, pp. 34, 50)

- Source Samples:

Sample ID	Sample Type	Date	Hazardous Substance	Hazardous Substance Concentration (µg/kg)	Detection Limit* (µg/kg)	Reference
WLS-1	sediment	1/91	methylene chloride toluene ethylbenzene naphthalene	21,500 33,800 39,600 2,040,000,000	9,300 20,000 24,000 110,000	Ref. 8, pp.5-4, 5-5; 6, table T116-04, pp. 1, 4, 10, 13
WLS-2	sediment	1/91	methylene chloride toluene ethylbenzene naphthalene	6,090 15,300 15,200 300,000,000	2,600 5,600 6,700 150,000	Ref. 8, pp.5-4, 5-5; 6, table T116-04, pp. 1, 4, 10, 13
ELS-1	sediment	1/91	methylene chloride benzene toluene ethylbenzene 1,2-dichlorobenzene 1,4-dichlorobenzene naphthalene	438 896 3,050 2,580 22,100 40,000 815,000,000	4,200 670 910 1100 5,800 13,000 4,800	Ref. 8, pp.5-4, 5-5; 6, table T116-04, pp. 1, 4, 10, 13
ELS-2	sediment	1/91	methylene chloride benzene toluene ethylbenzene naphthalene	5,330 23,400 63,100 43,300 25,200,000,000	4,200 6,700 9,100 11,000 240,000	Ref. 8, pp.5-4, 5-5; 6, T116-04, pp. 1, 4, 10, 13

Sample ID	Sample Type	Date	Hazardous Substance	Hazardous Substance Concentration (µg/kg)	Detection Limit* (µg/kg)	Reference
WLS-1	West Lagoon surface water	1/91	1,3-dichlorobenzene 1,4-dichlorobenzene naphthalene 1,2,4-trichlorobenzene	4.6 10.5 12.7 7.1	1.9 4.5 1.6 1.9	Ref. 8, pp.5-4,5-5; 6, table T116-06, pp. 1, 3, 5
ELS-1	East Lagoon surface water	1/91	chlorobenzene 1,2-dichlorobenzene 1,3-dichlorobenzene 1,4-dichlorobenzene naphthalene 1,2,4-trichlorobenzene	77.6 1.9 10.2 23 3.1 18.5	30.0 1.9 1.9 4.5 1.6 1.9	Ref. 8, pp.5-4,5-5; 6, table T116-06, pp. 1, 3, 5
A-1	Stage1 core/spoon sample 0.5-1.5 ft bgs	3/87	2,3,7,8-TCDD (dioxin)	2.6	0.001*	Ref. 12, pp. 21; 6 table T116-03, pp. 2
B-1	Stage1 core/spoon sample 0.4-1.2 ft bgs	3/87	2,3,7,8-TCDD (dioxin)	8.20	0.001	Ref. 12, pp. 21; 6 table T116-03, pp. 2
C-1	Stage1 core/spoon sample 0.0-0.8 ft bgs	3/87	2,3,7,8-TCDD (dioxin)	19.5	0.001	Ref. 12, pp. 21; 6 table T116-03, pp. 2
C-2H-SS	Stage 1 surface soil 1.2-2.1 ft bgs	3/87	2,3,7,8-TCDD (dioxin)	0.23	0.001	Ref. 12, pp. 21; 6 table T116-03, pp. 2
E-1	Stage1 core/spoon sample 0.0-0.5 ft bgs	3/87	2,3,7,8-TCDD (dioxin)	0.850	0.001	Ref. 12, pp. 21; 6 table T116-03, pp. 2
E-2-SS	Stage 1 surface soil 0.8-1.3 ft bgs	3/87	2,3,7,8-TCDD (dioxin)	31.9	0.001	Ref. 12, pp. 21; 6 table T116-03, pp. 2
E-3-SS	Stage II, III surface soil 1.6-1.9ft bgs	3/87	2,3,7,8-TCDD (dioxin)	2.9	0.001	Ref. 13, pp. 24; 6 table T116-03, pp. 3

Sample ID	Sample Type	Date	Hazardous Substance	Hazardous Substance Concentration (µg/kg)	Detection Limit* (µg/kg)	Reference
E-4-SS	Stage II, III surface soil 2.0-2.3 ft bgs	3/87	2,3,7,8-TCDD (dioxin)	1.2	0.001	Ref. 13, pp. 24; 6 table T116-03, pp. 3
F-1	Stage II, III core/spoon sample 0.0-0.6 ft bgs	3/87	2,3,7,8-TCDD (dioxin)	2.3	0.001	Ref. 13, pp. 24; 6 T116-03, pp. 3
F-4-SS	Stage1 surface soil 5.0-5.5 ft bgs	3/87	2,3,7,8-TCDD (dioxin)	4.3	0.001	Ref. 12, pp. 21; 6 table T116-03, pp. 2
G-1	Stage1 core/spoon sample 0.0-0.8 ft bgs	3/87	2,3,7,8-TCDD (dioxin)	2.8	0.001	Ref. 12, pp. 21; 6 table T116-03, pp. 2
I-2-SS	Stage 1 surface soil 1.3-1.8 ft bgs	3/87	2,3,7,8-TCDD (dioxin)	3.2	0.001	Ref. 12, pp. 21; 6 table T116-03, pp. 2
I-3-SS	Stage 1 surface soil 2.5-3.5 ft bgs	3/87	2,3,7,8-TCDD (dioxin)	38.4	0.001	Ref. 12, pp. 21; 6 table T116-03, pp. 2
I-4-SS	Stage 1 surface soil 4.5-5.5 ft bgs	3/87	2,3,7,8-TCDD (dioxin)	6.2	0.001	Ref. 12, pp. 21; 6 table T116-03, pp. 3
J-1H	Stage 1 core/spoon sample 0.1-1.1 ft bgs	3/87	2,3,7,8-TCDD (dioxin)	11.2	0.001	Ref. 12 , pp. 21; 6 table T116-03, pp. 3
J-3-SS	Stage II, III surface soil 2.9-3.9 ft bgs	3/87	2,3,7,8-TCDD (dioxin)	268	0.001	Ref. 13, pp. 24; 6 T116-03, pp. 3

Sample ID	Sample Type	Date	Hazardous Substance	Hazardous Substance Concentration (µg/kg)	Detection Limit* (µg/kg)	Reference
J-3-SS	Stage II, III surface soil 2.9-3.9 ft bgs	3/87	2,3,7,8-TCDD (dioxin)	237	0.001	Ref. 13, pp. 24; 6 table T116-03, pp. 3
J-4-SS	Stage II, III surface soil 5.0-5.8 ft bgs	3/87	2,3,7,8-TCDD (dioxin)	148	0.001	Ref. 13, pp. 24; 6 table T116-03, pp. 3
K-1H-SS	Stage1surface soil 0.1-1.1 ft bgs	3/87	2,3,7,8-TCDD (dioxin)	69.6	0.001	Ref. 12, pp. 21; 6 table T116-03, pp. 3
K-2-SS	Stage 1 surface soil 1.7-2.2 ft bgs	3/87	2,3,7,8-TCDD (dioxin)	2.7	0.001	Ref. 12, pp. 21; 6 table T116-03, pp. 3
K-3-SS	Stage II, III surface soil 2.4-3.1 ft bgs	3/87	2,3,7,8-TCDD (dioxin)	6.1	0.001	Ref. 13, pp. 24; 6 table T116-03, pp. 4
K-4-SS	Stage II, III surface soil 4.6-5.6 ft bgs	3/87	2,3,7,8-TCDD (dioxin)	3.7	0.001	Ref. 13, pp. 24; 6 table T116-03, pp. 4
L-1H-SS	Stage 1 surface soil 0.2-1.2 ft bgs	3/87	2,3,7,8-TCDD (dioxin)	0.710	0.001	Ref. 12, pp. 21; 6 table T116-03, pp. 3
R-1-SS	Stage 1 surface soil 0.0-0.8 ft bgs	3/87	2,3,7,8-TCDD (dioxin)	15.3	0.001	Ref. 12 , pp. 21; 6 table T116-03, pp. 3
R-2-SS	Stage 1 surface soil 2.5-3.2 ft bgs	3/87	2,3,7,8-TCDD (dioxin)	62.1	0.001	Ref. 12, pp. 21; 6 table T116-03, pp. 3
R-3-SS	Stage II, III surface soil 4.2-5.0 ft bgs	3/87	2,3,7,8-TCDD (dioxin)	190	0.001	Ref. 13, pp. 24; 6 table T116-03, pp. 4

Sample ID	Sample Type	Date	Hazardous Substance	Hazardous Substance Concentration (µg/kg)	Detection Limit* (µg/kg)	Reference
R-4-SS	Stage II, III surface soil 6.0-6.7 ft bgs	3/87	2,3,7,8-TCDD (dioxin)	46	0.001	Ref. 13, pp. 24; 6 table T116-03, pp. 4

note: bgs (below ground surface)
*Detection Limits for dioxin data that were not reported non-detect is not available as the EPA CLP SOW DLM01.4 does not require the lab to report detection limits for hit samples. Therefore, the Contract Required Quantitation Limit (CRQL) of 1.0 ng/kg is being used for those samples where the sample specific detection limit is not available (Ref. 26).

2.2.3 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY

Containment Description	Containment Factor Value	Ref.
Gas release to air:	NS	
Particulate release to air:	NS	
Release to ground water:	NS	
Release via overland migration and/or flood: In order to comply with the 1989 ACO, Standard Chlorine built up the low earthen berm surrounding the lagoons to provide a minimum of 2 ft freeboard in all areas. In addition, approximately 50 ft of the shoreline berm was stabilized using geotextile covered with stone rip rap. There is no liner and the base of the waste material is in contact with the water table.	9	Ref. 8, pp. 3-3, 5-3

Notes:
NS Not Scored

2.4.2 HAZARDOUS WASTE QUANTITY

2.4.2.1.1. Hazardous Constituent Quantity

Documentation is not sufficient to determine hazardous constituent quantity.

Hazardous Constituent Quantity Assigned Value: 0

2.4.2.1.2. Hazardous Wastestream Quantity

Documentation is not sufficient to determine hazardous wastestream quantity.

Hazardous Wastestream Quantity Assigned Value: 0

2.4.2.1.3. Volume

Description:

Source 1 is a lagoon that encompasses an area of approximately 33,000 square feet and extends to an average depth of 6 feet below grade (Ref. 10, pp.10). The lagoon is two contiguous bodies, designated as the east lagoon and west lagoon, containing a combined estimated volume of 7,300 cubic yards of material. (Ref. 10, pp.10; 9, pp.6; 23, pp.1)

Source Type	Description (# drums or dimensions)	Units (yd^3/gal)	References
surface impoundment	≈33,000 square feet by 6 feet deep	7,333.33 yd^3	Ref. 10, pp.10; 9, pp.6;

Sum (yd^3/gal): 7,333.33 yd^3
Equation for Assigning Value (Table 2-5): v/2.5

Volume Assigned Value: 2933.33

2.4.2.1.4. Area

Since the volume of the waste source can be determined, a value of 0 is given for area assigned value.

