NPL-U31-2-4-R3

HAZARD RANKING SYSTEM DOCUMENTATION RECORD FOR

ST. JULIENS CREEK ANNEX (U.S. NAVY)

CHESAPEAKE CITY, VIRGINIA

Prepared For:

U.S. Environmental Protection Agency
1650 Arch Street
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EPA Contract No.: 68-S5-3002
Technical Directive Document: 4-9906029

January 3, 2000

Site Name: St. Juliens Creek Annex (U.S. Navy), City of Chesapeake, Virginia

Contact Persons:

Site Contact: Todd Richardson, U.S. Environmental Protection Agency (EPA)
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Pathways, Components, or Threats Not Scored

The Hazard Ranking System (HRS) evaluation performed for the St. Juliens Creek Annex (U.S. Navy) is concentrated exclusively on the surface water pathway. The ground water, soil exposure, and air pathways were not scored because their contribution to the overall score for the site is minimal. Observed releases in ground water and surficial contamination in soils were established, but minimal targets were identified, reducing the contribution of such conditions to the overall score.

HRS DOCUMENTATION RECORD

Site Name: St. Juliens Creek Annex (U.S. Navy)

EPA Region: 3

Date Prepared: August 24, 1999
Date Revised: October 31, 1999
Date Revised: January 18, 2000

Street Address of Site: Victory Boulevard

County and State: City of Chesapeake, Virginia

General Location in the State: Tidewater region of southeastern Virginia

Topographic Maps: U.S. Geologic Survey (USGS), Norfolk South, Virginia Quadrangle, 1986; USGS, Norfolk North, Virginia Quadrangle, 1989; and USGS, Hampton, Virginia Quadrangle, 1986.

Latitude: 36°47′ 39.0″ (Ref. 21)

Longitude: 76°18′ 44.0″ (Ref. 21)

WORKSHEET FOR COMPUTING HRS SITE SCORE

		S	S^2
1.	Ground Water Migration Pathway Score (S_{gw}) (from HRS Table 3-1, Line 13)	NS[a]	NS
2a.	Surface Water Overland/Flood Migration Component (from HRS Table 4-1, Line 30)	100	10,000
2b.	Ground Water to Surface Water Migration Component (from HRS Table 4-25, Line 28)	NS	NS
2c.	Surface Water Migration Pathway Score (S_{sw}) (Enter the larger of the two scores from Lines 2a and 2b as the pathway score)	100	10,000
3.	Soil Exposure Pathway Score (S_s) (From HRS Table 5-1, Line 22)	NS	NS
4.	Air Migration Pathway Score (S_a) (From HRS Table 6-1, Line 12)	NS	NS
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		50.0

Note:

[a] NS = Not scored

ST JULIENS CREEK ANNEX
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	NS
2. Potential to Release by Overland Flow		
2a. Containment	10	NS
2b. Runoff	25	NS
2c. Distance to Surface Water	25	NS
2d. Potential to Release by Overland Flow [lines 2a x (2b +2c)]	500	NS
3. Potential to Release by Flood		
3a. Containment (Flood)	10	NS
3b. Flood Frequency	50	NS
3c. Potential to Release by Flood [lines 3a x 3b]	500	NS
4. Potential to Release [lines 2d + 3c]	500	NS
5. Likelihood of Release [higher of lines 1 and 4]	550	NS
Waste Characteristics		
6. Toxicity/Persistence	a	NS
7. Hazardous Waste Quantity	a	NS
8. Waste Characteristics	100	NS
Targets		
9. Nearest Intake	50	NS
10. Population		
10a. Level I Concentrations	b	NS
10b. Level II Concentrations	b	NS
10c. Potential Contamination	b	NS
10d. Population [lines 10a + 10b + 10c]	b	NS
11. Resources	5	NS
12. Targets [lines 9 + 10d + 11]	b	NS
Drinking Water Threat Score		
13. Drinking Water Threat Score [lines 5 x 8 x 12)/82,500][c]	100	NS

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

SURFACE WATER OVERLAND/FLOOD MIGRATION COMPONENT SCORESHEET (Continued)

	Factor Categories and Factors	Maximum Value	Value Assigned
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	5×10^8
16.	Hazardous Waste Quantity	a	100
17.	Waste Characteristics	1,000	320
	Targets		
18.	Food Chain Individual	50	45
19.	Population		
	19a. Level I Concentrations	b	0
	19b. Level II Concentrations	b	0.06
	19c. Potential Contamination	b	0
	19d. Population [lines 19a + 19b + 19c]	b	0.06
20.	Targets [lines 18 + 19d]	b	45.06
	Human Food Chain Threat Score		
21.	Human Food Chain Threat Score [lines 14 x 17 x 20)/82,500][c]	100	96.13

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

SURFACE WATER OVERLAND/FLOOD MIGRATION COMPONENT SCORESHEET (Continued)

	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	5×10^8
24.	Hazardous Waste Quantity	a	100
25.	Waste Characteristics	1,000	320
	Targets		
26.	Sensitive Environments		
	26a. Level I Concentrations	b	0
	26b. Level II Concentrations	b	875
	26c. Potential Contamination	b	0
27.	Targets [lines 26a + 26b + 26c]	b	875
	Environmental Threat Score		
28.	Environmental Threat Score [lines 22 x 25 x 27)/82,500][c]	60	60
	Surface Water Overland/Flood Migration Component Score for a Watershed		
29.	Watershed Score [lines 13 + 21 + 28][c]	100	100
	SURFACE WATER OVERLAND/FLOOD MIGRATION COMPONENT SCORE		
30.	Component Score (S_{of})[c] [highest score from line 29 for all watersheds evaluated][c]	100	100

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

REFERENCES

Reference Number	Description of the Reference
1	U.S. Environmental Protection Agency (EPA). Hazard Ranking System (HRS) Final Rule, Appendix A of the National Contingency Plan, 55 Federal Register 51583, 40 Code of Federal Regulations Part 300. U.S. Government Printing Office. Washington, DC. December 14, 1990. Not Included - Publicly Available Document.
2	EPA. Superfund Chemical Data Matrix (SCDM). Not Included - Publicly Available Document. June 1996.
3	U.S. Geological Survey (USGS). 7.5-Minute Series Topographic Maps of Norfolk South, Virginia Quadrangle (1986); and Norfolk North, Virginia Quadrangle (1986). Modified by Tetra Tech EM Inc. (Tetra Tech) to show the 15-mile target distance limit from St. Juliens Creek Annex. (1 sheet).
4	Naval Energy and Environmental Support Activity. Navy Assessment and Control of Installation Pollutants: Initial Assessment Study of St. Juliens Creek Annex, Norfolk Naval Shipyard. August 1981. (90 pages).
5	A. T. Kearney, Inc. and K. W. Brown and Associates, Inc. Phase II RCRA Facility Assessment of the St. Juliens Creek Annex Facility. March 1989. (166 pages).
6	EPA. Notification of Hazardous Waste Site. St. Juliens Creek Annex, Dump A. June 1981. (3 pages).
7	EPA. Notification of Hazardous Waste Site. St. Juliens Creek Annex, Dump B. June 1981. (3 pages).
8	NUS Corporation. Project for Performance of Remedial Response Activities at Uncontrolled Hazardous Substance Facilities - Zone 1, A Final Report of Norfolk Naval Shipyard, St. Juliens Creek Annex. August 11, 1983. (68 pages).
9	CH2MHill. Final Relative Risk Ranking System Data Collection Report, St. Juliens Creek Annex to the Norfolk Naval Base. April 23, 1996. (180 pages).
10	CDM Federal Programs Corporation. Draft Analytical Data Summary Tables and Sample Location Maps, St. Juliens Creek. October 3, 1997. (118 pages).
11	CDM Federal Programs Corporation. Letter Regarding Analytical Data from the Remedial Investigation and Feasibility Study. From Lynne J. France, P.G., Geologist. To Mr. Randy Jackson, LANTDV. October 3, 1997. (2 pages).
12	CH2MHill. Final Work Plan and Sampling and Analysis Plan for the Remedial Investigation and Feasibility Study, Landfill B (Site 2) and Burning Grounds (Site 5), St. Juliens Creek Annex. May 9, 1997. (63 pages).

REFERENCES (continued)

Reference Number	Description of the Reference
13	CH2MHill. Final Supplemental Field Investigation Plan, Landfill B and the Burning Grounds, St. Juliens Creek Annex Site. March 1999. (30 pages).
14	EPA. Notification of Hazardous Waste Site - Dump C. June 9, 1981. (4 sheets).
15	CH2MHill. Final Work Plan and Sampling and Analysis Plan for the Remedial Investigation and Feasibility Study, Landfill C (Site 3) and Landfill D (Site 4), St. Juliens Creek Annex. May 9, 1997. (60 pages).
16	CH2MHill. Final Supplemental Field Investigation Plan, Landfill C and Landfill D, St. Juliens Creek Annex Site. March, 1999. (29 pages).
17	EPA. Notification of Hazardous Waste Site - Dump D. June 9, 1981. (4 pages).
18	EPA. Notification of Hazardous Waste Site for Ordnance Burn Area E. June 9, 1981. (3 sheets).
19	EPA. Notification of Hazardous Waste Site for Small Burn Pit. June 9, 1981. (2 pages).
20	EPA. Notification of Hazardous Waste Site for Cross Street and Mine Road Area. June 9, 1981. (2 pages).
21	Tetra Tech. Latitude and Longitude Calculation Worksheet #2. St. Juliens Creek Annex. December 21, 1999. (2 pages).
22	Tetra Tech. Record of Telephone Conversation Regarding Closure of Landfills A, B, C, and D. Between Tim Reisch, Project Manager, Naval Facilities and Engineering Command and Alicia Shultz, Project Manager, Tetra Tech. December 17, 1999. (1 page).
23	Tetra Tech. Final Field Trip Report for the USN St. Juliens Creek Annex Facility, Chesapeake City, Virginia. September 7, 1999. (Excluding Appendix C). (36 pages).
24	Commonwealth of Virginia, Department of Game and Inland Fisheries. Letter Regarding Threatened and Endangered Species. From Thomas F. Wilcox. To Yazmine Yap-Deffler, Work Assignment Manager, EPA. May 18, 1995. (69 pages).
25	Lockheed Martin. Inorganic Data Validation. Case: 26801. SDGS: MCWH52, MCWH53. Site: USN St. Juliens Creek Annex. May 4, 1999. (215 pages).
26	Lockheed Martin. Organic Data Validation. Case: 26801. SDGS: CTB88, CTH08, and CTH12. Site: USN St. Juliens Creek Annex. May 6, 1999. (170 pages).

REFERENCES (continued)

Reference Number	Description of the Reference
27	Commonwealth of Virginia. Department of Conservation and Recreation. Letter Regarding Natural Heritage Resources. From Lesa S. Berlinghoff, Project Review Coordinator. To Cathy Cooney, Geologist, Tetra Tech. September 1, 1999. (3 pages).
28	U.S. Department of the Interior. Fish and Wildlife Service. National Wetlands Inventory for Norfolk South Virginia (1993) and Norfolk North Virginia (1995). (2 sheets).
29	Tetra Tech. Record of Telephone Conversation Regarding Remedial Investigations. Between Tim Reish, Project Manager, Naval Facilities and Engineering Command and Alicia Shultz, Project Manager, Tetra Tech. September 9, 1999. (1 sheet).
30	Department of the Navy. Letter Regarding Transfer of Control of St. Juliens Creek Annex from Norfolk Naval Shipyard to Norfolk Naval Base. From James K. Strickland, Director, Occupational Safety, Health and Environmental Office. February 28, 1997. (4 sheets).
31	EPA. Solid Waste and Emergency Response. Using Qualified Data to Document an Observed Release and Observed Contamination. November 1996. (18 sheets).

1.0 INTRODUCTION

The sections below describe the location and layout of the facility, facility operations, and operations that generated hazardous substances.

Facility Location

St. Juliens Creek Annex (U.S. Navy) is located in southeastern Virginia at the confluence of St. Juliens Creek and the Southern Branch of the Elizabeth River in the City of Chesapeake (Figure 1). The northern boundary of the annex is the boundary between the Cities of Portsmouth and Chesapeake, Virginia. The Elizabeth River and St. Juliens Creek form the eastern and southern boundaries, respectively, of the annex. Also to the north are residential developments and the Norfolk and Western Railroad; to the south, sewage disposal and industrial waste ponds. Residential developments and a residential section of City of Chesapeake lie to the west. Norfolk Naval Shipyard is located less than one mile to the north (Ref. 3; Ref. 4, p. 4). The Elizabeth River is a segment of the Intracoastal Waterway (Ref. 4, p. 18).

Facility Layout

St. Juliens Creek Annex occupies approximately 490 acres, which includes 407 acres of land, 14 acres of marsh, and 69 acres of surface water. Facilities at the annex include 244 buildings; 1,520 linear feet of wharf; 16 miles of paved roads; 17 miles of railroad tracks; a central heating plant; numerous industrial facilities that are not in operation; and miscellaneous structures, including a housing area (Ref. 4, pp. 4 and 7) (Figure 2). Blows Creek flows through the northeast section of the facility, flowing from the north to the southeast towards the Southern Branch of the Elizabeth River (Ref. 4, p. 7).

Facility Operations

St. Juliens Creek Annex began operations in 1849 as a storage facility for ordnance and material. In 1898, the facility was equipped with presses and extractors for assembling and breaking down fixed cartridges and dyes and stands for reforming small caliber cases. From 1898 until 1915, ammunitions were assembled at the facility. Projectiles were pressed into and withdrawn from cases by hand-operated machines geared to a four-foot-diameter wheel. Primers were pressed into cases, and cans were reformed by the same method. Explosives "D" (ammonium picrate) was loaded manually into projectiles. Black shell powder and gun cotton were the primary materials loaded into projectiles, warheads, and mines. In 1915, machines for pressing projectiles into cases and for extracting projectiles were modernized and equipped with motors. In 1917, 18 buildings and a wharf were built, and equipment was installed for loading MARK VI mines (Ref. 4, p. 10).

Between World War I and World War II, the facility assumed a peacetime mission of supplying ammunition to the fleet. The civilian work force decreased from 1,800 people to approximately 400 (Ref. 4, p. 12).

A copy of Figure 1 is available at the EPA Headquarters Superfund Docket:

U.S. CERCLA Docket Office
Crystal Gateway #1, 1st Floor
1235 Jefferson Davis Highway
Arlington, VA 22202

Telephone: (703) 603-8917
E-Mail: superfund.docket@epa.gov

A copy of Figure 2 is available at the EPA Headquarters Superfund Docket:

U.S. CERCLA Docket Office
Crystal Gateway #1, 1st Floor
1235 Jefferson Davis Highway
Arlington, VA 22202

Telephone: (703) 603-8917
E-Mail: superfund.docket@epa.gov

The entry of the United States into World War II in December 1941 caused an increase in the number of personnel employed at the facility to an estimated 5,340 people. The size of the annex also increased as additional magazines, filling houses, and other facilities were constructed. During World War II, the mission of the annex included loading, assembling, issuing, and receiving ammunition for naval guns. Shipments to fleets alone averaged 12,500 tons per month. The facility also served as principal experimental and test loading facility for new types of ammunition for the Bureau of Ordnance. Manufacturers' samples of projectiles for flight, plate, and ballistics tests were loaded and fused (Ref. 4, p. 12).

During the Korean conflict, the facility supplied ammunition to the fleet; gun ammunition was loaded and assembled. Personnel working at the facility numbered 1,500. After the Korean conflict, the work force was reduced once again (Ref. 4, p. 12).

In 1964, the facility was the prime source of gun ammunition for Navy and Marine Corps operations in Southeast Asia. At the peak of production, the operations employed approximately 900 civilians (Ref. 4, p. 12).

In 1969, St. Juliens Creek Annex was disestablished under the Department of Defense and was consolidated as an annex to the Naval Weapons Station, Yorktown, Virginia. During the 1970s, production continued to decline. In 1977, the annex was transferred to the Norfolk Naval Shipyard (Ref. 4, p. 12). In 1995, jurisdiction was transferred from Norfolk Naval Shipyard to Norfolk Naval Base (Ref. 30, p. 1).

Ordnance operations at the facility were terminated in the 1970s. An effort was made to decontaminate all ordnance-handling buildings, equipment, magazines, and burning grounds. Nevertheless, residues from the ordnance are expected to remain (Ref. 4, p. 40).

Although numerous concrete magazines are still present, none is used to store ammunition. St. Juliens Creek Annex is no longer an ammunitions facility. St. Juliens Creek Annex provides administrative offices, light industrial shops, and storage facilities for tenant naval commands. Its primary mission is to provide a radar testing range (35 acres) and various administrative and warehousing structures (Ref. 5, pp. 3-1 and 3-5).

Operations Generating Hazardous Waste:

Operations at the facility that potentially generated hazardous wastes include degreasing, painting, use of hydraulic equipment, maintenance of vehicles and locomotives, pest control, maintenance of lead acid batteries, printing, and ordnance operations (Ref. 4, pp. 41 and 42). Hazardous wastes also were stored at the facility (Ref. 4, p. 46). Trash and garbage generated at the facility were disposed in dumps on the property (Ref. 4, pp. 50 and 54). Beginning in the late 1930s, waste ordnance materials were disposed by open burning at the burning grounds. Before the 1930s, waste ordnance reportedly was disposed in one of the dumps on the property, Dump B. Ordnance disposed included black powder, smokeless powder, Explosive D, Composition A-3, and materials containing or contaminated with those compounds. The amount of ordnance disposed varied from year to year; 427 tons of

ordnance items were disposed at the burning grounds, in 1974. Reports stated that in the 1970s, the burning ground caught fire spontaneously several times before the decontamination effort was undertaken. A pit with a cage over it was located in the burning grounds, just west of building 23. Small items, such as igniters and fuses, were burned in the pit. The surface of the burning grounds was decontaminated in the mid-1970s (Ref. 4, p. 54).

Hazardous substances may have been released to the environment from the ordnance manufacturing and testing operations conducted in the past. Releases of hazardous substance may have resulted from the following activities:

- Ordnance wastewater and rinse waters and industrial wastewater were discharged to St. Juliens Creek, Blows Creek, and the Southern Branch of the Elizabeth River (Ref. 4, pp. 2, 34, 38, 44, and 50).

- Rinsate from powder cans drained into St. Juliens Creek (Ref. 4, p. 34).

- Wastewater from mine loading was discharged into the Southern Branch of the Elizabeth River or Blows Creek (Ref. 4, p. 34).

- Steam-out condensate was released to the Southern Branch of the Elizabeth River and Blows Creek (Ref. 4, p. 38).

- Degreasing operations caused releases to a storm drain that terminated at St. Juliens Creek, with constituents of the release including lye, sulfuric acid, and chromic acid (Ref. 4, p. 38).

- From the 1940s through the 1970s, degreasing operations used alodine caustic detergent, methyl ethyl ketone, and acetone, and those waste liquids usually were dumped at the railroad tracks at Building 13 (Ref. 4, p. 40).

- Cutting oil used in the machine shop was poured down the storm drain (Ref. 4, p. 41).

- Roads and fence lines were treated with hydraulic fluid and some solvents to kill weeds and control dust (Ref. 4, p. 41).

- Effluent from the washrack drained into a storm drain that emptied into St. Juliens Creek (Ref. 4, p. 44).

Wastes generated by operations at the facility were disposed both on and off site. Several sources identified at the St. Juliens Creek Annex may have released contaminants that have had adverse effects on human health or the environment. Table 1 summarizes the areas of potential contamination identified on the facility. Nine of the source areas were evaluated in this HRS documentation record for the St. Juliens Creek Annex and are shown on Figure 2. The other source areas were not evaluated, either because the inclusion of those sources in the package would not affect the HRS score significantly or because insufficient information is available to evaluate the source under the HRS.

