

**HRS DOCUMENTATION RECORD -- REVIEW COVER SHEET**

**Site Name:** Naval Weapons Station Yorktown - Cheatham Annex  
(Cheatham Annex)

**EPA ID No:** VA3170024605

**Contact Persons**

Site Contact: Robert Thomson, U.S. Environmental Protection Agency (EPA)  
Region 3  
(215) 814-3365

Documentation Record: Kevin Wood, EPA, Region 3  
(215) 814-3303

**Pathways, Components, or Threats Not Scored**

The ground water, soil exposure, and air pathways were not scored in this Hazard Ranking System (HRS) evaluation.

## HRS DOCUMENTATION RECORD

**Date Completed: November 8, 1999**

**Date Revised: January 3, 2000**

**Date Revised: January 12, 2000**

**Site Name:** Naval Weapons Station Yorktown - Cheatham Annex (Cheatham Annex)

**EPA Region:** 3

**Street Address of Site:** Cheatham Annex, Naval Supply Center

**County and State:** Williamsburg, York County, Virginia

**General Location in the State:** Along the York River basin near the mouth (Figure 1, Ref. 4)

**Topographic Maps:** Clay Bank, Virginia Quadrangle, 1984

**Latitude:** 37° 17' 05" N

**Longitude:** 76° 36' 27" W (Ref. 19)

### Pathway Scores

Air	Not Scored (NS)
Ground Water	NS
Soil Exposure	NS
Surface Water	97.43

**HRS SITE SCORE 48.72**

**WORKSHEET FOR COMPUTING HRS SITE SCORE**

	<u>S</u>	<u>S<sup>2</sup></u>
1. Ground Water Migration Pathway Score ( $S_{gw}$ ) (from Table 3-1, line 13)	NS	
2a. Surface Water Overland/Flood Migration Component (from Table 4-1, line 30)	97.43	9,493
2b. Ground Water to Surface-water Migration Component (from Table 4-25, line 28)	NS	
2c. Surface Water Migration Pathway Score ( $S_{sw}$ ) Enter the larger of lines 2a and 2b as the pathway score.	97.43	9,493
3. Soil Exposure Pathway Score ( $S_s$ ) (from Table 5-1, line 22)	NS	
4. Air Migration Pathway Score ( $S_a$ ) (from Table 6-1, line 12)	NS	
5. Total of $S_{gw}^2 + S_{sw}^2 + S_s^2 + S_a^2$		9,493
6. <b>HRS Site Score</b> Divide the value on line 5 by four and take the square root		48.72

**TABLE 4-1**

**SURFACE WATER OVERLAND/FLOOD MIGRATION COMPONENT SCORESHEET**

<u>Factor Categories and Factors</u>	<u>Maximum Value</u>	<u>Value Assigned</u>
<b>Drinking Water Threat</b>		
<u>Likelihood of Release</u>		
1. Observed Release	550	<u>550</u>
2. Potential to Release by Overland Flow		
2a. Containment	10	<u>---</u>
2b. Runoff	25	<u>---</u>
2c. Distance to Surface Water	25	<u>---</u>
2d. Potential to Release by Overland Flow [lines 2a x (2b +2c)]	500	<u>---</u>
3. Potential to Release by Flood		
3a. Containment (Flood)	10	<u>---</u>
3b. Flood Frequency	50	<u>---</u>
3c. Potential to Release by Flood [lines 3a x 3b]	500	<u>---</u>
4. Potential to Release [lines 2d + 3c, subject to a maximum of 500]	500	<u>---</u>
5. Likelihood of Release [higher of lines 1 and 4]	550	<u>550</u>
<u>Waste Characteristics</u>		
6. Toxicity/Persistence	a	<u>10,000</u>
7. Hazardous Waste Quantity	a	<u>100</u>
8. Waste Characteristics	100	<u>32</u>
<u>Targets</u>		
9. Nearest Intake	50	<u>0</u>
10. Population		
10a. Level I Concentrations	b	<u>0</u>
10b. Level II Concentrations	b	<u>0</u>
10c. Potential Contamination	b	<u>0</u>
10d. Population [lines 10a + 10b + 10c]	b	<u>0</u>
11. Resources	5	<u>5</u>
12. Targets [lines 9 + 10d + 11]	b	<u>5</u>
<u>Drinking Water Threat Score</u>		
13. Drinking Water Threat Score [(lines 5 x 8 x 12)/82,500, subject to a maximum of 100]	100	<u>1.07</u>

**SURFACE WATER OVERLAND/FLOOD MIGRATION COMPONENT  
SCORESHEET (Cont.)**

<u>Factor Categories and Factors Assigned</u>	<u>Maximum Value</u>	<u>Value Assigned</u>
<b>Human Food Chain Threat</b>		
<u>Likelihood of Release</u>		
14. Likelihood of Release [same value as line 5]	550	<u>550</u>
<u>Waste Characteristics</u>		
15. Toxicity/Persistence/Bioaccumulation	a	<u>5 x 10<sup>8</sup></u>
16. Hazardous Waste Quantity	a	<u>100</u>
17. Waste Characteristics	1,000	<u>320</u>
<u>Targets</u>		
18. Food Chain Individual	50	<u>45</u>
19. Population		
19a. Level I Concentrations	b	<u>0</u>
19b. Level II Concentrations	b	<u>0.03</u>
19c. Potential Human Food Chain Contamination	b	<u>-</u>
19d. Population [lines 19a + 19b + 19c]	b	<u>0.03</u>
20. Targets [lines 18 + 19d]	b	<u>45.03</u>
<u>Human Food Chain Threat Score</u>		
21. Human Food Chain Threat Score [(lines 14 x 17 x 20)/82,500, subject to a maximum of 100]	100	<u>96.06</u>

**SURFACE WATER OVERLAND/FLOOD MIGRATION COMPONENT  
SCORESHEET (Cont.)**

<u>Factor Categories and Factors Assigned</u>	<u>Maximum Value</u>	<u>Value Assigned</u>
<b>Environmental Threat</b>		
<u>Likelihood of Release</u>		
22. Likelihood of Release [same value as line 5]	550	<u>550</u>
<u>Waste Characteristics</u>		
23. Ecosystem Toxicity/Persistence/Bioaccumulation	a	<u>5 x 10<sup>8</sup></u>
24. Hazardous Waste Quantity	a	<u>100</u>
25. Waste Characteristics	1,000	<u>320</u>
<u>Targets</u>		
26. Sensitive Environments		
26a. Level I Concentrations	b	<u>0</u>
26b. Level II Concentrations	b	<u>0</u>
26c. Potential Contamination	b	<u>0.14</u>
26d. Sensitive Environments [lines 26a + 26b + 26c]	b	<u>0.14</u>
27. Targets [value from line 26d]	b	<u>0.14</u>
<u>Environmental Threat Score</u>		
28. Environmental Threat Score [(lines 22 x 25 x 27)/82,500, subject to a maximum of 60]	60	<u>0.30</u>
<u>Surface Water Overland/Flood Migration Component Score for a Watershed</u>		
29. Watershed Score <sup>c</sup> [lines 13 + 21 + 28, subject to a maximum of 100]	100	<u>97.43</u>

**SURFACE WATER OVERLAND/FLOOD MIGRATION COMPONENT SCORE**

30. Component Score (S <sub>o</sub> ) <sup>c</sup> [highest score from line 29 for all watersheds evaluated, subject to a maximum of 100]	100	<u>97.43</u>
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<sup>a</sup> Maximum value applies to waste characteristics category.

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

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

## **REFERENCES**

<u>Reference Number</u>	<u>Description of the Reference</u>
1.	U.S. Environmental Protection Agency (EPA). Hazard Ranking System, 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, D.C. December 14, 1990. Not Included - Publicly Available Document.
2.	EPA. Superfund Chemical Data Matrix (SCDM). Publication 9345.1-22, EPA/540/R-961029, PB96-963510. June 1996. Not Included - Publicly Available Document.
3.	Dames and Moore. Final Remedial Investigation Interim Report, Naval Supply Center (Norfolk) Cheatham Annex. February 1991. (179 pages)
4.	C.C. Johnson and Associates, Inc. and CH2M Hill. Initial Assessment Study of Naval Supply Center (Norfolk) Cheatham Annex and Yorktown Fuels Division. February 1984. (74 pages)
5.	Baker Environmental, Inc. (Baker) and Roy F. Weston, Inc. (Weston). Final Site Investigation for Sites 1, 10, and 11, Naval Supply Center, Cheatham Annex. November 1994. (164 pages).
6.	Dames & Moore. Confirmation Study, Step 1A (Verification), Round One, Naval Supply Center, Cheatham Annex, Williamsburg, Virginia and Naval Supply Center, Yorktown Fuel Division, Yorktown, Virginia. June 11, 1986. (46 pages).
7.	Weston. Final Site Inspection Narrative Report, Penniman Shell Loading Plant. August 9, 1999. (79 pages).
8.	EPA. Fact Sheet "Using Qualified Data to Document an Observed Release and Observed Contamination." Directive 9285.7-14FS, PB95-963320, EPA 540/F-95/033. November 1996. (9 pages).
9.	Tetra Tech. Record of Telephone Conversation Regarding 1999 Site Inspection Results. Between Donna Davies, Environmental Scientist and Robert McGlade, Project Manager, Weston. October 4, 1999. (1 page).
10.	Baker. Final Report, New HRS Deficiency Information Collection Efforts NSC Cheatham Annex Naval Facility. April 1991. (119 pages).
11.	Tetra Tech. Record of Telephone Conversation Regarding Fisheries. Between Donna Davies, Environmental Scientist and Gary Swayhart, Biologist, U.S. Fish and Wildlife Fisheries Department. November 19, 1998. (1 page).
12.	Tetra Tech. Record of Telephone Conversation Regarding Fisheries. Between Donna Davies, Environmental Scientist and Dean Fowler, Biologist, Virginia Department of Game and Inland Fisheries, Williamsburg Division. November 19, 1998. (1 page).

## REFERENCES (continued)

<u>Reference Number</u>	<u>Description of the Reference</u>
13.	Genium Publishing Corporation. <u>Guide to Environmental Analytical Methods</u> . Third Edition, June 1996. (7 pages).
14.	Tetra Tech. Record of Telephone Conversation Regarding 1999 Site Inspection Results. Between Donna Davies, Environmental Scientist and Robert McGlade, Project Manager, Weston. January 3, 2000. (1 page).
15.	EPA. Aerial Photographic Analysis USN Supply Center - Cheatham Annex. May 1998. (15 pages).
16.	Naval Facilities Engineering Command, Atlantic Division (LANTDIV). HRS II - LANTDIV and Activity Comments to Deficiencies for NSC, Cheatham Annex, Williamsburg, Virginia. January 17, 1992. (2 pages).
17.	Weston. Final Data Acquisition/Summary Report, Penniman Shell Loading Plant Site. October 29, 1999.
18.	Tetra Tech. Figure 4, 15-mile Downstream Target Distance Limit. No Date. (1 page).
19.	DynCorp. Latitude and Longitude Verification Worksheet. Attached to U.S.G.S. Topographic Map, Clay Bank, Virginia. January 12, 2000. (2 pages).
20.	Weston. Site Assessment Technical Assistance Standard Operating Procedures. SOP 303, Sediment Sampling. No Date. (19 pages).
21.	Weston. Soil Sampling Data Sheets. January 12, 1999 to January 13, 1999. (4 pages).
22.	Tetra Tech. Record of Telephone Conversation Regarding Naval Weapons Station Yorktown. Between Donna Davies, Environmental Scientist and Robert Thomson, EPA Region 3, Remedial Project Manager. January 5, 2000. (1 page).