Area Assigned Value: 0

2.4.2.1.5. Source Hazardous Waste Quantity Value

Highest assigned value assigned from Table 2-5: 2933.33

2.2.1 SOURCE IDENTIFICATION

Name of source: Contaminated Soil | Number of source: 2

Source Type: Contaminated Soil

Description and Location of Source:

During the field work for the 1993 Weston RI, a total of seventeen soil samples were collected. Ten surface soil samples (TSS-1 through TSS-10) were taken in the former above ground storage tank area around the distillation building north of the lagoons and analyzed for volatile organic compounds (VOCs) and Base neutrals and acids (BNAs) (Ref. 7, pp. 3; 8, pp.5-17). Samples were located near the ends of existing tanks near valves and joints. In areas where tanks were no longer present, samples were taken next to concrete cradles. The soil samples were obtained from a depth of one to two feet using a hand held bucket auger (Ref. 8, pp.4-15) Elevated levels of chlorobenzene were detected (highest concentration detected 99,600 µg/kg). Elevated levels of BNA compounds were detected, including naphthalene (2,370,000,000 µg/kg), 1,2-dichlorobenzene (4,680,000 µg/kg), 1,3-dichlorobenzene (1,270,000 µg/kg), 1,4-dichlorobenzene (4,840,000 µg/kg), and 1,2,4-trichlorobenzene (100,000,000 µg/kg) (Ref. 8, pp.5-17, fig 5-2). Background samples were not taken for these sample locations. However, each compound was either not detected or detected in at least one sample at levels less than three times background (Ref. 8, table 5-5). These samples were used to demonstrate that these manmade substances are not ubiquitous in the entire area.

Seven soil boring samples were taken at four boring locations adjacent to Building 2 and analyzed for VOCs, BNAs, pesticides/PCBs and metals. One of the samples was taken from the boring for monitoring well MW-2L adjacent to the active septic tank on the north side of Building 2. The other six samples (two per boring) were collected from three soil borings completed during the supplementary investigation near Building 2 (Ref. 8, pp.5-21, fig 5-1). One boring, Weston SB-2A/B, (location 2 on fig 5-1) was completed on the east side of Building 2 near monitoring well MW-15 and two additional borings, Weston SB-3A/B and Weston SB-4A/B, (locations 3 and 4) were completed to the west of Building 2 where in the past above ground storage tanks were located and chemicals for production or shipment were loaded (Ref. 8, pp.4-19, fig 5-1). One sample was taken from the shallow unsaturated zone (A) and one from the sandy sediments just above the clay horizon (B) (Ref. 8, pp.4-19, 5-21, fig 5-1). Elevated levels of chlorobenzene (220,000 µg/kg) were found in the soil samples. 1,2-dichlorobenzene (9,200,000 µg/kg), 1,3-dichlorobenzene (1,300,000 µg/kg), 1,4-dichlorobenzene (1,300,000 µg/kg) and 1,2,4-trichlorobenzene (34,000 µg/kg) were detected at elevated concentrations in all samples, but were highest in SB-2B located near MW-15L, between Buildings 2 and 4 (Ref. 8, pp-5-21, fig 5-1). Free phase product was observed in sample SB-2B from the sand just above the clay. Based on these results, it appears that the soils and free phase product in the vicinity of Building 2 are a continuing source of contamination. The origin of contamination appears to be from the handling of the materials shipped to and from the site (Ref. 8, pp. 5-24).

Soil borings were taken between August 5 and 16, 1996 during the Focused Remedial Investigation (FRI) performed by Environmental Resources Management (ERM) (Ref. 9, pp. 12). Thirteen soil borings, SB-2 through SB-14 were installed adjacent to the extent of the lagoons in the eastern portion of the site. Soil boring SB-01 was installed at the westernmost portion of the eastern portion of the site to help delineate the extent of the contamination (Ref. 9, pp.12). Eight of the soil samples were submitted for laboratory analysis. The samples were selected from borings in which waste material was encountered above the clay and/or where field screening of the sample head space indicated elevated organic vapor concentrations (Ref. 9, pp.13). Analysis indicates soil contamination in an area north of the lagoon area encompassing the eastern portion of the site. Using samples SB-01 taken on the western side of the drainage ditch, and SB-14 taken south of the lagoons as backgrounds, the samples collected indicated concentrations of site related contaminants at levels of magnitude higher than the background samples (Ref. 9, table 6A). These sample locations were chosen as backgrounds to demonstrate that the contamination is not ubiquitous in the area. These samples may also indicate the outer extent of the migration of the contamination (Ref. 9, pp.12). Contamination of the soils in this area of 1,2,3-trichlorobenzene (2,140,000

µg/kg), 1,2,4-trichlorobenzene (6,540,000 µg/kg), 1,2-dichlorobenzene (2,320,000 µg/kg), 1,3-dichlorobenzene (1,700,000 µg/kg), 1,4-dichlorobenzene (1,630,000 µg/kg), and naphthalene (5,750,000 µg/kg), may be the result of leakage or spillage from aboveground storage tanks, or migration of contaminants from the lagoons through the soils (Ref. 9, pp.12, Ref. 25, pp. 61, 70, Ref. 8, pp. 5-8).

2.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE

Unintentional releases by leaks or spills from pipes and aboveground product storage tanks represent a source of contamination to soils and groundwater in the former product handling and storage areas. All piping and all but five tanks in the building area north of the lagoons were removed after operations ceased. Analysis of the contents of the five remaining tanks indicates that they were used to store primarily trichlorobenzenes and dichlorobenzenes (Ref. 8, pp.3-3 - 3-4, 5-8 - 5-9, table 5-2). These tanks were cleaned out in 1990 (Ref. 8, pp.3-3,5-8). Historical area photographs and other evidence indicate the presence of former tank locations and a railroad spur entering the southeast corner of the property behind Building 2 where materials were handled and stored (Ref. 8, pp.5-8, 5-24; Ref. 25, pp-12, 36, 44-45, 52-53, 56-59,). These tanks did not appear to have secondary containment in 1963 (Ref. 25, pp.36). Historical aerial photographs and tank cradles in the process area north of the lagoons also indicate material storage in that area (Ref. 25, pp. 15-16, 22, 28, 34, 41, 43, 50-51,56-57, 61, 63). The 1985 Phase II Dioxin Investigation documented dichlorobenzene tanks at the western end of the property, dichlorobenzene and trichlorobenzene storage tanks on the eastern end of the site, and stained soil in several places on the site (Ref. 11, pp.10-11, fig. 2). Aerial photographs from 1995 indicate that dark toned ground stains were visible at the processing buildings north of the lagoons (Ref. 25, pp. 70-71). Historically, this area was used for naphthalene product production and this product was stored in this area over a longer period of time (Ref. 8, pp.5-8). An NJDEP inspection of the site on 31 August 1982 reported spillages of naphthalene and dichlorobenzenes on the ground surface at the site in several areas (Ref. 8, pp.1-8).

- Background Concentrations:

Sample ID	Sample Type	Date	Hazardous Substance	Hazardous Substance Concentration (µg/kg)	Detection Limit (µg/kg)	Reference
TSS-2	surface soil sample from tank area	12/90	chlorobenzene, tetrachloroethylene, trichloroethylene	ND** ND ND	8,700 5,900 2,800	Ref. 8, Table 5-5
TSS-3	surface soil sample from tank area	12/90	1,2,4-trichlorobenzene, methylene chloride trichloroethylene	6,360 ND ND	3,100 4.60 3.10	Ref. 8, Table 5-5
TSS-4	surface soil sample from tank area	12/90	methylene chloride tetrachloroethylene trichloroethylene	ND ND ND	2,100 3,100 1,400	Ref. 8, Table 5-5
TSS-5	surface soil sample from tank area	12/90	naphthalene	ND	4,100	Ref. 8, Table 5-5

Sample ID	Sample Type	Date	Hazardous Substance	Hazardous Substance Concentration (µg/kg)	Detection Limit (µg/kg)	Reference
TSS-6	surface soil sample from tank area	12/90	chlorobenzene	ND	100	Ref. 8, Table 5-5
TSS-8	surface soil sample from tank area	12/90	chlorobenzene 1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene	ND ND ND ND	9.10 2,900 2,900 6,600	Ref. 8, Table 5-5
TSS-9	surface soil sample from tank area	12/90	naphthalene	ND	2,400	Ref. 8, Table 5-5
Weston SB-2A	soil boring sample - shallow	10/92	chlorobenzene, 1,2,4-trichlorobenzene, 1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene tetrachloroethylene benzene	ND 6,000J*** 6,800J 3,500J 3,400J 3 J ND	13 13,000 13,000 13,000 13,000 13 13	Ref. 8, Table 5-6
Weston SB-3B	soil boring sample - deep	10/92	chlorobenzene benzene	91 J 110 J	1500 1500	Ref. 8, Table 5-6
Weston SB-4B	soil boring sample-deep	10/92	1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, tetrachloroethylene	ND ND ND ND	12,000 12,000 12,000 2000	Ref. 8, Table 5-6
SB-01	soil boring, 15.5-16 ft bgs*	08/16/96	1,2,3-trichlorobenzene, 1,2,4-trichlorobenzene, 1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, naphthalene	ND 2.1 BMDL**** 115 42.5 89.1 25.6	6.0[a]	Ref. 9, table 6A

Sample ID	Sample Type	Date	Hazardous Substance	Hazardous Substance Concentration (µg/kg)	Detection Limit (µg/kg)	Reference
SB-14	soil boring, 18.5-19 ft bgs	08/07/96	1,2,3-trichlorobenzene, 1,2,4-trichlorobenzene, 1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, naphthalene	91.9 350 70.2 50.9 53.5 3.49 BMDL	6.1[a]	Ref. 9, table 6A

Note: *bgs = below ground surface
**ND = non detect. These samples have been chosen to demonstrate a background level for these contaminants. All substances found in this source are man-made substances not ubiquitous in the area.
***J = concentrations detected below detection limit. Contaminated samples were detected at levels above the detection limits of these samples.
****BMDL = Concentration detected below Method Detection Limit
[a] Detection limits for these samples are the Method Detection Limits

- Source Samples:

Sample ID	Sample Type	Date	Hazardous Substance	Hazardous Substance Concentration (µg/kg)	Detection Limit (µg/kg)	Reference
TSS-1	surface soil sample from tank area	12/90	chlorobenzene 1,2,4-trichlorobenzene, 1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, naphthalene	99,600 75,000,000 3,850,000 1,210,000 2,230,000 2,370,000,000	38,000 12,000 12,000 12,000 27,000 10,000	Ref. 8, Table 5-5
TSS-2	surface soil sample from tank area	12/90	1,2,4-trichlorobenzene, 1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, naphthalene	3,040,000 4,680,000 738,000 4,840,000 167,000	2,700 2,700 2,700 6,400 2,300	Ref. 8, Table 5-5
TSS-3	surface soil sample from tank area	12/90	1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, naphthalene	12,100 14,500 54,600 191,000	3,100 3,100 7,200 2,600	Ref. 8, Table 5-5
TSS-4	surface soil sample from tank area	12/90	chlorobenzene 1,2,4-trichlorobenzene, 1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, naphthalene	5,490 14,100,000 34,400 9,590 15,000 5,020	4,500 2,900 2,900 2,900 6,600 2,400	Ref. 8, Table 5-5

Sample ID	Sample Type	Date	Hazardous Substance	Hazardous Substance Concentration (µg/kg)	Detection Limit (µg/kg)	Reference
TSS-5	surface soil sample from tank area	12/90	chlorobenzene 1,2,4-trichlorobenzene, 1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene tetrachloroethylene trichloroethylene methylene chloride	300 68,200,000 522,000 394,000 52,200 2,310 866 114	150 4,900 4,900 4,900 11,000 110 49 72	Ref. 8, Table 5-5
TSS-6	surface soil sample from tank area	12/90	1,2,4-trichlorobenzene, 1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, naphthalene methylene chloride	30,100 10,800 9,500 15,700 51,800 70.8	3,300 3,300 3,300 7,600 2,700 48.0	Ref. 8, Table 5-5
TSS-7	surface soil sample from tank area	12/90	1,2,4-trichlorobenzene, 1,2-dichlorobenzene, 1,3-dichlorobenzene, naphthalene tetrachloroethylene trichloroethylene methylene chloride	25,400 3,780 6,400 7,310 12.5 29.2 6.57	3,200 3,200 3,200 2,700 6.9 3.2 4.7	Ref. 8, Table 5-5
TSS-8	surface soil sample from tank area	12/90	1,2,4-trichlorobenzene, naphthalene	28,300 16,700	2,900 2,400	Ref. 8, Table 5-5
TSS-9	surface soil sample from tank area	12/90	chlorobenzene 1,2,4-trichlorobenzene, 1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, methylene chloride	33,500 100,000,000 4,340,000 1,270,000 876,000 7020	9,000 2,800 2,800 2,800 6,500 5200	Ref. 8, Table 5-5
TSS-10	surface soil sample from tank area	12/90	chlorobenzene 1,2,4-trichlorobenzene, 1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, naphthalene tetrachloroethylene	89.10 62,800 6,530 66,200 41,700 448,000 9.91	9.40 3,000 3,000 3,000 6,900 2,500 6.4	Ref. 8, Table 5-5