Table 1
Potential Sources of Contamination at St. Juliens Creek Annex
(Page 1 of 3)

Source Name	Description	Evaluated with the HRS	Reference
Storm Sewer	Before construction of the sanitary sewer, floor drains in buildings drained directly to the storm sewer.	No	4, pp. 38, 41, 44, 50; 5, pp. 3-11, 3-12, 3-13, 3-14, 3-18, 3-21, 3-27, 4-38, 4-43
Sanitary Sewer	Floor drains in buildings drained directly to the sanitary sewer system.	No	4, pp. 2, 38, 44; 5, pp. 3-13, 3-16, 4-38
Drainage Ditches	A series of overland drainage ditches were used to transport process wastewaters and runoff from process areas. Neither the locations of the drainage ditches nor the source of the process wastewaters has been determined.	No	5, p. 4-37
Dump A (Source 1)	Dump A was used from 1921 to 1924 for the disposal of trash and garbage. In addition, some pesticides, acids, and bases were dumped in the landfill. Waste was burned at the landfill, and the ashes were used to fill in marsh areas in a portion of the landfill that extends into Blows Creek.	Yes	4, pp. 50 and 51; 5, p. 4-3
Dump B (Source 2)	Dump B is an unlined landfill located along the southwestern border of the facility, adjacent to the north bank of St. Juliens Creek. From 1921 to 1947, Dump B was used for the disposal of an estimated 950,000 cubic feet of trash, garbage, acids, and waste ordnance. The refuse was burned on site, and the ash was used to fill in an adjacent swampy area.	Yes	4, pp. 50 and 51; 5, p. 4-4; 7, pp. 1 and 2
Dump C (Source 3)	Dump C covers 10 acres along the northern edge of the annex. The dump is unlined. Dump C was used from 1940 until approximately 1970 for the burning of refuse. Refuse included organic and inorganic materials, solvents, acids, bases, and mixed municipal waste. The area was originally a mudflat where refuse was dumped and burned; with the ash then used to fill the area.	Yes	5, p. 4-7; 4, p. 54; 14, p. 1

Table 1
Potential Sources of Contamination at St. Juliens Creek Annex
(Page 2 of 3)

Source Name	Description	Evaluated with the HRS	Reference
Dump D (Source 4)	Dump D covers an estimated five acres, approximately 300 feet south of Dump C. The source was an unlined trench-and-fill landfill that reportedly operated from 1970 to 1981. The first trench was approximately 1,000 feet long and was located parallel to and 500 feet north of Blows Creek. Soil from the excavation of later trenches was used to cover earlier trenches.	Yes	4, p. 54
Burning Grounds (Source 5)	The burning grounds are located off Cradock Street in the northern portion of the facility. Beginning in the 1930s, waste ordnance materials were disposed by open burning in the burning grounds. Three main pads at the burning grounds were used for the disposal of ordnance materials, including black powder, smokeless powder, Explosive D, Composition A-3, and materials containing or contaminated with those compounds. The amount of ordnance disposed at the burning grounds varied from year to year.	Yes	12, p. 2-2; 4, p. 54; 18, p. 2
Caged Pit (Source 6)	The small items pit, which had a cage over it, was located near the burning grounds west of Building 23. Small items, such as igniters and fuses, were burned in the pit. The pit currently is filled.	Yes	4, p. 54; 5, pp. 1-4 and 4-28; 19, p. 2
Cross Street and Mine Road Area (Source 7)	This source is located in an area adjacent to Building 212, across the street from Building M-1 and in the vicinity of Cross Street and Mine Road. The source, which is approximately 20,000 square feet in size, was used as a disposal area for rinse water from spray tanks. The spray tanks contained herbicides or insecticides. Rinse water from cleaning the tanks was discharged to the ground surface and allowed to drain into the soil. The source operated from approximately the early 1950s to the mid-1960s; during that time, an estimated 675,000 gallons of rinse water was disposed. In the 1980s, the source was observed to be void of vegetation.	Yes	4, p. 42; 5, pp. 4-1 and 4-12; 20, p. 2

Table 1
Potential Sources of Contamination at St. Juliens Creek Annex
(Page 3 of 3)

Source Name	Description	Evaluated with the HRS	Reference
Hazardous Waste Disposal Area at Building 53 (Source 8)	The hazardous waste disposal area at Building 53 reportedly was used for the disposal of waste solvents, including trichloroethylene (TCE) and possibly polychlorinated biphenyls (PCB), onto the ground adjacent to the building.	Yes	5, pp. 1-4 and 4-19
Clearing House Storage Area (Source 9)	The clearing house storage area is located at the central portion of the facility, on the east side of Cradock Street. The source was used as a clearing house for items the government had deemed to be in excess. The area of the source is approximately 10 acres, including 6 acres of bare soil and 4 acres covered with concrete or asphalt. Items stored there included scrap metal, obsolete equipment, and salvaged material. A warehouse located in the area was used to store such excess items as computers, copiers, and other electrical equipment. Oil stains have been observed in the source area.	Yes	5, p. 4-1
Hazardous Waste Disposal Area at Building 13 (Railroad Tracks)	Waste solvents generated by hardware cleaning operations were disposed on the railroad tracks.	No	5, p. 4-18
Old Storage Yard #1	This yard consists of a fenced outdoor grassy area used primarily to store a variety of materials, including hydraulic oil and lead-based paint.	No	5, p. 4-21
Fire Training Area at Building 271	This area includes two cells. One cell area consisted of a burning site where wooden pallets were soaked with diesel fuel and ignited; the flames were then extinguished with water. The other burning site is a buried stainless steel pit filled with diesel fuel that is ignited, with the fire then extinguished.	No	5, p. 4-31
Swale beneath Building 13	This unit is a swale that runs under Building 13 and drains into St. Juliens Creek. Rinse water generated from the washing of smokeless powder cans in Buildings 13 and 27 was emptied into the swale.	No	5, p. 4-36

SOURCE DESCRIPTION

2.2 Source Characterization

Source Number: 1

HRS Source Type: Landfill

Source Description: Dump A

Source 1, Dump A encompasses one acre along the southern section of Blows Creek, east of the Virginia Power (formerly VEPCO) right-of-way and west of a railroad roadbed (Figures 1 and 2). Source 1, Dump A was used from 1921 to 1924 for the disposal of trash and garbage (Ref. 4, pp. 50 and 51; Ref. 8, Appendix A, p. A-3). In addition, some pesticides, acids, and bases were dumped in the landfill (Ref. 5, p. 4-3). Waste was burned at the landfill and the ashes were used to fill in marsh areas in a portion of the landfill that extends into Blows Creek (Ref. 4, p. 50). The volume of waste estimated to have been burned at the landfill is 30,000 cubic feet. The landfill is not lined (Ref. 5, p. 4-3, Ref. 6, pp. 1 and 2). The landfill operated as an open dump and was never formally closed. The dump was graded when operations ceased (Ref. 22).

In April 1996, two surface soil samples were collected from Source 1, Dump A (Ref. 9, Appendix B, p. B-1 and p. T-2). The samples were analyzed for Target Compound List (TCL) organic compounds, Target Analyte List (TAL) inorganic compounds, and nitramines (Ref. 9, p. T-2). The Naval Facilities Engineering Command (NAVFACENGCOM) subcontracted the collection of the samples for evaluating the levels of contaminants at Source 1, Dump A (Ref. 9, p. 4-1). One of the surface soil samples, 01SS01, was collected outside the area of Source 1, Dump A and therefore is considered a background sample. One surface soil sample, 01SS02, was collected within the area of Source 1, Dump A (Ref. 9, p. F-2). Both samples were collected within 0 to 1 foot below ground surface (bgs) (Ref. 9, p. 3-1). When the results of analyses of 01SS01 are compared with the results of the analysis of 01SS02, the following contaminants are found to be above background: benzo(b)fluoranthene, chrysene, and fluoranthene (Ref. 9, pp. T-4 and T-5).

Source Location (with reference to a map):

Source 1, Dump A encompasses one acre along the southern section of Blows Creek, east of the Virginia Power right-of-way and west of a railroad roadbed (Figures 1 and 3).

A copy of Figure 3 is available at the EPA Headquarters Superfund Docket:

U.S. CERCLA Docket Office
Crystal Gateway #1, 1st Floor
1235 Jefferson Davis Highway
Arlington, VA 22202

Telephone: (703) 603-8917
E-Mail: superfund.docket@epa.gov

Containment:

Gas Release to Air: The air migration pathway was not scored.

Particulate Release to Air: The air migration pathway was not scored.

Release to Ground Water: The ground water migration pathway was not scored.

Release via Overland Migration/Flood: There is no evidence of migration of hazardous substances from Source 1, Dump A. However, neither of the following elements is present: (1) a maintained engineered cover or (2) a functioning and maintained run-on control system and runoff management system (Ref. 5, p. 4-3). Therefore, a surface water containment factor value of 10 was assigned (Ref. 1, p. 51609).

2.4.1 Hazardous Substances

The wastes disposed in Source 1, Dump A include organic and inorganic compounds, pesticides, acids, bases, and mixed municipal waste. Most of the material was burned. The Navy estimated the volume before burning to be 30,000 cubic feet (Ref. 5, p. 4-3; Ref. 6, pp. 1 and 2). Analytical data from soil samples indicate that the soil in Source 1, Dump A is contaminated with the following contaminants at levels above background: benzo(b)fluoranthene, chrysene, and fluoranthene (Ref. 9, pp. T-4 and T-5).

2.4.2 Hazardous Waste Quantity

2.4.2.1.1 Hazardous Constituent Quantity

The information available is insufficient to evaluate the hazardous constituent quantity for Source 1.

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

2.4.2.1.2 Hazardous Waste Stream Quantity

The information available is insufficient to evaluate the hazardous waste stream quantity for Source 1.

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

2.4.2.1.3 Volume

The information available is insufficient to evaluated the volume tier for Source 1.

Dimension of source (yd^3): Unknown
Reference(s): Ref. 4, p. 4-3; Ref. 6, pp 1 and 2
Volume Assigned Value: NA

2.4.2.1.4 Area

The area of Source 1, Dump A, has been estimated to be one acre (Ref. 6, pp. 1 and 2). The area of the landfill in square feet (ft^2) is 43,560. The area divisor for determining the hazardous waste quantity (HWQ) value assigned to a landfill is 3,400 (Ref. 1, p. 51591). The calculation of the HWQ value on the basis of the area of the source is:

43,560/3,400 = 12.81

Area of Source (ft^2): 43,560
Reference(s): 6, pp. 1 and 2
Area Assigned Value: 12.81

2.4.2.1.5 Source Hazardous Waste Quantity Value

For Source 1, Dump A, the source HWQ value is based on an area of one acre. The assigned value of the source is determined from HRS Table 2-5 (Ref. 1, p. 51591).

Source Hazardous Waste Quantity Value: 12.81

SOURCE DESCRIPTION

2.2 Source Characterization

Source Number: 2

HRS Source Type: Landfill

Source Description: Dump B

Source 2, Dump B is an unlined landfill located along the southwestern border of the facility, adjacent to the north bank of St. Juliens Creek (Figure 2) (Ref. 4, p. 51; Ref. 8, Appendix A, p. A-4). From 1921 to 1947, Source 2, Dump B was used for the disposal of an estimated 950,000 cubic feet of garbage, acids, and waste ordnance (Ref. 5, 4-4; Ref. 7, pp. 1 and 2). The refuse was burned on site, and the ash was used to fill an adjacent swampy area (Ref. 4, p. 50; Ref. 7, p. 2). The size of the swampy area is estimated to be 1.5 acres (Ref. 7, p. 2). In 1942, when an incinerator located on the landfill began operations, open burning ended. Source 2, Dump B closed after 1947 and since has become a swampy area covered with brush, trees, and grass. Blast grit from ship overhaul and repair operations also was dumped at the source, although the exact year in which that activity took place is not known. Remnants of the grit have been observed at the source (Ref. 5, p. 4-4). The landfill operated as an open dump and was never formally closed. The dump was graded when operations ceased (Ref. 22).

In 1988, Source 2, Dump B was used as a storage area for heavy equipment and machinery. A shed for storage of ceramic tile and several trailers containing tools, tires, and machinery were located at the source. The soil in Source 2, Dump B was stained with oil from leaks from stored equipment (Ref. 5, p. 4-4).

In April 1996, two surface soil samples were collected from Source 2, Dump B (Ref. 9, Appendix B, p. B-4 and T-9). Both surface soil samples were collected from within the area of Source 2, Dump B (Ref. 9, p. F-3). The samples were analyzed for TCL organic compounds, TAL inorganic compounds, and nitramines (Ref. 9, p. T-2). NAVFACENGCOM subcontracted the collection of the samples for evaluating levels of contaminants to evaluate contaminant levels at Source 2, Dump B (Ref. 9, p. 4-1). No background soil sample was identified. Therefore, a surface soil sample, 01SS01, collected outside the area of Source 1, Dump A, was considered a background sample (Ref. 9, p. F-2). All surface soil samples were collected within 0 to 1 foot bgs (Ref. 9, p. 3-1). When the results of analysis of 01SS01 are compared with the results of analysis of 02SS01 and 02SS02, the following contaminants are found to be above background: barium, chromium, cobalt, copper, lead, manganese, mercury, nickel, zinc, pesticides, Aroclor 1254, and bis(2-ethylhexyl)phthalate (Ref. 9, p. T-3 to T-5 through p. T-10).

Samples of soil were collected from Source 2, Dump B in June and July 1997 (Ref. 11, p.1). Ten surface soil samples were collected from Source 2, Dump B, which is referred to as Landfill B in the report that documents the analytical data (Ref. 10, pp. 2 and 100). A surface soil sample SJS02-SS01-000 was collected as the background sample (Ref. 11, pp. 1 and 2; Ref. 10, p. 100). The surface soil samples were analyzed for TCL organic and TAL inorganic compounds (Ref. 10, pp. 2 to 10). The following contaminants were detected in surface soil samples at levels three times the background concentrations and with no laboratory data qualifiers identifying the concentrations as estimated or detected in the laboratory blank: arsenic; barium; beryllium; chromium; cobalt; copper; cyanide; iron; lead; magnesium; manganese; mercury; nickel; selenium; thallium; vanadium; zinc; acetone; benzo(a)anthracene; benzo(a)pyrene; benzo(b)fluoranthene; chrysene; fluoranthene; phenanthrene; pyrene, 4,4'-DDD; 4,4'-DDE; 4,4'-DDT; and Aroclor 1260 (Ref. 10, pp. 2 to 10 and 100).

Soil boring samples also were collected from Source 2, Dump B (Landfill B) (Ref. 10, pp. 11 and 101). Soil boring sample SJS02-SB01 was collected as the background sample (Ref. 11, pp. 1 and 2; Ref. 10, p. 101). The soil boring samples were analyzed for TCL organic and TAL inorganic compounds (Ref. 10, pp. 11 to 14). The background soil boring sample was collected at 3 feet bgs (Ref. 11, pp. 1 and 2; Ref. 10, p. 11). The other boring samples were collected at 2 and 4 feet bgs (Ref. 11, pp. 1 and 2; Ref. 10, pp. 11 to 14). The following contaminants were detected in soil boring samples at levels three times the background concentration and with no laboratory data qualifiers identifying the concentrations as estimated or detected in the laboratory blank: cadmium; copper; lead; acetone; 4,4'-DDD; 4,4'-DDE; and 4,4'-DDT (Ref. 10, pp. 11 to 14 and 101).

In May 1997 a Final Work Plan and a Sampling Analysis Plan was submitted for the remedial investigation and feasibility study (RI/FS) at Source 2, Dump B (referred to as Landfill B in the plans) (Ref. 12). The analytical results from the RI/FS had not been received as of December 1999. However, the draft RI was submitted to NAVFACENGCOM in 1998 (Ref. 13, p. 1). NAVFACENGCOM has not released the RI because additional information is being added to the report (Ref. 29). A Supplemental Field Investigation Plan for Source 2, Dump B (Landfill B) was submitted in March 1999 (Ref. 13). The purpose of the supplemental field investigation was to acquire additional data to fully define the extent of contamination in Source 2, Dump B (Ref. 13, p. 1). Although the results of the investigation had not been received as of December 1999, the plan identified chemicals of potential concern (COPC) in Source 2, Dump B by media. Those COPCs are summarized in the table below.

Table 2
Chemicals of Potential Concern - Source 2, Dump B

Medium	Chemicals of Potential Concern	Reference
Surface soil	Metals, one PCB, pesticides, one volatile organic compound (VOC), and semi-volatile organic compounds (SVOC)	13, p. 6
Subsurface soil	Metals and one SVOC	13, p. 6
Surface water	Metals and phosphorous	13, p. 6
Sediment	Metals, phosphorous, pesticides, PCBs, and SVOCs	13, p. 6

The plan also indicated that elevated levels of metals had been detected in surface soil samples (Ref. 13, p. 5).

Source Location (with reference to a map):

Source 2, Dump B (Landfill B) is located along the southwestern border of the facility, adjacent to the north bank of St. Juliens Creek (Figure 4) (Ref. 4, p. 51; Ref. 13, p. 7).

Containment:

Gas Release to Air: The air migration pathway was not scored.

Particulate Release to Air: The air migration pathway was not scored.

Release to Ground Water: The ground water migration pathway was not scored.

Release via Overland Migration/Flood: There is no evidence of the migration of hazardous substances from Source 2, Dump B. However, neither of the following elements is present: (1) a maintained engineered cover or (2) a functioning and maintained runon control system and runoff management system (Ref. 5, p. 4-4). Therefore, a surface-water containment factor value of 10 was assigned (Ref. 1, p. 51609).

A copy of Figure 4 is available at the EPA Headquarters Superfund Docket:

U.S. CERCLA Docket Office
Crystal Gateway #1, 1st Floor
1235 Jefferson Davis Highway
Arlington, VA 22202

Telephone: (703) 603-8917
E-Mail: superfund.docket@epa.gov

2.4.1 Hazardous Substances

Source 2, Dump B (Landfill B) was used for the disposal of an estimated 950,000 cubic feet of garbage, acids, and waste ordnance. The refuse was burned on site, and the ash was used to fill an adjacent swampy area. Blast grit from ship overhaul and repair operations also was disposed in Source 2, Dump B (Ref. 4, p. 50; Ref. 5, p. 4-4; Ref. 7, pp. 1 and 2). Analytical data from soil samples indicate that the soil in Source 2, Dump B is contaminated with the following contaminants at levels above background: acetone; benzo(a)anthracene; benzo(a)pyrene; benzo(b)fluoranthene; bis(2-ethylhexyl)phthalate; chrysene; fluoranthene; phenanthrene; pyrene, 4,4'-DDD; 4,4'-DDE; 4,4'-DDT; Aroclor 1254; Aroclor 1260; arsenic; barium; beryllium; chromium; cobalt; copper; cyanide; iron; lead; magnesium; manganese; mercury; nickel; selenium; thallium; vanadium; and zinc (Ref. 10, pp. 2 to 10 and 100; Ref. 9, pp. T-3 to T-5 and p. T-9).

2.4.2 Hazardous Waste Quantity

2.4.2.1.1 Hazardous Constituent Quantity

The information available is insufficient to evaluate the hazardous constituent quantity for Source 2.

Sum (pounds): Unknown
Hazardous Constituent Quantity Value: NA

2.4.2.1.2 Hazardous Waste Stream Quantity

The information available is insufficient information to evaluate the hazardous waste stream quantity for Source 2, Dump B.

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

2.4.2.1.3 Volume

The information available is insufficient information to evaluate a volume tier for Source 2, Dump B (Ref. 1, p. 51591).

Dimension of source (yd^3): Unknown
Reference(s): Ref. 5, p. 4-4; Ref. 7, p. 2
Volume Assigned Value: NA

2.4.2.1.4 Area

The area of Source 2, Dump B, has been estimated to be 1.5 acres (Ref. 7, p. 2). The area of the dump in ft^2 is 1.5 acres × 43,560 ft^2/1 acre = 65,340 ft^2. The area divisor for determining the HWQ value assigned to a landfill is 3,400 (Ref. 1, p. 51591). The calculation of the HWQ value on the basis of the area of the source is:

65,340/3,400 = 19.21

Area of Source (ft^2): 65,340
Reference(s): 7, p. 2
Area Assigned Value: 19.21

2.4.2.1.5 Source Hazardous Waste Quantity Value

For Source 2, Dump B, the source HWQ value is based on an area of 1.5 acres. The assigned value of the source is determined from HRS Table 2-5 (Ref. 1, p. 51591).

Source Hazardous Waste Quantity Value: 19.21

SOURCE DESCRIPTION

2.2 Source Characterization

Source Number: 3

HRS Source Type: Landfill

Source Description: Dump C

Source 3, Dump C covers 10 acres at the northeastern corner of the annex (Figure 2) (Ref. 5, p. 4-7). Source 3, Dump C is an unlined landfill that was used from 1940 until approximately 1970 for the burning of refuse (Ref. 4, p. 54). Refuse burned there included organic and inorganic compounds, solvents, acids, bases, and mixed municipal waste (Ref. 5, p. 4-7; Ref. 14, p. 1). The area originally was a mudflat where refuse was dumped and burned; ash then was used to fill the area. Once every two weeks a bulldozer compacted and leveled the area. From 1952 to 1953, approximately 35,000 cubic yards (yd^3) per year of refuse were disposed in Source 3, Dump C. From 1963 to 1966, approximately 11,500 yd^3 per year of trash were burned in Source 3, Dump C weekly (Ref. 4, p. 54). The total volume of refuse disposed at Dump C was estimated to be 750,000 yd^3 before it was burned (Ref. 5, p. 4-7; Ref. 14, p. 2). Two pits were reported to have been located in the area of Source 3, Dump C for the disposal of waste oils and oil sludges that Naval Supply Center Craney Island (Craney Island) would not accept. It is not known why Craney Island would not accept the waste. Periodically, the oil was burned in the pits (Ref. 4, p. 54). The locations and sizes of the pits have not been determined. The amount of oil burned in them also has not been ascertained. The landfill operated as an open dump and was never formally closed. The dump was graded after operations ceased (Ref. 22). The dump was graded level and covered with grass on an unidentified date, but it has not been closed formally (Ref. 5, p. 4-7).