## ACRONYMS AND ABBREVIATIONS

EPA	U.S. Environmental Protection Agency
ft	Feet
ft <sup>2</sup>	Square feet
HRS	Hazard Ranking System
HWQ	Hazardous Waste Quantity
IA	Initial Assessment
mg/kg	Milligram per kilogram
NA	Not applicable
NE	Not evaluated
NL	Not listed
PPE	Probable point of entry
SCDM	Superfund Chemical Data Matrix
SI	Site Inspection
SVOC	Semi-volatile organic compound
µg/kg	Microgram per kilogram
yd <sup>3</sup>	Cubic yard

## INTRODUCTION

The Naval Weapons Station Yorktown - Cheatham Annex (Cheatham Annex) is a 1,579-acre federal facility located outside of Williamsburg, in York County, Virginia. The facility is located adjacent to the York River approximately 15-miles upstream of the Chesapeake Bay (Ref. 4, p. 4-1 and Figure 4). The primary mission of Cheatham Annex is receiving, storing, packing and shipping of materials to federal facilities on the east coast and major distribution centers in Europe (Ref. 4, p. 4-1). Cheatham Annex was commissioned in June 1943 as a satellite unit of the Naval Supply Depot to provide bulk storage facilities. During World War I, prior to establishment of the activity, a portion of the facility was the location of a large powder and shell-loading plant operated by DuPont. During this time the area included a city of 10,000 people and was named Penniman. The DuPont plant operated for approximately three years, closing at the end of World War I. Between 1918 and 1942 the land was used for farming or left idle. In 1942 work was begun for the new supply facility. The mission of Cheatham Annex has remained essentially the same since its commissioning (Ref. 4, p. 4-4). A portion of the old DuPont plant has been excised to the State of Virginia and the Department of the Interior (Ref. 4, p. 4-4 and Ref. 7 p. 3).

An Initial Assessment (IA) was completed at Cheatham Annex in 1984. This study identified twelve disposal sites and potential contamination areas. Four of the twelve sites were recommended for additional studies (Ref. 4, pp. 2-1 through 2-10). Three of these sites (identified as sites 1, 9, and 11 in the IA) are included as sources in this hazard ranking system (HRS) documentation record. A site inspection (SI) was completed at the Penniman Shell Loading Plant site in 1999 by EPA. This SI identified sources that were formerly part of the DuPont plant. Five of these sources have been evaluated in this HRS documentation record.

The sampling results collected from the eight sources currently identified at the facility indicate contamination with semi-volatile organic compounds (SVOCs), metals, volatile organic compounds (VOCs) and nitroaromatics. The sources are not contained, therefore the hazardous substances are available to migrate into adjacent surface waters. Cheatham Annex is located in an area characterized with the existence of excellent fisheries (Ref. 11 and 12). The only fishery sampled to date is Penniman Lake. The sample results indicate that a release of metals has occurred to this fishery. The other potential fisheries affected by onsite sources have not been sampled to date therefore the impact of hazardous substance migration into these surface waters is unknown at this time.

The Naval Weapons Station Cheatham Annex facility is currently under the command of the Naval Weapons Station Yorktown commanding officer. The Yorktown facility borders the Cheatham Annex facility to the south (Ref. 22, and Figure 4).

## **SUMMARY OF POTENTIAL SOURCES NOT SCORED**

Several potential sources of hazardous substances have been identified at the Cheatham Annex Facility that have not been included in this HRS documentation record. Information currently available is not sufficient to document hazardous substances associated with these sources. A brief summary of each of these potential sources is provided below:

### **U.S. Navy Area of Concern (AOC) 1 - Scrap Metal Dump (Jones Pond Landfill)**

This approximately 1.25-acre area is located in the western portion of the facility within two ravines associated with the unnamed tributaries to Jones Pond (Ref. 17, p. 2-12 and Figure 2.2). Various types of debris have been located in this area including: wood; automobile parts; large metal objects and machinery; empty metal drums; metal drums containing a grease-like product; gas cylinders; concrete debris; piping; and construction debris (Ref. 17, p. 2-12). During the 1999 EPA SI sediment samples were collected from the ravines surrounding this potential source as well as surface water samples from Jones Pond. Sample results detected evaluated levels of cadmium, chromium, and manganese in the surface water sample collected from Jones Pond downstream of these two ravines. Chromium and manganese were detected at elevated levels in the sediment samples collected from the ravines (Ref. 17, p. 2-13). Jones Pond is utilized as a drinking water reservoir (Ref. 17, p. 2-14). No samples have been collected from the source to date.

### **U.S. Navy Area of Concern 2 - Dextrose Dump (Dextrose Bottle Area)**

This area is located in the southern portion of the facility and currently consists of several rows of concrete foundation piers that were once part of a shipping house associated with the Penniman Shell Loading Plant (Ref. 17, pp. 2-14, 2-15, and Figure 2-2). This potential source also includes several areas of exposed buried materials including glass bottles containing a clear, colorless liquid confirmed to be dextrose. Several partially buried drums have also been located in this area. The origin of these wastes are unknown. A geophysical survey completed in this area by a Navy contractor in 1998 detected several significant magnetic anomalies in this area. Soil and groundwater samples were also collected in 1998. Results indicated that no significant chemical contamination was present in this area; however the area where the magnetic anomalies was detected were not investigated (Ref. 17, pp. 2-14, 2-15, and Figure 2-2).

### **U.S. Navy Site 3 - Submarine Dye Disposal Area**

This area is located in the northeastern portion of the facility, at the northeast corner of building CAD 15 and is currently used as a storage lot (Ref. 17, p. 2-16 and Figure 2-2). During the early 1970s green fluorescein submarine dye was stored in 55-gallon drums in this area. Some of these storage drums corroded and began leaking dye, which would enter the sewer system and eventually the York River. These drums have subsequently been removed. Fluorescein has been approved by the U.S. Food and Drug Administration for use in externally applied drugs and cosmetics (Ref. 17, pp. 2-21, 2-22, and Figure 2-2).

#### **U.S. Navy Site 4 - Medical Supply Disposal Area**

This area is located in the northeastern portion of the facility between buildings CAD 11 and CAD 12 along the pond just upgradient of Youth Pond (Ref. 17, p. 2-22 and Figure 2-2). In 1968 or 1969 out-of-date medical supplies, possibly including syringes, empty intravenous bottles, and 1-inch metal banding, were dumped down a bank and covered with soil in this area. It is estimated that as much as 7,000 cubic yards of material were disposed of at this location. Following reports of deer with syringe needles stuck in their hooves, an unspecified amount of this waste was removed from this area. Reports of syringe-like items floating in an adjacent pond and Youth Pond following a heavy rain have persisted (Ref. 17, p. 2-22). In May 1998 a contractor for the Navy performed a limited clean-up of the area to remove surficial debris. During this clean-up approximately 200 pounds of debris and 13 pounds of metal sharps were removed and incinerated. Other debris, including metal banding, railroad ties, and corroded metal drums were found during this clean-up but were not removed. No samples have been collected in this area to date (Ref. 17, pp. 2-22 and 2-23).

#### **U.S. Navy Site 5 - Photographic Chemical Disposal Area**

This area is reportedly in the southern portion of the facility (Ref. 17, Figure 2-2). According to available information approximately 20 to 40 gallons of outdated photographic chemicals, including developers and fixers, were disposed of in a pit of unspecified dimensions in 1967 or 1968. The exact location of this potential source has not been located, no samples have been collected to date from this source (Ref. 17, p. 2-23).

#### **U.S. Navy Site 6 - Spoiled Food Disposal Area**

This area is located in the southern portion of the facility (Ref. 17, Figure 2-2). The area consists of a 12 to 15 foot deep pit that was reportedly used for the disposal of approximately 750 cubic yards of spoiled food around 1970. No sample results are available to confirm that no hazardous chemicals were disposed of in this pit (Ref. 17, pp. 2-23 and 2-24).

#### **U.S. Navy Site 7 - Old DuPont Disposal Area**

The exact location of this area has not been adequately defined, however based on available information the currently accepted location of Site 7 is along the York River northeast of building CAD 13 (Ref. 17, p. 2-24 and Figure 2-2). Site 7 was used as a disposal area during the early 1900s reportedly receiving wastes from the City of Penniman and the DuPont production facility. Specific information documenting the nature of the wastes disposed of in this area or sampling data is not available (Ref. 4, p. 2-2 and Ref. 17, pp. 2-24 and 2-25).

**U.S. Navy Site 8 - Landfill Near Building CAD 14**

This area is located in the northern portion of the facility, approximately 300 feet north of Building CAD 14 in a grassy area reportedly less than a ¼-acre in size (Ref. 17, p. 2-25 and Figure 2-2). According to available reports, between the early 1940s and 1980, trenches approximately 10 feet deep and 2,000 square feet in area were dug in this area to dispose of waste such as spoiled food and clothing. The actual nature of the wastes disposed in this area has not been confirmed, although it has been reported to be non-hazardous (Ref. 17, p. 2-25).

**U.S. Navy Site 10 - Decontamination Agent Area**

This area is located in the southern area of the facility (Ref. 17, Figure 2-2). Approximately 75 to 100 gallons of decontamination agent DS-2 were buried in this area prior to 1982. DS-2 is a decontamination agent used on equipment to remove nerve or blister chemical warfare agents. DS-2 is comprised of 70% diethylene triamine, 20% ethylene glycol monomethyl ether, and 2% sodium hydroxide and is considered toxic to humans. Soil sampling completed in this area detected low levels of methylene chloride, TCE, and acetone. The levels detected were not sufficiently elevated to satisfactorily document any hazardous substances at this source under the HRS. Groundwater samples collected from monitoring wells located in this area detected dichloropropane, acetone, and mercury. A magnetometer survey in this area was completed in 1985. This survey identified several magnetic anomalies. The source of the magnetic anomalies has not been confirmed and the buried containers of DS-2 have not been located to date (Ref. 17, pp. 2-27 and 2-28).

**SUMMARY OF SOURCES SCORED**

Provided below is a list that summarizes the sources at Cheatham Annex that were evaluated with the HRS. Figure 1 shows a general location of the facility. Figure 2 shows the locations of the sources evaluated with the HRS.

**SOURCES SCORED**

<b>Source No.</b>	<b>Source Name</b>	<b>Source Type</b>
1	Landfill Near Incinerator (Site 1)	Landfill
2	Transformer Storage Area (Site 9)	Contaminated Soil
3	Bone Yard (Site 11)	Landfill
4	Ammonia Settling Pits	Surface Impoundment
5	TNT Graining House Sump	Surface Impoundment
6	TNT Catch Box Ruins	Surface Impoundment
7	Waste Slag Material	Pile
8	1918 Drum Storage Area	Contaminated Soil

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](mailto: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](mailto:superfund.docket@epa.gov)

## SOURCE DESCRIPTION

### 2.2 Source Characterization

Source Number: 1

Source Description: Landfill Near Incinerator (Site 1)

Source Type: Landfill

This approximately two-acre source is located adjacent to the York River northwest of the facility's inactive incinerator (Building CAD 129). From 1942 until 1951 residues from the incinerators were disposed of here, and from 1951 until its closure in 1981 the source was used as a domestic/industrial/commercial solid waste landfill (Ref. 4, pp. 2-1 and 2-7). Wastes disposed of at source 1 include empty paint and paint thinner cans, cartons of ether and other unspecified drugs, railroad ties, tar paper, sawdust, rags, concrete, and lumber. Approximately 34,500 tons of solid waste was buried at the landfill (Ref. 4, pp. 2-1 and 2-7.)

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

Source 1 is located in the northeast portion of the facility, adjacent to the York River (Figure 2).

Containment:

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

Release via overland migration and/or flood: According to the 1984 Initial Assessment Study contaminants from the landfill could enter the water table aquifer and York River indicating that no containment structures were in place. Because there is not a maintained engineered cover or functioning and maintained run-on control system and runoff management system, a containment factor value of 10 was assigned (Ref. 1, Table 4-2, p. 51609 and Ref. 4, p. 2-7).

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

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

**2.4.1 Hazardous Substances**

Soil samples were collected from source 1 during the 1994 site investigation (SI). The soils were collected from a soil boring (ISB07) completed within the landfilled areas of source 1.

Four samples (including one duplicate sample) were collected from this boring at three different depths. The samples collected from the 0-2 foot and 8-11 foot intervals consisted of incinerated fill material (Ref. 5, pp. 4-10, 4-11, and Appendix A, Soil Boring Log for ISB07). The table below summarizes the hazardous substances detected in this fill material. A soil boring was also completed outside the boundary of source 1. This soil boring, ISB08 consisted of natural soils and is shown below to provide documentation of the surrounding background levels at the same depths (Ref. 5, pp. 4-10, 4-11, and Appendix A, Soil Boring Log for ISB08). Contract Laboratory Program (CLP) analytical methods were used to analyze the soil samples collected during the SI (Ref. 5, p. 3-17).