Sample ID	Sample Type	Date	Hazardous Substance	Hazardous Substance Concentration (µg/kg)	Detection Limit (µg/kg)	Reference
Weston SB-2B	soil boring sample - deep	10/92	chlorobenzene 1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene benzene	220,000 9,200,000 1,300,000 1,300,000 48,000 J	71,000 1,200,000 1,200,000 1,200,000 71,000	Ref. 8, Table 5-6
Weston SB-3A	soil boring sample - shallow	10/92	chlorobenzene 1,2,4-trichlorobenzene, 1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene benzene	15,000 34,000 400,000 410,000 430,000 320 J	1,400 12,000 12,000 12,000 12,000 1400	Ref. 8, Table 5-6
Weston SB-3B	soil boring sample - deep	10/92	tetrachloroethylene	16,000	1,500	Ref. 8. Table 5-6
Weston SB-4B	soil boring sample - deep	10/92	chlorobenzene	27,000	2000	Ref. 8, Table 5-6
ERM SB-03	Soil boring, 14.5-15 ft bgs	08/05/96	1,2,3-trichlorobenzene, 1,2,4-trichlorobenzene, 1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, naphthalene	1,770,000 6,540,000 1,080,000 1,700,000 1,630,000 1,010,000	630,000[a]	Ref. 9, table 6A
ERM SB-04	Soil boring, 15-15.5 ft bgs	08/12/96	1,2,3-trichlorobenzene, 1,2,4-trichlorobenzene, 1,2-dichlorobenzene, 1,4-dichlorobenzene, naphthalene	1,000,000 1,870,000 1,310,000 677,000 2,400,000	630,000[a]	Ref. 9, table 6A
ERM SB-09	Soil boring, 15-15.5 ft bgs	08/12/96	1,2,3-trichlorobenzene, 1,2,4-trichlorobenzene, 1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, naphthalene	345,000 1,180,000 506,000 210,000 257,000 181,000	160,000[a]	Ref. 9, table 6A

Sample ID	Sample Type	Date	Hazardous Substance	Hazardous Substance Concentration (µg/kg)	Detection Limit (µg/kg)	Reference
ERM SB-10R	Soil boring, 16-16.5 ft bgs	08/16/96	1,2,3-trichlorobenzene, 1,2,4-trichlorobenzene, 1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, naphthalene	2,140,000 2,290,000 2,320,000 557,000 1,160,000 5,750,000	290,000[a]	Ref. 9, table 6A

Note: *bgs = below ground surface
[a] Detection limits for these samples are the Method Detection Limits

2.2.3 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY

Containment Description	Containment Factor Value	Ref.
Gas release to air:	NS	
Particulate release to air:	NS	
Release to ground water:	NS	
Release via overland migration and/or flood: There are no containment structures (ie: engineered cover, run-on control system, runoff management system, liners) associated with source 2. While an IRM of asphalt and stone covers have been placed over portions of the site by Chemical Land Holdings to fulfill their ACO with NJDEP, this cover was not placed over all the unpaved areas of the site and has been placed only to prevent human exposure to the chromium contaminated fill.	10	Ref. 6, pp.2-4; 14, pp. 11-12;

Notes:
NS Not Scored

2.4.2 HAZARDOUS WASTE QUANTITY

2.4.2.1.1. Hazardous Constituent Quantity

Documentation is not sufficient to determine hazardous constituent quantity.

Hazardous Constituent Quantity Assigned Value: 0

2.4.2.1.2. Hazardous Wastestream Quantity

Documentation is not sufficient to determine hazardous wastestream quantity.

Hazardous Wastestream Quantity Assigned Value: 0

2.4.2.1.3. Volume

Description

Based on analytical results of surface and subsurface soil samples taken during the sampling events conducted for the Weston 1993 Remedial Investigation Report and the ERM 1997 Focused Remedial Investigation Report, it is apparent that some amount of soil contamination is present at depth; however, the exact volume of contamination is unknown (Ref. 8, pp. 4-15, 4-19, 5-17, 5-21, 5-24, fig 5-1, 5-2, table 5-5, 5-6; 9, pp. 12-13, Table 6A). Therefore, a source volume of >0 but unknown will be assigned.

Source Type	Description (# drums or dimensions)	Units (yd^3/gal)	References
contaminated soil	contaminated soil indicated by soil samples TSS-1 though TSS-10; Weston SB-3A, SB-2B; ERM SB-03, SB-04, SB-09, SB-10R	yd3	Ref. 8, Tables 5-5, 5-6; 9, Table 6A

Sum (yd^3/gal): >0
Equation for Assigning Value (Table 2-5): V/2,500

Volume Assigned Value: >0

2.4.2.1.4. Area

Since the volume of the waste source can be determined, a value of 0 is given for area assigned value.

Area Assigned Value: 0

2.4.2.1.5. Source Hazardous Waste Quantity Value

Based on analytical results of surface and subsurface soil samples taken during the sampling events conducted for the Weston 1993 Remedial Investigation Report and the ERM 1997 Focused Remedial Investigation Report, it is apparent that some amount of soil contamination is present at depth; however, the exact volume of contamination is unknown (Ref. 8, pp. 4-15, 4-19, 5-17, 5-21, 5-24, fig 5-1, 5-2, table 5-5, 5-6; 9, pp. 12-13, Table 6A). Therefore, a source hazardous waste quantity of >0 but unknown will be assigned.

Highest assigned value assigned from Table 2-5: >0

SUMMARY OF SOURCE DESCRIPTIONS

Source No.	Source Hazardous Waste Quantity Value	Source Hazardous Constituent Quantity Complete? (Y/N)	Containment Factor Value by Pathway				
			Ground Water (GW) (Table 3-2)	Surface Water (SW)		Air	
				Overland/flood (Table 4-2)	GW to SW (Table 3-2)	Gas (Table 6-3)	Particulate (Table 6-9)
1	2933.33	N	NS	9	NS	NS	NS
2	>0	N	NS	10	NS	NS	NS

Description of Other Possible Sources

Building Discharges into Southern Drainage Ditch

Under New Jersey Pollutant Discharge Elimination System (NJPDES) Discharge to Surface Water (DSW) Permit No. NJD0001856, Standard Chlorine was permitted to discharge septic tank overflow, boiler blowdown and stormwater runoff into the southern drainage ditch. The permit, effective 1 February 1986 through 31 January 1991, granted permission to discharge to the Hackensack River in accordance with effluent limitations and monthly monitoring requirements (Ref. 8, pp.1-8).

Analysis of historical aerial photographs show discharges into the drainage ditch near Building 2 (Ref. 25, pp. 24, 30, 36, 42, 52, 56, 62, 72).

SC-SED-19 was taken below a drainage pipe entering the drainage ditch at Building 2 (Ref. 14, pp. 19, 956). This sample was the most heavily contaminated with 250,000 µg/kg of chlorobenzene, 6,000,000 µg/kg of 1,4-dichlorobenzene, 3,900,000 µg/kg of 1,3-dichlorobenzene, 5,300,000 µg/kg of 1,2-dichlorobenzene, 2,900,000 µg/kg of 1,2,4-trichlorobenzene, and 23,000 µg/kg of naphthalene (Ref. 14, pp. 626, 725).

Free Phase Product

Contaminated fill material from non-site related chromium ore processing activities is present on the site property, as well as on other properties in the Hackensack Meadowlands, particularly in floodplain areas adjacent to principal waterways such as the Hackensack River. Surface slag fill material was placed prior to the 1940's along areas of low lying conditions to achieve greater topographic relief (Ref. 6, pp. 1-3). The fill material consists of both coarse and fine grained materials and consists of clay, silt, sand, gravel, slag, cinders and was found to be of random thickness across the entire lagoon area, ranging from six to eleven feet thick throughout the site (Ref. 9, pp. 20). This fill is underlain by organic silt, humus and reed peat deposits (meadow mat) (Ref. 9, pp. 6, 20). These deposits are typically formed in bogs along rivers and in flood plains, and are characterized by peats and associated silt, clay and sand sediments (Ref. 9, pp. 20). The meadow mat ranges from approximately two to five feet thick (Ref. 9, pp. 20). The fill and meadow mat are underlain by a Holocene sand layer (the Lower Sand unit). This sand is present beneath the entire lagoon area and is approximately 3 to 6 feet thick (Ref. 9, pp. 20). The Lower Sand unit is primarily silty sand to sand with trace silt. Discontinuous silt lenses are present. The coarse and fine fractions grade laterally into each other indicative of stream channel sands and adjacent floodplain sediments of a fluvial depositional environment. The unit is completely saturated and the lower portion of the sand unit showed evidence of the presence of free product in several areas (Ref. 9, pp. 21). A varved clay

(Pleistocene Age) unit is present beneath the sand. The thickness of the clay is approximately 25 to 35 feet thick (Ref. 9, pp. 20). The sequence of fill/peat underlain by sand, which is underlain by varved clay (glacial till) comprises the overburden stratigraphy at the Site. The bedrock beneath the overburden consists of the Triassic age Brunswick formation. (Ref. 9, pp. 4, 6) The bottom of the lagoon appears to lie within or on top of the meadow mat surface (Ref. 9, pp. 21). The high permeability of the surrounding fill material evidently disperses drainage (Ref. 8, pp. 5-3)

The southern drainage ditch receives flow from shallow groundwater. Shallow groundwater flows laterally in the sands and discharges to the southern drainage ditch and to the Hackensack River (Ref. 8, pp. 2-5). Free phase product has been observed discharging into the southern drainage ditch (Ref. 7, pp. 7-9; 14, pp. 15; 28, pp.5-8). Contaminants of concern can be found in groundwater and soils as free phase product across the site. The highest concentrations of dichlorobenzenes are found in the western portion of the site and highest concentrations of naphthalene and phenols and phenolics occur in the eastern portion of the site (Ref. 8, pp. 5-52). Free phase product was observed in sample SB-2B from the sand just above the clay and in the groundwater from MW-15L (Ref. 8, pp. 5-24). Sample analysis indicates that sample SB-2B contained toluene (960J µg/kg), benzene (48,000J µg/kg), chlorobenzene (220,000 µg/kg), 1,2-dichlorobenzene (9,200,000 µg/kg), 1,3-dichlorobenzene (1,300,000 µg/kg), 1,4-dichlorobenzene (1,300,000 µg/kg), and 1,2,4-trichlorobenzene (2,400,000J µg/kg) (Ref. 8, table 5-6). Analysis of samples taken from MW-15L indicate contamination with benzene (3010 µg/kg), chlorobenzene (1830 µg/kg). 1,4-dichlorobenzene (19,500 µg/kg), 1,2-dichlorobenzene (20,600 µg/kg), 1,3-dichlorobenzene (15,200 µg/kg), 1,2,4-trichlorobenzene (81.2 µg/kg), and naphthalene (20.4 µg/kg) (Ref. 8, table 5-11). Based on these results, it appears that soils and free phase product in the vicinity of Building 2 are a continuing source of contamination to the groundwater (Ref. 8, pp. 5-24).