In April 1996, two surface soil samples were collected from Source 3, Dump C (Ref. 9, Appendix B, pp. B-2, B-3 and T-9). Both surface soil samples were collected from within the area of Source 3, Dump C (Ref. 9, p. F-4). The samples were analyzed for TCL organic compounds, TAL inorganic compounds, and nitramines (Ref. 9, p. T-2). NAVFACENGCOM subcontracted the collection of the samples for evaluating levels of contaminants at Source 3, Dump C (Ref. 9, p. 4-1). No background soil sample was identified. Therefore, a surface soil sample, 01SS01, collected outside the area of Source 1, Dump A was considered a background sample (Ref. 9, p. F-2). All surface soil samples were collected within 0 to 1 foot bgs (Ref. 9, p. 3-1). When the results of analysis of 01SS01 are compared with results of analysis of 03SS01 and 03SS02, the following contaminants are found to be above background: copper; zinc; 4,4'-DDT; fluorene; and pyrene (Ref. 9, pp. T-3 to T-5 and T-16 to T-18).

Additional samples of soil were collected from Source 3, Dump C in June and July 1997 (Ref. 11, p.1). Ten surface soil samples were collected from Source 3, Dump C, which is referred to as Landfill C in the report that documents the analytical data (Ref. 10, pp. 25 and 31). The surface soil samples were analyzed for TCL organic and TAL inorganic compounds (Ref. 10, pp. 2 to 10). Surface soil sample SJS03-SS01 was collected as the background sample (Ref. 11, pp. 1 and 2; Ref. 10, p. 104). The following contaminants were detected in surface soil samples at levels three times the background concentration and with no laboratory data qualifiers identifying the concentrations as estimated or detected in the laboratory blank: benzo(a)anthracene; benzo(b)fluoranthene; benzo(k)fluoranthene; chrysene; fluoranthene; indeno(1,2,3-cd)pyrene; phenanthrene; pyrene; 4,4'-DDD; 4,4'-DDE; 4,4'-DDT; Aroclor 1254; antimony; arsenic; barium; beryllium; cadmium, chromium; copper; iron; lead; mercury; thallium; and zinc (Ref. 10, pp. 25 to 31 and 104).

Soil boring samples also were collected from Source 3, Dump C (Landfill C) (Ref. 10, pp. 32 and 105). The soil boring samples were analyzed for TCL organic and TAL inorganic compounds (Ref. 10, pp. 32 to 37). Soil boring sample SJS03-SB01 was collected as the background sample (Ref. 11, pp. 1 and 2; Ref. 10, p. 101). The background soil boring sample was collected at 1 feet bgs (Ref. 11, pp. 1 and 2; Ref. 10, p. 32). The other boring samples were collected at 1 and 2 feet bgs (Ref. 11, pp. 1 and 2; Ref. 10, pp. 32 to 37). Mercury was the only contaminant detected in soil boring samples at levels three times the background concentration and with no laboratory data qualifiers identifying the concentration as estimated or detected in the laboratory blank (Ref. 10, pp. 32 to 37 and 105).

In May 1997, a Final Work Plan and a Sampling Analysis Plan were submitted for the RI/FS at Source 3, Dump C (referred to as Landfill C in the plans) (Ref. 15). The analytical results from the RI/FS had not been received as of December 1999. The draft RI was submitted to NAVFACENGCOM in 1998 (Ref. 16, p. 1). However, NAVFACENGCOM has not released the RI because additional information is being added to the report (Ref. 29). A Supplemental Field Investigation Plan for Source 3, Dump C (Landfill C) was submitted in March 1999 (Ref. 16). The purpose of the supplemental field investigation was to acquire additional data to fully define the extent of contamination in Source 3, Dump C (Ref. 6, p. 1). The results of the investigation had not been received as of December 1999.

Source Location (with reference to a map):

Source 3, Dump C (Landfill C) is located at the northeastern corner of the facility (Figures 2 and 5) (Ref. 15, p. 2-2).

A copy of Figure 5 is available at the EPA Headquarters Superfund Docket:

U.S. CERCLA Docket Office
Crystal Gateway #1, 1st Floor
1235 Jefferson Davis Highway
Arlington, VA 22202

Telephone: (703) 603-8917
E-Mail: superfund.docket@epa.gov

Containment:

Gas Release to Air: The air migration pathway was not scored.

Particulate Release to Air: The air migration pathway was not scored.

Release to Ground Water: The ground water migration pathway was not scored.

Release via Overland Migration/Flood: There is no evidence of the migration of hazardous substances from Source 3. However, neither of the following elements is present: (1) a maintained engineered cover or (2) a functioning and maintained runon control system and runoff management system (Ref. 5, p. 4-7). Therefore, a surface water containment factor value of 10 was assigned (Ref. 1, p. 51609).

2.4.1 Hazardous Substances

Approximately 750,000 yd^3 of garbage, acids, and waste ordnance were burned at Source 3, Dump C (Landfill C). The ash was used to fill in a mudflat (Ref. 5, p. 4-7; Ref. 14, p. 2). Analytical data from soil samples indicate that the soil in Source 3, Dump C is contaminated with the following contaminants at levels above background: benzo(a)anthracene; benzo(b)fluoranthene; benzo(k)fluoranthene; chrysene; flourene, fluoranthene; indeno(1,2,3-cd)pyrene; phenanthrene; pyrene; 4,4'-DDD; 4,4'-DDE; 4,4'-DDT; Aroclor 1254; antimony; arsenic; barium; beryllium; cadmium; chromium; copper; iron; lead; mercury; thallium; and zinc (Ref. 10, pp. 25 to 31 and 104).

2.4.2 Hazardous Waste Quantity

2.4.2.1.1 Hazardous Constituent Quantity

The information available is insufficient to evaluate the hazardous constituent quantity for Source 3.

Sum (pounds): Unknown
Hazardous Constituent Quantity Value: NA

2.4.2.1.2 Hazardous Waste Stream Quantity

The information available is insufficient to evaluate the hazardous waste stream quantity for Source 3.

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

2.4.2.1.3 Volume

The information available is insufficient to evaluate the volume tier for Source 3 (Ref. 1, p. 51591).

Dimension of source (yd^3): Unknown
Reference(s): Ref. 5, p. 4-7; Ref. 14, p. 2
Volume Assigned Value: NA

2.4.2.1.4 Area

The area of Source 3, Dump C, has been estimated to be 10 acres (Ref. 14, p. 2). The area of the landfill in ft^2 is 10 acres × 43,560 ft^2/1 acre =435,600 ft^2. The area divisor for determining the HWQ value assigned to a landfill is 3,400 (Ref. 1, p. 51591). The calculation of the HWQ value on the basis of the area of the source is:

435,600/3,400 = 128.12

Area of Source (ft^2): 435,600
Reference(s): 14, p. 2
Area Assigned Value: 128.12

2.4.2.1.5 Source Hazardous Waste Quantity Value

For Source 3, Dump C, the source HWQ value is based on an area of 10 acres. The assigned value of the source is determined from HRS Table 2-5 (Ref. 1, p. 51591).

Source Hazardous Waste Quantity Value: 128.12

SOURCE DESCRIPTION

2.2 Source Characterization

Source Number: 4

HRS Source Type: Landfill

Source Description: Dump D

Source 4, Dump D covers an estimated five acres, approximately 300 feet south of Source 3, Dump C (Figure 2). The source was an unlined trench-and-fill landfill that reportedly operated from 1970 to 1981. The first trench was approximately 1,000 feet long and was located parallel to and 500 feet north of Blows Creek. Soil excavated from later trenches was used to cover earlier trenches (Ref. 4, p. 54). The total number of trenches excavated in the landfill is not known. The landfill operated as an open dump and was never formally closed. The dump was graded when operations ceased (Ref. 22).

Wastes disposed in Source 4, Dump D includes garbage and construction materials. Some solvents, pesticides, acids, bases, and PCBs, also were disposed in the dump. Drums were stored on the surface of Source 4, Dump D, and others were buried. Neither the contents nor the number of drums stored at the landfill is known. Some of the drums may have contained PCBs from fluorescent light fixtures (Ref. 5, p. 4-8). A dumpster labeled with the words "Asbestos Only" was observed on the landfill (Ref. 5, p. 4-9). The quantity of waste disposed in Source 4, Dump D is estimated to be 1,500,000 yd^3 (Ref. 17, p. 2).

In April 1996, three surface soil samples were collected from Source 4, Dump D (Ref. 9, p. F-5 and Appendix B, pp. B-2, B-3, and T-22). The surface soil samples were collected from within the area of Source 4, Dump D (Ref. 9, p. F-4). The samples were analyzed for TCL organic compounds, TAL inorganic compounds, and nitramines (Ref. 9, p. T-2). NAVFACENGCOM subcontracted the collection of the samples for evaluating levels of contaminants at Source 4, Dump D (Ref. 9, p. 4-1). No background soil sample was identified. Therefore, a surface soil sample, 01SS01, collected outside the area of Source 1, Dump A, was considered a background sample (Ref. 9, p. F-2). All surface soil samples were collected within 0 to 1 foot bgs (Ref. 9, p. 3-1). When the results of analysis of 01SS01 are compared with results of analysis of 04SS01, 04SS02, and 04SS03, the following contaminants are found to be above background: arsenic; beryllium; chromium; cobalt; copper; lead; manganese; mercury; nickel; vanadium; zinc; 4,4'-DDD; 4,4'-DDE; 4,4'-DDT; alpha-Chlordane; Aroclor 1254; dieldrin; Endosulfan II; and gama-chlordane (Ref. 9, pp. T-3 to T-5 and T-22 to T-25).

Samples of soil were collected from Source 4, Dump D in June and July 1997 (Ref. 11, p.1). Ten surface soil samples were collected from Source 4, Dump D, which is referred to as Landfill D in the report that documents the analytical data (Ref. 10, pp. 47 and 108). The surface soil samples were analyzed for TCL organic and TAL inorganic compounds (Ref. 10, pp. 47 to 56).

Surface soil sample SJS04-SS01 was collected as the background sample (Ref. 11, pp. 1 and 2; Ref. 10, p. 108). The following contaminants were detected in surface soil samples at levels three times the background concentrations and with no laboratory data qualifiers identifying the concentration as estimated or detected in the laboratory blank: antimony; chromium; copper; nickel; zinc; 2-butanone; fluoranthene; phenanthrene; pyrene; 4,4'-DDE; dieldrin; alpha-chlordane; Aroclor 1260; and gamma-chlordane (Ref. 10, pp. 47 to 56 and 108).

Soil boring samples also were collected from Source 4, Dump D (Landfill D) (Ref. 10, pp. 57 and 109). The soil boring samples were analyzed for TCL organic and TAL inorganic compounds (Ref. 10, pp. 57 to 59). Soil boring sample SJS04-SB01 was collected as the background sample (Ref. 11, pp. 1 and 2; Ref. 10, p. 109). All the soil boring samples were collected at 2 feet bgs (Ref. 11, pp. 1 and 2; Ref. 10, pp. 57 to 59). The following contaminants were detected in soil boring samples at levels three times the background concentrations and with no laboratory data qualifiers identifying the concentration as estimated or detected in the laboratory blank: barium; beryllium; selenium and Aroclor 1254 (Ref. 10, pp. 57 through 59 and 109).

In May 1997, a Final Work Plan and a Sampling Analysis Plan were submitted for the RI/FS at Source 4, Dump D (Landfill D) (Ref. 15). The analytical results from the RI/FS had not been received as of December 1999. However, the draft RI was submitted to NAVFACENGCOM in 1998 (Ref. 16, p. 1). NAVFACENGCOM has not released the RI because additional information is being added to the report (Ref. 29). A Supplemental Field Investigation Plan for Source 4, Dump D (Landfill D) was submitted in March 1999 (Ref. 16). The purpose of the supplemental field investigation was to acquire additional data to fully define the extent of contamination in Source 4, Dump D (Ref. 16, p. 1). The results of the investigation had not been received as of December 1999.

Source Location (with reference to a map):

Source 4, Dump D (Landfill D) is located along the northeastern portion of the facility, north of Blows Creek and on the west bank of the Southern Branch of the Elizabeth River (Figure 6) (Ref. 15, p. 2-2).

Containment:

Gas Release to Air: The air migration pathway was not evaluated.

Particulate Release to Air: The air migration pathway was not evaluated.

Release to Ground Water: The ground water migration pathway was not evaluated.

Release via Overland Migration/Flood: There is no evidence of the migration hazardous substances from Source 4. However, neither of the following elements is present: (1) a maintained engineered cover or (2) a functioning and maintained runon control system and runoff management system (Ref. 5, p. 4-9). Therefore, a surface water containment factor value of 10 was assigned (Ref. 1, p. 51609).

A copy of Figure 6 is available at the EPA Headquarters Superfund Docket:

U.S. CERCLA Docket Office
Crystal Gateway #1, 1st Floor
1235 Jefferson Davis Highway
Arlington, VA 22202

Telephone: (703) 603-8917
E-Mail: superfund.docket@epa.gov

2.4.1 Hazardous Substances

Approximately 1,500,000 yd^3 of organic and inorganic compounds, solvents, pesticides, acids, bases, PCBs, and mixed municipal waste were disposed in Source 4, Dump D (Ref. 17, pp. 1 and 2). Analytical data from soil samples indicate that the soil in Source 4, Dump D is contaminated with the following contaminants at levels above background: 2-butanone; fluoranthene; phenanthrene; 4,4'-DDE; 4,4'-DDT; alpha-chlordane; Aroclor 1254; dieldrin; Endosulfan II; Aroclor 1260; gamma-chlordane; antimony; arsenic; barium; beryllium; chromium; cobalt; copper; lead; manganese; mercury; nickel; selenium; vanadium; and zinc (Ref. 10, pp. 47 to 56 and 108).

2.4.2 Hazardous Waste Quantity

2.4.2.1.1 Hazardous Constituent Quantity

The information available is insufficient to evaluate the hazardous constituent quantity for Source 4.

Sum (pounds): Unknown
Hazardous Constituent Quantity Value: NA

2.4.2.1.2 Hazardous Waste Stream Quantity

The information available is insufficient to evaluate the hazardous waste stream quantity for Source 4.

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

2.4.2.1.3 Volume

The information available is insufficient to evaluate the volume tier for Source 4 (Ref. 1, p. 51591).

Dimension of source (yd^3): Unknown
Reference(s): Ref. 17, p. 2
Volume Assigned Value: NA

2.4.2.1.4 Area

The area of Source 4, Dump D, has been estimated to be 5 acres (Ref. 17, p. 2). The area of the landfill in ft^2 is 5 acres × 43,560 ft^2/1 acre = 217,800 ft^2. The area divisor for determining the HWQ value assigned to a landfill is 3,400 (Ref. 1, p. 51591). The calculation of the HWQ value on the basis of the area of the source area is:

217,800/3,400 = 64.06

Area of Source (ft^2): 217,800
Reference(s): 17, p. 2
Area Assigned Value: 64.06

2.4.2.1.5 Source Hazardous Waste Quantity Value

For Source 4, Dump D, the source HWQ value is based on an area of 5 acres. The assigned value of the source is determined from HRS Table 2-5 (Ref. 1, p. 51591).

Source Hazardous Waste Quantity Value: 64.06

SOURCE DESCRIPTION

2.2 Source Characterization

Source Number: 5

HRS Source Type: Contaminated Soil

Source Description: Burning Grounds

Source 5, the burning grounds, is located east of Cradock Street in the northern portion of the facility (Figure 2) (Ref. 12, p. 2-2). The burning grounds currently consist of an open field with areas overgrown with tall reeds (Ref. 5, p. 4-11). Beginning in the 1930s, waste ordnance materials were disposed by open burning at the burning grounds. Three main pads at the burning grounds were used for the disposal of ordnance materials, including black powder, smokeless powder, Explosive D, Composition A-3, and materials containing or contaminated with those compounds. The amount of ordnance disposed at the burning grounds varied from year to year. A pit with a cage over it was located near the burning grounds, west of Building 23. Small items, such as igniters and fuses, were burned in the pit (Ref. 19, p. 2). The pit currently is filled (Ref. 18, p. 2). Other wastes disposed in the burning grounds include trichloroethylene, paint sludge, and pesticides (Ref. 4, pp. 40 and 41). In 1977, the surface area was burned with oil and straw, diced, and burned again, in an effort to decontaminate the soil (Ref. 4, pp. 40 and 54).

In April 1996, four surface soil samples were collected from the burning grounds (Ref. 9, p. F-6 and Appendix B, pp. B-5, B-6, B-7, and T-30). NAVFACENGCOM subcontracted the collection of the samples for evaluating levels of contaminants at the burning grounds (Ref. 9, p. 4-1). The surface soil samples were collected from within the area of the burning grounds (Ref. 9, p. F-6). The soil samples were analyzed for TCL organic compounds, TAL inorganic compounds, and nitramines (Ref. 9, pp. T-2 and T-30 to T-32). No background soil sample was identified. Therefore, a surface soil sample, 01SS01, collected outside the area of Source 1, Dump A, was considered a background sample (Ref. 9, p. F-2). All surface soil samples were collected within 0 to 1 foot bgs (Ref. 9, p. 3-1). When the results of analysis of 01SS01 are compared with 05SS01, 05SS02, 05SS03, and 05SS04, the following contaminants are found to be above background: arsenic; barium; cadmium; copper; lead; manganese; mercury; nickel; zinc; 4,4'-DDD; 4,4'-DDE; 4,4'-DDT; Aroclor-1254; 2,4-dinitrotoluene; fluoranthene; indeno(1,2,3-cd)pyrene; and pyrene (Ref. 9, pp. T-3 to T-5 and T-30 through T-32).

Samples of soil were collected from the burning grounds in June and July 1997 (Ref. 11, p.1). Nine surface soil samples were collected from the burning grounds (Ref. 10, pp. 71 to 79 and 112). The surface soil samples were analyzed for TCL organic and TAL inorganic compounds (Ref. 10, pp. 71 to 79). Surface soil sample SJS05-SS01 was collected as the background sample (Ref. 11, pp. 1 and 2; Ref. 10, p. 112). The following contaminants were detected in surface soil samples at levels three times the background concentration and with no laboratory data qualifiers identifying the concentrations as estimated or detected in the laboratory blank: aluminum; cyanide; 2-butanone; acetone; benzo(g,h,i)perylene; benzo(k)fluoranthene; chrysene; di-n-butylphthlate; indeno(1,2,3-cd)pyrene; n-nitrosodiphenylamine; 4,4'-DDT; and dieldrin (Ref. 10, pp. 47 to 56 and 108).

Soil boring samples also were collected from the burning grounds (Ref. 10, pp. 80 and 113). The soil boring samples were analyzed for TCL organic and TAL inorganic compounds and dioxin (Ref. 10, pp. 80 to 90). Soil boring sample SJS05-SB01 was collected as the background sample (Ref. 11, pp. 1 and 2; Ref. 10, p. 113). The background soil boring sample was collected at 3 feet bgs, and the release samples were collected at 2 feet bgs (Ref. 11, pp. 1 and 2; Ref. 10, pp. 80 to 90). The following contaminants were detected in soil boring samples at levels three times the background concentration and with no laboratory data qualifiers identifying the concentrations as estimated or detected in the laboratory blank: cobalt; nickel; 2-butanone; benzo(b)fluoranthene; fluoranthene; pyrene; 4,4'-DDD; 4,4'-DDE; 4,4'-DDT; and dioxin (Ref. 10, pp. 80 to 90 and 113).

Source Location (with reference to a map):

The burning grounds are located east of Cradock Street in the northern portion of the facility (Figures 2 and 7) (Ref. 12, p. 2-2).

Containment:

Gas Release to Air: The air migration pathway was not scored.

Particulate Release to Air: The air migration pathway was not scored.

Release to Ground Water: The ground water migration pathway was not scored.

Release via Overland Migration/Flood: There is no evidence of migration of hazardous substances from Source 5. However, neither of the following elements is present: (1) a maintained engineered cover or (2) a functioning and maintained runon control system and runoff management system (Ref. 5, p. 4-11). Therefore, a surface water containment factor value of 10 was assigned (Ref. 1, p. 51609).