Hazardous Substance	Evidence	Concentration (µg/kg)	Background Concentration (ISB08) (µg/kg)	Reference
Phenanthrene	ISB071B	770	<370	5, p. 4-12; Appendix H, pp. 43 and 45
Fluoranthene	ISB071B	1,200	94J (940)	5, p. 4-12; Appendix H, pp. 43 and 45
Benzo(a)anthracene	ISB071B	730	<370	5, p. 4-12; Appendix H, pp. 43 and 45
Chrysene	ISB071B	990	<370	5, p. 4-12; Appendix H, pp. 43 and 45
Benzo(k)fluoranthene	ISB071B	2,100	<370	5, p. 4-12; Appendix H, pp. 43 and 45
Benzo(a)pyrene	ISB071B	1,100	<370	5, p. 4-12; Appendix H, pp. 43 and 45
Indeno(1,2,3-cd)pyrene	ISB071B	1,100	<370	5, p. 4-12; Appendix H, pp. 43 and 45
Dibenzo(a,h)anthracene	ISB071B	500	<370	5, p. 4-12; Appendix H, pp. 43 and 45
Benzo(g,h,i)perylene	ISB071A	560	<370	5, p. 4-12; Appendix H, pp. 43 and 45
Aroclor-1260	ISB073A	89	<36	5, p. 4-12; Appendix H, p. 62
Hazardous Substance	Evidence	Concentration (mg/kg)	Background Concentration (ISB081A) (mg/kg)	Reference
<b>Metals</b>				
Antimony	ISB071A	59.0L (116.8)	2.3J	5, p. 4-13; Appendix H, pp. 53 and 54
Cadmium	ISB071B	27.4	0.42J	5, p. 4-13; Appendix H, pp. 53 and 54
Chromium	ISB071A	51.3	16.1	5, p. 4-13; Appendix H, pp. 53 and 54
Copper	ISB072A	783	31.7	5, p. 4-13; Appendix H, pp. 53 and 54
Lead	ISB072A	1,020	65.2	5, p. 4-13; Appendix H, pp. 53 and 54
Manganese	ISB072A	407	67.0	5, p. 4-13; Appendix H, pp. 53 and 54
Mercury	ISB072A	0.33	.18J	5, p. 4-13; Appendix H, pp. 53 and 54
Nickel	ISB071A	451	7.8J	5, p. 4-13; Appendix H, pp. 53 and 54
Silver	ISB071A	7.9	1.0J	5, p. 4-13; Appendix H, pp. 53 and 54
Zinc	ISB071B	2,060	130	5, p. 4-13; Appendix H, pp. 53 and 54

2.4.2 Hazardous Waste Quantity

2.4.2.1.1 Hazardous Constituent Quantity

<u>Hazardous Substance</u>	<u>Constituent Quantity (pounds)</u>	<u>Reference</u>
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Information available is not sufficient to adequately evaluate the hazardous constituent quantity for Source 1.

**Sum (pounds):** Unknown

**Hazardous Constituent Quantity Value (C):** NA

2.4.2.1.2 Hazardous Waste Stream Quantity

<u>Hazardous Waste Stream</u>	<u>Quantity (pounds)</u>	<u>Reference</u>
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Information available is not sufficient to adequately evaluate the hazardous waste stream for Source 1.

**Sum (pounds):** Unknown

**Hazardous Waste Stream Quantity Value:** NA

2.4.2.1.3 Volume

According to the 1994 Initial Assessment approximately 34,500 tons of waste was buried at the landfill (Ref. 4, p. 2-7).

**Dimension of source (yd<sup>3</sup> or gallons):** 34,500 yd<sup>3</sup>

**Volume Assigned Value:** 13.8

2.4.2.1.4 Area

The volume of the source has been provided therefore the area has been assigned a 0 (Ref. 1, p. 51591).

**Area of Source:** 0

2.4.2.1.5 Source Hazardous Waste Quantity Value

The source hazardous waste quantity value for Source 1 is assigned the value for the volume of the landfill.

**Source Hazardous Waste Quantity Value:** 13.8

## 2.2 Source Characterization

Source Number: 2

Source Description: Transformer Storage Area (Site 9)

Source Type: Contaminated Soil

This approximately 7,000 square foot source was used for the storage of electrical transformers including those containing polychlorinated biphenyls (PCBs). Reportedly, transformers awaiting repair or disposal were stored at Source 2 from 1973 through 1980. The number of transformers stored at any one time varied from six to thirty. During this period the surface of the storage area consisted of exposed soil that was enclosed with an earthen containment wall. After 1980 transformers were no longer stored at this location and the source was graded and covered with gravel (Ref. 4, p. 8-11).

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

Source 2, Transformer Storage Area (Site 9) is located in the northwest portion of the facility (Figure 2).

Containment:

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

Release via overland migration and/or flood: The earthen containment wall is the only containment structure reported for Source 2. Because there is no maintained engineered cover or functioning and maintained run-on control system and runoff management system, a containment factor of 10 was assigned (Ref. 1, Table 4-2, p. 51609 and Ref. 4, p. 8-11).

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

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

**2.4.1 Hazardous Substances**

Thirteen soil samples were collected at and around Source 2 during the 1986 Confirmation Study (Ref. 6, pp. 2-4 and 2-12). Six of the samples were collected at the source. As shown in the table below, Aroclor-1260 was detected in four of these samples. Analytical results indicated no detectable PCBs in three soil samples (CA9S03, CA9S02, and CA9S01) collected north of Source 2.

<b>Hazardous Substance</b>	<b>Evidence</b>	<b>Concentration (µg/kg)</b>	<b>Background Concentration (CA9S03, CA9S02, CA9S01) (µg/kg)</b>	<b>Reference</b>
Aroclor-1260 (PCB)	9S04	41	<10	6, pp. 2-4 and 2-12
	9S05	35	<10	6, pp. 2-4 and 2-12
	9S06	22	<10	6, pp. 2-4 and 2-12
	9S09	195	<10	6, pp. 2-4 and 2-12

2.4.2 Hazardous Waste Quantity

2.4.2.1.1 Hazardous Constituent Quantity

<u>Hazardous Substance</u>	<u>Constituent Quantity (pounds)</u>	<u>Reference</u>
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Information available is not sufficient to adequately evaluate the hazardous constituent quantity for Source 2.

**Sum (pounds):** Unknown

**Hazardous Constituent Quantity Value (C):** NA

2.4.2.1.2 Hazardous Waste Stream Quantity

<u>Hazardous Waste Stream</u>	<u>Quantity (pounds)</u>	<u>Reference</u>
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Information available is not sufficient to adequately evaluate the hazardous waste stream quantity for Source 2.

**Sum (pounds):** Unknown

**Hazardous Waste Stream Quantity Value:** NA

2.4.2.1.3 Volume

Information available is not sufficient to adequately quantify the volume of contaminated soils for Source 2.

**Dimension of source (yd<sup>3</sup> or gallons):** 0

**Volume Assigned Value:** 0

2.4.2.1.4 Area

According to available reports the area of Source 2 is 7,000 square feet (Ref. 4, p. 8-11).

**Area of source (ft<sup>2</sup>):** 7,000

**Area Assigned Value:** 0.206

2.4.2.1.5 Source Hazardous Waste Quantity Value

The source hazardous waste quantity value is assigned the value for the area of Source 2.

**Source Hazardous Waste Quantity Value:** 0.206

## 2.2 Source Characterization

Source Number: 3

Source Description: Bone Yard (Site 11)

Source Type: Landfill

Available information indicates that Source 3 was used for waste disposal from around the World War II era until as recently as 1978. Based on visual observations and other reports, the wastes deposited at the source include oil, possibly from automobile maintenance, fuel oil sludge, gasoline, and asphalt oil from road maintenance (Ref. 4, p. 8-13). Observations of Source 3 were documented during the initial assessment site visit. Immediately inside the gate at Source 3 a one-acre clearing was observed on which numerous pieces of scrap metal, old containers (fuel oil containers, mixing tanks, etc.) fence posts and abandoned cars were noted. Also scattered around this area were various discarded clamshell buckets, metal objects used in heavy construction and approximately ten, 5-gallon cans labeled “paraplastic” (concrete sealant) (Ref. 4, p. 8-13). South of this one-acre clearing numerous barrels containing petroleum products as well as several 500-gallon square tanks which reportedly were filled with asphalt or oil were observed (Ref. 4, p. 8-13). It was reported at the time of the initial assessment site visit that these containers had leaked. Also observed at Source 3 were numerous tar cylinders used for roofing. The cardboard cylinders had decomposed at the time of the site visit and the tar had melted (Ref. 4, p. 8-13).

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

Source 3, Bone Yard (Site 11) is located approximately 500 feet west of Penniman Lake (Figure 2).

Containment:

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

Release via overland migration and/or flood: There is no maintained engineered cover or functioning and maintained run-on control system and runoff management system, therefore a containment factor of 10 was assigned (Ref. 1, p. 51609, Table 4-2, p. 51609, Ref. 4, p. 8-13; and Ref. 16, p. 1).

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

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

**2.4.1 Hazardous Substances**

RCRA characterization analyses was performed on samples collected from the 15 drums located at Source 3 during the 1986 confirmation study. The analysis results on these drum samples indicated that the contents of five drums were hazardous waste, one due to sulfite content, one due to ignitables, and three due to the leachable lead content in excess of 5 mg/l (Ref. 6, pp. 2-18 and 2-19).

Also analyzed during the 1986 confirmation study were nine soil samples and 18 drum samples (from 15 drums) (Ref. 6, p. 2-13). As shown in the table below various hazardous substances were detected in on-site soils and the drums located at the source. Source 3 was also investigated during a SI completed at the facility in 1994. Twelve soil samples were collected during this SI (Ref. 5, p. 4-27). Hazardous substances detected in soils at Source 3 during the SI are shown in the table below.

**1986 Confirmation Study**

During the 1986 Confirmation Study nine soil samples were collected in the area of Source 3. A sample (11S07) collected outside the boundaries of the source has been included to document background conditions (Ref. 6, p. 2-5).

<b>Hazardous Substance</b>	<b>Evidence</b>	<b>Concentration (µg/kg)</b>	<b>Background Concentration (11S07) (µg/kg)</b>	<b>Reference</b>
Naphthalene	11S02	1515	<35	6, p. 2-14
bis(2-ethylhexyl)phthalate	11S06	510	<163	6, p. 2-14
Fluoranthene	11S05	1,937	<82	6, p. 2-15
	11S08	1,104	<82	6, p. 2-15
Chrysene	11S05	928	<150	6, p. 2-15
	11S08	1,395	<150	6, p. 2-15
Pyrene	11S05	1,681	<85	6, p. 2-15
Phenanthrene	11S05	2,108	<63	6, p. 2-15
Anthracene	11S05	642	<63	6, p. 2-15
Benzo(a)anthracene	11S05	851	<150	6, p. 2-15
	11S08	449	<150	6, p. 2-15
Benzo(b)fluoranthene	11S05	550	<187	6, p. 2-15
Benzo(k)fluoranthene	11S05	528	<187	6, p. 2-15
Benzo(a)pyrene	11S05	729	<208	6, p. 2-15
Ideno(1,2,3-c,d)pyrene	11S05	429	<237	6, p. 2-15
Acenaphthylene	11S02	4,967	<42	6, p. 2-15

**2.4.1 Hazardous Substances (continued)**

**1994 Site Inspection**

During the 1994 SI no surface soil samples were collected outside the boundaries of Source 3, therefore the background sample (PEN1-SO-15) collected during the 1999 SI has been included to document surrounding soil levels. This sample was chosen because it is also a surface soil sample, it was collected outside the influence of Source 3 and it was collected and analyzed according to the same protocol as the source samples collected in 1994 (Ref. 5, pp. 3-10, 3-17 through 3-19; Ref. 7, pp. 1, 7, 11; and Ref. 14).