Offsite Sources

Surface water drains from the site along two paths which each lead to outfalls to the Hackensack River at the northeastern and southeastern corners of the property. The northeast outfall receives drainage from the northwest corner of the property where runoff collects in a depression which drains through a culvert into a buried storm drain which runs along the entire northern border of the property. This storm drain also receives runoff from the Belleville Turnpike (Ref. 8, pp. 5-24).

Most of the site drainage reaches the southern drainage ditch which also receives runoff from the Koppers property to the south. Shallow groundwater also discharges to the ditch. The sediments in the drainage ditch have a yellow-brown color which also forms a scum on the water surface. This appears to be related to the chromium fill (Ref. 7, pp. 7-9; 8, pp. 5-25; 28, pp. 5-8). While it is possible that surface water and sediments in the southern drainage ditch may be impacted from contaminants from the Koppers property to the south of the site, the highest concentration of contaminants were detected in the center of the Standard Chlorine property where the ditch originates onsite. The contaminants detected in the surface water and sediment samples collected in the southern drainage ditch are all site attributable compounds (Ref. 8, 5-33).

4.0 SURFACE WATER MIGRATION PATHWAY

4.1 OVERLAND/FLOOD MIGRATION COMPONENT

4.1.1.1 Definition of Hazardous Substance Migration Path for Overland/flood Component

Standard Chlorine is located in flat former meadow land that has been filled in with chromium ore processing residue (COPR). The property is bounded on the east by the Hackensack River and on the south by an unnamed creek referred to as the southern drainage ditch. The southern drainage ditch is the northern border of an area of wetlands that are present in the northern portion of the Koppers property just south of the Standard Chlorine property (Ref. 8, pp. 2-1 - 2- 2, fig 2-1). The surface water and sediments in the ditch and the wetlands is discolored with oily material and a pale yellow skim which is possibly associated with the chromium waste (Ref. 7, pp. 7-9; 8, pp. 2-1 - 2-2; 14, pp.11-20, 928, 930-931, 936- 937, 940, 943-955, 957, 959-961; 28, pp.5-8). The creek and the wetland are separated from the Hackensack River by a wooden berm with an outflow culvert. The outflow culvert is equipped with a tidal gate which is supposed to prevent backflow during high tides, however, it does not prevent the discharge of the creek into the Hackensack River (Ref. 8, pp. 2-2; Ref. 14, pp. 3, 8, 28, pp. 8). Aerial photographs from April 16, 1973 show an outfall plume at the end of the southern drainage ditch into the Hackensack River (Ref. 25, pp. 51-52).

The southern drainage ditch received flow from drainage ways near buildings 2, 3, and 4 in the southwestern portion of the site. This flow included NPDES permitted wastewater effluent from active buildings (Ref. 8, pp.1-8, 2-2; Ref. 25, pp. 24, 30, 36, 42, 52, 56, 62, 72). During the EPA October 2002 sampling event, SC-SW/SED 19 was taken at a point in the drainage ditch directly at a pipe which seemed to drain from this building area (Ref. 14, pp. 19, 956-957). This sample location has been designated **Probable Point of Entry (PPE) 3** on the National Wetlands Inventory map (Ref. 5). Analysis of surface water sample SC-SW-19 indicates concentrations of 1,4-dichlorobenzene (46 µg/kg) above 3 times background (Ref. 14, pp. 694, 956). Sediment sample SC-SED-19 contained concentrations of naphthalene (23,000 µg/kg), 1,4-dichlorobenzene (6,000,000 µg/kg), 1,2,4-trichlorobenzene (2,900,000 µg/kg), chlorobenzene (250,000 µg/kg) and 2,3,7,8-TCDD (85.1 ng/kg) (Ref. 14, pp. 626, 725, 889, 956-957).

Historical area photographs and other evidence indicate the presence of former tank locations and a railroad spur entering the southeast corner of the property behind Building 2 where materials were handled and stored (Ref. 8, pp.5-8, 5-24; 25, pp-12, 36, 44-45, 52-53, 56-59). These tanks did not appear to have secondary containment in 1963 (Ref. 25, pp.36). Soil samples taken from the area surrounding Building 2 during Weston RI indicate soil contamination with dichlorobenzenes, 1,2,4-trichlorobenzene, and chlorobenzene in the percentage range (Ref. 8, table 5-6). Sample SC-SW/SED-21was taken in the southern drainage ditch south of Building 2 (Ref. 14, pp. 20, 960-961). Observed releases by chemical analysis of 1,4-dichlorobenzene (240,000 µg/kg), 1,2,4-trichlorobenzene (25,000 µg/kg), and chlorobenzene (41,000 µg/kg) to the sediment and of 1,4-dichlorobenzene (610 µg/kg), 1,2,4-trichlorobenzene (200 µg/kg), and chlorobenzene (760 µg/kg) to the surface water are representative of historical operations at this site (Ref. 14, pp. 632-633, 700-701, 728, 751). This location has been designated **PPE4** (Ref. 5).

A small drainage way south of the lagoons along the eastern side of the abandoned railroad spur in the center of the site also drains southward to the ditch (Ref. 8, pp. 2-2, fig 2-1; 14, pp. 4, 13, 932-933). Sample SC-SW/SED 07 was taken during the October 2002 sampling event at the point where a pipe enters this branch of the southern drainage ditch (Ref. 14, pp. 13, 932-933) . This point has been designated **PPE 2** (Ref. 5). There is an observed release by chemical analysis of naphthalene (270 µg/kg), 1,4-dichlorobenzene (200 µg/kg), and 1,2,4-trichlorobenzene (82 µg/kg) to the surface water at this point (Ref. 14, pp. 659, 932).

Surface water also drains from the site through a buried stormdrain under the road along the northern boundary of the site which discharges to the Hackensack River through a tidal gate near the northeast corner of the property. Runoff collects in a depression on the northwest corner of the property which then drains through a culvert into the buried stormdrain. (Ref. 8, pp. 2-2, 4-14, 5-24, fig 2-1). The outfall is totally emerged at high tide (Ref. 8,

pp.5-24-25). While the tidal gate has been installed to prevent the backflow of water into the stormdrain, the tidal gate appeared to be in disrepair during a 2002 EPA site visit (Ref. 7, pp. 1-2). This northern outfall has been designated **PPE 5** (Ref. 5).

The southern drainage ditch also receives flow from shallow groundwater. Shallow groundwater flows laterally in the sands and discharges to the southern drainage ditch and to the Hackensack River (Ref. 8, pp. 2-5; 28, pp. 8). Free phase product has been observed discharging into the southern drainage ditch (Ref. 7, pp. 7,9; 14, pp. 15; 28, pp. 5). Contaminants of concern can be found in groundwater soils as free phase product across the site. The highest concentrations of dichlorobenzene are found in the western portion of the site and highest concentrations of naphthalene and phenols and phenolics occur in the eastern portion of the site (Ref. 8, pp. 5-52).

During the October 2002 EPA sampling event, a seep was observed entering the Hackensack River from the sediment 8.7 feet to the southeast of the outfall where the southern drainage ditch confluences with the Hackensack River (Ref. 14, pp. 3, 920). The seep was black in color with observed sediment (Ref. 14, pp. 3, 920). Chemical analysis of the seep indicates the presence of 1,4-dichlorobenzene (Ref. 14, pp. 542, 641). This seep has been designated as **PPE1** (Ref. 5).

The Hackensack River is part of the Newark Bay Complex and the New York Bight Watershed. The Hackensack River also runs through the Hackensack Meadowlands, the largest remaining brackish wetland complex in the New York-New Jersey Harbor Estuary (Ref. 22, pp. 26). The Hackensack Meadowlands habitat complex includes the remaining tidal wetlands and adjacent palustrine wetlands and uplands along the lower Hackensack River north of Jersey City, New Jersey. The habitat complex is generally bounded by the Conrail railroad tracks and Route 17 to the west south, the New York, Susquehanna, and Western Railroad tracks to the east, and Route 46 to the north; its northwest corner is bounded by the runways at Teterboro Airport. The complex also includes the aquatic habitat and adjacent upland habitat of Overpeck Creek which feeds into the Hackensack River at the complex's northeastern end. This 8,400 acre wetland area encompasses the remaining wetlands and open space habitats that support significant concentrations of waterfowl, wading birds, shorebirds, raptors, anadromous fish, and estuarine fish (Ref. 22, pp. 26, 37).

There is a Health Advisory issued for the Hackensack River regarding the consumption of blue crab and striped bass due to dioxin contamination and american eel, white perch, and white catfish due to PCB contamination in the river. The Hackensack River advisory is included as part of the Newark Bay complex advisory (Ref. 18; 19). Fishing for consumption regularly takes place on the Hackensack River despite the Health Advisory (Ref, 20; 21). There are two popular fishing locations on the banks of the river both up and downstream from Standard Chlorine and hook and line fishing from boats takes place on the River off the Standard Chlorine property (Ref. 20; 21;28, pp. 13-15).

The surface water migration pathway has a maximum score of 100.00 based on actually contaminated fisheries and sensitive environments, therefore potential surface water targets were not evaluated. Although not evaluated in this documentation package, it should be noted that there are numerous other surface water targets within the TDL. The Hackensack River is tidally influenced, however the extent of tidal carry at the site is unknown. Just upstream of the site lies a tidal wetlands complex that has been designated a priority habitat in the Meadowlands. This wetland complex consists of three sites: the Kingsland Impoundment, Kearny Marsh, and Sawmill Creek Wildlife Management Area. The Sawmill Creek Wildlife Management Area is a 900 acre wildlife management area managed by the state of New Jersey. The Kingsland Impoundment is 700 acres managed by the Hackensack Meadowlands Development Commission. Kearny Marsh consists of approximately 400 acres of predominantly freshwater, flooded, reed marsh (Ref. 22, pp. 28, 37-38).

4.1.2.1 Likelihood of Release

4.1.2.1.1 Observed Release

Direct Observation

- Basis for Direct Observation:

During the October 2002 EPA sampling event, a seep was observed entering the Hackensack River from the sediment 8.7 feet to the southeast of the outfall where the southern drainage ditch confluences with the Hackensack River (Ref. 14, pp. 3, 920). The seep was black in color with observed sediment (Ref. 14, pp. 3, 920). Chemical analysis of the seep documents the presence of 1,4-dichlorobenzene as well as other potentially identified substances (Ref. 14, pp. 542, 641).

Standard Chlorine has been found in violation of the Spill Compensation and Control Act, specifically N.J.S.A. 58:10-23.11c, and the Water Pollution Control Act, specifically N.J.S.A. 58:10A-6. as stated in the Administrative Consent Order issued by the NJDEP and signed by NJDEP and Standard Chlorine on October 20 and October 18, 1989, respectively (Ref. 23, pp.5,18). The violations were issued for the past and current discharges of hazardous substances and pollutants into the waters and onto the lands of the State of New Jersey (Ref. 23, pp.2-5). The hazardous substances and pollutants referenced in the violations include dioxin, naphthalene, 1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, 1,2,3-trichlorobenzene, 1,2,4-trichlorobenzene, trichloroethylene, tetrachloroethylene, benzene, chlorobenzene, toluene, and hydrochloric acid (Ref. 23, pp. 2-5) .

Both of these incidents document that hazardous substances from the site have directly entered the surface water.