A copy of Figure 7 is available at the EPA Headquarters Superfund Docket:

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Crystal Gateway #1, 1st Floor
1235 Jefferson Davis Highway
Arlington, VA 22202

Telephone: (703) 603-8917
E-Mail: superfund.docket@epa.gov

2.4.1 Hazardous Substances

Wastes disposed in the burning grounds include black powder, smokeless powder, Explosive D, Composition A-3, and materials containing or contaminated with those compounds. The amount of ordnance disposed at the burning grounds varied from year to year (Ref. 4, p. 54; Ref. 18, p. 2). Other wastes disposed in the burning grounds include trichloroethylene, paint sludge, and pesticides (Ref. 4, pp. 40 and 41). Soil samples collected from the burning grounds indicate that the soil in the burning grounds is contaminated with the following compounds: 2-butanone; acetone; aluminum; arsenic; barium; cadmium; cobalt; copper; cyanide; lead; manganese; mercury; nickel; zinc; 4,4'-DDD; 4,4'-DDE; 4,4'-DDT; dieldrin; Aroclor 1254; dioxin; 2,4-dinitrotoluene; benzo(g,h,i)perylene; benzo(k)fluoranthene; chrysene, di-n-butylphthlate, fluoranthene, indeno(1,2,3-cd)pyrene; n-nitrosodiphenylamine; and pyrene (Ref. 9, pp. T-3 to T-5 and T-30 to T-32; Ref. 10, pp. 80 to 90 and 113).

2.4.2 Hazardous Waste Quantity

2.4.2.1.1 Hazardous Constituent Quantity

The information available is insufficient to evaluate the hazardous constituent quantity for Source 5.

Sum (pounds): Unknown
Hazardous Constituent Quantity Value: NA

2.4.2.1.2 Hazardous Waste Stream Quantity

The information available is insufficient to evaluate the hazardous waste stream quantity for Source 5.

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

2.4.2.1.3 Volume

The information available is insufficient to evaluate the volume hazardous waste quantity for Source 5.

Dimension of source (yd^3): Unknown
Reference(s): Ref. 18, p. 2
Volume Assigned Value: NA

2.4.2.1.4 Area

The area of Source 5, the burning grounds, has been estimated to be 3 acres (Ref. 18, p.2). The area of the landfill in ft^2 is 3 acres × 43,560 ft^2/1 acre = 130,680 ft^2. The area divisor for determining the HWQ value assigned to an area of contaminated soil is 34,000 (Ref. 1, p. 51591). The calculation of the HWQ value on the basis of the area of the area is:

130,680/34,000 = 3.84

Area of Source (ft^2): 130,680
Reference(s): 18, p. 2
Area Assigned Value: 3.84

2.4.2.1.5 Source Hazardous Waste Quantity Value

For Source 5, the burning grounds, the source HWQ value is based on an area of 3 acres. The assigned value of the source is determined from HRS Table 2-5 (Ref. 1, p. 51591).

Source Hazardous Waste Quantity Value: 3.84

SOURCE DESCRIPTION

2.2 Source Characterization

Source Number: 6

HRS Source Type: Contaminated Soil

Source Description: Caged Pit

Source 6, the caged pit or small items pit, is located near the burning grounds (Source 5), west of Building 23 (Figure 2). Small items, such as igniters and fuses, were burned in the pit. The pit currently is filled (Ref. 4, p. 54; Ref. 5, pp. 1-4 and 4-28; Ref. 19, p. 2). The size of the source and the period of time during which the source was used are not known (Ref. 5, p. 4-28).

In April 1996, one surface soil sample was collected from the area at the caged pit (Ref. 9, p. F-7 and Appendix B, pp. B-4 and T-37). NAVFACENGCOM subcontracted the collection of the soil sample for evaluating levels of contaminants at the caged pit (Ref. 9, p. 4-1). The soil sample was analyzed for TCL organic compounds, TAL inorganic compounds, and nitramines (Ref. 9, pp. T-37 to T-40). No background soil sample was identified. Therefore, a surface soil sample, 01SS01, collected outside the area of Source 1, Dump A, was considered a background sample (Ref. 9, p. F-2). The surface soil sample was collected within 0 to 1 foot bgs (Ref. 9, p. 3-1). When the results of analysis of 01SS01 are compared with the results of analysis of 06SS01, the following contaminants are found to be above background: lead; manganese; zinc; 44'-DDD; 4,4'-DDE; 4,4'-DDT; benzo(a)anthracene; benzo(a)pyrene; benzo(b)fluoranthene; benzo(g,h,i)perylene; chrysene; fluoranthene; phenanthrene; and pyrene (Ref. 9, pp. T-37 to T-40).

Source Location (with reference to a map):

The caged pit is located near the burning grounds, west of Building 23 in the northern portion of the facility (Figures 2 and 7) (Ref. 5, p. 1-4).

Containment:

Gas Release to Air: The air migration pathway was not scored.

Particulate Release to Air: The air migration pathway was not scored.

Release to Ground Water: The ground water migration pathway was not scored.

Release via Overland Migration/Flood: There is no evidence of the migration of hazardous substances from Source 6. However, neither of the following elements is present: (1) a maintained engineered cover or (2) a functioning and maintained runon control system and runoff management system (Ref. 5, p. 4-28). Therefore, a surface water containment factor value of 10 was assigned (Ref. 1, p. 51609).

2.4.1 Hazardous Substances

The caged pit was used for burning igniters and fuses (Ref. 4, p. 54; Ref. 19, p. 2). A soil sample from the area of the caged pit indicate that soil in the area is contaminated with the following compounds: lead; manganese; zinc; 44'-DDD; 4,4'-DDE; 4,4'-DDT; benzo(a)anthracene; benzo(a)pyrene; benzo(b)fluoranthene; benzo(g,h,i)perylene; chrysene; fluoranthene; phenanthrene; and pyrene (Ref. 9, pp. T-37 to T-40 and F-7).

2.4.2 Hazardous Waste Quantity

2.4.2.1.1 Hazardous Constituent Quantity

The information available is insufficient to evaluate the hazardous constituent quantity for Source 6.

Sum (pounds): Unknown
Hazardous Constituent Quantity Value: NA

2.4.2.1.2 Hazardous Waste Stream Quantity

The information available is insufficient to evaluate the hazardous waste stream quantity for Source 6.

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

2.4.2.1.3 Volume

The information available is insufficient to evaluate the volume hazardous waste quantity for Source 6.

Dimension of source (yd^3): Unknown
Reference(s): Ref. 19, p. 2
Volume Assigned Value: NA

2.4.2.1.4 Area

The area of Source 6, the caged pit, has been estimated to be 100 ft^2 (Ref. 19, p. 2). The area divisor for determining the HWQ value assigned to an area of contaminated soil is 34,000 (Ref. 1, p. 51591). The calculation of the HWQ value on the basis of the area of the source is:

$100/34{,}000 = 2.94 \times 10^{-3}$

Area of Source (ft^2): 100
Reference(s): 19, p. 2
Area Assigned Value: 2.94×10^{-3}

2.4.2.1.5 Source Hazardous Waste Quantity Value

For Source 6, the caged pit, the source HWQ value is based on an area of 100 ft^2. The assigned value of the source is determined from HRS Table 2-5 (Ref. 1, p. 51591).

Source Hazardous Waste Quantity Value: 2.94×10^{-3}

SOURCE DESCRIPTION

2.2 Source Characterization

Source Number: 7

HRS Source Type: Contaminated Soil

Source Description: Cross Street and Mine Road

Source 7, the Cross Street and Mine Road area, is located in the east central portion of the facility. It is located in an area adjacent to Building 212, across the street from Building M-1, in the vicinity of Cross Street and Mine Road (Figure 2) (Ref. 4, p. 42; Ref. 5, p. 4-1). The source, which is approximately 20,000 ft^2 in size, was used as a disposal area for rinse water from spray tanks (Ref. 20, p. 2). The spray tanks contained herbicides or insecticides. Rinse water from cleaning the tanks was discharged to the ground surface and allowed to filter into the soil. The source operated from approximately the early 1950s to the mid-1960s; during that time, an estimated 675,000 gallons of rinse water were disposed. In the 1980s, the source was observed to be void of vegetation (Ref. 5, p. 4-12).

In April 1996, four surface soil samples were collected from the Cross Street and Mine Road area and analyzed for pesticides (Ref. 9, p. F-9 and Appendix B, pp. B-15 and T-45). The following pesticides were detected in the sample: 4,4-DDD; 4,4-DDE; 4,4-DDT; and endrin (Ref. 9, p. T-45). One ground water sample also was collected and analyzed for pesticides but none was detected (Ref. 9, p. T-46).

Source Location (with reference to a map):

This source is located in the east central portion of the facility. It is located in an area adjacent to Building 212, across the street from Building M-1, in the vicinity of Cross Street and Mine Road (Figures 2 and 8) (Ref. 4, p. 42; Ref. 5, p. 4-1).

Containment:

Gas Release to Air: The air migration pathway was not scored.

Particulate Release to Air: The air migration pathway was not scored.

Release to Ground Water: The ground water migration pathway was not scored.

Release via Overland Migration/Flood: There is no evidence of the migration of hazardous substances from Source 7. However, neither of the following elements is present: (1) a maintained engineered cover or (2) a functioning and maintained runon control system and runoff management system (Ref. 5, p. 4-12). Therefore, a surface water containment factor value of 10 was assigned (Ref. 1, p. 51609).

A copy of Figure 8 is available at the EPA Headquarters Superfund Docket:

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Crystal Gateway #1, 1st Floor
1235 Jefferson Davis Highway
Arlington, VA 22202

Telephone: (703) 603-8917
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2.4.1 Hazardous Substances

Source 7, the Cross Street and Mine Road Area, was used as a disposal area for rinse water from spray tanks. The spray tanks contained either herbicides or pesticides (Ref. 20, p. 2). Soil samples from the Cross Street and Mine Road area indicate that the area is contaminated with the following compounds: 4,4-DDD; 4,4-DDE; 4,4-DDT; and endrin (Ref. 9, pp. T-45 and F-9).

2.4.2 Hazardous Waste Quantity

2.4.2.1.1 Hazardous Constituent Quantity

The information available is insufficient to evaluate the hazardous constituent quantity for Source 7.

Sum (pounds): Unknown
Hazardous Constituent Quantity Value: NA

2.4.2.1.2 Hazardous Waste Stream Quantity

The information available is insufficient to evaluate the hazardous waste stream quantity for Source 7.

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

2.4.2.1.3 Volume

The volume of contaminated soil in Source 7 is not known, therefore the volume was not calculated.

Dimension of source (yd^3): Unknown
Reference(s): Ref. 20, p. 2
Volume Assigned Value: NA

2.4.2.1.4 Area

The area of Source 7, the Cross Street and Mine Road area, has been estimated to be 20,000 ft^2 (Ref. 20, p.2). The area divisor for determining the HWQ value assigned to an area of contaminated soil is 34,000 (Ref. 1, p. 51591). The calculation of the HWQ value on the basis of the area of the source is:

20,000/34,000 = 0.59

Area of Source (ft^2): 20,000
Reference(s): 20, p. 2
Area Assigned Value: 0.59

2.4.2.1.5 Source Hazardous Waste Quantity Value

For Source 7, the Cross Street and Mine Road area, the source HWQ value is based on an area of 20,000 ft^2. The assigned value of the source is determined from HRS Table 2-5 (Ref. 1, p. 51591).

Source Hazardous Waste Quantity Value: 0.59

SOURCE DESCRIPTION

2.2 Source Characterization

Source Number: 8

HRS Source Type: Contaminated Soil

Source Description: Hazardous Waste Disposal Area Outside Building 53

Source 8, the hazardous waste disposal area outside Building 53, reportedly was used for the disposal of waste solvents, including trichloroethylene (TCE) and possibly PCBs, onto the ground adjacent to the building (Figure 2). Neither the quantity of waste disposed nor the size of the source is known (Ref. 5, pp. 1-4 and 4-19).

In April 1996, one surface soil sample was collected from the disposal area (Source 8) and analyzed for TCL organic and TAL inorganic compounds (Ref. 9, p. F-12 and Appendix B, pp. B-15 and T-57 through T-60). NAVFACENGCOM subcontracted the collection of the soil sample for evaluating levels of contaminants at the disposal area (Ref. 9, p. 4-1). No background soil sample was identified. Therefore, a surface soil sample, 01SS01, collected outside the area of Source 1, Dump A, was considered background (Ref. 9, p. F-2). The surface soil sample was collected within 0 to 1 foot below bgs (Ref. 9, p. 3-1). When the results of analysis of 01SS01 are compared with the results of analysis of 11SS01, the following contaminants are found to be above background: cadmium; copper; lead; manganese; mercury; zinc; 4,4'-DDE; 4,4'-DDT; Aroclor 1260; dieldrin; and endrin (Ref. 9, pp. T-57 to T-60).

Source Location (with reference to a map):

The hazardous waste disposal area is located adjacent to Building 53 in the central portion of the facility, on the east side of Cradock Street (Figures 2 and 9) (Ref. 5, p. 1-4).

Containment:

Gas Release to Air: The air migration pathway was not scored.

Particulate Release to Air: The air migration pathway was not scored.

Release to Ground Water: The ground water migration pathway was not scored.

Release via Overland Migration/Flood: There is no evidence of the migration of hazardous substances from Source 8. However, neither of the following elements is present: (1) a maintained engineered cover or (2) a functioning and maintained runon control system and runoff management system (Ref. 5, p. 4-19). Therefore, a surface water containment factor value of 10 was assigned (Ref. 1, p. 51609).

A copy of Figure 9 is available at the EPA Headquarters Superfund Docket:

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2.4.1 Hazardous Substances

The area adjacent to Building 53 was used for the disposal of waste solvents including TCE and PCBs onto the ground surface (Ref. 5, p. 4-19). A soil sample from the area adjacent to Building 53 indicates that the soil in the area is contaminated with the following compounds: cadmium; copper; lead; manganese; mercury; zinc; 4,4'-DDE; 4,4'-DDT; Aroclor 1260; dieldrin; and endrin (Ref. 9, pp. T-57 to T-60 and F-12).

2.4.2 Hazardous Waste Quantity

2.4.2.1.1 Hazardous Constituent Quantity

The information available is insufficient to evaluate the hazardous constituent quantity for Source 8.

Sum (pounds): Unknown
Hazardous Constituent Quantity Value: NA

2.4.2.1.2 Hazardous Waste Stream Quantity

The information available is insufficient to evaluate the hazardous waste stream quantity for Source 8.

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

2.4.2.1.3 Volume

The information available is insufficient to evaluate the volume hazardous waste quantity value for Source 8.

Dimension of source (yd^3): Unknown
Reference(s): Ref. 5, p. 4-19
Volume Assigned Value: NA

2.4.2.1.4 Area

The area of the hazardous waste disposal area outside of Building 53 (Source 8) has not been determined (Ref. 5, p. 4-19). However, the area of Source 8 is greater than 0. Therefore, the area assigned value for Source 8 is a value of greater than zero (Ref. 1, p. 51591).

Area of Source (ft^2): greater than zero
Reference(s): 5, p. 4-19
Area Assigned Value: greater than zero

2.4.2.1.5 Source Hazardous Waste Quantity Value

For Source 8, the disposal area outside Building 53, the source HWQ value is based on an area of greater than zero. The assigned value of the source is determined from HRS Table 2-5 (Ref. 1, p. 51591).

Source Hazardous Waste Quantity Value: greater than 0

SOURCE DESCRIPTION

2.2 Source Characterization

Source Number: 9

HRS Source Type: Contaminated Soil

Source Description: Clearing House Storage Area (Storage Yard)

Source 9, the clearing house storage area, is located in the west central portion of the facility, on the west side of Cradock Street (Ref. 5, p. 1-4). The source was used as a clearing house for items the government had deemed to be in excess. The area of the source is approximately 10 acres, including 6 acres of bare soil and 4 acres paved with concrete or asphalt. Items stored there included scrap metal, obsolete equipment, and salvaged material. A warehouse located in the area was used to store such excess items such as computers, copiers, and other electrical equipment. Oil stains have been observed in the source area (Ref. 5, p. 4-32).

In April 1996, four surface soil samples were collected from the clearing house storage area (Source 9) and analyzed for TCL organic and TAL inorganic compounds (Ref. 9, p. F-14 and Appendix B, pp. B-13 and T-73 to T-76). NAVFACENGCOM subcontracted the collection of the soil samples for evaluating the levels of contaminants at the clearing house storage area (Ref. 9, p. 4-1). No background soil sample was identified. Therefore, a surface soil sample, 01SS01, collected outside the area of Source 1, Dump A, was considered a background sample (Ref. 9, p. F-2). All surface soil samples were collected within 0 to 1 foot bgs (Ref. 9, p. 3-1). When the results of analysis of 01SS01 are compared with the results of analysis of 16SS01; 16SS02; 16SS03; and 16SS04, the following contaminants are found to be three times background: antimony; cadmium; chromium; cobalt; copper; iron; lead; manganese; mercury; nickel; zinc; 4,4'-DDD; 4,4'-DDT; aldrin; alpha-chlordane; Aroclor 1254; dieldrin; endrin; endrin aldehyde; and gamma-chlordane (Ref. 9, pp. T-73 to T-76).

Source Location (with reference to a map):

Source 9, the clearing house storage area, is located in the west central portion of the facility, on the west side of Cradock Street (Figures 2 and 10) (Ref. 5, p. 1-4).

A copy of Figure 10 is available at the EPA Headquarters Superfund Docket:

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1235 Jefferson Davis Highway
Arlington, VA 22202

Telephone: (703) 603-8917
E-Mail: superfund.docket@epa.gov

Containment:

Gas Release to Air: The air migration pathway was not scored.

Particulate Release to Air: The air migration pathway was not scored.

Release to Ground Water: The ground water migration pathway was not scored.

Release via Overland Migration/Flood: There is no evidence of the migration of hazardous substances from Source 9. However, neither of the following elements is present: (1) a maintained engineered cover or (2) a functioning and maintained runon control system and runoff management system (Ref. 5, p. 4-32). Therefore, a surface water containment factor value of 10 was assigned (Ref. 1, p. 51609).

2.4.1 Hazardous Substances

Items stored in the clearing house storage area included scrap metal, obsolete equipment, and salvaged material. A warehouse located in the area was used to store such excess items as computers, copiers, and other electrical equipment. Oil stains have been observed in the source area (Ref. 5, p. 4-32). Soil samples from the area indicate that the soil is contaminated with the following compounds: antimony; cadmium; chromium; cobalt; copper; iron; lead; manganese; mercury; nickel; zinc; 4,4'-DDD; 4,4'-DDT; aldrin; alpha-chlordane; Aroclor-1254; dieldrin; endrin; endrin aldehyde; and gamma chlordane (Ref. 9, p. T-73 to T-76 and F-14).

2.4.2 Hazardous Waste Quantity

2.4.2.1.1 Hazardous Constituent Quantity

The information available is insufficient to evaluate the hazardous constituent quantity for Source 9.

Sum (pounds): Unknown
Hazardous Constituent Quantity Value: NA

2.4.2.1.2 Hazardous Waste Stream Quantity

The information available is insufficient to evaluate the hazardous waste stream quantity for Source 9.

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

2.4.2.1.3 Volume

The information available is insufficient to evaluate the volume hazardous waste quantity value for Source 9.

Dimension of source (yd^3): Unknown
Reference(s): Ref. 5, p. 4-32
Volume Assigned Value: NA

2.4.2.1.4 Area

The area of Source 9 is approximately 6 acres (ref 5, p. 4-32). The area of the contamination in ft^2 is 6 acres x 43,560 ft^2/acres = 261,360 ft^2. The area divisor for determining the HWQ value assigned to an area of contaminated soil is 34,000. The calculation of HWQ value on the basis of the area of the source is:

261,360/34,000 = 7.69

Area of Source (ft^2): 261,360
Reference(s): 5, p. 4-32
Area Assigned Value: 7.69

2.4.2.1.5 Source Hazardous Waste Quantity Value

For Source 9, the clearing house storage area, the source HWQ value is based on six acres. The assigned value of the source is determined from HRS Table 2-5 (Ref. 1, p. 51591).

Source Hazardous Waste Quantity Value: 7.69

Summary of Site Source Descriptions

Source Number	Source Name	Source HWQ Value	Containment			
			Ground Water	Surface Water	Air Gas	Air Particulate
1	Dump A	12.81	NS	10	NS	NS
2	Dump B	19.21	NS	10	NS	NS
3	Dump C	128.12	NS	10	NS	NS
4	Dump D	64.06	NS	10	NS	NS
5	Burning Grounds	3.84	NS	10	NS	NS
6	Caged Pit	2.94×10^{-3}	NS	10	NS	NS
7	Cross Street and Mine Road	0.59	NS	10	NS	NS
8	Hazardous Waste Disposal Area Outside Building 53	>0	NS	10	NS	NS
9	Clearing House Storage Area	7.69	NS	10	NS	NS

NS - Not Scored

HWQ Total = 236.32

4.0 Surface Water Migration Pathway

The surface water migration pathway has been evaluated for Sources 1 through 9 at the St. Juliens Creek Annex. Surface water runoff from Sources 2 and 8 flows to St. Juliens Creek, which flows into the Southern Branch of the Elizabeth River. Surface water runoff from Sources 1 and 3 through 9 flows to Blows Creek, which also flows into the Southern Branch of the Elizabeth River. Both surface water migration pathways are evaluated. However, only one of those pathways are used to calculate the HRS score for the site. For the surface water pathway, the overland and flood migration component has been evaluated, however, the ground water-to-surface water migration component was not evaluated.