<b>Hazardous Substance</b>	<b>Evidence</b>	<b>Concentration (µg/kg)</b>	<b>Background Concentration (PEN1-SO-15) (µg/kg)</b>	<b>Reference</b>
Naphthalene	11SS05	8,300J	<390	5, p. 4-45; 7, p. 47
Acenaphthylene	11SS05	11,000J	<390	5, p. 4-45; 7, p. 47
Dibenzofuran	11SS05	10,000J	<390	5, p. 4-45; 7, p. 48
Fluorene	11SS05	22,000J	<390	5, p. 4-45; 7, p. 48
Phenanthrene	11SS05	84,000	<390	5, p. 4-45; 7, p. 48
Anthracene	11SS05	18,000J	<390	5, p. 4-45; 7, p. 48
Carbazole	11SS05	7,000J	<390	5, p. 4-45; 7, p. 48
Fluoranthene	11SS05	82,000	<390	5, p. 4-45; 7, p. 48
Pyrene	11SS05	67,000	<390	5, p. 4-45; 7, p. 48
Benzo(a)anthracene	11SS05	39,000	<390	5, p. 4-45; 7, p. 48
Benzo(a)pyrene	11SS05	39,000	<390	5, p. 4-45; 7, p. 48
Chrysene	11SS05	48,000	<390	5, p. 4-45; 7, p. 48
Benzo(b)fluoranthene	11SS05	30,000	<390	5, p. 4-45; 7, p. 48
Benzo(k)fluoranthene	11SS05	27,000	<390	5, p. 4-45; 7, p. 48
Indeno(1,2,3-cd)pyrene	11SS05	24,000 J	<390	5, p. 4-45; 7, p. 48
Benzo(g,h,i)perylene	11SS05	25,000 J	<390	5, p. 4-45; 7, p. 48

**2.4.1 Hazardous Substances (continued)**

<b>Hazardous Substance</b>	<b>Evidence</b>	<b>Concentration (mg/kg)</b>	<b>Background Concentration (PEN1-SO-15) (mg/kg)</b>	<b>Reference</b>
<b>Metals</b>				
Antimony	11SS02	2.8J	<0.82	5, p. 4-47; 7, p. 44
	11SS04	3.4J	<0.82	5, p. 4-47; 7, p. 44
	11SS07	4.1J	<0.82	5, p. 4-47; 7, p. 44
	11SS09	3.4J	<0.82	5, p. 4-47; 7, p. 44
Arsenic	11SS02	3.0	<0.87	5, p. 4-47; 7, p. 44
	11SS04	4.4	<0.87	5, p. 4-47; 7, p. 44
	11SS05	59.4L	<0.87	5, p. 4-47; 7, p. 44
	11SS07	6.0L	<0.87	5, p. 4-47; 7, p. 44
	11SS09	8.3L	<0.87	5, p. 4-47; 7, p. 44
	11SS10	3.8	<0.87	5, p. 4-47; 7, p. 44
Cadmium	11SS02	0.72J	<0.07	5, p. 4-47; 7, p. 44
	11SS05	4.3	<0.07	5, p. 4-47; 7, p. 44
Chromium	11SS01	25.2	2.6	5, p. 4-47; 7, p. 44
	11SS02	22.0	2.6	5, p. 4-47; 7, p. 44
	11SS03	9.8	2.6	5, p. 4-47; 7, p. 44
	11SS04	16.0	2.6	5, p. 4-47; 7, p. 44
	11SS05	19.0	2.6	5, p. 4-47; 7, p. 44
	11SS06	8.9	2.6	5, p. 4-47; 7, p. 44
	11SS07	24.4	2.6	5, p. 4-47; 7, p. 44
	11SS09	19.6	2.6	5, p. 4-47; 7, p. 44
Cobalt	11SS01	3.0J	0.44	5, p. 4-47; 7, p. 44
	11SS02	3.1J	0.44	5, p. 4-47; 7, p. 44
	11SS03	2.1J	0.44	5, p. 4-47; 7, p. 44
	11SS04	2.5J	0.44	5, p. 4-47; 7, p. 44
	11SS05	6.6J	0.44	5, p. 4-47; 7, p. 44
	11SS06	1.8J	0.44	5, p. 4-47; 7, p. 44
	11SS07	3.2J	0.44	5, p. 4-47; 7, p. 44
	11SS08	1.4J	0.44	5, p. 4-47; 7, p. 44
	11SS09	2.3J	0.44	5, p. 4-47; 7, p. 44
	11SS10	3.1J	0.44	5, p. 4-47; 7, p. 44
	11SS11	2.7J	0.44	5, p. 4-47; 7, p. 44
	11SS12	1.9J	0.44	5, p. 4-47; 7, p. 44

**2.4.1 Hazardous Substances (continued)**

<b>Hazardous Substance</b>	<b>Evidence</b>	<b>Concentration (mg/kg)</b>	<b>Background Concentration (PEN1-SO-15) (mg/kg)</b>	<b>Reference</b>
Lead	11SS02	62.9	11	5, p. 4-47; 7, p. 44
	11SS03	48.7	11	5, p. 4-47; 7, p. 44
	11SS05	365	11	5, p. 4-47; 7, p. 44
	11SS09	245	11	5, p. 4-47; 7, p. 44
	11SS10	59.9	11	5, p. 4-47; 7, p. 44
	11SS11	93.4	11	5, p. 4-47; 7, p. 44
	11SS12	58.9	11	5, p. 4-47; 7, p. 44
Manganese	11SS02	108	16.08J	5, p. 4-47; 7, p. 44
	11SS03	113	16.08J	5, p. 4-47; 7, p. 44
	11SS04	80	16.08J	5, p. 4-47; 7, p. 44
	11SS05	670	16.08J	5, p. 4-47; 7, p. 44
	11SS06	82.6	16.08J	5, p. 4-47; 7, p. 44
	11SS07	86.1	16.08J	5, p. 4-47; 7, p. 44
	11SS08	69.9	16.08J	5, p. 4-47; 7, p. 44
	11SS09	123	16.08J	5, p. 4-47; 7, p. 44
	11SS10	96.1	16.08J	5, p. 4-47; 7, p. 44
	11SS11	132	16.08J	5, p. 4-47; 7, p. 44
Mercury	11SS05	0.28	<0.06	5, p. 4-47; 7, p. 44
	11SS11	0.18	<0.06	5, p. 4-47; 7, p. 44
Nickel	11SS01	7.0J (5.2)	1.3	5, p. 4-47; 7, p. 44
	11SS02	6.6J (4.9)	1.3	5, p. 4-47; 7, p. 44
	11SS03	5.4J (4.0)	1.3	5, p. 4-47; 7, p. 44
	11SS04	5.7J (4.2)	1.3	5, p. 4-47; 7, p. 44
	11SS05	15.9J (11.8)	1.3	5, p. 4-47; 7, p. 44
	11SS06	3.3J (2.4)	1.3	5, p. 4-47; 7, p. 44
	11SS07	6.9J (5.1)	1.3	5, p. 4-47; 7, p. 44
	11SS08	3.0J (2.2)	1.3	5, p. 4-47; 7, p. 44
	11SS09	6.4J (4.74)	1.3	5, p. 4-47; 7, p. 44
	11SS10	6.6J (4.9)	1.3	5, p. 4-47; 7, p. 44
	11SS12	4.6J (3.4)	1.3	5, p. 4-47; 7, p. 44
Silver	11SS01	1.7J (0.98)	0.23	5, p. 4-47; 7, p. 44
	11SS07	2.8J (1.6)	0.23	5, p. 4-47; 7, p. 44
Vanadium	11SS01	28.5	6.5	5, p. 4-47; 7, p. 44
	11SS02	21.5	6.5	5, p. 4-47; 7, p. 44
	11SS04	21.1	6.5	5, p. 4-47; 7, p. 44
	11SS07	28.0	6.5	5, p. 4-47; 7, p. 44
	11SS09	26.1	6.5	5, p. 4-47; 7, p. 44
	11SS10	22.9	6.5	5, p. 4-47; 7, p. 44
Zinc	11SS02	81.6	17.42J	5, p. 4-47; 7, p. 44
	11SS05	549	17.42J	5, p. 4-47; 7, p. 44

2.4.2 Hazardous Waste Quantity

2.4.2.1.1 Hazardous Constituent Quantity

<u>Hazardous Substance</u>	<u>Constituent Quantity (pounds)</u>	<u>Reference</u>
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Information available is not sufficient to adequately evaluate the hazardous constituent quantity for Source 3.

**Sum (pounds):** Unknown

**Hazardous Constituent Quantity Value (C):** NA

2.4.2.1.2 Hazardous Waste Stream Quantity

<u>Hazardous Waste Stream</u>	<u>Quantity (pounds)</u>	<u>Reference</u>
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Information available is not sufficient to adequately evaluate the hazardous waste stream quantity for Source 3.

**Sum (pounds):** Unknown

**Hazardous Waste Stream Quantity Value:** NA

2.4.2.1.3 Volume

Information available is not sufficient to adequately quantify the volume for Source 3.

**Dimension of source (yd<sup>3</sup> or gallons):** 0

**Volume Assigned Value:** 0

2.4.2.1.4 Area

According to available reports Source 3 encompasses eight acres of soils (Ref. 5, p. 1-16).

**Area of source (ft<sup>2</sup>):** 348,480

**Area Assigned Value:** 102.5

2.4.2.1.5 Source Hazardous Waste Quantity Value

The source hazardous waste quantity value is assigned the value from the area of Source 3.

**Source Hazardous Waste Quantity Value:** 102.5

## 2.2 Source Characterization

Source Number: 4

Source Description: Ammonia Settling Pits

Source Type: Surface Impoundment

This source consists of earthen ammonia settling pits that were part of a former shell loading area located on Cheatham Annex (Ref. 7, pp. 5 and 8 and Ref. 9). Wastewater from an ammonia finishing building was discharged through these settling pits. The settling pits discharged into Penniman Lake, approximately 20 feet to the east (Ref. 7, p. 8).

### Source Location

Source 4 is located approximately 20 feet west of Penniman Lake (Figure 2).

### Containment:

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

**Release via overland migration and/or flood:** According to the 1999 SI this source discharged directly to Penniman Lake, therefore a containment factor of 10 was assigned (Ref. 1, Table 4-2, p. 51610; Ref. 7, p. 8; Ref. 9).

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

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

**2.4.1 Hazardous Substances**

One soil sample was collected from Source 4 during the 1999 SI. The hazardous substances detected in this sample are shown below:

<b>Hazardous Substance</b>	<b>Evidence</b>	<b>Concentration (mg/kg)</b>	<b>Background Concentration PEN1-SO-15 (mg/kg)</b>	<b>Reference</b>
Arsenic	PEN1-SO-01	6	<0.87	7, pp. 8, 12, 44 and 51
Beryllium	PEN1-SO-01	.24	<0.07	7, pp. 8, 12, 44 and 51
Chromium	PEN1-SO-01	14.8	2.6	7, pp. 8, 12, 44 and 51
Cobalt	PEN1-SO-01	2	0.44	7, pp. 8, 12, 44 and 51
Iron	PEN1-SO-01	13,900	2,370	7, pp. 8, 12, 44 and 51
Mercury	PEN1-SO-01	0.26	<0.06	7, pp. 8, 12, 44 and 51
Nickel	PEN1-SO-01	4.3	1.3	7, pp. 8, 12, 44 and 51
Vanadium	PEN1-SO-01	25.1	6.5	7, pp. 8, 12, 44 and 51

2.4.2 Hazardous Waste Quantity

2.4.2.1.1 Hazardous Constituent Quantity

<u>Hazardous Substance</u>	<u>Constituent Quantity (pounds)</u>	<u>Reference</u>
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Information available is not sufficient to adequately evaluate the hazardous constituent quantity for Source 4.

**Sum (pounds):** Unknown

**Hazardous Constituent Quantity Value (C):** NA

2.4.2.1.2 Hazardous Waste Stream Quantity

<u>Hazardous Waste Stream</u>	<u>Quantity (pounds)</u>	<u>Reference</u>
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Information available is not sufficient to adequately evaluate the hazardous waste stream quantity for Source 4.

**Sum (pounds):** Unknown

**Hazardous Waste Stream Quantity Value:** NA

2.4.2.1.3 Volume

Information available is not sufficient to adequately quantify the volume for Source 4.

**Dimension of source (yd<sup>3</sup> or gallons):** 0

**Volume Assigned Value:** 0

2.4.2.1.4 Area

According to the 1999 SI there are three ammonia settling pits, each 10 feet in diameter for a total of 235.61 ft<sup>2</sup>.

**Area of source (ft<sup>2</sup>):** 235.61

**Area Assigned Value:** 18.12

2.4.2.1.5 Source Hazardous Waste Quantity Value

The source hazardous waste quantity value is assigned the value from the area of Source 4.

**Source Hazardous Waste Quantity Value:** 18.12

## 2.2 Source Characterization

Source Number: 5

Source Description: TNT Graining House Sump

Source Type: Container

This source consists of a concrete-lined, open top pit believed to be the sump pit for the TNT graining house in the former shell loading area (Ref. 7, p. 8 and Ref. 9).

### **Source Location**

Source 5 is located approximately 25 feet west of Penniman Lake (Figure 2) (Ref. 7, pp. 8 and 12).

### **Containment:**

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

**Release via overland migration and/or flood:** There is no diking (or similar structure) surrounding the sump pit, therefore a containment factor of 10 was assigned (Ref. 1, p. 51610 and Ref. 14).