- Hazardous Substances in Release:

Hazardous Substance	Evidence	Reference
1,4-Dichlorobenzene	SC-SW-01, NJDEP signed ACO, NJDEP Selected Substances Report	Ref. 14, pp. 3, 542, 641, 920; 23 pp. 2-5; 8, pp.1-7
2,3,7,8-TCDD	NJDEP signed ACO	Ref. 23 pp. 2-5
naphthalene	NJDEP signed ACO, NJDEP Selected Substances Report	Ref. 23 pp. 2-5; 8, pp.1-7
1,2-dichlorobenzene	NJDEP signed ACO , NJDEP Selected Substances Report	Ref. 23 pp. 2-5; 8, pp.1-7
1,3-dichlorobenzene	NJDEP signed ACO , NJDEP Selected Substances Report	Ref. 23 pp. 2-5; 8, pp.1-7
1,2,3-trichlorobenzene	NJDEP signed ACO	Ref. 23 pp. 2-5
1,2,4-trichlorobenzene	NJDEP signed ACO, NJDEP Selected Substances Report	Ref. 23 pp. 2-5; 8, pp.1-7
chlorobenzene	NJDEP signed ACO	Ref. 23 pp. 2-5
trichloroethylene	NJDEP signed ACO	Ref. 23 pp. 2-5
tetrachloroethylene	NJDEP signed ACO	Ref. 23 pp. 2-5
benzene	NJDEP signed ACO	Ref. 23 pp. 2-5

Hazardous Substance	Evidence	Reference
toluene	NJDEP signed ACO	Ref. 23 pp. 2-5
hydrochloric acid	NJDEP signed ACO	Ref. 23 pp. 2-5

Chemical Analysis

On 2 and 3 October, 2002, the EPA Superfund Contract Support Team conducted a sampling event at the Standard Chlorine site to investigate the extent of VOC, BNA, PCB, pesticides, total metals and dioxin contamination in the surface water and sediments located in the southern drainage ditch onsite and on the banks of the Hackensack River (Ref. 14, pp. 2).

Samples SC-SW/SED-01 through SC-SW/SED-04 were taken in the Hackensack River during low tide. SC-SED-01 was taken downstream of the Standard Chlorine site, off shore of the Koppers property. SC-SW/SED-04 were taken upstream from the Standard Chlorine site off shore of the Diamond Shamrock property. Sample SC-SW-01 was taken from a visible seep in the river bank 8.7 feet east of the southern outfall. SC-SW-02 was collected directly from the surface water discharging from the culvert pipe into the Hackensack River. SED-02 was collected 18.5 feet east of the southern outfall and SC-SW/SED-03 were collected where the bank came in contact with the River, 72 ft east of the outfall (Ref. 14, pp. 3, 93).

Samples SC-SW/SED-05 through SC-SW/SED-08 were taken in the southern drainage ditch on the eastern portion of the site, between the right of way and the Hackensack River. SC-SW/SED-07 was taken from a branch of the drainage ditch that seems to originate south of lagoon area (Ref. 14, pp.4, 93).

Samples SC-SW/SED-09 through SC-SW/SED-12 were collected from the southern drainage ditch on the west side of the right of way. Duplicate SC-SW/SED-30 was collected with SC-SW/SED-10 (Ref. 14, pp.5, 93).

Samples SC-SW/SED-13 through SC-SW/SED-16 were taken in the open water where the drainage ditch appears to have deteriorated and opened up into the wetlands. This area was accessed by boat. SC-SW/SED-13 was located at the confluence of the wetlands and the upstream segment of the southern drainage ditch. SC-SW/SED-14, 15, and 16 were taken in the wetlands area on the Koppers property (Ref. 14, pp.5-6, 93).

Samples SC-SW/SED-17 though SC-SW/SED-20 were taken in the upstream portion of the drainage ditch that originates onsite. SC-SW/SED-19 was taken in a cove that branched off to the west. The sample was taken at a pipe which appears to empty into this cove area. SC-SW/SED-20 was taken as close to the origination point as was accessible by boat. A duplicate sample SC-SW/SED-31 was taken with SC-SW/SED-18. (Ref. 14, pp.6, 93) This portion of the stream was apparently lined by a responsible party as an interim remedial measure, but it has not been maintained, as plant growth has grown through tears and holes (Ref. 28, pp.2). It also does not appear to line the entire ditch as sediment samples were easily obtained without encountering the liner (Ref. 14, pp. 18-20). Sample SC-SW/SED-21 was from the portion of the ditch south of Building 2 (Ref. 14, pp. 6, 93).

Because the southern drainage ditch originates onsite, background sample locations were not found. However, not all contaminants were found in all sample locations, therefore, this lack of uniform distribution of these not naturally occurring man-made substances will serve to set a "background level" of non-detect.

- Background Concentrations:

Sample ID	Sample Medium	Sample Location	Depth	Date	Reference
SC-SW-04	surface water	upstream Hackensack River, 263' north of north outfall and 24' from bank	surface	10/02/02	Ref. 14, pp. 93, 926
SC-SW-05	surface water	east end of drainage ditch, 11' west of wooden berm wall.	surface	10/02/02	Ref. 14, pp. 93, 928
SC-SW-09	surface water	19'4" west of center of right of way	surface	10/03/02	Ref. 14, pp. 93, 936
SC-SW-10	surface water	94'10" west of center of right of way	surface	10/03/02	Ref. 14, pp. 93, 938
SC-SW-11	surface water	155'8" west of center of right of way	surface	10/03/02	Ref. 14, pp. 93, 940
SC-SW-13	surface water	wetland area at confluence of southern drainage ditch and wetlands, near fence	surface	10/03/02	Ref. 14, pp. 93, 944
SC-SW-14	surface water	southwest wetland area, across from drainage ditch entry	surface	10/03/02	Ref. 14, pp. 93, 946
SC-SW-15	surface water	northeast wetland area, across from SC-SW-14 and south of drainage ditch	surface	10/03/02	Ref. 14, pp. 93, 948
SC-SW-16	surface water	cove in west end of wetland, as far west as possible	surface	10/03/02	Ref. 14, pp. 93, 950
SC-SW-17	surface water	originating onsite drainage ditch, 21'2" from fence at channel confluence	surface	10/03/02	Ref. 14, pp. 93, 952
SC-SW-18	surface water	originating onsite ditch, 106'9" from fence at channel confluence, at bend in ditch	surface	10/03/02	Ref. 14, pp. 93, 954
SC-SW-21	surface water	112' west of southeast corner of existing building 2	surface	10/03/02	Ref. 14, pp. 93, 960

Sample ID	Sample Medium	Sample Location	Depth	Date	Reference
SC-SED-05	sediment	east end of drainage ditch, 11' west of wooden berm wall.	0-3.0 inches	10/02/02	Ref. 14, pp. 93, 929
SC-SED-06	sediment	east end of drainage ditch, 312' west of wooden bermed wall	0-3.0 inches	10/02/02	Ref. 14, pp. 93, 931
SC-SED-07	sediment	east end of drainage ditch, from a cove to the north, 67 ft east of right of way, directly below a pipe south of lagoons	0-3.0 inches	10/02/02	Ref. 14, pp. 93, 933
SC-SED-08	sediment	east end of drainage ditch, 21'7" feet east of right of way	0-3.0 inches	10/02/02	Ref. 14, pp. 93, 935
SC-SED-09	sediment	19'4" west of center of right of way	0-3.0 inches	10/03/02	Ref. 14, pp. 93, 937
SC-SED-10	sediment	94'10" west of center of right of way	0-3.0 inches	10/03/02	Ref. 14, pp. 93, 939
SC-SED-11	sediment	155'8" west of center of right of way	0-3.0 inches	10/03/02	Ref. 14, pp. 93, 941
SC-SED-12	sediment	246'8" west of center of right of way	0-3.0 inches	10/03/02	Ref. 14, pp. 93, 943
SC-SED-15	sediment	northeast wetland area, across from SC-SW-14 and south of drainage ditch	0-3.0 inches	10/03/02	Ref. 14, pp. 93, 949
SC-SED-17	sediment	originating onsite ditch, 21'2" from fence at channel confluence	0-3.0 inches	10/03/02	Ref. 14, pp. 93, 953
SC-SED-20	sediment	originating drainage ditch, as far north as accessible, 96'1" from SC-SED-19	0-3.0 inches	10/03/02	Ref. 14, pp. 93, 959
SC-SED-21	sediment	drainage ditch, 112' west of southeast corner of existing building 2	0-3.0 inches	10/03/02	Ref. 14, pp. 93, 961

Sample ID	Hazardous Substance	Concentration (µg/kg)	Reporting Limit (µg/kg)	Reference
SC-SW-04	naphthalene 1,2,4-trichlorobenzene 1,4-dichlorobenzene	ND* ND ND	4.0 4.0 4.0	14, pp. 650
SC-SW-05	chlorobenzene	ND	10	14, pp. 561
SC-SW-09	1,4-dichlorobenzene	5.6	4.0	14, pp. 665
SC-SW-10	naphthalene 1,2,4-trichlorobenzene 1,4-dichlorobenzene	ND ND 6.0	4.0 4.0 4.0	14, pp. 668
SC-SW-11	naphthalene 1,2,4-trichlorobenzene 1,4-dichlorobenzene	ND ND 6.3	4.0 4.0 4.0	14, pp. 670-671
SC-SW-13	naphthalene 1,2,4-trichlorobenzene	ND ND	4.0 4.0	14, pp. 677
SC-SW-14	chlorobenzene 1,2,4-trichlorobenzene	ND ND	10 4.0	14, pp. 680, 740
SC-SW-15	chlorobenzene 1,2,4-trichlorobenzene	ND ND	10 4.0	14, pp. 683, 742
SC-SW-16	chlorobenzene 1,2,4-trichlorobenzene 1,4-dichlorobenzene	ND ND 4.2	10 4.0 4.0	14, pp. 685, 686, 743
SC-SW-17	1,2,4-trichlorobenzene	ND	4.0	14, pp. 689
SC-SW-18	naphthalene	ND	4.0	14, pp. 692
SC-SW-21	naphthalene	5.6	4.0	14, pp. 697
SC-SED-05	chlorobenzene 1,2,4-trichlorobenzene	ND ND	4,900 1,400	14, pp. 549, 584
SC-SED-06	1,2,4-trichlorobenzene	ND	860	14, pp. 587
SC-SED-07	1,4-dichlorobenzene	480 JQM***	520	14, pp. 589
SC-SED-08	chlorobenzene	ND	2,800	14, pp. 553
SC-SED-09	chlorobenzene	ND	2,900	14, pp. 711
SC-SED-10	naphthalene chlorobenzene 1,2,4-trichlorobenzene	ND ND ND	650 2,900 650	14, pp. 599, 712
SC-SED-11	chlorobenzene 1,2,4-trichlorobenzene	ND ND	2,700 780	14, pp. 603, 714
SC-SED-12	chlorobenzene	ND	3,600	14, pp. 715

Sample ID	Hazardous Substance	Concentration (µg/kg)	Reporting Limit (µg/kg)	Reference
SC-SED-15	chlorobenzene 1,2,4-trichlorobenzene 1,4-dichlorobenzene	ND ND 5,100	11,000 3,300 3,300	14, pp. 614, 720
SC-SED-17	naphthalene	ND	1,500	14, pp. 620
SC-SED-20	naphthalene	ND	1,600	14, pp. 630

Notes: * ND = non-detect. These samples have been chosen to demonstrate a background level for these contaminants. These contaminants are man-made substance which are not ubiquitous in the area.
*** JQM is the qualifier used to indicate that the results are estimated values below the established "Reporting Limit" of the method. The Laboratory generally reports results down to the reporting limit of the method. Results with a "J" have a decreased accuracy relative to results that are reported equal to or above the Reporting Limit of the method (Ref. 14, pp. 542). The Reporting limit of samples qualified JQM is being used as the value indicative of a relative background level for this contaminant. Even though the contaminant is present, it is present below a value that is still three times below the values of the release samples.