4.1 Overland/Flood Migration Component

For the overland and flood migration component, the threats to drinking water and the human food chain and the environment were evaluated for Sources 1 through 9.

4.1.1.1 Definition of Hazardous Substance Migration Pathway for Overland Flow/Flood Component

The St. Juliens Creek Annex is bordered by the Southern Branch of the Elizabeth River along its southeastern boundary and St. Juliens Creek along its southwestern boundary. Blows Creek flows from the north through wetlands to the southeast, bisecting the annex (Ref. 3; Ref. 23, p. 6). Both Blows Creek and St. Juliens Creek flow to the Southern Branch of the Elizabeth River (Ref. 3). Surface water runoff from the portion of St. Juliens Creek Annex northwest of the Virginia Power right-of-way flows either to St. Juliens Creek or to Blows Creek (Figures 1 and 2). The remainder of the annex is served by storm drains that empty into St. Juliens Creek or into the Southern Branch of the Elizabeth River (Ref. 4, pp. 18 and 23).

The Southern Branch of the Elizabeth River is characterized by a single deep central channel, fringed by shallows, tidal flats, and developed shorelines (Ref. 22, p. 1). It flows though a highly industrial area in which oil storage facilities, fertilizer plants, and creosote industries are located (Ref. 4, p. 18; Ref. 3). The Southern Branch of the Elizabeth River routes the major small boat traffic on the Intracoastal Waterway around the Great Dismal Swamp to Albemarle Sound, North Carolina (Ref. 4, p. 18; Ref. 22, p. 1). The Southern Branch of the Elizabeth River, St. Juliens Creek, and Blows Creek are tidally influenced (Ref. 22, p. 2; Ref. 23, p. 6; Ref. 8, p. 3-1).

The Southern Branch of the Elizabeth River has been classified by the Commonwealth of Virginia as a Class IIB River, with water and sediments contaminated by kepone from manufacturing activities of a private firm located several miles from St. Juliens Creek Annex. Harvesting shellfish from Class IIB waters is prohibited, but bathing and fishing are permitted (Ref. 4, pp. 18 and 25). The waters of the Southern Branch of the Elizabeth River, St. Juliens Creek, and Blows Creek are brackish (Ref. 4, p. 30). Both the Southern Branch of the Elizabeth River and St. Juliens Creek are used for recreational fishing (Ref. 4, p. 32; Ref. 23, p. 6).

Migratory (anadromous) finfish and species of special concern, as identified by the state, including the common barn owl, the great egret, the yellow-crowned night heron, and the least tern, use the Southern Branch of the Elizabeth River (Ref. 22, p. 1; Ref. 23, p. 2 and pp. 2, 3, and 4 of Table 1). The peregrine falcon, a federally designated endangered species, and the northern diamondback terrapin, a federally designated threatened species, were identified as occurring in the area represented on the Norfolk North United States Geological Survey (USGS) topographic map (Ref. 23, pp. 1 and 2 and p. 1 of Table 3; Ref. 27, pp. 1 to 3). Species of special concern, as identified by the state, that occur in the same area include: the common barn owl, the great egret; the yellow-crowned night-heron, and the foster's tern (Ref. 23, pp. 1 and 2 and pp. 1 and 2 of Table 3; Ref. 27, pp. 1 to 3). Those species are expected to use both the Southern Branch of the Elizabeth River and St. Juliens Creek as a habitat. In addition, several species of birds are expected to use Blows Creek.

The surface water overland flow for each source are described below. Figure 11 shows the probable points of entry (PPE) to surface water from each of the sources.

Source 1 - Overland Flow and PPE - 1

Surface water runoff from Source 1, Dump A is expected to flow 40 feet to the north to Blows Creek (Ref. 4, pp. 23 and 51). Figure 12 shows the overland flow distance and Figures 11 and 12 show the PPE to Blows Creek (Ref. 9, p. F-2). The 15-mile downstream target distance limit (TDL) from Source 1 is described below and shown in Reference 3.

Table 3
Source 1 - Target Distance Limit

Segment	Description	Length (feet)	Mile/Feet Marker
1	From the PPE to Blows Creek (PPE-1 on Reference 3) to the Southern Branch of the Elizabeth River	1,320	0.25/1,320
2	From the Southern Branch of the Elizabeth River to the Elizabeth River (measured from the convergence of Blows Creek and the Southern Branch of the Elizabeth River to the beginning of the Elizabeth River as shown on Reference 3)	21,120	4.25/22,440
3	From the Elizabeth River to Hampton Roads (measured from the beginning of the Elizabeth River to the beginning of Hampton Roads as shown on Reference 3)	36,960	11.25/59,400
4	From the beginning of Hampton Roads to 3.75 miles into Hampton Roads (see Reference 3)	19,800	15/79,200

A copy of Figure 11 is available at the EPA Headquarters Superfund Docket:

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A copy of Figure 12 is available at the EPA Headquarters Superfund Docket:

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Source 2 - Overland Flow and PPE - 2

The location of Source 2, Dump B was a low, swampy area. Ash from the burning of waste in the dump was used to fill the swampy area (Ref. 4, p. 50). Therefore, wastes were disposed directly into the surface water of St. Juliens Creek (Ref. 4, pp. 50 and 51). Surface water runoff from Source 2, Dump B (Landfill B) is not controlled and flows directly to St. Juliens Creek through an underground storm drain (Ref. 23, p. 1). On October 10, 1996, the eastern part of the dump was covered with water that appeared to drain into St. Juliens Creek to the south (Ref. 13, p. 3-5). The overland flow distance, or the distance that water travels from the storm drain to St. Juliens Creek, is estimated to be 150 feet. That estimate is based on Figure 13 (Ref. 13, p. 7). Figures 11 and 13 show the location of the PPE to St. Juliens Creek. The 15-mile downstream TDL from Source 2 is described below and shown in Reference 3.

Table 4
Source 2 - Target Distance Limit

Segment	Description	Length (feet)	Mile/Feet Marker
1	From the PPE to St. Juliens Creek (PPE 2 on Reference 3) to the Southern Branch of the Elizabeth River	2,112	0.40/2,112
2	From the Southern Branch of the Elizabeth River to the Elizabeth River (measured from the confluence of St. Juliens Creek and the Southern Branch of the Elizabeth River to the beginning of the Elizabeth River as shown on Reference 3)	23,760	4.90/25,872
3	From the Elizabeth River to Hampton Roads (measured from the beginning of the Elizabeth River, to the beginning of Hampton Roads, as shown on Reference 3)	36,960	11.90/62,835
4	From the beginning of Hampton Roads to 3.10 miles into Hampton Roads (see Reference 3)	16,365	15/79,200

A copy of Figure 13 is available at the EPA Headquarters Superfund Docket:

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Source 3 - Overland Flow and PPE - 3

The location of Source 3 Dump C was a low-lying area including mud flats that were reclaimed with rubbish and ashes (Ref. 4, p. 54). Therefore, wastes were deposited directly into surface water. Surface water runoff from Source 3, Dump C, flows south approximately 1,800 feet to Blows Creek (Ref. 22, p. 3; Ref. 4, p. 23; Ref. 5, p. 1-4; Ref. 15, p. 3-5). The overland flow and the PPE are shown on Figure 11. The 15-mile downstream TDL from Source 3 is described below and shown in Reference 3.

Table 5
Source 3 - Target Distance Limit

Segment	Description	Length (feet)	Mile/Feet Marker
1	From the PPE to Blows Creek (PPE 3 on Reference 3) to the Southern Branch of the Elizabeth River	792	0.15/792
2	From the Southern Branch of the Elizabeth River to the Elizabeth River (measured from the convergence of Blows Creek and the Southern Branch of the Elizabeth River, to the beginning of the Elizabeth River as shown on Reference 3)	21,120	4.15/21,912
3	From the Elizabeth River to Hampton Roads (measured from the beginning of the Elizabeth River to the beginning of Hampton Roads, as shown on Reference 3)	36,960	11.15/58,872
4	From the beginning of Hampton Roads to 3.85 miles into Hampton Roads (see Reference 3)	20,328	15/79,200

Source 4 - Overland Flow and PPE - 4

Surface water runoff from Source 4, Dump D, flows south and southeast to wetlands that lie alongside Blows Creek (Ref. 23, p. 3; Ref. 15, p. 3-6). The shortest overland flow distance from Source 4, Dump D, to Blows Creek is less than 25 feet, as shown in Figure 15 (Ref. 16, p. 12). Since surface water runoff is not contained, such runoff from Dump D can enter Blows Creek at any point within the area shaded on Figures 11 and 14 (Ref. 5, p. 4-9). Surface water runoff also can enter the Southern Branch of the Elizabeth River. The overland flow distance to the river is less than 50 feet (Ref. 16, p. 12). Since surface water runoff is not contained, such runoff from Dump D can enter the Southern Branch of the Elizabeth River at any point within the area shaded on Figure 14 (Ref. 5, p. 4-9). The 15-mile TDL from Source 4 is described below and shown in Reference 3.

Table 6
Source 4 - Target Distance Limit

Segment	Description	Length (feet)	Mile/Feet Marker
1	From the PPE to Blows Creek (PPE 4 on Reference 3) to the Southern Branch of the Elizabeth River	792	0.15/792
2	From the Southern Branch of the Elizabeth River to the Elizabeth River (measured from the confluence of Blows Creek and the Southern Branch of the Elizabeth River, to the beginning of the Elizabeth River as shown on Reference 3)	21,120	4.15/21,912
3	From the Elizabeth River to Hampton Roads (measured from the beginning of the Elizabeth River to the beginning of Hampton Roads, as shown on Reference 3)	36,960	11.15/58,872
4	From the beginning of Hampton Roads to 3.85 miles into Hampton Roads (see Reference 3)	20,328	15/79,200

A copy of Figure 14 is available at the EPA Headquarters Superfund Docket:

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Source 5 - Overland Flow and PPE - 5

Surface water runoff from Source 5, the burning grounds, flows to an drainage ditch of Blows Creek (Ref. 23, p. 3). The drainage ditch flows from the burning grounds 270 feet south to Blows Creek, as shown in Figures 11 and 15. The 15-mile downstream TDL from Source 5 is described below and shown in Reference 3.

Table 7
Source 5 - Target Distance Limit

Segment	Description	Length (feet)	Mile/Feet Marker
1	From the PPE to Blows Creek (PPE 5 on Reference 3) to the Southern Branch of the Elizabeth River	1,100	0.21/1,100
2	From the Southern Branch of the Elizabeth River to the Elizabeth River (measured from the confluence of Blows Creek and the Southern Branch of the Elizabeth River to the beginning of the Elizabeth River, as shown on Reference 3)	21,120	4.21/22,220
3	From the Elizabeth River to Hampton Roads (measured from the beginning of the Elizabeth River to the beginning of Hampton Roads, as shown on Reference 3)	36,960	11.21/59,180
4	From the beginning of Hampton Roads to 3.79 miles into Hampton Roads (see Reference 3)	20,011	15/79,200

A copy of Figure 15 is available at the EPA Headquarters Superfund Docket:

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Source 6 - Overland Flow and PPE - 6

Surface water runoff from Source 6, the caged pit, flows to a drainage ditch (Ref. 23, p. 3). The drainage ditch flows 700 feet west and south and converges with Blows Creek, as shown in Figures 11 and 15. The 15-mile downstream TDL from Source 6 is described below and shown in Reference 3.

Table 8
Source 6 - Target Distance Limit

Segment	Description	Length (feet)	Mile/Feet Marker
1	From the PPE to Blows Creek (PPE 6 on Reference 3) to the Southern Branch of the Elizabeth River	1,100	0.21/1,100
2	From the Southern Branch of the Elizabeth River to the Elizabeth River (measured from the convergence of Blows Creek and the Southern Branch of the Elizabeth River, to the beginning of the Elizabeth River as shown on Reference 3)	21,120	4.21/22,220
3	From the Elizabeth River to Hampton Roads (measured from the beginning of the Elizabeth River to the beginning of Hampton Roads, as shown on Reference 3)	36,960	11.21/59,180
4	From the beginning of Hampton Roads to 3.79 miles into Hampton Roads (see Reference 3)	20,011	15/79,200

Source 7 - Overland Flow and PPE - Unknown

Surface water runoff from Source 7, the Cross Street and Mine Road area, is expected to enter the storm sewer. The sewer discharges to Blows Creek or to the Southern Branch of the Elizabeth River (Ref. 8, p. 5-3; Ref. 23, p. 5). Because of the size of the annex, the distance is not expected to be more than two miles (Figure 2).

Source 8 - Overland Flow and PPE - Unknown

Surface water runoff from the hazardous waste disposal area outside Building 53 (Source 8) flows to drainage ditches that discharge to Blows Creek or St. Juliens Creek (Ref. 23, p. 5). The exact locations at which the drainage ditches discharge to the surface water have not been determined. However, because of the size of the annex, the distances are not expected to be more than two miles (Figure 2).

Source 9 - Overland Flow and PPE - Unknown

Surface water runoff from Source 9, the clearing house storage area, flows to drainage ditches that discharge to Blows Creek (Ref. 23, p. 5). The exact locations at which the drainage ditches discharge to Blows Creek have not been determined. However, because of the size of the annex, the distances are not expected to be more than two miles (Figure 2).

4.1.2.1 LIKELIHOOD OF RELEASE

The surface water migration pathway is evaluated against the criteria for an observed release of hazardous substances, supported by chemical analysis.

4.1.2.1.1 Observed Release

An observed release to St. Juliens Creek, Blows Creek, and the Southern Branch of the Elizabeth River has been documented by chemical analysis of sediment samples collected in February 1999 (Ref. 23). A discussion of the documentation that supports observed releases to each of those surface water bodies is provided in the section below.

Chemical Analysis

Chemical analysis of sediment samples collected from St. Juliens Creek, Blows Creek, and the Southern Branch of the Elizabeth River in February 1999 documents an observed release of hazardous substances to surface water. A discussion of the background samples and release samples is provided below.

Background Samples

One background sample each was collected from St. Juliens Creek (SD-9), Blows Creek (SD-15), and the Southern Branch of the Elizabeth River (SD-22) (Ref. 23, Appendix A, Table 1). The table below summarizes the locations of the background samples, the sample depths, and the dates on which the samples were collected. Figures 16 and 17 show the locations from which the samples were taken.

Table 9
Background Sample Locations

Sample ID	Sample Location	Depth (inches)	Date	Reference
SD-9	St. Juliens Creek, approximately 500 feet upstream of Cradock Road	0 - 8	2/4/99	23, pp. 2 and 4 and Appendix A, Table 1
SD-15	Blows Creek, adjacent to the north side of a road that leads to building 182	0 - 8	2/4/99	23, pp. 2 and 4 and Appendix A, Table 1
SD-22	Southern Branch of the Elizabeth River, adjacent to Gilmerton Bridge on the west side of the Southern Branch of the Elizabeth River	0 - 8	2/4/99	23, pp. 2 and 4 and Appendix A, Table 1

A copy of Figure 16 is available at the EPA Headquarters Superfund Docket:

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A copy of Figure 17 is available at the EPA Headquarters Superfund Docket:

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Contaminated Samples

The results of an analysis of sediment samples collected from St. Juliens Creek, Blows Creek, and the Southern Branch of the Elizabeth River document an observed release to surface water. Table 10 summarizes the locations from which the contaminated samples were collected. Figures 16 and 17 show the locations from which the samples were collected.

Observed Release - St. Juliens Creek

Tables 11 and 12 provide a summary of the concentrations of inorganic and organic hazardous substances detected in the background, SD-9, and in the observed release samples collected from St. Juliens Creek in February 1999 (Ref. 23, Appendix A, Tables 1, 6, and 7). The concentrations of hazardous substances in release samples that are equal to or greater than three times the background concentration and are above the detection limit if not detected in the background sample appear in the table in bold and italics type. Those samples meet the analytical criteria for documenting an observed release to surface water by chemical analysis (Ref. 1, pp. 51589 and 51609).

Observed Release - Blows Creek

Tables 13 and 14 provide a summary of the concentrations of inorganic and organic hazardous substances detected in the background, SD-15, and in the observed release samples collected from Blows Creek in February 1999 (Ref. 23, Appendix A, Tables 1, 2, and 3). The concentrations of hazardous substances in release samples that are equal to or greater than three times the background concentration and are above the detection limit if not detected in the background sample appear in the table in bold and italics type. Those samples meet the analytical criteria for documenting an observed release to surface water by chemical analysis (Ref. 1, pp. 51589 and 51609).

Observed Release - Southern Branch of the Elizabeth River

Tables 15 and 16 provide a summary of the concentrations of inorganic and organic hazardous substances detected in the background, SD-22, and the observed release samples collected from the Southern Branch of the Elizabeth River in February 1999 (Ref. 23, Appendix A, Tables 1, 8, and 9). The concentrations of hazardous substances in release samples that are equal to or greater than three times the background concentration or above the detection limit if not detected in the background sample appear in the table in bold and italics. Those samples meet the analytical criteria for documenting an observed release to surface water by chemical analysis (Ref. 1, pp. 51589 and 51609).

Table 10
Contaminated Samples

Sample Number	Date	Time	Depth	Location	Sources Upstream of Sample Location	Description	Reference
Southern Branch of the Elizabeth River							
SD-1	2/4/99	1040	0-8"	Approximately 1,000 feet downstream of SD-2 in the Southern Branch of the Elizabeth River	Sources 1 through 9	Grayish-brown sand	23, Appendix A, Table 1 and Figures 1 and 2, pp. 2 and 4
SD-2	2/4/99	1030	0-8"	Approximately 1,500 feet downstream of SD-3 in the Southern Branch of the Elizabeth River	Sources 1 through 9	Silty clay, with orange mottles in gray matrix	23, Appendix A, Table 1 and Figures 1 and 2, pp. 2 and 4
SD-3	2/4/99	1007	0-8"	Approximately 500 feet downstream of SD-4 in the Southern Branch of the Elizabeth River	Sources 1 through 9	Reddish-gray sand, with roots and black mottles	23, Appendix A, Table 1 and Figures 1 and 2, pp. 2 and 4
SD-4	2/4/99	1019	0-8"	Approximately 500 feet downstream of SD-5 in the Southern Branch of the Elizabeth River	Sources 1 through 9	Organic matter with black streaking	23, Appendix A, Table 1 and Figures 1 and 2, pp. 2 and 4
SD-5	2/4/99	0930	0-8"	Approximately 100 feet downstream of Blows Creek in a wetland adjacent to the Southern Branch of the Elizabeth River	Sources 1 through 9	Black and gray sand with roots	23, Appendix A, Table 1 and Figures 1 and 2, pp. 2 and 4
SD-6	2/4/99	0900	0-8"	Approximately 100 feet upstream of Blows Creek in a wetland adjacent to the Southern Branch of the Elizabeth River	Source 2	Gray sand with black mottles and some roots	23, Appendix A, Table 1 and Figures 1 and 2, pp. 2 and 4
SD-7	2/4/99	0910	0-8"	Approximately 200 feet upstream of SD-6 in a wetland adjacent to the Southern Branch of the Elizabeth River	Source 2	Gray sand with black and red mottles and some roots	23, Appendix A, Table 1 and Figures 1 and 2, pp. 2 and 4
SD-8	2/4/99	0910	0-8"	Duplicate of SD-7	Source 2	Gray sand with black and red mottles and some roots	23, Appendix A, Table 1 and Figures 1 and 2, pp. 2 and 4
St. Juliens Creek							
SD-11	2/4/99	1210	0-8"	St Juliens Creek, adjacent to a boom, approximately 250 feet upstream of SD-12	Source 2	Black sand	23, Appendix A, Table 1 and Figures 1 and 2, pp. 2 and 4
SD-12	2/4/99	1415	0-8"	St Juliens Creek, approximately 1,000 feet upstream of SD-13	Source 2	Black sand	23, Appendix A, Table 1 and Figures 1 and 2, pp. 2 and 4
SD-13	2/4/99	1400	0-8"	St Juliens Creek, approximately 1,000 feet upstream of SD-14	Source 2	Black sand	23, Appendix A, Table 1 and Figures 1 and 2, pp. 2 and 4
SD-14	2/4/99	1210	0-8"	St Juliens Creek, at its confluence with the Southern Branch of the Elizabeth River	Source 2	Black gray sand with strong rotten-egg odor and some roots	23, Appendix A, Table 1 and Figures 1 and 2, pp. 2 and 4
Blows Creek							
SD-16	2/4/99	1610	0-8"	Blows Creek, approximately 450 feet downstream of SD-17	Sources 1, 5, and 6	Black silt and sand	23, Appendix A, Table 1 and Figures 1 and 2, pp. 2 and 4
SD-17	2/4/99	1538	0-8"	Blows Creek, approximately 300 feet downstream of Cradock Street	Source 1	Black sand	23, Appendix A, Table 1 and Figures 1 and 2, pp. 2 and 4
SD-19	2/4/99	1745	0-8"	Blows Creek, approximately 450 feet downstream of SD-16	Sources 1, 3, 5, and 6	Black silt and sand	23, Appendix A, Table 1 and Figures 1 and 2, pp. 2 and 4
SD-20	2/4/99	1430	0-8"	Blows Creek, approximately 300 feet upstream of its confluence with the Southern Branch of the Elizabeth River	Sources 1, 3, 4, 5, and 6	Black gray organic matter and sand	23, Appendix A, Table 1 and Figures 1 and 2, pp. 2 and 4
SD-21	2/4/99	1430	0-8"	Duplicate of SD-20	Sources 1, 3, 4, 5, and 6	Black gray organic matter and sand	23, Appendix A, Table 1 and Figures 1 and 2, pp. 2 and 4