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

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

**2.4.1 Hazardous Substances**

One soil sample was collected from Source 5 during the 1999 SI. The hazardous substances detected in this sample are shown below:

<b>Hazardous Substance</b>	<b>Evidence</b>	<b>Concentration (mg/kg)</b>	<b>Background Concentration PEN1-SO-15 (ug/kg)</b>	<b>Reference</b>
2,4,6-Trinitrotoluene	PEN1-SO-03	26	<0.25	7, pp. 49 and 61
<b>Hazardous Substance</b>	<b>Evidence</b>	<b>Concentration (mg/kg)</b>	<b>Background Concentration PEN1-SO-15 (mg/kg)</b>	<b>Reference</b>
Arsenic	PEN1-SO-03	12.5	<0.87	7, pp. 44 and 51
Barium	PEN1-SO-03	183	12.4	7, pp. 44 and 51
Cadmium	PEN1-SO-03	4	<0.07	7, pp. 44 and 51
Chromium	PEN1-SO-03	14.8	2.6	7, pp. 44 and 51
Cobalt	PEN1-SO-03	5.3	0.44	7, pp. 44 and 51
Lead	PEN1-SO-03	7580	11	7, pp. 44 and 51
Magnesium	PEN1-SO-03	605J	154	7, pp. 44 and 51
Manganese	PEN1-SO-03	705	16.08J	7, pp. 44 and 51
Mercury	PEN1-SO-03	0.49	<0.06	7, pp. 44 and 51
Nickel	PEN1-SO-03	15.6	1.3	7, pp. 44 and 51
Selenium	PEN1-SO-03A	3.7 L	<0.73	7, pp. 44 and 51
Silver	PEN1-SO-03	2.7	0.23	7, pp. 44 and 51
Vanadium	PEN1-SO-03	28	6.5	7, pp. 44 and 51
Zinc	PEN1-SO-03	1010	17.42J	7, pp. 44 and 51
Cyanide	PEN1-SO-03	0.57	<0.04	7, pp. 44 and 51

2.4.2 Hazardous Waste Quantity

2.4.2.1.1 Hazardous Constituent Quantity

<u>Hazardous Substance</u>	<u>Constituent Quantity (pounds)</u>	<u>Reference</u>
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Information available is not sufficient to adequately evaluate the hazardous constituent quantity for Source 5.

**Sum (pounds):** Unknown

**Hazardous Constituent Quantity Value (C):** NA

2.4.2.1.2 Hazardous Waste Stream Quantity

<u>Hazardous Waste Stream</u>	<u>Quantity (pounds)</u>	<u>Reference</u>
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Information available is not sufficient to adequately evaluate the hazardous waste stream quantity for Source 5.

**Sum (pounds):** Unknown

**Hazardous Waste Stream Quantity Value:** NA

2.4.2.1.3 Volume

Information available is not sufficient to adequately quantify the volume for Source 5.

**Dimension of source (yd<sup>3</sup> or gallons):** 0

**Volume Assigned Value:** 0

2.4.2.1.4 Area

According to the 1999 SI this source is six feet long by three feet wide (Ref. 7, p. 8).

**Area of source (ft<sup>2</sup>):** 18

**Area Assigned Value:** 1.38

2.4.2.1.5 Source Hazardous Waste Quantity Value

The source hazardous waste quantity value is assigned the value from the area of Source 5.

**Source Hazardous Waste Quantity Value:** 1.38

## 2.2 Source Characterization

Source Number: 6

Source Description: TNT Catch Box Ruins

Source Type: Surface Impoundment

This source consists of an earthen, brick-lined depression located immediately adjacent to the TNT graining house in the former shell loading area (Ref. 7, p. 8 and Ref. 9). Reportedly this source was used to separate TNT particles from wastewater prior to being discharged into Penniman Lake (Ref. 7, p. 8).

### Source Location

Source 6 is located adjacent to the western border of Penniman Lake (Figure 2) (Ref. 7, pp. 8 and 12).

### Containment:

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

Release via overland migration and/or flood: There is no free liquid remaining at Source 6, therefore, the containment factor value is evaluated with the “All Sources” criteria (Ref. 1, p. 51610). Because there is no maintained engineered cover or functioning and maintained run-on control system and runoff management system a containment factor of 10 was assigned (Ref. 1, p. 51609 and Ref. 14).

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

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

**2.4.1 Hazardous Substances**

One soil sample was collected from Source 6 during the 1999 SI. The hazardous substances detected in this sample are shown below:

<b>Hazardous Substance</b>	<b>Evidence</b>	<b>Concentration (µg/kg)</b>	<b>Background Concentration (PEN1-SO-15) (µg/kg)</b>	<b>Reference</b>
2,4,6-Trinitrotoluene	PEN1-SO-04	620	<0.25	7, pp. 49 and 61
<b>Hazardous Substance</b>	<b>Evidence</b>	<b>Concentration (mg/kg)</b>	<b>Background Concentration (PEN1-SO-15) (mg/kg)</b>	<b>Reference</b>
Arsenic	PEN1-SO-04	11	<0.87	7, pp. 44 and 51
Beryllium	PEN1-SO-04	0.36	<0.07	7, pp. 44 and 51
Chromium	PEN1-SO-04	15.1	2.6	7, pp. 44 and 51
Cobalt	PEN1-SO-04	2.4	0.44	7, pp. 44 and 51
Lead	PEN1-SO-04	813	11	7, pp. 44 and 51
Magnesium	PEN1-SO-04	648	154	7, pp. 44 and 51
Mercury	PEN1-SO-04	0.07	<0.06	7, pp. 44 and 51
Nickel	PEN1-SO-04	5.4	1.3	7, pp. 44 and 51
Silver	PEN1-SO-04	0.76	0.23	7, pp. 44 and 51
Vanadium	PEN1-SO-04	22.5	6.5	7, pp. 44 and 51
Cyanide	PEN1-SO-04	0.07L	<0.04	7, pp. 44 and 51

2.4.2 Hazardous Waste Quantity

2.4.2.1.1 Hazardous Constituent Quantity

<u>Hazardous Substance</u>	<u>Constituent Quantity (pounds)</u>	<u>Reference</u>
----------------------------	--------------------------------------	------------------

Information available is not sufficient to adequately evaluate the hazardous constituent quantity for Source 6.

**Sum (pounds):** Unknown

**Hazardous Constituent Quantity Value (C):** NA

2.4.2.1.2 Hazardous Waste Stream Quantity

<u>Hazardous Waste Stream</u>	<u>Quantity (pounds)</u>	<u>Reference</u>
-------------------------------	--------------------------	------------------

Information available is not sufficient to adequately evaluate the hazardous waste stream quantity for Source 6.

**Sum (pounds):** Unknown

**Hazardous Waste Stream Quantity Value:** NA

2.4.2.1.3 Volume

Information available is not sufficient to adequately quantify the volume for Source 6.

**Dimension of source (yd<sup>3</sup> or gallons):** 0

**Volume Assigned Value:** 0

2.4.2.1.4 Area

According to the 1999 SI this source is 15 feet long by 6 feet wide (Ref. 7, p. 8).

**Area of source (ft<sup>2</sup>):** 90

**Area Assigned Value:** 6.9

2.4.2.1.5 Source Hazardous Waste Quantity Value

The source hazardous waste quantity value is assigned the value from the area of Source 6.

**Source Hazardous Waste Quantity Value:** 6.9

## 2.2 Source Characterization

Source Number: 7

Source Description: Waste Slag Material

Source Type: Pile

Waste metallic slag material is located throughout the shell loading area predominantly along the railroad tracks. It is speculated that this material might be slag broken out of the boilers of the steam locomotives along the rail lines by engineers during operations at the shell loading plant (Ref. 7, p. 9 and Ref. 9).

### Source Location

The waste source pile that was sampled during the 1999 SI is located in the southern portion of the facility (Figure 2) (Ref. 7, pp. 9 and 12).

### Containment:

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

**Release via overland migration and/or flood:** There is no maintained engineered cover or functioning and maintained run-on control system and runoff management system, therefore a containment factor of 10 was assigned (Ref. 1, p. 51609 and Ref. 9).

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

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

**2.4.1 Hazardous Substances**

One soil sample was collected from Source 7 during the 1999 SI. The hazardous substances detected in this sample are shown below:

<b>Hazardous Substance</b>	<b>Evidence</b>	<b>Concentration (mg/kg)</b>	<b>Background Concentration (PEN1-SO-15) (mg/kg)</b>	<b>Reference</b>
Antimony	PEN1-SO-07	4.6L (9.11)	0.82 UL	7, pp. 44 and 51
Arsenic	PEN1-SO-07	33.4	<.87	7, pp. 44 and 51
Barium	PEN1-SO-07	261	12.4	7, pp. 44 and 51
Chromium	PEN1-SO-07	32.9	2.6	7, pp. 44 and 51
Cobalt	PEN1-SO-07	14.9	0.44	7, pp. 44 and 51
Copper	PEN1-SO-07	127.27J (104.3)	14.74J	7, pp. 44 and 51
Lead	PEN1-SO-07	2600	11	7, pp. 44 and 51
Magnesium	PEN1-SO-07	824	154	7, pp. 44 and 51
Manganese	PEN1-SO-07	1725J (1391)	16.08J	7, pp. 44 and 51
Mercury	PEN1-SO-07	0.07	<0.06	7, pp. 44 and 51
Nickel	PEN1-SO-07	34.1	1.3	7, pp. 44 and 51
Selenium	PEN1-SO-07	3.6	<0.73	7, pp. 44 and 51
Silver	PEN1-SO-07	9.1	0.23	7, pp. 44 and 51
Zinc	PEN1-SO-07	110.77J (73.85)	17.42J	7, pp. 44 and 51
Cyanide	PEN1-SO-07	0.64L	<0.04	7, pp. 44 and 51

2.4.2 Hazardous Waste Quantity

2.4.2.1.1 Hazardous Constituent Quantity

<u>Hazardous Substance</u>	<u>Constituent Quantity (pounds)</u>	<u>Reference</u>
----------------------------	--------------------------------------	------------------

Information available is not sufficient to adequately evaluate the hazardous constituent quantity for Source 7.

**Sum (pounds):** Unknown

**Hazardous Constituent Quantity Value (C):** NA

2.4.2.1.2 Hazardous Waste Stream Quantity

<u>Hazardous Waste Stream</u>	<u>Quantity (pounds)</u>	<u>Reference</u>
-------------------------------	--------------------------	------------------

Information available is not sufficient to adequately evaluate the hazardous waste stream quantity for Source 7.

**Sum (pounds):** Unknown

**Hazardous Waste Stream Quantity Value:** NA

2.4.2.1.3 Volume

Information available is not sufficient to adequately quantify the volume for Source 7.

**Dimension of source (yd<sup>3</sup> or gallons):** 0

**Volume Assigned Value:** 0

2.4.2.1.4 Area

According to the 1999 SI the waste pile sampled is 25 feet long by 10 feet wide (Ref. 7, p. 9).

**Area of source (ft<sup>2</sup>):** 250

**Area Assigned Value:** 19.23

2.4.2.1.5 Source Hazardous Waste Quantity Value

The source hazardous waste quantity value is assigned the value from the area of Source 7.

**Source Hazardous Waste Quantity Value:** 19.23

## **2.2 Source Characterization**

Source Number: 8

Source Description: 1918 Drum Storage Area

Source Type: Contaminated Soil

This area was used for the storage of 55-gallon drums when the shell loading area was active. Drums were observed stored in this area in a panoramic photograph taken of the Penniman Shell Loading Plant in 1918 (Ref. 7, p. 10 and Ref. 9).

### **Source Location**

Source 8 is located in the center of the facility (Figure 2) (Ref. 7, pp. 10 and 12).

### **Containment:**

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

**Release via overland migration and/or flood:** Because there is no maintained engineered cover or functioning and maintained run-on control system and runoff management system, a containment factor of 10 was assigned (Ref. 1, Table 4-2, p. 51609 and Ref. 9).

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

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

**2.4.1 Hazardous Substances**

Two soil samples were collected in this area during the 1999 SI. The hazardous substances detected in these samples are shown below.