Sample ID	Hazardous Substance	Concentration nanograms/kilogram (ng/kg)	EMPC/EDL *** (ng/kg)	Reference
SC-SED-08	2,3,7,8-TCDD	ND*	4.05	14, pp. 845
SC-SED-11	2,3,7,8-TCDD	1.53	10.0	14, pp. 857
SC-SED-20	2,3,7,8-TCDD	ND	0.982	14, pp. 899
SC-SED-21	2,3,7,8-TCDD	21.7	20.0	14, pp. 903

Notes: * ND = non-detect. These samples have been chosen to demonstrate a background level for this contaminant. 2,3,7,8-TCDD is a man-made substance which is not ubiquitous in the area.
***Estimated Maximum Possible Concentrations/Estimated Detection Level is reported by laboratory for samples that are non-detect. The SOW DLM01.4 does not require the lab to report EDLs for hit samples. Therefore, the Contract Required Quantitation Limit (CRQL) of 1.0 ng/kg is being used for those samples where the sample specific EDL is not available. CRQLs of samples that have been diluted have been adjusted for the dilution factor (Ref. 26).

- Sample Concentrations Adjusted for Total Organic Carbon

In order to account for the variations in total organic carbon found in the sediment samples and its possible influence on contaminant levels, the concentration of contaminant in µg/kg was divided by the total organic carbon in µg/kg. The result was then multiplied by 10^6 in order to make the results more manageable numbers. The resultant value represents the concentration of contaminant in grams per kilogram (g/kg) per g/kg of total organic carbon. This was done to ensure that the observed releases were due to actual increases in contamination, not due to the nature of the media. All samples used in the observed release have been normalized and are three times above the normalized background concentrations.

Sample ID	Hazardous Substance	Concentration (µg/kg)	Total Organic Carbon (TOC) (µg/kg)	Normalized Concentration (concentration/ TOC)*10^6	Normalized Concentration of Reporting Limit (concentration/ TOC)*10^6	Reference
SC-SED-05	chlorobenzene 1,2,4-trichlorobenzene	ND ND	29,000,000	ND		14, pp. 549, 584, 765; 15
SC-SED-06	1,2,4-trichlorobenzene	ND	15,000,000	ND		14, pp. 587, 766; 15
SC-SED-07	1,4-dichlorobenzene	480 JQM***	25,000,000	19.2	20.8	14, pp. 589, 767; 15
SC-SED-08	chlorobenzene	ND	27,000,000	ND		14, pp. 553, 768; 15
SC-SED-09	chlorobenzene	ND	18,000,000	ND		14, pp. 711, 769; 15
SC-SED-10	naphthalene chlorobenzene 1,2,4-trichlorobenzene	ND ND ND	11,000,000	ND ND ND		14, pp. 599, 712, 770; 15
SC-SED-11	chlorobenzene 1,2,4-trichlorobenzene	ND ND	14,000,000	ND ND		14, pp. 603, 714, 771; 15
SC-SED-12	chlorobenzene	ND	12,000,000	ND		14, pp. 715, 772; 15
SC-SED-15	chlorobenzene 1,2,4-trichlorobenzene 1,4-dichlorobenzene	ND ND 5,100	170,000,000	ND ND 30.0		14, pp. 614, 720, 775; 15

Sample ID	Hazardous Substance	Concentration (µg/kg)	Total Organic Carbon (TOC) (µg/kg)	Normalized Concentration (concentration/ TOC)*10^6	Normalized Concentration of Reporting Limit (concentration/ TOC)*10^6	Reference
SC-SED-17	naphthalene	ND	28,000,000	ND		14, pp. 620, 777; 15
SC-SED-20	naphthalene	ND	14,000,000	ND		14, pp. 630, 780; 15

Notes:
*** JQM is the qualifier used to indicate that the results are estimated values below the established "Reporting Limit" of the method. The Laboratory generally reports results down to the reporting limit of the method. Results with a "J" have a decreased accuracy relative to results that are reported equal to or above the Reporting Limit of the method (Ref. 14, pp. 542). The Reporting limit of samples qualified JQM is being used as the value indicative of a relative background level for this contaminant. Even though the contaminant is present, it is present below a value that is still three times below the values of the release samples.

Sample ID	Hazardous Substance	Concentration nanograms/kilogram (ng/kg)	Total Organic Carbon (TOC) (µg/kg)	Normalized Concentration (concentration/ TOC)*10^6	Reference
SC-SED-08	2,3,7,8-TCDD	ND*	27,000,000	ND	14, pp. 768, 845; 15
SC-SED-11	2,3,7,8-TCDD	1.53	14,000,000	.000109	14, pp. 771, 857; 15
SC-SED-20	2,3,7,8-TCDD	ND	14,000,000	ND	14, pp. 780, 899; 15
SC-SED-21	2,3,7,8-TCDD	21.7	160,000,000	.000136	14, pp. 781, 903; 15

- Contaminated Samples:

Sample ID	Sample Medium	Sample Location	Distance from PPE	Depth	Date	Reference
SC-SW-02	surface water	directly from outfall from southern drainage ditch into Hackensack River	≈1084' 4" PPE4	surface	10/02/02	14, pp. 93, 922
SC-SW-03	surface water	Hackensack River 72' east of southern outfall	≈1156' PPE4	surface	10/02/02	14, pp. 93, 924
SC-SW-06	surface water	east end of drainage ditch 312' west of wooden berm wall	≈772' PPE4	surface	10/02/02	14, pp. 93, 930
SC-SW-07	surface water	east end of drainage ditch, from a cove to the north, 67 ft north of the edge of right of way, directly below a pipe south of lagoons	0ft - PPE2	surface	10/02/02	14, pp. 93, 932
SC-SW-08	surface water	east end of drainage ditch, 21'7" east of right of way	≈665'7" PPE4	surface	10/02/02	14, pp. 93, 934
SC-SW-09	surface water	19'4" west of center of right of way	≈561'5" PPE3	surface	10/03/02	14, pp. 93, 936
SC-SW-12	surface water	246'8" west of center of right of way	≈398' PPE4	surface	10/03/02	14, pp. 93, 942
SC-SW-19	surface water	104' from SC-SW-18; just past bend in drainage ditch there is a cove to west. Collected below a 6 inch pipe just east of building 2.	0 ft - PPE3	surface	10/03/02	14, pp. 93, 956
SC-SW-20	surface water	originating drainage ditch, as far north as accessible, 96'1" from SC-SW-19	96'1" - PPE3	surface	10/03/02	14, pp. 93, 958
SC-SW-21	surface water	drainage ditch, 112' west of the southeast corner of Building 2	0ft - PPE4	surface	10/03/02	14, pp. 93, 960
SC-SED-05	sediment	east end of drainage ditch, 11' west of wooden bermed wall	≈1073' PPE4	0-3.0 inches	10/02/02	14, pp. 93, 928

Sample ID	Sample Medium	Sample Location	Distance from PPE	Depth	Date	Reference
SC-SED-08	sediment	east end of drainage ditch, 21'7" east of right of way	≈665'7" PPE4	0-3.0 inches	10/02/02	14, pp. 93, 935
SC-SED-09	sediment	19'4" west of center of right of way	≈561'5" PPE3	0-3.0 inches	10/03/02	14, pp. 93, 937
SC-SED-11	sediment	155'8" west of center of right of way	≈301'9" PPE3	0-3.0 inches	10/03/02	14, pp. 93, 941
SC-SED-12	sediment	246'8" west of center of right of way	≈398' PPE4	0-3.0 inches	10/03/02	14, pp. 93, 943
SC-SED-13	sediment	wetland area at confluence of onsite originating ditch and wetlands, near fence	≈378'4" PPE4	0-3.0 inches	10/03/02	14, pp. 93, 945
SC-SED-14	sediment	southwest wetland area, across from drainage ditch entry.	>210'9" PPE3	0-3.0 inches	10/03/02	14, pp. 93, 947
SC-SED-15	sediment	northeast wetland area, across from SC-SED-14, south of drainage ditch	>210'9" PPE3	0-3.0 inches	10/03/02	14, pp. 93, 949
SC-SED-16	sediment	cove in west end of wetland area, as far west as possible	>378'4" PPE4	0-3.0 inches	10/03/02	14, pp. 93, 951
SC-SED-18	sediment	onsite originating ditch, 106'9" from fence at channel confluence, at bend in ditch	104' from PPE3	0-3.0 inches	10/03/02	14, pp. 93, 955
SC-SED-19	sediment	104' from SC-SED-18; just past bend in drainage ditch there is a cove to west. Collected below a 6 inch pipe just east of building 2.	0ft - PPE3	0-3.0 inches	10/03/02	14, pp. 93, 957
SC-SED-20	sediment	originating drainage ditch, as far north as accessible, 96'1" from SC-SED-19	96'1" from PPE3	0-3.0 inches	10/03/02	14, pp. 93, 959

Sample ID	Sample Medium	Sample Location	Distance from PPE	Depth	Date	Reference
SC-SED-21	sediment	drainage ditch, 112' west of southeast corner of building 2	0ft - PPE4	0-3.0 inches	10/03/02	14, pp. 93, 961

Sample ID	Hazardous Substance	Concentration (µg/kg)	Reporting Limit (µg/kg)	Reference
SC-SW-02	naphthalene 1,2,4-trichlorobenzene 1,4-dichlorobenzene	45 12 4.0 JQM	4.0	14, pp. 644
SC-SW-03	naphthalene 1,2,4-trichlorobenzene 1,4-dichlorobenzene	42 11 4.0 JQM	4.0	14, pp. 647
SC-SW-06	naphthalene 1,2,4-trichlorobenzene 1,4-dichlorobenzene	77 16 79	5.0	14, pp. 656
SC-SW-07	naphthalene 1,2,4-trichlorobenzene 1,4-dichlorobenzene	270 82 200	5.0	14, pp. 659
SC-SW-08	naphthalene 1,2,4-trichlorobenzene 1,4-dichlorobenzene	100 33 77	4.0	14, pp. 662
SC-SW-09	naphthalene	33	4.0	14, pp. 665
SC-SW-12	chlorobenzene 1,2,4-trichlorobenzene 1,4-dichlorobenzene	31 6.7 15	10 4.0 4.0	14, pp. 674, 737
SC-SW-19	1,4-dichlorobenzene	46	4.0	14, pp. 694
SC-SW-20	chlorobenzene 1,2,4-trichlorobenzene 1,4-dichlorobenzene	600 45 420	10 4.0 4.0	14, pp. 697, 749
SC-SW-21	chlorobenzene 1,2,4-trichlorobenzene 1,4-dichlorobenzene	760 200 610	10 4.0 4.0	14, pp. 700, 751
SC-SED-05	naphthalene	1,900	860	14, pp. 584
SC-SED-08	naphthalene 1,2,4-trichlorobenzene 1,4-dichlorobenzene	4,500 1,400 3,000	680	14, pp. 593

Sample ID	Hazardous Substance	Concentration (µg/kg)	Reporting Limit (µg/kg)	Reference
SC-SED-09	naphthalene	6,300	890	14, pp. 596
SC-SED-11	naphthalene	840	780	14, pp. 603
SC-SED-12	naphthalene	3,700	1,200	14, pp. 605
SC-SED-13	naphthalene 1,4-dichlorobenzene	3,400 18,000	2,600	14, pp. 608-609
SC-SED-14	naphthalene	4,900	3,100	14, pp. 611
SC-SED-16	naphthalene 1,4-dichlorobenzene	5,700 13,000	25,00	14, pp. 617
SC-SED-18	naphthalene	970	960	14, pp. 624
SC-SED-19	naphthalene chlorobenzene 1,2,4-trichlorobenzene 1,4-dichlorobenzene	23,000 250,000 2,900,000 6,000,000	13,000 26,000 13,000 13,000	14, pp. 626, 725
SC-SED-20	chlorobenzene 1,2,4-trichlorobenzene 1,4-dichlorobenzene	43,000 1,700 21,000	43,000 1,600 1,600	14, pp. 629-630, 727
SC-SED-21	chlorobenzene 1,2,4-trichlorobenzene 1,4-dichlorobenzene	41,000 25,000 240,000	7,400 3,900 3,900	14, pp. 632-633, 728

Notes:
*** JQM is the qualifier used to indicate that the results are estimated values below the established "Reporting Limit" of the method. The Laboratory generally reports results down to the reporting limit of the method. Results with a "J" have a decreased accuracy relative to results that are reported equal to or above the Reporting Limit of the method (Ref. 14, pp. 542).