Table 11
Inorganics Observed Release - St. Juliens Creek
St. Juliens Creek Annex

Tetra Tech Sample No.			SD-9		SD-11		SD-12		SD-13		SD-13		SD-14	
CLP Sample No.			MCWH20		MCWJ22		MCWJ23		MCWJ24		MCWY90		MCWJ25	
Date Sampled			2/4/99		2/4/99		2/4/99		2/4/99		2/4/99		2/4/99	
% Solids			80.3		75.4		76.1		58.8		60.9		44.3	
Reference			23, Appendix A, Table 6; 25, Table 3, p. 1 and Appendix A, p. 12		23, Appendix A Table 6; 25, Table 3, p. 2 and Appendix A, p. 14		23, Appendix A, Table 6; 25, Table 3, p. 2 and Appendix A, p. 15		23, Appendix A, Table 6; 25, Table 3, p. 2 and Appendix A, p. 16		23, Appendix A, Table 6; 25, Table 3, p. 2 and Appendix A, p. 22		23, Appendix A, Table 6; 25, Table 3, p. 2 and Appendix A, p. 17	
Sample Location	Units	CRDL	St. Juliens Creek Background	Q	St. Juliens Creek	Q	St. Juliens Creek	Q	St. Juliens Creek	Q	St. Juliens Creek	Q	St. Juliens Creek	Q
Analyte														
Copper	mg/kg	5	7.30		***28.60***		***30.20***		***55.30***		***42.40***		***72.20***	
Lead	mg/kg	0.6	7.30		***21.90***		20.20		***53.80***		***73.60***		***97.20***	
Magnesium	mg/kg	1000	[1110.00]		[1200.00]		2730.00		2640.00		***6000.00***		3050.00	
Manganese	mg/kg	3	20.20		24.60		33.70		***66.20***		***110.00***		***110.00***	
Nickel	mg/kg	8	[3.60]		[3.90]		[3.80]		[8.20]		[9.00]		***[16.50]***	
Selenium	mg/kg	1	ND		ND		***1.6***	***K***		UL	***2.00***	***K***	***[1.80]***	***K***
Thallium	mg/kg	2	ND		ND		[1.10]		[1.60]	L	***[2.40]***		ND	
Zinc	mg/kg	4	15.20		***131.00***		***91.50***	***L***	***188.00***		***219.00***		***241.00***	

Notes:
- B — Not detected substantially above the level reported in laboratory or field blanks.
- K — Analyte present. Reported value may be biased high. Actual value is expected to be lower.
- UL — Not detected, quantitation limit is probably higher.
- L — Analyte present. Reported value may be biased low. Actual value is expected to be higher.
- ***BOLD*** — Concentration meets criteria for observed release as given in HRS Table 2-3 (three times background concentration, or detection with a non-detect background), with consideration of data qualifiers (Ref. 13).
- [ ] — Analyte present. As values approached the Instrument Detection Limit (IDL) the quantitation limit may not be accurate.
- CRDL — Contract Required Detection Limit.
- Q — Data qualifier
- mg/kg — Milligram per kilogram
- SD — Sediment

Table 12
Organics Observed Release - St. Juliens Creek
St. Juliens Creek Annex

Tetra Tech Sample No.			SD-9		SD-13		SD-14	
CLP Sample No.			CTB96		CTH00		CTH01	
Date Sampled			2/4/99		2/4/99		2/4/99	
% Moisture			20		36		70	
Reference			23, App. A, Table 7; 26, App. B, p. B-7		23, App. A, Table 7; 26, App. B, p. B-8		23, App. A, Table 7; 26, App. B, p. B-8	
Sample Location	Units	CRQL	St. Juliens Creek Background	Q	St. Juliens Creek	Q	St. Juliens Creek	Q
Base Neutral Acids								
Acenaphthylene	µg/kg	330	ND		***600***		190	J
Phenanthrene	µg/kg	330	ND		***1800***		320	J
Anthracene	µg/kg	330	ND		***1400***		290	J
Fluoranthene	µg/kg	330	ND		***9200****		***2500***	
Pyrene	µg/kg	330	ND		***8100****		***1900***	
Benzo(a)anthracene	µg/kg	330	ND		***4400****		***1200***	
Chrysene	µg/kg	330	ND		***4400****		***1500***	
Benzo(b)fluoranthene	µg/kg	330	ND		***4800****		***2100***	
Benzo(k)fluoranthene	µg/kg	330	ND		***2500***		***1900***	
Benzo(a)pyrene	µg/kg	330	ND		***2700***		***1400***	
Indeno(1,2,3-cd)pyrene	µg/kg	330	ND		***1400***		550	J
Dibenz(a,h)anthracene	µg/kg	330	ND		***670***		180	J
Benzo(g,h,i)perylene	µg/kg	330	ND		***780***		340	J
Pesticides and Polychlorinated Biphenyls								
Reference			23, App. A, Table 7; 26, App. B, p. B-12		23, App. A, Table 7; 26, App. B, p. B-13		23, App. A, Table 7; 26, App. B, p. B-13	
4,4'-DDE	µg/kg	3.3	ND		***16***		***70***	
Endosulfan sulfate	µg/kg	3.3	ND		ND		***93***	
4,4'-DDT	µg/kg	3.3	ND		ND		34	J
4,4'-DDD	µg/kg	3.3	ND		***20***		ND	

Notes:
- B — Not detected substantially above the level reported in laboratory or field blanks.
- Q — Data qualifier
- ND — Not detected
- [ ] — Analyte present. As values approached the Instrument Detection Limit (IDL) the quantitation limit may not be accurate.
- ***BOLD*** — Concentration meets criteria for observed release as given in HRS Table 2-3 (three times background concentration, or detection with a non-detect background), with consideration of data qualifiers (Ref. 31).
- CRQL — Contract Required Quantitation Limit
- J — Analyte present. Reported value may not be accurate or precise.
- µg/kg — Microgram per kilogram
- * — Results reported from diluted analysis
- SD — Sediment

Table 13
Inorganics Observed Release - Blows Creek
St. Juliens Creek Annex

Tetra Tech Sample No.			SD-15		SD-20		SD-21	
CLP Sample No.			MCWJ26		MCWH53		MCWH54	
Date Sampled			2/4/99		2/4/99		2/4/99	
% Solids			76.1		53.4		54.3	
Reference			23, App. A, Table 2; 25, Table 3, p. 2 and App. A, p. 18		23, App. A, Table 2; 25, Table 3, p. 4 and App. AA, p. 2		23, App. A, Table 2; 25, Table 3, p. 4 and App. AA, p. 3	
Sample Location	Units	CRDL	Blows Creek Background	Q	Blows Creek	Q	Dup. of SD-20	Q
Analyte								
Antimony	mg/kg	12	ND		***[15.70]***	K	***[16.20]***	
Barium	mg/kg	40	[36.90]		***1900.00***		***820.00***	
Chromium	mg/kg	2	20.80		***139.00***		***181.00***	
Copper	mg/kg	5	78.50		***823.00***		***915.00***	
Iron	mg/kg	20	21100.00		***88300.00***		49000.00	
Lead	mg/kg	0.6	151.00		***1560.00***		***1410.00***	
Manganese	mg/kg	3	172.00		***593.00***		***763.00***	
Mercury	mg/kg	0.1	0.37	K	***1.40***		***1.50***	
Zinc	mg/kg	4	352.00		***2550.00***		***2010.00***	

Notes:

B	Not detected substantially above the level reported in laboratory or field blanks.	CRDL	Contract Required Detection Limit
K	Analyte present. Reported value may be biased high. Actual value is expected to be lower.	Q	Data qualifie.
UL	Not detected, quantitation limit is probably higher.	ND	Not detected
L	Analyte present. Reported value may be biased low. Actual value is expected to be higher.	[ ]	Analyte present. As values approached the IDL, the quantitation limit may not be accurate.
mg/kg	Milligram per kilogram		
BOLD	Concentration meets criteria for observed release as given in HRS Table 2-3 (three times background concentration, or detection with a non-detect background), with consideration of data qualifiers (Ref. 31).		

Table 14
Organics Observed Release - Blows Creek
St. Juliens Creek Annex

Tetra Tech Sample No.			SD-15		SD-18		SD-21	
CLP Sample No.			CTH02		CTH05		CTH08	
Date Sampled			2/4/99		2/4/99		2/4/99	
% Moisture			69		41		43	
Reference			23, App. A, Table 3; 26, App. B, p. B-8		23, App. A, Table 3; 26, App. B, p. B-10		23, App. A, Table 3; 26, App. B, p. B-17	
Sample Location	Units	CRQL	Blows Creek Background	Q	Blows Creek	Q	Dup. of SD-20	Q
Base Neutral Acids								
Fluorene	µg/kg	330	ND		***480***		***580***	
Phenanthrene	µg/kg	330	430	J	ND		***4,800***	
Carbazole	µg/kg	330	ND		***2,100***		***860***	

Notes:
- Q — Data qualifier
- B — Not detected significantly above the level reported in laboratory and field blanks.
- CRQL — Contract Required Quantitation Limit
- J — Analyte present. Reported value may not be accurate or precise.
- R — Unusable result. Analyte may or may not be present in the sample. Supporting data necessary to confirm results.
- ***BOLD*** — Concentration meets criteria for observed release as given in HRS Table 2-3 (three times background concentration, or detection with a non-detect background), with consideration of data qualifiers (Ref. 31).
- ND — Not detected
- µg/kg — Microgram per kilogram
- * — Results reported from diluted analysis

Table 15
Inorganics Observed Release - Southern Branch of Elizabeth River
St. Juliens Creek Annex

Tetra Tech Sample No.			SD-22		SD-5		SD-4		SD-3		SD-2	
CLP Sample No.			MCWH55		MCWJ16		MCWJ15		MCWJ14		MCWJ13	
Date Sampled			2/4/99		2/4/99		2/4/99		2/4/99		2/4/99	
% Solids			81.0		73.7		20.2		72.2		54.3	
Reference			23, App. A, Table 8; 25, Table 3, p. 4 and App. AA, p. 4		23, App. A, Table 8; 25, Table 3, p. 1 and A pp. A, p. 8		23, App. A, Table 8; 25, Table 3, p. 1 and A pp. A, p. 7		23, App. A, Table 8; 25, Table 3, p. 1 and A pp. A, p. 6		23, App. A, Table 8; 25, Table 3, p. 1 and A pp. A, p. 5	
Sample Location	Units	CRDL	Southern Branch of the Elizabeth River Background	Q	Southern Branch of the Elizabeth River	Q	Southern Branch of the Elizabeth River	Q	Southern Branch of the Elizabeth River	Q	Southern Branch of the Elizabeth River	Q
Analyte												
Barium	mg/kg	40	[11.70]		***[47.60]***		[14.70]		[9.60]		***[42.60]***	
Cobalt	mg/kg	10	[0.77]	K	***[2.70]***	***L***	***[14.10]***	L	***[3.80]***	L	***[6.70]***	L

Notes:
- B — Not detected substantially above the level reported in laboratory or field blanks.
- K — Analyte present. Reported value may be biased high. Actual value is expected to be lower.
- UJ — Not detected, quantitation limit may be inaccurate or imprecise.
- L — Analyte present. Reported value may be biased low. Actual value is expected to be higher.
- [ ] — Analyte present. As values approached the Instrument Detection Limit (IDL) the quantitation limit may not be accurate.
- ***BOLD*** — Concentration meets criteria for observed release as given in HRS Table 2-3 (three times background concentration, or detection with a non-detect background), with consideration of data qualifiers (Ref. 31).
- CRDL — Contract Required Detection Limit.
- Q — Data qualifier
- UL — Not detected, quantitation limit is probably higher.
- ND — Not detected
- mg/kg — Milligrams per kilogram

Table 16
Organics Observed Release - Southern Branch of the Elizabeth River
St. Juliens Creek Annex

Tetra Tech Sample No.			SD-22		SD-5		SD-3	
CLP Sample No.			CTH09		CTB92		CTB90	
Date Sampled			2/4/99		2/4/99		2/4/99	
% Moisture			18.0		23.0		29	
Reference			23, App. A, Table 9, p. 1 26, App. B, p. B-17		23, App. A, Table 9, p. 1; 26, App. B, p. B-6		23, App. A, Table 9, p. 1; 26, App. B, p. B-6	
Sample Location	Units	CRQL	Southern Branch of the Elizabeth River Background	Q	Southern Branch of the Elizabeth River	Q	Southern Branch of the Elizabeth River	Q
Base Neutral Acids								
Naphthalene	µg/kg	330	ND		***560***		100	J
Anthracene	µg/kg	330	ND		***1,400***		ND	
Di-n-butylphthalate	µg/kg	330	ND		110		460	***L***
Fluoranthene	µg/kg	330	ND		***1,700***		***1100***	***L***
Pyrene	µg/kg	330	120	J	***1,500***		***910***	
Benzo(a)anthracene	µg/kg	330	ND		***1,000***		***600***	***L***
Chrysene	µg/kg	330	ND		***1,500***		***770***	***L***
Benzo(b)fluoranthene	µg/kg	330	ND		***1,100***		***620***	***L***
Benzo(k)fluoranthene	µg/kg	330	ND		***890***		***570***	***L***
Benzo(a)pyrene	µg/kg	330	43	J	***880***		***540***	***L***

Notes:
- Q — Data qualifier
- B — Not detected significantly above the level reported in laboratory and field blanks.
- J — Analyte present. Reported value may not be accurate or precise.
- L — Analyte present. Reported value may be biased low. Actual value is expected to be higher.
- CRQL — Contract Required Quantitation Limit
- µg/kg — Microgram per kilogram
- ***BOLD*** — Concentration meets criteria for observed release as given in HRS Table 2-3 (three times background concentration, or detection with a non-detect background), with consideration of data qualifiers (Ref. 31).

Attribution:

The three sections below discuss the attribution to sources located at St. Juliens Creek Annex of hazardous substances detected in sediments at concentrations three times the background concentration in St. Juliens Creek, Blows Creek, and the Southern Branch of the Elizabeth River.

St. Juliens Creek

Contaminants detected in sediment samples collected from St. Juliens Creek downstream of Source 2, Dump B, and in soil samples collected from Source 2 at concentrations that equal or exceed three times the background level, as documented in Tables 11 and 12 and Section 2.2, Source 2 of this documentation record include: copper, lead, magnesium, manganese, nickel, selenium, thallium, zinc, acenaphthylene, phenanthrene, anthracene, fluoranthene, pyrene, benzo(a)anthracene, chrysene, benzo(b)fluoranthene, and benzo(a)pyrene (see Tables 2 and 3 and Section 2.2, Source 2 of this documentation record and Ref. 23, pp. 2 and 4). Surface water runoff from Source 2 is not contained and drains directly to St. Juliens Creek (Ref. 5, p. 4-4). A swampy area was formerly located in the area of Source 2 (Ref. 4, p. 50; Ref. 7, p. 2). Therefore, wastes were disposed directly into surface water. The absence of surface water containment at Source 2 (Ref. 5, p. 4-4) and the presence of contaminants in soil samples obtained from Source 2 and in sediment samples obtained from St. Juliens Creek downstream of Source 2 at concentrations that equal or exceed three times the background level indicate that the contaminants in the soil of Source 2 have been released to St. Juliens Creek. The presence of those contaminants in St. Juliens Creek is at least partially attributable to Source 2.

Hazardous Substances Released:

Hazardous substances detected in sediments from St. Juliens Creek at concentrations that document an observed release from Source 2, Dump B include: copper, lead, magnesium[a], manganese[a], nickel, selenium, thallium, zinc, phenanthrene, fluoranthene, pyrene, benzo(a)anthracene, chrysene, benzo(b)fluoranthene, and benzo(a)pyrene.

[a] This contaminant is not listed as a Comprehensive Environmental Response Compensation, and Liability Act (CERCLA) hazardous substance as set forth in 40 Code of Federal Regulations (CFR) 302.4, but is a CERCLA pollutant or contaminant according to the HRS (Ref. 1).

Observed Release Factor Value: 550

Blows Creek

A sediment sample (SD-20) and its duplicate (SD-21) collected in Blows Creek, approximately 300 feet upstream of its confluence with the Southern Branch of the Elizabeth River and downstream of sources 1, 3, 4, 5, and 6, revealed the presence of inorganic and organic compounds at concentrations that equal or exceed three times the background level, as documented in Tables 13 and 14 of this documentation record (Ref. 23, pp. 2 and 4 and Appendix A, Table 1). Those compounds include: antimony, barium, chromium, copper, iron, lead, manganese, mercury, zinc, fluorene, phenanthrene, and carbazole (see Tables 4 and 5 of this documentation record and Ref. 23, pp. 2 and 4 and Appendix A, Table 1).

Antimony, barium, chromium, copper, iron, lead, manganese, and mercury also were detected in surface soil samples collected from sources 1, 3, 4, 5, and 6, as documented in Section 2.2 of this documentation record. The surface water runoff from those sources drains to Blows Creek, as documented in Section 2.2 of this documentation record. The only organic compound detected in Blows Creek at a concentration that exceeds or equals three times the background level and in surface soil samples collected from sources that drain to Blows Creek (Sources 3, 4, and 6) is phenanthrene. Therefore, the presence of antimony, barium, chromium, copper, iron, lead, manganese, mercury, and phenanthrene in the sediment of Blows Creek at concentrations that equal or exceed three times background is at least partially attributable to the contaminated soils in sources 1, 3, 4, 5, and 6. In addition, wastes disposed in sources 1, 3, 4, and 5 included inorganic compounds (Ref. 6, p. 1; Ref. 14, p. 1; Ref. 17, p. 1; Ref. 18, p. 1). No other potential sources of contamination to Blows Creek have been identified. Blows Creek originates at St. Juliens Creek Annex (Ref. 3).

Hazardous Substances Released:

Hazardous substances detected in sediments collected from Blows Creek at concentrations that document an observed release from sources 1, 3, 4, 5, and 6 include: antimony, barium[a], chromium, copper, iron[a], lead, manganese[a], mercury, and phenanthrene.

[a] This contaminant is not listed as a hazardous substance under CERCLA as set forth in 40 CFR 302.4, but is a CERCLA pollutant or contaminant according to the HRS (Ref. 1).

Observed Release Factor Value: 550

Southern Branch of the Elizabeth River

In February 1999, seven sediment samples, including one background sample, were collected from the Southern Branch of the Elizabeth River (Ref. 23, pp. 2 and 4 and Appendix A, Table 1). Tables 15 and 16 summarize the contaminants detected in the sediment samples at concentrations that equal or exceed three times the background concentrations. Four of those samples, SD-2 through SD-5, contained concentrations of inorganic compounds at levels that equal or exceed three times the background concentrations. The samples were collected downstream of Blows Creek and sources 1, 3, 4, 5, and 6. Inorganic compounds detected at levels that equal or exceed three times the background concentrations in sediment samples obtained from the Southern Branch of the Elizabeth River, downstream of Blows Creek and sources 1, 3, 4, 5, and 6 include: aluminum, arsenic, barium, beryllium, chromium, cobalt, copper, iron, magnesium, manganese, nickel, vanadium, and zinc (see Table 15 and Figures 16 and 17). Those inorganic compounds, with the exception of magnesium, also were detected in soil samples collected from sources 1, 3, 4, 5, and 6, as documented in Section 2.2 of this documentation record. With the exception of barium, none of those metals was detected in the three sediment samples (SD-5, SD-6, and SD-7) collected in the Southern Branch of the Elizabeth River upstream of the convergence of Blows Creek with the Southern Branch of the Elizabeth River (see Figures 16 and 17) at levels that equal or exceed three times the background concentrations (see Table 15). Therefore metals are present in sediments of the Southern Branch of the Elizabeth River downstream of Blows Creek in significant concentrations and are not in sediments of the Southern Branch of the Elizabeth River upstream of Blows Creek. That trend in concentrations indicates that inorganic compounds are being released to the Southern Branch of the Elizabeth River from sources 1, 3, 4, 5, and 6 through Blows Creek and that the presence of those inorganic compounds is at least partially attributable to sources 1, 3, 4, 5, and 6.