<b>Hazardous Substance</b>	<b>Evidence</b>	<b>Concentration (mg/kg)</b>	<b>Background Concentration PEN1-SO-15 (mg/kg)</b>	<b>Reference</b>
Arsenic	PEN1-SO-13	4.7	<0.87	7, pp. 44 and 52
	PEN1-SO-14	5.5	<0.87	7, pp. 44 and 52
Barium	PEN1-SO-13	50.4	12.4	7, pp. 44 and 52
	PEN1-SO-14	41.9	12.4	7, pp. 44 and 52
Beryllium	PEN1-SO-13	0.52	<0.07	7, pp. 44 and 52
	PEN1-SO-14	0.52	<0.07	7, pp. 44 and 52
Cadmium	PEN1-SO-14	0.22	<0.07	7, pp. 44 and 52
Chromium	PEN1-SO-13	21	2.6	7, pp. 44 and 52
	PEN1-SO-14	20.2	2.6	7, pp. 44 and 52
Cobalt	PEN1-SO-13	2.8	0.44	7, pp. 44 and 52
	PEN1-SO-14	1.8	0.44	7, pp. 44 and 52
Magnesium	PEN1-SO-13	1090	154	7, pp. 44 and 52
	PEN1-SO-14	977	154	7, pp. 44 and 52
Manganese	PEN1-SO-13	100J	16.08J	7, pp. 44 and 52
Nickel	PEN1-SO-13	5.9	1.3	7, pp. 44 and 52
Silver	PEN1-SO-13	0.77	0.23	7, pp. 44 and 52
	PEN1-SO-14	1.0	0.23	7, pp. 44 and 52
Vanadium	PEN1-SO-13	25.7	6.5	7, pp. 44 and 52
	PEN1-SO-14	26.3	6.5	7, pp. 44 and 52
Zinc	PEN1-SO-14	138.46J	17.42J	7, pp. 44 and 52

2.4.2 Hazardous Waste Quantity

2.4.2.1.1 Hazardous Constituent Quantity

<u>Hazardous Substance</u>	<u>Constituent Quantity (pounds)</u>	<u>Reference</u>
----------------------------	--------------------------------------	------------------

Information available is not sufficient to adequately evaluate the hazardous constituent quantity for Source 8.

**Sum (pounds):** Unknown

**Hazardous Constituent Quantity Value (C):** NA

2.4.2.1.2 Hazardous Waste Stream Quantity

<u>Hazardous Waste Stream</u>	<u>Quantity (pounds)</u>	<u>Reference</u>
-------------------------------	--------------------------	------------------

Information available is not sufficient to adequately evaluate the hazardous waste stream quantity for Source 8.

**Sum (pounds):** Unknown

**Hazardous Waste Stream Quantity Value:** NA

2.4.2.1.3 Volume

Information available is not sufficient to adequately quantify the volume for Source 8.

**Dimension of source (yd<sup>3</sup> or gallons):** 0

**Volume Assigned Value:** 0

2.4.2.1.4 Area

According to the 1999 SI the drum storage area measured 200 feet by 50 feet (Ref. 7, p. 10).

**Area of source (ft<sup>2</sup>):** 10,000

**Area Assigned Value:** 0.29

2.4.2.1.5 Source Hazardous Waste Quantity Value

The source hazardous waste quantity value is assigned the value from the area of Source 8.

**Source Hazardous Waste Quantity Value:** 0.29

**SD-Hazardous Waste Quantity Value**

**SUMMARY OF SOURCES EVALUATED**

Source No.	Source Name	Source Hazardous Waste Quantity Value	Source Containment Values			
			Ground Water	Surface Water	Air Gas	Air Particulate
1	Landfill Near Incinerator (Site 1)	13.8	NS	10	NS	NS
2	Transformer Storage Area (Site 9)	0.206	NS	10	NS	NS
3	Bone Yard (Site 11)	102.5	NS	10	NS	NS
4	Ammonia Settling Pits	18.12	NS	10	NS	NS
5	TNT Graining House Sump	1.38	NS	10	NS	NS
6	TNT Catch Box Ruins	6.9	NS	10	NS	NS
7	Waste Slag Material	19.23	NS	10	NS	NS
8	1918 Drum Storage Area	0.29	NS	10	NS	NS

**Sum of HWQ Values: 162.43**

## 4.0 SURFACE-WATER MIGRATION PATHWAY

### 4.1 OVERLAND/FLOOD MIGRATION COMPONENT

The Cheatham Annex Facility is located in York County, Virginia within the York River drainage basin. The facility lies on the southern bank of the York River Estuary, approximately 15 miles upstream of the mouth of the river. The York River discharges into the Chesapeake Bay (Ref. 10, p. 3) (Figure 4).

The tidal reaches of the York River extend throughout Cheatham Annex, upstream through the entire 30-mile length of the river itself, and another 30 miles up both of its tributaries, the Maltaponi and Pamunky River (Ref. 4, p. 4-11). In the vicinity of Cheatham Annex the tidal influence in the surrounding surface waters extends approximately one-mile upstream from the confluence with the York River (Ref. 4, p. 4-11).

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

All of the eight sources evaluated in the source description section have containment values of 10. Based on the topographic map and observations recorded during the 1999 SI, the overland flow of surface water from these eight sources would terminate at five different probable points of entry (PPEs) into three different surface water bodies. The PPEs for Source 4, 5 and 6 have been combined into one because of their proximity to each other (Figure 3). The York River is tidal the entire 30-mile length of the river, however the distance hazardous substances would be carried upstream by the tide cannot be documented, therefore only the downstream targets have been evaluated. The PPEs are shown on Figure 3, the downstream segment of the surface water migration pathway is shown on Figure 4.

#### Cheatham Pond

Based on the topographic map and the 1991 RI, the overland segment for Source 2 is approximately 1,200 feet to the PPE into Cheatham Pond (Ref. 3, p. 4-18 and Figure 3). The surface water segment lengths from Cheatham Pond are shown in the table below.

#### **Downstream Segment Lengths**

<b>Segment ID</b>	<b>Segment Description</b>	<b>Approximate Segment Length (ft/mile)</b>	<b>Cumulative Length (ft/mile)</b>
1	PPE in Cheatham Pond to discharge into Queen Creek	4,800/.91	4,800/.91
2	Queen Creek to confluence with York River	2,000/.38	6,800/1.29
3	York River	72,389/13.71	79,200/15

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](mailto:superfund.docket@epa.gov)

## York River

Source 1 is located adjacent to the York River (Ref. 4, p. 8-1). Based the topographic map, the overland segment to the PPE in the York River is approximately 250 feet (Figure 3). The downstream segment length from the PPE in the York River is shown below.

### **Downstream Segment Lengths**

<b>Segment ID</b>	<b>Segment Description</b>	<b>Approximate Segment Length (ft/mile)</b>	<b>Cumulative Length (ft/mile)</b>
1	PPE in York River to confluence with Chesapeake Bay	75,000/14.2	75,000/14.2
2	Chesapeake Bay	4,200/.80	79,200/15

## Penniman Lake

According to the 1999 SI, Source 4 is located approximately 20 feet from Penniman Lake and Source 5 is approximately 25 feet west of Penniman Lake (Ref. 7, p. 8). Based on measurements taken from the 1999 figures included in the 1999 SI, Source 6 is approximately 100 feet from Penniman Lake and Source 8 is approximately 750 feet north of Penniman Lake (Ref. 7, pp. 8 and 12). Due to their proximities the PPEs for Sources 4, 5, and 6 have been combined. Based on the topographic map the overland segment for Source 3 would measure approximately 500 feet (Figure 3). The Penniman Lake segments are shown from the PPEs of Sources 3 and 8, to 15 miles downstream from the PPE of Sources 4, 5, and 6.

### **Downstream Segment Lengths**

<b>Segment ID</b>	<b>Segment Description</b>	<b>Approximate Segment Length (ft/mile)</b>	<b>Cumulative Length (ft/mile)</b>
1	PPE in Penniman Lake to discharge into King Creek	4,200/.80	4,200/.80
2	King Creek to confluence with York River	7,600/1.4	11,800/2.2
3	York River to confluence with Chesapeake Bay	65,472/12.4	77,272/14.6
4	Chesapeake Bay	2,640/0.5	79,912/15.0

## King Creek

Based on the topographic map the overland segment from Source 7 would be approximately 1,000 feet to the PPE into King Creek (Ref. 7, pp. 8 and 12 and Figure 3).

### **Downstream Segment Lengths**

<b>Segment ID</b>	<b>Segment Description</b>	<b>Approximate Segment Length (ft/mile)</b>	<b>Cumulative Length (ft/mile)</b>
1	PPE in King Creek to confluence with York River	8,500/1.61	8,500/1.61
2	York River to confluence with Chesapeake Bay	68,000/12.9	76,500/14.5
3	Chesapeake Bay	2,700/.50	79,200/15

**4.1.2.1 Likelihood of Release**

**4.1.2.1.1 Observed Release - Penniman Lake**

**Chemical Analysis - Sediment**

**- Background Concentrations**

Analytical results to document an observed release are only available for Penniman Lake. Those results are shown below.

Because the surface-water flow entering Penniman Lake may be influenced by hazardous substances released from Sources 3, 4, 5, 6, and 8, a sample collected during the 1999 SI from an analogous water body (Cheatham Pond), outside the area influenced by these sources, was chosen to document background conditions. Cheatham Pond and Penniman Lake are located within the same environmental setting and are of similar size and type (Figure 1). At one time facility buildings and process buildings of the DuPont plant surrounded the lakes, however currently both lakes are predominately surrounded by vegetation. The current setting has been the environmental setting since the release samples were collected in 1986 (Ref. 14). Both lakes are located within the York River Basin and both are tidally influenced (Ref. 4, p. 4-11). According to the Virginia Department of Game and Inland Fisheries, both Cheatham Pond and Penniman Lake have been determined to be excellent marine fisheries (Ref. 11). An aerial photograph analysis was completed for Cheatham Annex in May of 1998 (Ref. 15). According to this analysis no environmentally significant conditions or changes occurred in the area of Cheatham Pond or Penniman Lake within the time period when the background (1999) and release samples (1986 and 1992) were collected (Ref. 15, pp. 13, 32, 33, 34, 35, 36, 37, 46, and 47). The 1986 Confirmation Study was completed by a Navy subcontractor in accordance with approved work plans (Ref. 3, p. 1-1). Although specific sampling protocol followed by Navy subcontractors in accordance with approved work plans (Ref. 5, p. 3-10). A similar protocol was followed during the 1999 SI (Ref. 14 and Ref. 20). The analytical methodologies for the 1986, 1992, and 1999 sampling events were the same. The background and release samples were all analyzed using CLP methodologies (Ref. 3, Appendix D, Ref. 5, pp. 3-17 through 3-19 and Ref. 7, p. 1). The composition for the sediments collected for the 1986 and 1992 sampling events were not recorded, however, during the 1999 sampling event the sediments of Cheatham Pond and Penniman Lake were found to be of similar composition (Ref. 14 and Ref. 21).

<b>Sample ID</b>	<b>Sample Location</b>	<b>Depth (in.)</b>	<b>Date</b>	<b>Reference</b>
PENI-SED-09	Cheatham Pond	0 to 12	1/11/99	Ref. 7, pp. 7, 11, and 44

- Background Concentrations (continued)

Sample ID	Hazardous Substance	Sample Concentration (µg/kg)	Detection Limit (µg/kg)	Reference	
PEN-SED-09	Bis(2-ethylhexyl)phthalate	0.34 B	330	7, pp. 1 and 48; 13	
	Hazardous Substance	Sample Concentration (mg/kg)	Detection Limit (mg/kg)	Reference	
	Metals				
	Antimony	1.1B	60	7, pp. 1 and 44; 13	
	Arsenic	4.2	10	7, pp. 1 and 44; 13	
	Barium	19.8	200	7, pp. 1 and 44; 13	
	Beryllium	0.2	5	7, pp. 1 and 44; 13	
	Chromium	4.9	10	7, pp. 1 and 44; 13	
	Cobalt	0.98	50	7, pp. 1 and 44; 13	
	Lead	5.1	3	7, pp. 1 and 44; 13	
	Manganese	20.8	15	7, pp. 1 and 44; 13	
	Mercury	ND	0.2	7, pp. 1 and 44; 13	
	Nickel	2.3	40	7, pp. 1 and 44; 13	
	Selenium	ND	5	7, pp. 1 and 44; 13	
	Silver	ND	10	7, pp. 1 and 44; 13	
	Thallium	ND	10	7, pp. 1 and 44; 13	
	Vanadium	7.2	50	7, pp. 1 and 44; 13	
Zinc	9.8	20	7, pp. 1 and 44; 13		

**SWOF/Observed Release**

**- Release Samples**

All samples meeting the criteria for an observed release to surface water (Penniman Lake) are presented below.