Sample ID	Hazardous Substance	Concentration (ng/kg)	EMPC/EDL *** (ng/kg)	Reference
SC-SED-13	2,3,7,8-TCDD	96.4	30.0	14, pp. 865
SC-SED-14	2,3,7,8-TCDD	81.0	30.0	14, pp. 869
SC-SED-15	2,3,7,8-TCDD	91.7	20.0	14, pp. 873
SC-SED-16	2,3,7,8-TCDD	50.0	10.0	14, pp. 877
SC-SED-19	2,3,7,8-TCDD	85.1	20.0	14, pp. 889

Notes:
***Estimated Maximum Possible Concentrations/Estimated Detection Level is reported by laboratory for samples that are non-detect. The SOW DLM01.4 does not require the lab to report EDLs for hit samples. Therefore, the Contract Required

Quantitation Limit (CRQL) of 1.0 ng/kg is being used for those samples where the sample specific EDL is not available. CRQLs of samples that have been diluted have been adjusted for the dilution factor (Ref. 26).

- Sample Concentrations Adjusted for Total Organic Carbon

In order to account for the variations in total organic carbon found in the sediment samples and its possible influence on contaminant levels, the concentration of contaminant in µg/kg was divided by the total organic carbon in µg/kg. The result was then multiplied by 10^6 in order to make the results more manageable numbers. The resultant value represents the concentration of contaminant in grams per kilogram (g/kg) per g/kg of total organic carbon. This was done to ensure that the observed releases were due to actual increases in contamination, not due to the nature of the media. All samples used in the observed release have been normalized and are three times above the normalized background concentrations.

Sample ID	Hazardous Substance	Concentration (µg/kg)	Total Organic Carbon (TOC) (µg/kg)	**Normalized Concentration (concentration/ TOC)*10^6	Reference
SC-SED-05	naphthalene	1,900	29,000,000	65.517	14, pp. 584, 765; 15
SC-SED-08	naphthalene 1,2,4-trichlorobenzene 1,4-dichlorobenzene	4,500 1,400 3,000	27,000,000	166.667 51.852 111.111	14, pp. 593, 768; 15
SC-SED-09	naphthalene	6,300	18,000,000	350.000	14, pp. 596, 769; 15
SC-SED-11	naphthalene	840	14,000,000	60.000	14, pp. 603, 771; 15
SC-SED-12	naphthalene	3,700	12,000,000	308.333	14, pp. 605, 772; 15
SC-SED-13	naphthalene 1,4-dichlorobenzene	3,400 18,000	130,000,000	26.154 138.462	14, pp. 608-609, 773; 15
SC-SED-14	naphthalene	4,900	120,000,000	40.833	14, pp. 611, 774; 15
SC-SED-16	naphthalene 1,4-dichlorobenzene	5,700 13,000	120,000,000	47.500 108.333	14, pp. 617, 776; 15
SC-SED-18	naphthalene	970	16,000,000	60.625	14, pp. 624, 778; 15
SC-SED-19	naphthalene chlorobenzene 1,2,4-trichlorobenzene 1,4-dichlorobenzene	23,000 250,000 2,900,000 6,000,000	100,000,000	230.000 2,500 29,000 60,000	14, pp. 626, 725, 779; 15
SC-SED-20	chlorobenzene 1,2,4-trichlorobenzene 1,4-dichlorobenzene	43,000 1,700 21,000	14,000,000	3071.429 121.429 1,500	14, pp. 629-630, 727, 780; 15

Sample ID	Hazardous Substance	Concentration (µg/kg)	Total Organic Carbon (TOC) (µg/kg)	**Normalized Concentration (concentration/ TOC)*10^6	Reference
SC-SED-21	chlorobenzene 1,2,4-trichlorobenzene 1,4-dichlorobenzene	41,000 25,000 240,000	160,000,000	256.25 156.25 1,500	14, pp. 632-633, 728, 781; 15

Sample ID	Hazardous Substance	Concentration (ng/kg)	Total Organic Carbon (TOC) (µg/kg)	**Normalized Concentration (concentration/ TOC)*10^6	Reference
SC-SED-13	2,3,7,8-TCDD	96.4	130,000,000	.000742	14, pp. 773, 865; 15
SC-SED-14	2,3,7,8-TCDD	81.0	120,000,000	.000675	14, pp. 774, 869; 15
SC-SED-15	2,3,7,8-TCDD	91.7	170,000,000	.000539	14, pp. 775, 873; 15
SC-SED-16	2,3,7,8-TCDD	50.0	120,000,000	.000417	14, pp. 776, 877; 15
SC-SED-19	2,3,7,8-TCDD	85.1	100,000,000	.000851	14, pp. 779, 889; 15

Attribution

Standard Chlorine operations at the site included manufacturing of moth crystals and flakes from dichlorobenzene. Standard Chlorine separated dichlorobenzenes at the site from 1963 to 1982. Standard Chlorine also separated and stored 1,2,4-trichlorobenzene at the site from 1970 to 1980. SNP processed liquid petroleum naphthalene at the site from 1963 until 1982. Raw materials were transported to the site by rail and tank truck for processing. Chloroben Chemical Corporation (Chloroben), a subsidiary of Standard Chlorine, operated a batch formulation and blending operation at the site for various drain cleaners known as "Chloroben". From 1963 until 1981, chloroben products were made from 1,2-dichlorobenzene, after which they were produced from hydrochloric acid, sulfuric acid, and methyl benzoate (Ref. 23, pp.2).

A NJDEP Selected Substances Report dated August 1980 indicates that Standard Chlorine disposed of an estimated 12,000 lb/yr of waste from the processing of 1,2,4-trichlorobenzene into the lagoon system between 1975 and 1979 (Ref. 23, pp.2; 6, pp.1-7). Also listed as substances present at the site include 1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, 1,2,4-trichlorobenzene, and naphthalene (Ref. 23, pp.2).

Standard Chlorine has been found in violation of the Spill Compensation and Control Act, specifically N.J.S.A. 58:10-23.11c, and the Water Pollution Control Act, specifically N.J.S.A. 58:10A-6. as stated in the ACO issued by the NJDEP and signed by NJDEP and Standard Chlorine on October 20 and October 18, 1989, respectively (Ref. 23, pp.5, 18). The violations were issued for the past and current discharges of hazardous substances and pollutants into the waters and onto the lands of the State of New Jersey (Ref. 23, pp.5). The hazardous substances and pollutants referenced in the violations include dioxin, naphthalene, 1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, 1,2,3-trichlorobenzene, 1,2,4-trichlorobenzene, trichloroethylene, tetrachloroethylene, benzene, chlorobenzene, toluene, and hydrochloric acid (Ref. 23, pp. 2-5).

In 1985, NJDEP conducted the Phase II Dioxin Investigation, which identified 23 sites in New Jersey suspected of contamination with halogenated dibenzo-p-dioxins, specifically 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD, or dioxin). The Standard Chlorine site was included in the investigation because Standard Chlorine once produced and stored two dioxin related compounds at the site, 1,2,4-trichlorobenzene and 1,2-dichlorobenzene (Ref. 11, pp. 7). Results from this sampling event prompted a more in-depth dioxin investigation by Standard Chlorine (Ref. 23, pp.3). In February and March 1987, a "Stage I" dioxin sampling event was conducted (Ref. 6, pp.2-2; 12; 23, pp.4). Samples were collected at four depths at a total of 20 locations. The first two shallow samples were analyzed and the two deeper core samples were archived to be analyzed for dioxin if the shallow samples revealed contamination (Ref. 12, pp. 19; 23, pp.4). The results of the re-analyzed samples are referred to as Stages II and III (Ref. 6, pp. 2-2; 12, pp. 19; 13, pp. 11-12). These samples were taken in the lagoon area and show contamination of 2,3,7,8-TCDD (Ref. 6, pp. 2-3, fig. 116-2.8; 12, pp. 8-9, 21, 24; 13, pp. 13,14-15, 24, 25).

Most of the site drainage reaches the southern drainage ditch which also receives runoff from the Koppers property to the south. Shallow groundwater also discharges to the ditch. The sediments in the drainage ditch have a yellow-brown color which also forms a scum on the water surface (Ref. 7, pp. 7-9; 28, pp.5-8). This appears to be related to the chromium fill (Ref. 8, pp. 5-25). While it is possible that surface water and sediments in the southern drainage ditch may be impacted from contaminants from the Koppers property to the south of the site, the highest concentration of contaminants were detected in the center of the property where the ditch originates onsite. The contaminants detected in the surface water and sediment samples collected in the southern drainage ditch are all site attributable compounds (Ref. 8, 5-33).

Furthermore, the observed release by direct observation demonstrates that at least part of the significant increase in contaminant concentrations is due to releases from the site (Ref. 14, pp. 3, 542, 641, 920;23, pp. 2-5).

Hazardous Substances Released

naphthalene
1,4-dichlorobenzene
1,2,4-trichlorobenzene
chlorobenzene
2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD, or dioxin)
1,2-dichlorobenzene
1,3-dichlorobenzene
1,2,3-trichlorobenzene
trichloroethylene
tetrachloroethylene
benzene
toluene
hydrochloric acid

Surface Water Observed Release Factor Value: 550

4.1.3.2 Human Food Chain Threat Waste Characteristics

4.1.3.2.1 Toxicity/Persistence/Bioaccumulation

Hazardous Substance	Source No.	Toxicity Factor Value	Persistence Factor Value*	Bioaccu-mulation Value**	Toxicity/ Persistence/ Bioaccumulation Factor Value (Table 4-16)	Ref.
1,4-dichlorobenzene	1,2, OR	10	.4000	50	200	2, pp. B-7
2,3,7,8-TCDD	1, OR	10000	1	5000	50,000,000	2, pp. B-17
naphthalene	1,2, OR	100	.4000	500**	20,000	2, pp. B-13
1,2,4-trichlorobenzene	1,2, OR	100	.4000	500	20,000	2, pp. B-18
chlorobenzene	1,2, OR	100	.0007	50	3.5	2, pp. B-4
1,2 dichlorobenzene	1,2, OR	10	.4000	50	200	2, pp. B-7
1,3 dichlorobenzene	1,2, OR	0	.4000	50	0	2, pp. B-7
1,2,3 trichlorobenzene	2, OR	0	0	0	0	2, pp. B-18
trichloroethylene	2, OR	10	.4000	50	200	2, pp. B-18
tetrachloroethylene	2, OR	100	.4000	50	2000	2, pp. B-16
benzene	1,2, OR	100	.4000	5000	200,000	2, pp. B-2
toluene	1,2, OR	10	.4000	50	200	2, pp. B-17
hydrochloric acid	OR	1000	.4000	0.5	200	2, pp. B-11
methylene chloride	1,2	10	.4000	5.0	20	2, pp. B-13
ethylbenzene	1	10	.4000	50	200	2, pp. B-9

Notes:

- * Persistence value for Rivers
- ** Bioaccumulation factor value for higher of freshwater or saltwater - Bioaccumulation factor for naphthalene is the saltwater value. HRS states that if any fisheries are in brackish water [Hackensack River has a salinity ranging from 0-16 parts per thousand (Ref. 22, pp. 27)], use the BCF data that yield the higher factor value to assign the bioaccumulation potential factor value to the hazardous substance (HRS 4.1.3.2.1.3, pp.51617)

Toxicity/Persistence/Bioaccumulation Factor Value: $5x10^7$

4.1.3.2.2 Hazardous Waste Quantity

Source No.	Source Type	Source Hazardous Waste Quantity
1	surface impoundment	2033.33
2	contaminated soil	>0

Sum of Values: 2933

Hazardous Waste Quantity Factor Value: 100
(Table 2-6)

4.1.3.2.3 Waste Characteristics Factor Category Value

Toxicity/Persistence Factor Value: 10,000
Hazardous Waste Quantity Factor Value: 100
Bioaccumulation value: 5,000

Toxicity/Persistence Factor Value x Hazardous Waste Quantity Factor Value: $1x10^6$
($10,000 \times 100 = 1x10^6$)
(Max $1x10^8$)

Bioaccumulation potential factor value x
(Toxicity/Persistence Factor Value x Hazardous Waste Quantity Factor Value): $5x10^9$
($5,000 \times 1x10^6 = 5x10^9$)
(Max $1x10^{12}$)

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

4.1.3.3 Human Food Chain Threat Targets

Actual Human Food Chain Contamination

Sample ID	Sample Medium	Distance from PPE	Hazardous Substance	Bioaccumulation Factor Value	Refs.
SC-SW-02, SC-SW-03	surface water	SW-03 is ≈1073'5" ft from PPE3	naphthalene	20000	14, pp. 93, 644, 647, 922, 924; 2, pp. B-13, B-18
SC-SW-02, SC-SW-03	surface water	SW-03 is ≈1137' from PPE4	1,2,4-trichlorobenzene	20000	14, pp. 93, 644, 647, 922 924; 2, pp. B-13, B-18

- Closed Fisheries: While no fisheries are designated as closed, there is a Health Advisory issued for the Hackensack River regarding the consumption of blue crab and striped bass due to dioxin contamination and american eel, white perch, and white catfish due to PCB contamination in the river. The Hackensack River advisory is included as part of the Newark Bay complex advisory (Ref. 18; 19).