Surface water runoff from Source 4, Dump D, can flow directly to the Southern Branch of the Elizabeth River at locations upstream of SD-2 through SD-5 (see Figures 14 and 16). Arsenic, barium, beryllium, chromium, cobalt, copper, manganese, nickel, vanadium, and zinc were detected in surface soil samples obtained from Source 4 at levels that equal or exceed three times the background concentration (see Section 2.2, Source 4). Those inorganic compounds also were detected in at least one of the release samples (SD-2 through SD-5) (see Table 15). Therefore, the presence of those inorganic compounds in the sediment of the Southern Branch of the Elizabeth River is at least partially attributable to Source 4, Dump D.

The sediment sample collected in the Southern Branch of the Elizabeth River with the highest concentrations of organic contaminants is SD-5 (see Figures 16 and 17 and Table 16). That sample was collected 100 feet downstream of Blows Creek (Ref. 23, Appendix A, Table 1). The concentrations of organic contaminants detected in sediment samples collected downstream of SD-5 in the Southern Branch of the Elizabeth River (SD-1, SD-2, SD-3, and SD-4) are significantly lower. That trend in concentrations indicates that organic compounds are being released to the Southern Branch of the Elizabeth River from sources 1, 3, 4, 5, and 6 through Blows Creek and that the presence of those organic compounds is at least partially attributable to sources 1, 3, 4, 5, and 6. The following organic compounds were detected at levels that equal or exceed three times the background concentrations in the sediment samples collected in the Southern Branch of the Elizabeth River downstream of Blows Creek and sources 1, 3, 4, 5, and 6 and in soil samples collected from sources 1, 3, 4, 5, and 6: di-n-butylphthalate, fluoranthene, pyrene, benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, and benzo(a)pyrene (see Section 2.2 and Table 16).

Hazardous Substances Released (Southern Branch of the Elizabeth River):

Hazardous substances detected in sediments collected from the Southern Branch of the Elizabeth River at concentrations that document an observed release from sources 1, 3, 4, 5, and 6 include: barium[a], beryllium[a], chromium, cobalt[a], copper, iron[a], magnesium[a], manganese[a], nickel, vanadium[a], zinc, di-n-butylphthalate, fluoranthene, pyrene, benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, and benzo(a)pyrene.

[a] This contaminant is not listed as a hazardous substance under CERCLA , as set forth in 40 CFR 302.4, but is a CERCLA pollutant or contaminant according to the HRS (Ref. 1)

Observed Release Factor Value: 550

4.1.2.2 WASTE CHARACTERISTICS

The waste characteristics factor category for the drinking water threat is evaluated on the basis of the HWQ and the toxicity and persistence of hazardous substances available to migrate to surface water. Those factors and the waste characteristics factor category value for the drinking water threat are discussed below.

4.1.2.2.1 Toxicity/Persistence

Hazardous substances known to be associated with sources evaluated at the St. Juliens Creek Annex include organic and inorganic compounds. Because the maximum toxicity and persistence factor value of 10,000 is attained for observed release substances, only hazardous substances included in the observed releases to surface water are presented in the table below. Toxicity and persistence factor values for those hazardous substances were obtained from the Superfund Chemical Data Matrix (SCDM) (Ref. 2). The toxicity and persistence factor values were obtained from HRS Table 4-12 (Ref. 1, p. 51613).

Table 17
Toxicity and Persistence Values - Drinking Water

Hazardous Substance	Source No.	Surface water Observed Release Documented	Toxicity Factor Value	Persistence Factor Value	Toxicity/ Persistence Factor Value	Reference
Inorganic Compounds						
Aluminum[b]	5	SBER	- -[a]	1	- -	2
Antimony	3, 4, 9	BC	10,000	1	10,000	2
Arsenic	2, 3, 4, 5	SBER	10,000	1	10,000	2
Barium[b]	2, 3, 4, 5	BC, SBER	10,000	1	10,000	2
Beryllium[b]	2, 3, 4	SBER	10,000	1	10,000	2
Chromium	2, 3, 4, 9	BC, SBER	10,000	1	10,000	2
Cobalt[b]	2, 4, 5, 9	SBER	1	1	1	2
Copper	2, 3, 4, 5, 8, 9	BC, SJ, SBER	- -[a]	1	- -	2
Iron[b]	2, 3, 8, 9	BC, SBER	1	1	1	2
Lead	2, 3, 4, 5, 6, 8, 9	BC, SJ	10,000	1	10,000	2
Magnesium[b]	2	SJ, SBER	- -[a]	1	- -	2
Manganese[b]	2, 4, 5, 6, 8, 9	BC, SJ, SBER	10,000	1	10,000	2
Mercury	3, 4, 5, 9	BC	10,000	0.4	4,000	2
Nickel	2, 4, 5, 8, 9	SJ, SBER	10,000	1	10,000	2
Selenium	2, 4	SJ	100	1	100	2
Thallium	2, 3	SJ	100	1	100	2
Vanadium[b]	2, 4	SBER	100	1	100	2
Zinc	2, 3, 4, 5, 6, 8, 9	SJ, SBER	10	1	10	2

Table 17 (continued)
Toxicity and Persistence Values - Drinking Water

Hazardous Substance	Source No.	Surface water Observed Release Documented	Toxicity Factor Value	Persistence Factor Value	Toxicity/ Persistence Factor Value	Reference
Organic Compounds						
Benzo(a)anthracene	2, 3, 6	SJ, SBER	1,000	1	1,000	2
Benzo(a)pyrene	2, 6	SJ, SBER	10,000	1	10,000	2
Benzo(b)fluoranthene	1, 2, 3, 6	SJ, SBER	1,000	1	1,000	2
Benzo(k)fluoranthene	3, 5	SBER	100	1	100	2
Chrysene	1, 2, 3, 5, 6	SJ, SBER	10	1	10	2
Di-n-butylphthalate	5	SBER	10	1	10	2
Fluoranthene	1, 2, 3, 4, 5, 6	SJ, SBER	100	1	100	2
Phenanthrene	2, 3, 4, 6	BC, SJ	- -[a]	1	- -	2
Pyrene	2, 3, 5, 6	SJ, SBER	100	1	100	2

Notes:

BC Blows Creek
SJ St. Juliens Creek
SBEL Southern Branch of the Elizabeth River

[a] No factor value is provided in the Superfund Chemical Data Matrix.

[b] This contaminant is not listed as a hazardous substances under CERCLA as set forth in 40 CFR 302.4, but is a CERCLA pollutant or contaminant according to the HRS (Ref. 1).

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Toxicity/Persistence Factor Value: 10,000

4.1.2.2.2 Hazardous Waste Quantity

HWQ values assigned to each source evaluated at the St. Juliens Creek Annex are listed below (see Section 2.4.2.1.5 of the HRS documentation record). The HWQ factor value for the surface water pathway was determined from HRS Table 2-6 (Ref. 1, p. 51591).

Table 18
Blows Creek HWQ Value

Source No.	Source Name	Source Hazardous Waste Quantity Value (HRS Section 2.4.2.1.5)	Is source hazardous constituent quantity data complete?
1	Source 1, Dump A	12.81	No
2	Dump B	19.21	No
3	Dump C	128.12	No
4	Dump D	64.06	No
5	Burning grounds	3.84	No
6	Caged pit	2.94×10^{-3}	No
7	Cross Street and Mine Road Area	0.59	No
8	Hazardous waste disposal area outside Building 53	>0	No
9	Clearing House Storage Area	7.69	No
	Total		236.32

The assigned HWQ factor value for the surface water migration pathway that includes is 100 because, as documented in section 4.1.3.3.2.2, a Level II fishery is documented in St. Juliens Creek (Ref. 1, p. 51593).

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4.1.2.2.3 Waste Characteristics Factor Category Value

The waste characteristics factor category value is obtained by multiplying the highest toxicity and persistence factor value by the HWQ factor value. The product is assigned a waste characteristics factor category value from HRS Table 2-7 (Ref. 1, p. 51592).

The highest toxicity and persistence values assigned to the surface water migration pathway were for antimony, arsenic, barium, beryllium, chromium, lead, manganese, mercury, nickel, and benzo(a)pyrene, which all have a toxicity factor value of 10,000 and a persistence factor value of 1.

Toxicity/persistence factor value (10,000) × HWQ factor value (100) = 1×10^6

A waste characteristics factor category value of 32 was assigned from HRS Table 2-7 (Ref. 1, p. 51592).

Hazardous Waste Quantity Factor Value: 10,000
Waste Characteristics Factor Category Value: 32

4.1.2.3 DRINKING WATER TARGETS

Because of its brackish character, surface water within the TDL is not known to be used for drinking water (Ref. 4, p. 30). No documentation was identified that indicated that Blows Creek, St. Juliens Creek, the Southern Branch of the Elizabeth River, the Elizabeth River, or Hampton Roads is a major or designated recreational area. Therefore, the threat to drinking water targets and resources is not scored.

4.1.3.2 WASTE CHARACTERISTICS

The waste characteristics factor category for the threat to the human food chain is evaluated on the basis of the HWQ and the toxicity, persistence and bioaccumulation of hazardous substances available to migrate to surface water. Those factors and the waste characteristics factor category value for the threat to the human food chain are discussed below.

4.1.3.2.1 Toxicity/Persistence/Bioaccumulation

Hazardous substances known to be associated with sources evaluated at the St. Juliens Creek Annex include organic and inorganic compounds. Because the maximum toxicity and persistence factor value is attained for observed release substances, only hazardous substances included in the observed releases to surface water are presented in the table below. Toxicity, persistence, and bioaccumulation factor values for those hazardous substances were obtained from the Superfund Chemical Data Matrix (Ref. 2). The toxicity and persistence factor values were obtained from HRS Table 4-12 (Ref. 1, p. 51613) and the toxicity, persistence, and bioaccumulation factor values were obtained from HRS Table 4-16 (Ref. 1, p. 51619).

Table 19
Food Chain-Toxicity/Persistence/Bioaccumulation

Hazardous Substance	Source No.	Surface water	Toxicity Factor Value[c]	Persistence Factor Value[c]	Food Chain Bioaccumulation Factor Value[c]	Toxicity/ Persistence/ Bioaccumulation Factor Value[c]	Ref.
Inorganic Compounds							
Aluminum[b]	5	SBER	- -[a]	1	50	- -	2
Antimony	3, 4, 9	BC	10,000	1	0.5	5,000	2
Arsenic	3, 4, 5	SBER	10,000	1	500	5×10^6	2
Barium[b]	3, 4, 5	BC, SBER	10,000	1	0.5	5,000	2
Beryllium[b]	3, 4	SBER	10,000	1	50	5×10^5	2
Chromium	2, 3, 4, 9	BC, SBER	10,000	1	500	5×10^6	2
Cobalt[b]	2, 4, 5, 9	SBER	1	1	0.5	0.5	2
Copper	2, 3, 4, 5, 8, 9	BC, SJ, SBER	- -[a]	1	50,000	- -a	2
Iron[b]	2, 3, 8, 9	BC, SBER	1	1	0.5	0.5	2
Lead	2, 3, 4, 5, 6, 8, 9	BC, SJ	10,000	1	5,000	5×10^7	2
Magnesium[b]	2	SJ, SBER	- -[a]	1	0.5	- -	2
Manganese[b]	2, 4, 5, 6, 8, 9	BC, SJ, SBER	10,000	1	0.5	5,000	2
Mercury	3, 4, 5, 8, 9	BC	10,000	0.4	50,000	2×10^8	2
Nickel	2, 4, 5, 9	SJ, SBER	10,000	1	500	5×10^6	2
Selenium	2, 4	SJ	100	1	5,000	5×10^5	2
Thallium	2, 3	SJ	100	1	500	5×10^4	2
Vanadium[b]	2, 4	SBER	100	1	0.5	50	2
Zinc	2, 3, 4, 5, 6, 8, 9	SJ, SBER	10	1	50,000	5×10^5	2

Hazardous Substance	Source No.	Surface water	Toxicity Factor Value[c]	Persistence Factor Value[c]	Food Chain Bioaccumulation Factor Value[c]	Toxicity/ Persistence/ Bioaccumulation Factor Value[c]	Ref.
Organic Compounds							
Benzo(a)anthracene	2, 3, 6	SJ, SBER	1,000	1	50,000	5×10^7	2
Benzo(a)pyrene	2, 6	SJ, SBER	10,000	1	50,000	5×10^8	2
Benzo(b)fluoranthene	1, 2, 3, 6	SJ, SBER	1,000	1	50,000	5×10^7	2
Benzo(k)fluoranthene	3, 5	SBER	100	1	50,000	5×10^6	2
Chrysene	1, 2, 3, 5, 6	SJ, SBER	10	1	500	5,000	2
Di-n-butylphthalate	5	SBER	10	1	5,000	5×10^4	2
Fluoranthene	1, 2, 3, 4, 5, 6	SJ, SBER	100	1	5,000	5×10^5	2
Phenanthrene	2, 3, 4, 6	BC, SJ	- -[a]	1	50	- -	2
Pyrene	2, 3, 5, 6	SJ, SBER	100	1	5000	5×10^5	2

Notes:

BC Blows Creek
SJ St. Juliens Creek
SBEL Southern Branch of the Elizabeth River

[a] No factor value provided in the Superfund Chemical Data Matrix.

[b] This contaminant is not listed as a hazardous substance under CERCLA, as set forth in 40 CFR 302.4, but is a CERCLA pollutant or contaminant according to the HRS (Ref. 1).

[c] The water of Blows Creek, St. Juliens Creek, and the Southern Branch of the Elizabeth River are brackish (Ref. 4, p. 30). Therefore, the higher of the two values (one for fresh water and one for salt water) for bioaccumulation is used (Ref. 1, p. 51617).

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

4.1.3.2.2 Hazardous Waste Quantity

HWQ values assigned to each source evaluated at St. Juliens Creek Annex are listed below (see Section 2.4.2.1.5 of the HRS documentation record). The HWQ factor value for the surface water pathway was determined from HRS Table 2-6 (Ref. 1, p. 51591).

Table 20
HWQ Value - Food Chain

Source No.	Source Name	Source Hazardous Waste Quantity Value (HRS Section 2.4.2.1.5)	Is source hazardous constituent quantity data complete?
1	Source 1, Dump A	12.81	No
2	Dump B	19.21	No
3	Dump C	128.12	No
4	Dump D	64.06	No
5	Burning Grounds	3.84	No
6	Caged Pit	2.94×10^{-3}	No
7	Cross Street and Mine Road Area	0.59	No
8	Hazardous Waste Disposal Area outside Building 53	>0	No
9	Clearing House Storage Area	7.69	No
	Total		236.32

The assigned HWQ factor value for the surface water migration pathway is 100 for the threat to the human food chain because, as documented in Section 4.1.3.3.2.2, a Level II fishery is documented in St. Juliens Creek (Ref. 1, p. 51592).

4.1.3.2.3 Waste Characteristics Factor Category Value

The waste characteristics factor category value is obtained by multiplying the highest toxicity, persistence, and bioaccumulation factor value by the HWQ factor value (Ref. 1, 51620). The product is assigned a waste characteristics factor category value from HRS Table 2-7 (Ref. 1, p. 51592).

The highest toxicity, persistence, and bioaccumulation factor value assigned to the surface water migration pathway was for benzo(a)pyrene, which had a toxicity factor value of 10,000, a persistence factor value of 1, and a bioaccumulation factor value of 50,000 (Ref. 2).

Toxicity/persistence/bioaccumulation factor value (5×10^8) × HWQ factor value (100) = 5×10^{10}

A waste characteristics factor category value of 320 was assigned from HRS Table 2-7 (Ref. 1, p. 51592).

Hazardous Waste Quantity Assigned Value: 5×10^{10}
Waste Characteristics Factor Category Value: 320

4.1.3.3 HUMAN FOOD CHAIN THREAT-TARGETS

A variety of hazardous substances, including organic and inorganic compounds that have bioaccumulation factor values of 500 or more have been detected in sediments of St. Juliens Creek, Blows Creek, and the Southern Branch of the Elizabeth River, downstream of sources at St. Juliens Creek Annex. St. Juliens Creek and the Southern Branch of the Elizabeth River are used for recreational fishing (Ref. 4, p. 32; Ref. 23, p. 6). The extent and level of contamination of the human food chain in St. Juliens Creek and the Southern Branch of the Elizabeth River is discussed below.

Actual Human Food Chain Contamination - St. Juliens Creek

In February 1999, sediment samples were collected from St. Juliens Creek. The samples revealed the presence of a number of inorganic and organic contaminants that meet the criteria for documentation of an observed release to St. Juliens Creek, as described in Section 4.1.2.1.1 of this documentation record. Figure 18 shows the locations from which the samples were collected. Sediment samples SD-11, SD-12, SD-13, and SD-14 were collected downstream of Source 2 (Ref. 23, p. 4, Figure 2 and Appendix A, Table 1). Those four sediment samples contained levels of copper and zinc that meet the criteria for documentation of an observed release to St. Juliens Creek and have bioaccumulation factor values of more than 500, as documented in Section 4.1.2.1.1 of this documentation record. Other contaminants also were detected in the sediment samples at levels that meet the criteria for documenting an observed release and have a bioaccumulation factor value of more than 500; however, those contaminants were not detected in each of the four sediment samples.

The distance between SD-11 and SD-14 is approximately 2,250 feet (Ref. 23, p. 4, Figure 2 and Appendix A, Table 1). SD-11 is located approximately at the PPE of Source 2 (see Figures 12 and 18). Table 21 presents a summary of the extent of actual contamination of the human food chain.

Table 21
Extent of Actual Food Chain Contamination - St. Juliens Creek

Sample ID	Distance from PPE (feet)	Hazardous Substance	Bioaccumulation Potential Factor Value
SD-11	0	Copper	50,000
SD-11	0	Zinc	50,000
SD-12	250	Copper	50,000
SD-12	250	Zinc	50,000
SD-13	1,250	Copper	50,000
SD-13	1,250	Zinc	50,000
SD-14	2,250	Copper	50,000
SD-14	2,250	Zinc	50,000

A copy of Figure 18 is available at the EPA Headquarters Superfund Docket:

U.S. CERCLA Docket Office
Crystal Gateway #1, 1st Floor
1235 Jefferson Davis Highway
Arlington, VA 22202

Telephone: (703) 603-8917
E-Mail: superfund.docket@epa.gov

Closed Fisheries (St. Juliens Creek)

No closed fisheries caused by releases from St. Juliens Creek Annex have been documented in St. Juliens Creek.

Benthic Tissue

No samples of benthic tissue have been collected from St. Juliens Creek to document actual contamination of the human food chain.

Level I Concentrations

No level I concentrations have been documented in St. Juliens Creek.

Sample ID: NA
Sample Medium: NA
Location: NA

Level II Fisheries

Section 4.1.2.1.1 documents an observed release to sediments of St. Juliens Creek of hazardous substances that have bioaccumulation factor values of 500 or greater. Therefore, a Level II fishery in St. Juliens Creek has been documented. The hazardous substances that demonstrate the greatest extent of contamination in St. Juliens Creek that meet the criteria for an observed release, and that have bioaccumulation factor values of 500 or greater, include copper and zinc.

Actual Human Food Chain Contamination - Southern Branch of the Elizabeth River

In February 1999, sediment samples were collected from the Southern Branch of the Elizabeth River. Those samples revealed the presence of a number of inorganic and organic contaminants that meet the criteria for documentation of an observed release to the Southern Branch of the Elizabeth River, as described in Section 4.1.2.1.1 of this documentation record. Figure 16 shows the locations from which those samples were collected. Sediment samples SD-5 and SD-3 were collected downstream of Source 4 and downstream of Blows Creek, which receives surface water runoff from sources 1, 3, 4, 5, 6, 7, 8, and 9 (Ref. 23, p. 4, Figure 2 and Appendix A, Table 1; Section 4.1.1.1 of this documentation record). The two sediment samples contained organic contaminants that have bioaccumulation factor values of 500 or more at levels that meet the criteria for documentation of an observed release to the Southern Branch of the Elizabeth River, as documented in Section 4.1.2.1.1 of this documentation record. Those contaminants include: benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, and fluoranthene. The distance between SD-5 and SD-3 is approximately 1,000 feet (Ref. 23, p. 2, Figure 1 and Appendix A, Table 1). SD-4, collected from a location that lies between those two sample locations, also contained concentrations of those hazardous substances; however, the concentrations were qualified with a J, estimated concentrations. Therefore, the concentrations were not used to document an observed release. SD-5 is located at one of the potential PPEs from Source 4 to the Southern Branch of the Elizabeth River (see Figures 14 and 17). Table 22 provides a summary of the extent of actual contamination of the human food chain.