<b>Sample ID</b>	<b>Sample Location</b>	<b>Depth (inches)</b>	<b>Date</b>	<b>Reference</b>
11SD02	Penniman Lake	0-12	1986	6, pp. 1-1 and 2-5
11SD03	Penniman Lake	0-12	1986	6, pp. 1-1 and 2-5
11SD01(1A)	Penniman Lake	0-12	8/13/92	5, pp. 3-5, 3-10, 4-27, and Appendix H
11SD02(1A)	Penniman Lake	0-12	8/13/92	5, pp. 3-5, 3-10, 4-27, and Appendix H
11SD03(1A)	Penniman Lake	0-12	8/13/92	5, pp. 3-5, 3-10, 4-27, and Appendix H

- Release Samples

Sample ID	Hazardous Substance	Sample Concentration (mg/kg)	Detection Limit (µg/kg)	Reference
11SD02	Bis(2-ethylhexyl)phthalate	233	330	6, pp. 2-5 and 2-14; 13, p. 6
	Lead	39	3	6, pp. 2-5 and 2-15; 13, p. 7
11SD03	Lead	16.5	3	6, pp. 2-5 and 2-15; 13, p. 7
11SD01(A)	Lead	23.1L	3	5, pp. 3-10, 3-17 through 3-19, 4-27 4-59, and Appendix H, p. 20; 13, p. 7
11SD02(1A)	Chromium	19.4	10	5, pp. 3-10, 3-17 through 3-19, 4-27 4-59, and Appendix H, p. 20; p. 8; 13, p. 7
	Lead	33.0L	3	5, pp. 3-10, 3-17 through 3-19, 4-27 and 4-59, and Appendix H, p. 20; 13, p. 7
	Manganese	123	15	5, pp. 3-10, 3-17 through 3-19, 4-27 and 4-59, and Appendix H, p. 20; 13, p. 7
	Zinc	59.6K (39.7)	20	5, pp. 3-10, 3-17 through 3-19, 4-27 and 4-59, and Appendix H, p. 20; 13, p. 7
11SD03(1A)	Chromium	25.8	10	5, pp. 3-10, 3-17 through 3-19, 4-27, 4-59, and Appendix H, p. 20; 13, p. 7
	Lead	27.8L	3	5, pp. 3-10, 3-17 through 3-19, 4-27, 4-59, and Appendix H, p. 20; 13, p. 7
	Zinc	55.1K (36.73)	20	5, pp. 3-10, 3-17 through 3-19, 4-27, 4-59, and Appendix H, p. 20; 13, p. 7

Note: All qualified data has been adjusted in accordance with the November 1996 EPA fact sheet entitled "Using Qualified Data to Document an Observed Release or Observed Contamination" (Ref. 8). The adjusted value is shown in parenthesis.

**Attribution:**

During the 1984 IA twelve disposal and potential contamination areas were identified. Of these twelve areas four were recommended for further study (Ref. 4, pp. 2-1 through 2-10). Sampling at three of these areas has identified hazardous substances that are available for migration into adjacent surface-waters. These areas have been documented in the source description section and are identified in this HRS documentation record as Sources 1, 2, and 3. Surface water sample results are only available for Penniman Lake at this time. Only Source 3 has a PPE into Penniman Lake. Hazardous substances documented at Source 3 at levels exceeding background concentrations include 1,1,1-trichloroethane, benzo(a)pyrene, pyrene, chromium, cobalt, lead, selenium, thallium, vanadium, and zinc. These hazardous substances have also been documented in sediments of Penniman Lake at concentrations three times background levels.

Also documented in this HRS documentation record are five sources associated with the DuPont ammunition plant (also known as Penniman Shell Loading Plant) that operated on a portion of the Cheatham Annex property prior to World War I (Ref. 4, p. 4-4). Three of these sources (Source 4, 5, and 6) have PPEs into Penniman Lake (Figure 3). Hazardous substances documented at concentrations above background levels in the Penniman Lake sediments are also documented above background levels in these three sources.

**4.1.2.2 WASTE CHARACTERISTICS****4.1.2.2.1 Toxicity/Persistence**

Presented below are the hazardous substances documented at a source that has a surface water containment value greater than zero.

<b>Hazardous Substance</b>	<b>Source No.</b>	<b>Toxicity Factor Value</b>	<b>Persistence Factor Value</b>	<b>Toxicity/Persistence Factor Value</b>	<b>Ref.</b>
Bis(2-ethylhexyl)phthalate	3	100	1.0	100	2, p. B-3
Phenanthrene	1, 3	NL <sup>a</sup>	1.0	NA <sup>b</sup>	2, p. B-16
Anthracene	3	10	1.0	10	2, p. B-2
Fluoranthene	1, 3	100	1.0	100	2, p. B-10
Benzo(a)anthracene	1, 3	1000	1.0	1000	2, p. B-2
Chrysene	1, 3	10	1.0	10	2, p. B-5
Benzo(k)fluoranthene	1, 3	100	1.0	100	2, p. B-3
Benzo(a)pyrene	1, 3	10000	1.0	10000	2, p. B-2
Indeno(1,2,3-cd)pyrene	1, 3	1000	1.0	1000	2, p. B-12
Dibenzo(a,h)anthracene	1	10000	1.0	10000	2, p. B-7
Benzo(g,h,i)perylene	1, 3	NL <sup>a</sup>	1.0	NA <sup>b</sup>	2, p. B-3
Benzo(b)fluoranthene	3	10000	1.0	10000	2, p. B-3
Aroclor-1260	1, 2	10000	1.0	10000	2, p. B-16
Naphthalene	3,	100	0.4	40	2, p. B-14
Fluorene	3	100	1.0	100	2, p. B-10
Pyrene	3, 6	100	1.0	100	2, p. B-17
Acenaphthylene	3	NL <sup>a</sup>	0.4	NA <sup>b</sup>	2, p. B-1
Dibenzofuran	3	NL <sup>a</sup>	1.0	NA <sup>b</sup>	2, p. B-7
Carbazole	3	10	0.4	4	2, p. B-4
2,4,6-Trinitrotoluene	5	1000	0.07	70	2, p. B-20
Antimony	1, 3	10000	1.0	10000	2, p. B-2
Arsenic	3, 4, 5, 6, 7, 8	10000	1.0	10000	2, p. B-2
Barium	5, 6, 7, 8	10000	1.0	10000	2, p. B-2
Beryllium	4, 6, 8	10000	1.0	10000	2, p. B-3

**SWOF/Drinking - Toxicity/Persistence**

<b>Hazardous Substance</b>	<b>Source No.</b>	<b>Toxicity Factor Value</b>	<b>Persistence Factor Value</b>	<b>Toxicity/Persistence Factor Value</b>	<b>Ref.</b>
Cadmium	1, 3, 5, 8	10000	1.0	10000	2, p. B-4
Chromium	1, 3, 4, 6, 7, 8	10000	1.0	10000	2, p. B-5
Cobalt	3, 4, 5, 6, 7, 8	1	1.0	1	2, p. B-6
Copper	1, 7	NL <sup>a</sup>	1.0	NA <sup>b</sup>	2, p. B-6
Iron	4	1	1.0	1	2, p. B-12
Lead	1, 3, 5, 6, 7	10000	1.0	10000	2, p. B-13
Magnesium	5, 6, 7, 8	NL <sup>a</sup>	1.0	NA <sup>b</sup>	2, p. B-13
Manganese	1, 3, 5, 7, 8	10000	1.0	10000	2, p. B-13
Mercury	1, 3, 4, 5, 6, 7	10000	.4	4000	2, p. B-13
Nickel	1, 3, 4, 5, 6, 7, 8	10000	1.0	10000	2, p. B-14
Selenium	5, 7, 8	100	1.0	100	2, p. B-17
Silver	1, 3, 5, 6, 7, 8	100	1.0	100	2, p. B-18
Vanadium	3, 4, 5, 6, 8	100	1.0	100	2, p. B-20
Zinc	1, 3, 5, 6, 7, 8	10	1.0	10	2, p. B-20
Cyanide	5,6,7	100	0.4	40	2, p. B-6

<sup>a</sup> No value listed in the SCDM.    <sup>b</sup> Not applicable.

**4.1.2.2.2 Hazardous Waste Quantity**

Source hazardous waste quantity values assigned to each source are summarized below.

Source No.	Source Name	Source Hazardous Waste Quantity Value (Section 2.4.2.1.5)	Is Source Hazardous Constituent Quantity Data Complete? (Yes/No)
1	Landfill Near Incinerator (Site 1)	13.8	No
2	Transformer Storage Area (Site 9)	0.206	No
3	Bone Yard (Site 11)	102.5	No
4	Ammonia Settling Pits	18.12	No
5	TNT Graining House Sump	1.38	No
6	TNT Catch Box Ruins	6.9	No
7	Waste Slag Material	19.23	No
8	Contaminated Soil - Building 159	0.29	No
<b>TOTAL</b>		<b>162.43</b>	

**4.1.2.2.3 Waste Characteristics Factor Category Value**

The waste characteristics for the drinking water threat is calculated below, as specified in the HRS Final Rule (Ref. 1, pp. 51591 and 51613):

Toxicity/Persistence Factor Value = 10,000

HWQ Factor Value = 100

Toxicity/Persistence Factor Value × HWQ Factor Value =  $1 \times 10^6$

=====

**Hazardous Waste Quantity Factor Value: 100**  
**Waste Characteristics Factor Category Value: 32**

**4.1.2.3 DRINKING WATER TARGETS**

According to the York County Department of Engineering Design, and Surveying and the U.S. EPA Region III Inland Area Contingency Plan there is one surface water intake within the vicinity of Cheatham Annex. This intake is located on Jones Pond. Jones Pond is not along the 15-mile target distance limit therefore there are no drinking water intakes identified and the drinking water threat was not scored (Ref. 7, p. 18 and Figure 3).

**4.1.2.3.1 Nearest Intake**

There are no drinking water targets located upstream or downstream within the 15-mile target distance limit therefore the waste characteristics for the drinking water threat was not scored.

=====

**Nearest Intake Factor Value: 0**

**SWOF/Drinking-Level I/II Concentrations**

**4.1.2.3.2 Population**

**4.1.2.3.2.2 Level I Concentrations**

<b><u>Intake</u></b>	<b><u>Distance Along the In-Water Segment from the Probable Point of Entry</u></b>	<b><u>Population</u></b>	<b><u>References</u></b>
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NA

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Population Served by Level I Intakes: 0

**Level I Concentrations Factor Value: 0**

**SWOF/Drinking-Level I/II Concentrations**

**4.1.2.3.2.3 Level II Concentrations**

<b><u>Intake</u></b>	<b><u>Distance Along the In-Water Segment from the Probable Point of Entry</u></b>	<b><u>Population</u></b>	<b><u>References</u></b>
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NA

=====  
Population Served  
by Level II Intakes: 0

**Level II Concentrations Factor Value: 0**

**SWOF/Drinking-Potential Contamination**

**4.1.2.3.2.4 Potential Contamination**

<b>Average Intake</b>	<b>Annual Flow (cfs)</b>	<b>Population Served</b>	<b>References</b>
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NA

<b>Type of Surface Water Body</b>	<b>Total Population</b>	<b>Dilution-Weighted Population (HRS Table 4-14)</b>
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NA

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Dilution-Weighted Population Served by Potentially Contaminated Intakes: 0

**Potential Contamination Factor Value: 0**

**4.1.2.3.3      Resources**

- **Major or designated recreation area, excluding drinking water use**

The York River is used for recreational purposes including boating and swimming (Ref. 10, p. 7).

=====

**Resources Factor Value: 5**

## SWOF/Food Chain-Toxicity/Persistence/Bioaccumulation

### 4.1.3.2 Waste Characteristics

#### 4.1.3.2.1 Toxicity/Persistence/Bioaccumulation

Presented below are the combined toxicity/persistence factor values, the human food chain bioaccumulation factor value, and the combined toxicity/persistence/bioaccumulation factor values for all hazardous substances associated with a source that has a surface water containment value greater than zero.