Identity of Fishery	Sample ID	Distance from PPE	Hazardous Substance	Refs.
Hackensack River	SC-SW-02	≈1084'4" from PPE4	naphthalene 1,2,4-trichlorobenzene	14, pp. 93, 644, 922
Hackensack River	SC-SW-03	≈1156' from PPE4	naphthalene 1,2,4-trichlorobenzene	14, pp. 93, 647, 924

Level I Concentrations

No Level I fisheries were identified in the TDL.

Most Distant Level II Sample

Sample ID: SC-SW-03
Distance from the probable point of entry: ≈1156 ft from PPE4
Reference: 14, pp. 93, 647, 924

Fishing for consumption regularly takes place on the Hackensack River despite the Health Advisory (Ref, 20; 21). There are two popular fishing locations on the banks of the river both up and downstream from Standard Chlorine and hook and line fishing from boats takes place on the River off the Standard Chlorine property (Ref. 20; 21;28, pp. 13-15).

Level II Fisheries

Identity of Fishery	Extent of Level II Fishery (Relative to PPE or Level I Fishery)	Refs.
Hackensack River	There is a Level II Fishery in the Hackensack River at SC-SW-03. SC- SW-03 is located approximately 1156 ft from PPE4.	14, pp. 93, 647, 924; 18; 19; 20; 21

4.1.3.3.1 Food Chain Individual

Sample ID: SC-SW-03
Level I/Level II/or Potential: Level II
Hazardous Substance: naphthalene, 1,2,4-trichlorobenzene
Bioaccumulation Potential: 20,000

Identity of Fishery	Type of Surface Water Body	Dilution Weight (Table 4-13)	Refs.
Hackensack River	moderate to large stream	0.01	24

Food Chain Individual Factor Value: 45

4.1.3.3.2 Population

4.1.3.3.2.1 Level I Concentrations

No Level I fisheries were identified within the TDL.

4.1.3.3.2.2 Level II Concentrations

Identity of Fishery	Annual Production (pounds)	References	Human Food Chain Population Value (Table 4-18)
Hackensack River	>0	20; 21	.03

Sum of Level II Human Food Chain Population Values: 0.03

Level II Concentrations Factor Value: 0.03

4.1.3.3.2.3 Potential Contamination

The surface water migration pathway has a maximum score of 100.00 based on actual contamination, therefore potential surface water targets were not evaluated.

Potential Contamination Factor Value: 0

4.1.4.2 Environmental Threat Waste Characteristics

4.1.4.2.1 Ecosystem Toxicity/Persistence/Bioaccumulation

Hazardous Substance	Source No.	Ecosystem Toxicity Factor Value[a]	Persistence Factor Value*	Environmental Bioaccu-mulation Value**	Ecosystem Toxicity/ Persistence/ Bioaccumulation Factor Value (Table 4-21)	Ref.
1,4-dichlorobenzene	1,2, OR	100	.4000	50	2000	2, pp. B-7
2,3,7,8-TCDD***	1, OR	10000	1	5000	$5x10^7$	2, pp. B-17
naphthalene	1,2, OR	1000	.4000	5000**s	$2x10^6$	2, pp. B-13
1,2,4-trichlorobenzene	1,2, OR	1000	.4000	500	$2x10^5$	2, pp. B-18
chlorobenzene	1,2, OR	1000	.0007	50	35	2, pp. B-4
1,2 dichlorobenzene	1,2, OR	100	.4000	50	2000	2, pp. B-7
1,3 dichlorobenzene	1,2, OR	100	.4000	50	2000	2, pp. B-7
1,2,3 trichlorobenzene	2, OR	0	0	0	0	2, pp. B-18
trichloroethylene	2, OR	100*f	.4000	50	2000	2, pp. B-18
tetrachloroethylene	2, OR	100*f	.4000	50	2000	2, pp. B-16
benzene	1,2, OR	1000*s	.4000	50000**s	$2x10^7$	2, pp. B-2
toluene	1,2, OR	100	.4000	50	2000	2, pp. B-17
hydrochloric acid	OR	1	.4000	0.5	0.2	2, pp. B-11
methylene chloride	1,2	10*s	.4000	5.0	20	2, pp. B-13
ethylbenzene	1	100*f	.4000	50	2000	2, pp. B-9

Notes:

* Persistence value for Rivers

** Bioaccumulation factor value for Salt water - Bioaccumulation factors for naphthalene and benzene are the Saltwater values. HRS states that if any sensitive environments are in brackish water [Hackensack River has a salinity ranging from 0-16 parts per thousand (Ref. 22, pp. 27)], use the BCF data that yield the higher factor value to assign the bioaccumulation potential factor value to the hazardous substance (HRS 4.1.4.2.1.3, pp.51617)

*** Data for TCDD

[a] Ecosystem Toxicity factor value for saltwater (*s) or freshwater (*f). HRS states that if some of the sensitive environments being evaluated are in freshwater and some are in saltwater, or if any are in brackish water [Hackensack River has a salinity ranging from 0-16 parts per thousand (Ref. 22, pp. 27)], use the value (freshwater or marine) that yields the higher factor value to assign the ecosystem toxicity factor value to the hazardous substance (HRS 4.1.4.2.1.1, pp.51621)

Ecosystem Toxicity/Persistence/Bioaccumulation Factor Value: $5x10^7$

4.1.4.2.2. Hazardous Waste Quantity

Source No.	Source Type	Source Hazardous Waste Quantity
1	surface impoundment	2933.33
2	contaminated soil	>0

Sum of Values: 2933

Hazardous Waste Quantity Factor Value: 100
(Table 2-6)

4.1.4.2.3. Waste Characteristics Factor Category Value

Ecosystem Toxicity/Persistence Factor Value: 10,000
Hazardous Waste Quantity Factor Value: 100
Bioaccumulation value: 5,000

Ecosystem Toxicity/Persistence Factor Value x Hazardous Waste Quantity Factor Value: $1x10^6$
($10,000 \times 100 = 1x10^6$)
(max $1x10^8$)

Bioaccumulation potential factor value x
(Ecosystem Toxicity/Persistence Factor Value x Hazardous Waste Quantity Factor Value): $5x10^9$
($5,000 \times 1x10^6 = 5x10^9$)
(Max $1x10^{12}$)

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

4.1.4.3 Environmental Threat Targets

Level I Concentrations

Because none of the contaminants found in the observed release have applicable benchmark values, all actually contaminated targets are subject to Level II contamination. Therefore there are no Level I targets in the TDL.

Most Distant Level II Sample

Sample ID: SC-SW-03
Distance from the probable point of entry: ≈1156 ft from PPE4
Reference: 14, pp. 93, 647, 924

4.1.4.3.1 Sensitive Environments

4.1.4.3.1.1. Level I Concentrations

Because none of the contaminants found in the observed release have applicable ecological benchmark values, all targets are subject to Level II contamination. Therefore there are no Level I targets in the TDL.

Level I Concentrations Factor Value: 0

4.1.4.3.1.2. Level II Concentrations

Because none of the contaminants found in the observed release have applicable benchmark values, all actually contaminated targets are subject to Level II contamination.

Sensitive Environments

The Hackensack Meadowlands Habitat Complex has been identified by the US Fish and Wildlife Service as a Significant Habitat Complex of the New York Bight Watershed at the request of the US EPA's New York - New Jersey Harbor Estuary Program (Ref. 22, pp. 6). The Hackensack Meadowlands habitat complex includes the remaining tidal wetlands and adjacent palustrine wetlands and uplands along the lower Hackensack River north of Jersey City, New Jersey. The habitat complex is generally bounded by the Conrail railroad tracks and Route 17 to the west south, the New York, Susquehanna, and Western Railroad tracks to the east, and Route 46 to the north; its northwest corner is bounded by the runways at Teterboro Airport. The complex also includes the aquatic habitat and adjacent upland habitat of Overpeck Creek which feeds into the Hackensack River at the complex's northeastern end. This 8,400 acre wetland area encompasses the remaining wetlands and open space habitats that support significant concentrations of waterfowl, wading birds, shorebirds, raptors, anadromous fish, and estuarine fish (Ref. 22, pp. 26, 37).

Sensitive Environment	Distance from PPE to Nearest Sensitive Environment	References	Sensitive Environment Value (Table 4-23)
Hackensack Meadowlands	PPE1 is in Sensitive Environment. SC-SW-03 is located approximately 1156 ft from PPE4.	14, pp. 93, 542, 641, 647, 920, 924; 22 pp.26	Sensitive Area identified under National Estuary Program - 100

Sum of Level II Sensitive Environments Value: 100

Wetlands

The southern drainage ditch forms the northern frontage of 2 wetland areas designated on National Wetland Inventory maps as PEM1R (palustrine, emergent, persistent, seasonal-tidal), PEM5R (palustrine, emergent,) and E2EM5P (estuarine, Intertidal, emergent, mesohaline, irregularly flooded). The National Wetland Inventory Geographic Information Systems (GIS) data layer was overlain on a New Jersey Digital Orthophoto Quadrangle (DOQ). Wetland frontage was measured using the GIS scale in feet. Ref. 5 shows this overlay. It can be observed on the map that the NWI wetlands polygons do not properly line up with the known boundaries of the wetlands (the southern drainage ditch). This is believed to be an issue of the overlay. Photo-documentation and field observations indicate that wetlands extend to the southern drainage ditch and that this ditch does form the northern boundary of the wetlands (Ref. 14, pp. 11-17, 20, 944-951; 28, pp. 4-8). Wetland frontage was measured from the boundary of the NWI polygons, recognizing that this would be a conservative measurement.

Wetland	Wetland Frontage (miles)	References
PEM5R, PEM1R	905.81 ft = 0.17 miles	5
E2EM5P	444.54 ft = 0.08 miles	5

Sum of Level II Wetland Frontages: 0.25 miles
Wetlands Value (Table 4-24): 25

Sum of Level II Sensitive Environments Value + Wetlands Value: 125

Level II Concentrations Factor Value: 125

4.1.4.3.1.3 Potential Contamination

The surface water migration pathway has a maximum HRS score of 100.00 based on actual contamination, therefore potential surface water targets were not evaluated.

Potential Contamination Factor Value: 0