Table 22
Extent of Actual Contamination of the Human Food Chain -
Southern Branch of The Elizabeth River

Sample ID	Distance from PPE (feet)	Hazardous Substance	Bioaccumulation Potential Factor Value
SD-5	0	Benzo(a)anthracene	50,000
SD-5	0	Benzo(a)pyrene	50,000
SD-5	0	Benzo(b)fluoranthene	50,000
SD-5	0	Benzo(k)fluoranthene	50,000
SD-5	0	Chrysene	500
SD-5	0	Fluoranthene	5,000
SD-3	1,000	Benzo(a)anthracene	50,000
SD-3	1,000	Benzo(a)pyrene	50,000
SD-3	1,000	Benzo(b)fluoranthene	50,000
SD-3	1,000	Benzo(k)fluoranthene	50,000
SD-3	1,000	Chrysene	500
SD-3	1,000	Fluoranthene	5,000

Closed Fisheries (Southern Branch of the Elizabeth River)

No closed fisheries caused by releases from St. Juliens Creek Annex have been documented in the Southern Branch of the Elizabeth River.

Benthic Tissue

No samples of benthic tissue have been collected from the Southern Branch of the Elizabeth River to document actual contamination of the human food chain.

Level I Concentrations

No level I concentrations have been documented in the Southern Branch of the Elizabeth River.

Sample ID: NA
Sample Medium: NA
Location: NA

Level II Fisheries

Section 4.1.2.1.1 documents an observed release to sediments of the Southern Branch of the Elizabeth River of hazardous substances that have bioaccumulation factor values of 500 or greater. Therefore, a Level II fishery in the Southern Branch of the Elizabeth River has been documented. The hazardous substances that demonstrate the greatest extent of contamination in the Southern Branch of the Elizabeth River that meet the criteria for an observed release, and that have bioaccumulation factor values of 500 or greater, include benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, and fluoranthene (see sections 4.1.2.1.1 and 4.1.3.2.1).

4.1.3.3.1 Food Chain Individual

Observed releases of hazardous substances to both St. Juliens Creek and the Southern Branch of the Elizabeth River from sources at St. Juliens Creek Annex have been documented by chemical analysis of sediment samples collected from surface water (see Section 4.1.2.1.1). Those hazardous substances present in observed releases that have bioaccumulation potential factor values of 500 or more are listed in Tables 19 and 23. St. Juliens Creek and the Southern Branch of the Elizabeth River are used for recreational fishing (Ref. 4, p. 32; Ref. 23, p. 6). The presence of hazardous substances in sediment of both St. Juliens Creek and the Southern Branch of the Elizabeth River at levels documenting an observed release and with a bioaccumulation factor value of 500 or more document the presence of a Level II fishery in both surface water bodies. A food chain individual factor value of 45 therefore was assigned as specified in HRS Section 4.1.3.3.1 (Ref. 1, p. 51620).

Table 23
Human Food Chain Individual

Hazardous Substance	Surface Water	Bioaccumulation Potential Factor Value	Reference
Inorganic Compounds			
Copper	St. Juliens Creek	50,000	2
Zinc	St. Juliens Creek	50,000	2
Organic Compounds			
Benzo(a)anthracene	Southern Branch of the Elizabeth River	50,000	2
Benzo(a)pyrene	Southern Branch of the Elizabeth River	50,000	2
Benzo(b)fluoranthene	Southern Branch of the Elizabeth River	50,000	2
Benzo(k)fluoranthene	Southern Branch of the Elizabeth River	50,000	2
Chrysene	Southern Branch of the Elizabeth River	500	2
Fluoranthene	Southern Branch of the Elizabeth River	5,000	2

Food Chain Individual Value: 45
(St. Juliens Creek and the Southern Branch of the Elizabeth River)

4.1.3.3.2 Population

4.1.3.3.2.1 Level I Concentrations

Identity of Fishery	Annual Production (pounds)	Reference	Human Food Chain Population Value
NA			

Sum of Human Food Chain Population Values: 0

==========

Level I Concentration Factor Values: 0

4.1.3.3.2.2 Level II Concentrations

Level II concentrations have been documented in St. Juliens Creek and in the Southern Branch of the Elizabeth River. Both bodies of surface water are used for recreational fishing (Ref. 4, p. 32; Ref. 23, p. 6). No data on the pounds of fish or number of fish caught per year have been identified. Therefore, the annual production in pounds for both surface water bodies is greater than zero.

Table 24
Human Food Chain Population Value

Identity of Fishery	Annual Production (pounds)	Reference	Human Food Chain Population Value
St. Juliens Creek	>0	23, p. 6	0.03
Southern Branch of the Elizabeth River	>0	4, p. 32	0.03

Sum of Human Food Chain Population Values: 0.06

==========

Level II Concentration Factor Values: 0.06

4.1.3.3.2.3 Potential Human Food Chain Contamination

The surface water TDL for the St. Juliens Creek Annex is delineated in topographic maps included in Reference 3. Fisheries within the TDL are subject to potential contamination of the human food chain. Fishery production data for those bodies of surface water, the St. Juliens Creek, the Southern Branch of the Elizabeth River, the Elizabeth River, and Hampton Roads, have not been identified. Therefore, the potential for contamination of the human food chain is not evaluated and is assigned a potential contamination factor value of 0. The inclusion of this target value is not expected to have a significant effect on the HRS score for the site.

4.1.4.2 WASTE CHARACTERISTICS

The waste characteristics factor category for the environmental threat is evaluated on the basis of the HWQ and the ecosystem toxicity, persistence and bioaccumulation of hazardous substances available to migrate to surface water. Those factors and the waste characteristics factor category value for the environmental threat are discussed below.

4.1.4.2.1 Ecosystem Toxicity/Persistence/Bioaccumulation

Hazardous substances known to be associated with sources evaluated at the St. Juliens Creek Annex include organic and inorganic compounds. Because the maximum ecosystem toxicity and persistence factor value is attained for observed release substances, only hazardous substances included in the observed releases to surface water are presented in the table below. The values are taken from the SCDM (Ref. 2). The water of St. Juliens Creek and the Southern Branch of the Elizabeth River are brackish (Ref. 4, p. 30). Therefore, the higher of the saltwater or freshwater value for ecosystem toxicity and ecosystem bioaccumulation is used (Ref. 1, 51617).

Table 25
Ecosystem Toxicity/Persistence

Hazardous Substance	Source No.	Surface water	Ecosystem Toxicity Factor Value	Persistence Factor Value	EcoToxicity/ Persistence Factor Value	Ref.
Inorganic Compounds						
Aluminum[b]	5	SBER	100	1	100	2
Antimony	3, 4, 9	BC	100	1	100	2
Arsenic	3, 4, 5	SBER	100	1	100	2
Barium[b]	3, 4, 5	BC, SBER	--[a]	1	--	2
Beryllium[b]	3, 4	SBER	--[a]	1	--	2
Chromium	2, 3, 4, 9	BC, SBER	100	1	100	2
Cobalt[b]	2, 4, 5, 9	SBER	--[a]	1	--	2
Copper	2, 3, 4, 5, 8, 9	BC, SJ, SBER	100	1	100	2
Iron[b]	2, 3, 8, 9	BC, SBER	10	1	10	2
Lead	2, 3, 4, 5, 6, 8, 9	BC, SJ	1,000	1	1,000	2
Magnesium[b]	2	SJ, SBER	--[a]	1	--	2
Manganese[b]	2, 4, 5, 6, 8, 9	BC, SJ, SBER	--[a]	1	--	2
Mercury	3, 4, 5, 8, 9	BC	10,000	0.4	4,000	2
Nickel	2, 4, 5, 9	SJ, SBER	1,000	1	1,000	2
Selenium	2, 4	SJ	1,000	1	1,000	2
Thallium	2, 3	SJ	100	1	100	2
Vanadium[b]	2, 4	SBER	--[a]	1	--	2
Zinc	2, 3, 4, 5, 6, 8, 9	SJ, SBER	100	1	100	2

Table 25 (Continued)
Ecosystem Toxicity/Persistence

Hazardous Substance	Source No.	Surface water	Ecosystem Toxicity Factor Value	Persistence Factor Value	EcoToxicity/ Persistence Factor Value	Ref.
Organic Compounds						
Benzo(a)anthracene	2, 3, 6	SJ, SBER	10,000	1	10,000	2
Benzo(a)pyrene	2, 6	SJ, SBER	10,000	1	10,000	2
Benzo(b)fluoranthene	1, 2, 3, 6	SJ, SBER	--[a]	1	--	2
Benzo(k)fluoranthene	3, 5	SBER	--[a]	1	--	2
Chrysene	1, 2, 3, 5, 6	SJ, SBER	1,000	1	1,000	2
Di-n-butylphthalate	5	SBER	10,000	1	10,000	2
Fluoranthene	1, 2, 3, 4, 5, 6	SJ, SBER	10,000	1	10,000	2
Phenanthrene	2, 3, 4, 6	BC, SJ	1,000	1	1,000	2
Pyrene	2, 3, 5, 6	SJ, SBER	10,000	1	10,000	2

Notes:

BC Blows Creek
SJ St. Juliens Creek
SBEL Southern Branch of the Elizabeth River

[a] No factor value provided in the SCDM.

[b] This contaminant is not listed as a hazardous substance under CERCLA, as set forth in 40 CFR 302.4, but is a CERCLA pollutant or contaminant according to the HRS (Ref. 1).

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Toxicity/Persistence Factor Value: 10,000

4.1.4.2.1 Ecosystem Toxicity/Persistence/Bioaccumulation (continued)

Table 26
Ecosystem Toxicity/Persistence/Bioaccumulation

Hazardous Substance	Source No.	Surface water	Ecosystem Toxicity/ Persistence Factor Value (Ref. 1, Table 4-20)	Ecosystem Bioaccumulation Factor Value (HRS Section 4.1.3.2.1.3)	Ecosystem Toxicity/ Persistence/ Bioaccumulation Factor Value (HRS Table 4-21)	Ref.
Inorganic Compounds						
Aluminum[b]	5	SBER	100	50	5,000	2
Antimony	3, 4, 9	BC	100	5	500	2
Arsenic	3, 4, 5	SBER	100	500	50,000	2
Barium[b]	3, 4, 5	BC, SBER	--[a]	0.5	--	2
Beryllium[b]	3, 4	SBER	--[a]	50	--	2
Chromium	2, 3, 4, 9	BC, SBER	100	500	50,000	2
Cobalt[b]	2, 4, 5, 9	SBER	--[a]	5000	--	2
Copper	2, 3, 4, 5, 8, 9	BC, SJ, SBER	100	50,000	5×10^6	2
Iron[b]	2, 3, 8, 9	BC, SBER	10	0.5	5	2
Lead	2, 3, 4, 5, 6, 8, 9	BC, SJ	1,000	5,000	5×10^6	2
Magnesium[b]	2	SJ, SBER	--[a]	0.5	--	2
Manganese[b]	2, 4, 5, 6, 8, 9	BC, SJ, SBER	--[a]	50,000	--	2
Mercury	3, 4, 5, 8, 9	BC	4,000	50,000	2×10^8	2
Nickel	2, 4, 5, 9	SJ, SBER	1,000	500	5×10^5	2
Selenium	2, 4	SJ	1,000	5,000	5×10^6	2
Thallium	2, 3	SJ	100	500	50,000	2
Vanadium[b]	2, 4	SBER	--[a]	0.5	--	2
Zinc	2, 3, 4, 5, 6, 8, 9	SJ, SBER	100	50,000	5×10^6	2

Table 26 (Continued)
Ecosystem Toxicity/Persistence/Bioaccumulation

Hazardous Substance	Source No.	Surface water	Ecosystem Toxicity/ Persistence Factor Value (Ref. 1, Table 4-20)	Ecosystem Bioaccumulation Factor Value (HRS Section 4.1.3.2.1.3)	Ecosystem Toxicity/ Persistence/ Bioaccumulation Factor Value (HRS Table 4-21)	Ref.
Organic Compounds						
Benzo(a)anthracene	2, 3, 6	SJ, SBER	10,000	50,000	5×10^8	2
Benzo(a)pyrene	2, 6	SJ, SBER	10,000	50,000	5×10^8	2
Benzo(b)fluoranthene	1, 2, 3, 6	SJ, SBER	--[a]	50,000	--	2
Benzo(k)fluoranthene	3, 5	SBER	--[a]	50,000	--	2
Chrysene	1, 2, 3, 5, 6	SJ, SBER	1,000	5,000	5×10^6	2
Di-n-butylphthalate	5	SBER	10,000	5,000	5×10^7	2
Fluoranthene	2, 3, 4, 5, 6	SJ, SBER	10,000	5,000	5×10^8	2
Phenanthrene	2, 3, 4, 6	BC, SJ	1,000	5,000	5×10^6	2
Pyrene	2, 3, 5, 6	SJ, SBER	10,000	5,000	5×10^7	2

Notes: BC = Blows Creek SJ = St. Juliens Creek SBEL = Southern Branch of the Elizabeth River

[a] No factor value provided in the SCDM.

[b] This contaminant is not listed as a hazardous substance under CERCLA, as set forth in 40 CFR 302.4, but is a CERCLA pollutant or contaminant according to the HRS (Ref. 1).

==========

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

4.1.4.2.2 Hazardous Waste Quantity

HWQ values assigned to each source at St. Juliens Creek Annex evaluated are listed below (see Section 2.4.2.1.5 of the HRS documentation record). The HWQ factor value for the surface water pathway was determined from HRS Table 2-6 (Ref. 1, p. 51591).

Table 27
HWQ Value - Environmental

Source No.	Source Name	Source Hazardous Waste Quantity Value (HRS Section 2.4.2.1.5)	Is source hazardous constituent quantity data complete?
1	Dump A	12.81	No
2	Dump B	19.21	No
3	Dump C	128.12	No
4	Dump D	64.06	No
5	Burning Grounds	3.84	No
6	Caged Pit	2.94×10^{-3}	No
7	Cross Street and Mine Road Area	0.59	No
8	Hazardous Waste Disposal Area outside Building 53	>0	No
9	Clearing House Storage Area	7.69	No
	Total		236.32

The assigned HWQ factor value for the Blows Creek surface water pathway is 100 for the environmental threat because, as documented in Section 4.1.3.3.2.2, St. Juliens Creek is a Level II fishery (Ref. 1, p. 51592).

4.1.4.2.3 Waste Characteristics Factor Category Value

The waste characteristics factor category value is obtained by multiplying the highest ecosystem toxicity, persistence and bioaccumulation factor value by the HWQ factor value (Ref. 1, 51620). The product is assigned a waste characteristics factor category value from HRS Table 2-7 (Ref. 1, p. 51592).

Blows Creek

The highest ecosystem toxicity, persistence and bioaccumulation factor values assigned to the surface water migration pathway for were for benzo(a)anthracene, benzo(a)pyrene, and fluoranthene all of which have an ecosystem toxicity factor value of 10,000, a persistence factor value of 1, and a bioaccumulation factor value of 50,000 (Ref. 2).

Ecosystem toxicity/persistence/bioaccumulation factor value (5×10^8) × HWQ factor value (100) = 5×10^{10}

A waste characteristics factor category value of 320 was assigned from HRS Table 2-7 (Ref. 1, p. 51592).

Hazardous Waste Quantity Assigned Value: 5×10^{10}
Waste Characteristics Factor Category Value: 320

4.1.4.3 ENVIRONMENTAL THREAT - TARGETS

The surface water migration pathways for St. Juliens Creek Annex encompass wetlands and other sensitive environments. No aqueous samples demonstrate observed releases to surface water at or downstream of the site; therefore, these targets are not evaluated as subject to Level I concentrations. However, sediment samples demonstrate an observed release to surface water; therefore, Level II concentrations have been documented.

Level I Concentrations:

Sample ID: NA
Sample Medium: NA
Location: NA
Reference: NA

Hazardous Substance	Hazardous Substance Concentration	Benchmark Concentration	Benchmark
NA			

Reference for Benchmarks:

Most Distant Level I Sample

Sample ID: NA
Distance from the PPE: NA
Reference: NA

St. Juliens Creek Most Distant Level II Sample

Sample ID: Sediment sample SD-14
Distance from the PPE: 2,250 feet downstream of the PPE for Source 2, Dump B

Reference: 23, p. 4, Figure 2 and Appendix A, Table 1 and Section 4.1.2.1.1 of this documentation record

Southern Branch of the Elizabeth River Most Distant Level II Sample

Sample ID: Sediment sample SD-1
Distance from the PPE: 3,500 feet downstream of the PPE for Source 4, Dump D

Reference: 23, p. 2, Figure 1 and Appendix A, Table 1; Section 4.1.2.1.1 of this documentation record; and 28

4.1.4.3.1 Sensitive Environments

4.1.4.3.1.1 Level I Concentrations

No Level I concentrations have been documented for surface water targets within the TDL for the St. Juliens Creek Annex site.

Sensitive Environments

Sensitive Environment	Distance from PPE to Nearest Sensitive Environment	Reference	Value(s)
NA			

Sum of Sensitive Environments Value: 0

Wetlands

Wetland	Wetlands Frontage	Reference
NA		

Total Wetlands Frontage: 0
Wetlands Value: 0

Sum of Sensitive Environments Value + Wetlands Value: 0
==========

Level I Concentrations Factor Value: 0

4.1.4.3.1.2 Level II Concentrations

Sensitive Environments

An observed release to surface water has been established for St. Juliens Creek and the Southern Branch of the Elizabeth River based on sediment sampling results. Wetlands and habitat known to be used by Federal and State Endangered and Threatened Species are documented within or along St. Juliens Creek Annex and the Southern Branch of the Elizabeth River (Ref. 6; Ref. 7). All the species listed below feed within or live within the waters of the Southern Branch of the Elizabeth River.

Table 28
Level II Sensitive Environments

Sensitive Environment	Distance from PPE to Nearest Sensitive Environment	Reference	Environment Value(s)
Atlantic loggerhead	0	24, Table 1, p. 1; 27	75
Northern diamondback terrapin	0	24, Table 1, p. 1 and Table 3, p. 1; 27	75
Eastern tiger salamander	0	24, Table 1, p. 1; 27	50
Mabee's salamander	0	24, Table 1, p. 2 and Table 3, p. 1; 27	50
Barking tree frog	0	24, Table 1, p. 2 and Table 3, p. 1; 27	50
Canebrake rattlesnake	0	24, Table 1, p. 2; 27	50
American peregrin falcon	0	24, Table 1, p. 1 and Table 3, p. 1; 27	75
Piping plover	0	24, Table 1, p. 1; 27	75
Upland sandpipper	0	24, Table 1, p. 2; 27	50
Eastern big-eared bat	0	24, Table 1, p. 1 and Table 3, p. 1; 27	75
Roseate tern	0	24, Table 1, p. 1; 27	75
Dismal Swamp southeastern shrew	0	24, Table 1, p. 1 and Table 3, p. 1; 27	75
Pgymy shrew	0	24, Table 1, p. 1; 27	75
		TOTAL	**850**

Sum of Sensitive Environments Value: 850

Wetlands

Two zones of actual contamination have been established, one for St. Juliens Creek and one for the Southern Branch of the Elizabeth River, based on sediment sampling results. No wetlands are shown on the National Wetland Inventory maps for St. Juliens Creek (Ref. 28). However, wetlands were observed on the northern banks of the creek during a sampling investigation (Ref. 23). A wetland delineation was not completed during the investigation. Therefore, these wetlands are not included in this evaluation. For the Southern Branch of the Elizabeth River a zone of Level II concentrations begins at the most upstream PPE (Source 4 PPE) and ends at the most downstream sediment sampling location from which a sample was collected that documents an observed release to surface water (SD-1). The length of wetlands included within this zone is shown in Reference 28 and is estimated to be 0.66 miles. The wetlands value was assigned from HRS Table 4-24 (Ref. 1, p. 51625).

Wetland	Wetlands Frontage (miles)	References
Shorelines of the Southern Branch of the Elizabeth River from Source 4 PPE downstream to sampling location SD-1	0.66	28 and Section 4.1.2.1.1 of this Documentation Record

Total Wetlands Frontage: 0.66 miles

Wetlands Value: 25

Sum of Sensitive Environments Value + Wetlands Value: 875

==========

Level II Concentrations Factor Value: 875

4.1.4.3.1.3 Potential Contamination

Potential contamination to sensitive environments is not evaluated because of the large value assigned to Level II sensitive environments. Evaluation of potential contamination of sensitive environments is not expected to affect the site score.

Sensitive Environments

NA

Type of Surface Water Body	Sensitive Environment	Reference(s)	Sensitive Environment Value(s)

NA

Wetlands

NA

Type of Surface Water Body	Wetlands Frontage (miles)	Reference(s)	Wetlands Value for Type of Surface Water Body

NA

Type of Surface Water Body	Sum of Sensitive Environment Values (S_j) $D_j(W_j + S_j)$	Wetlands Frontage Value (W_j)	Dilution Weight (D_j) (HRS Table 4-13)

NA

Sum of $D_j(W_j + S_j)$: 0
(Sum of $D_j(W_j + S_j)$)/10: 0

==========

Potential Contamination Factor Value: 0