Hazardous Substance	Source No.	Toxicity Factor Value	Persistence Factor Value	Toxicity/Persistence Factor Value	Human Food Chain Bioaccumulation Value	Toxicity Persistence Bioaccumulation Factor Value	Ref.
Bis(2-ethylhexyl)phthalate	1, 3	100	1.0	100	50,000	5 x 10 <sup>6</sup>	2, p. B-3
Phenanthrene	1, 3	NL <sup>a</sup>	1.0	NA <sup>b</sup>	50	NA <sup>b</sup>	2, p. B-16
Anthracene	1, 3	10	1.0	10	5000	5 x 10 <sup>4</sup>	2, p. B-2
Fluoranthene	1, 3	100	1.0	100	5000	5 x 10 <sup>5</sup>	2, p. B-10
Benzo(a)anthracene	1, 3	1000	1.0	1000	50000	5 x 10 <sup>7</sup>	2, p. B-2
Chrysene	1, 3	10	1.0	10	500	5000	2, p. B-5
Benzo(k)fluoranthene	1, 3	100	1.0	100	50000	5 x 10 <sup>6</sup>	2, p. B-3
Benzo(a)pyrene	1, 3	10000	1.0	10000	50000	5 x 10 <sup>8</sup>	2, p. B-2
Indeno(1,2,3-cd)pyrene	1, 3	1000	1.0	1000	50000	5 x 10 <sup>7</sup>	2, p. B-12
Dibenzo(a,h)anthracene	1	10000	1.0	10000	50000	5 x 10 <sup>8</sup>	2, p. B-7
Benzo(g,h,i)perylene	1, 3	NL <sup>a</sup>	1.0	NA <sup>b</sup>	50000	NA <sup>b</sup>	2, p. B-3
Benzo(b)fluoranthene	1, 3	1000	1.0	1000	50000	5 x 10 <sup>7</sup>	2, p. B-3
Aroclor-1260	1, 2	1000	1.0	1000	50000	5 x 10 <sup>7</sup>	2, p. B-16
Naphthalene	3,	100	0.4	40	500	2 x 10 <sup>4</sup>	2, p. B-14
Fluorene	3	100	1.0	100	5000	5 x 10 <sup>5</sup>	2, p. B-10
Pyrene	3, 6	100	1.0	100	50	5000	2, p. B-17
Acenaphthylene	3	NL <sup>a</sup>	0.4	NA <sup>b</sup>	500	NA <sup>b</sup>	2, p. B-1
Dibenzofuran	3	NL <sup>a</sup>	1.0	NA <sup>b</sup>	500	NA <sup>b</sup>	2, p. B-7
Carbazole	3	10	0.4	4	500	2000	2, p. B-4
2,4,6-Trinitrotoluene	5	1000	0.7	70	5.0	350	2, p. B-20
Antimony	1, 3	10000	1.0	10000	0.5	5000	2, p. B-2
Arsenic	3, 4, 5, 6, 7, 8	10000	1.0	10000	5.0	5 x 10 <sup>4</sup>	2, p. B-2
Barium	5, 6, 7, 8	10000	1.0	10000	0.5	5 x 10 <sup>3</sup>	2, p. B-2
Beryllium	4, 6, 8	10000	1.0	10000	50	5 x 10 <sup>5</sup>	2, p. B-3
Cadmium	1, 3, 5, 8	10000	1.0	10000	5000	5 x 10 <sup>7</sup>	2, p. B-4
Chromium	1, 3, 4, 6, 7, 8	10000	1.0	10000	5.0	5 x 10 <sup>4</sup>	2, p. B-5
Cobalt	3, 4, 5, 6, 7, 8	1	1.0	1	0.5	0.5	2, p. B-6
Copper	1, 7	NL <sup>a</sup>	1.0	NA <sup>b</sup>	50000	NA <sup>b</sup>	2, p. B-6

### SWOF/Food Chain-Toxicity/Persistence/Bioaccumulation

Hazardous Substance	Source No.	Toxicity Factor Value	Persistence Factor Value	Toxicity/Persistence Factor Value	Human Food Chain Bioaccumulation Value	Toxicity Persistence Bioaccumulation Factor Value	Ref.
Iron	4	1	1.0	1	0.5	0.5	2, p. B-12
Lead	1, 3, 5, 6, 7	10000	1.0	10000	50	5 x 10 <sup>5</sup>	2, p. B-13
Magnesium	5, 6, 7, 8	NL <sup>a</sup>	1.0	NA <sup>b</sup>	0.5	NA <sup>b</sup>	2, p. B-13
Manganese	1, 3, 5, 7, 8	10000	1.0	10000	0.5	5,000	2, p. B-13
Mercury	1, 3, 4, 5, 6, 7	10000	4	4000	50000	2 x 10 <sup>8</sup>	2, p. B-13
Nickel	1, 3, 4, 5, 6, 7, 8	10000	1.0	10000	.5	5000	2, p. B-14
Selenium	5, 7, 8	100	1.0	100	5000	5 x 10 <sup>5</sup>	2, p. B-17
Silver	1, 3, 5, 6, 7, 8	100	1.0	100	50	5,000	2, p. B-18
Vanadium	3, 4, 5, 6, 8	100	1.0	100	0.5	50	2, p. B-20
Zinc	1, 3, 5, 6, 7, 8	10	1.0	10	500	5,000	2, p. B-20
Cyanide	5,6,7	100	0.4	40	0.5	20	2, p. B-6

<sup>a</sup> No value listed in the SCDM. <sup>b</sup> Not applicable.

=====

**Toxicity/Persistence/Bioaccumulation Factor Value: 5x10<sup>8</sup>**

## SWOF/Food Chain-Hazardous Waste Quantity

### 4.1.3.2.2 Hazardous Waste Quantity

Source hazardous waste quantity values assigned to each source are summarized below.

<b>Source No.</b>	<b>Source Name</b>	<b>Source Hazardous Waste Quantity Value (Section 2.4.2.1.5)</b>	<b>Is Source Hazardous Constituent Quantity Data Complete? (Yes/No)</b>
1	Landfill Near Incinerator (Site 1)	13.8	No
2	Transformer Storage Area (Site 9)	0.206	No
3	Bone Yard (Site 11)	102.5	No
4	Ammonia Settling Pits	18.12	No
5	TNT Graining House Sump	1.38	No
6	TNT Catch Box Ruins	6.9	No
7	Waste Slag Material	19.23	No
8	Contaminated Soil - Building 159	0.29	No
	<b>TOTAL</b>	<b>162.43</b>	

**Hazardous Waste Quantity Factor Value: 100**

## SWOF/Food Chain-Hazardous Waste Quantity

### 4.1.3.2.3 Waste Characteristics Factor Category Value

The waste characteristics factor value for the Human Food Chain Threat is calculated below, as specified in the HRS Final Rule (Ref. 1, Section 4.1.3.2.3, p. 51620):

Toxicity/Persistence Factor Value = 10,000

HWQ Factor Value = 100

Bioaccumulation Potential Factor Value =  $5 \times 10^4$

$(\text{Toxicity/Persistence} \times \text{HWQ}) = (10,000 \times 100) = 1 \times 10^6$

$(\text{Toxicity/Persistence} \times \text{HWQ}) \times (\text{Bioaccumulation Potential Factor Value}) =$

$(1 \times 10^6) \times (5 \times 10^4) = 5 \times 10^{10}$

**Toxicity/Persistence Factor Value x Hazardous Waste Quantity Factor Value:  $1 \times 10^6$**   
**(Toxicity/Persistence x HWQ) x Bioaccumulation Potential Factor Value:  $5 \times 10^{10}$**

=====

**Hazardous Waste Quantity Assigned Value: 100**  
**Waste Characteristics Factor Category Value: 320**

### 4.1.3.3 HUMAN FOOD CHAIN THREAT-TARGETS

#### Sediment Samples - Penniman Lake

Sediment samples that contain hazardous substances that have a bioaccumulation potential factor value of 500 or greater and that meet the criteria for an observed release are presented below. Samples are documented in Section 4.1.2.1.1 and bioaccumulation potential factor values are documented in Section 4.1.3.2.1 of this documentation record.

Sample ID	Hazardous Substance	Sample Concentration (µg/kg)	Detection Limit (µg/kg)	Bioaccumulation Value
11SD02	Bis(2-ethylhexyl)phthalate	233	163	50,000
11SD02A	Zinc	59.6K (39.7)	20	500
11SD03(1A)	Zinc	55.1K (82.65)	20	500

Various semi-volatile organic compounds and metals have been detected in sediment samples collected from Penniman Lake. Penniman Lake is a designated fishery for military personnel (Ref. 11).

Samples that demonstrate actual contamination of the human food chain in Penniman Lake are shown below.

#### **Actual Contamination of the Human Food Chain**

Actual contamination of Penniman Lake can be demonstrated by the analytical results of sediment samples.

#### **Closed Fisheries**

No closed fisheries have been established within the target distance limit.

#### **Level I Concentrations**

No Level I concentrations have been established.

#### **Most Distant Level II Sample**

Analysis of sediment samples 11SD03 and 11SD03(1A) detected hazardous substances in Penniman Lake that were also detected in soil and source samples that have PPEs into Penniman Lake.

**Sample ID:** 11SD03 and 11SD03(1A)

**Distance from PPE8:** 500 feet

**Reference:** 6, p. 2-5; 5, p. 4-27 and Figure 4

## SWOF/Food Chain-Targets

### Level II Fisheries

Hazardous substances that have bioaccumulation potential factor values of 500 or greater were detected in sediment samples from Penniman Lake. The extent of Level II fisheries include the distance from the PPE to the observed release at sediment sample location 11SD03 and 11SD03(1A).

<u>Identity of Fishery</u>	<u>Extent of the Level II Fishery (Relative to Probable Point of Entry No. 8)</u>
Penniman Lake	500 feet

**4.1.3.3.1      Food Chain Individual**

A food chain individual factor value of 45 is assigned because a portion of the Penniman Lake fishery is subject to Level II concentrations (Ref. 1, p. 51620).

=====

**Food Chain Individual Factor Value: 45**

**SWOF/Food Chain-Level I Concentrations**

**4.1.3.3.2      Population**

**4.1.3.3.2.1    Level I Concentrations**

No Level I concentrations can be documented with the available data.

=====

**Level I Concentrations Factor Value: 0**

## SWOF/Food Chain-Level II Concentrations

### 4.1.3.3.2.2 Level II Concentrations

The Penniman Lake is a fishery that has been documented to be subject to Level II concentrations. The actual production value is unknown. Therefore, the minimum production value is assigned for the area of actual contamination. The human food chain population value is based on HRS Table 4-18 (Ref. 1, p. 51621).

Identity of Fishery	Annual Production (lbs)	References	Human Food Chain Population Value
Penniman Lake	> 0 to 100	11 and 12	0.03

=====  
**Level II Concentrations Factor Value: 0.03**

## **SWOF/Food Chain-Potential Human Food Chain Contamination**

### **4.1.3.3.2.3 Potential Human Food Chain Contamination**

King Creek, Cheatham Pond, Queen Creek, the York River, and a small portion of the Chesapeake Bay are all designated fisheries located within the 15-mile upstream and downstream target distance limit.

Production values for King Creek, Queen Creek, and Cheatham Pond are not known, therefore, the potential for human food contamination is not scored and is assigned a contamination factor value of 0.

## SWOF/Environment-Toxicity/Persistence/Bioaccumulation

### 4.1.4 ENVIRONMENTAL THREAT

#### 4.1.4.2 Waste Characteristics

##### 4.1.4.2.1 Ecosystem Toxicity/Persistence/Bioaccumulation

Summarized below are the hazardous substances that are documented at a source that has a surface water containment factor value greater than zero. The ecosystem toxicity and persistence values were obtained from the SCDM (Ref. 2). The combined ecosystem toxicity/persistence factor value was obtained from HRS Table 4-20 (Ref. 1, p. 51622).

Hazardous Substance	Source No.	Ecosystem Toxicity Factor Value	Persistence Factor Value	Ecosystem Toxicity/Persistence Factor Value	Reference
Bis(2-ethylhexyl)phthalate	1, 3	1,000	1.0	1,000	2, p. B-3
Phenanthrene	1, 3	1,000	1.0	1,000	2, p. B-16
Anthracene	1, 3	10,000	1.0	10,000	2, p. B-2
Fluoranthene	1, 3	10,000	1.0	10,000	2, p. B-10
Benzo(a)anthracene	1, 3	10,000	1.0	10,000	2, p. B-2
Chrysene	1, 3	1,000	1.0	1,000	2, p. B-5
Benzo(k)fluoranthene	1, 3	NL <sup>a</sup>	1.0	NA <sup>b</sup>	2, p. B-3
Benzo(a)pyrene	1, 3	10,000	1.0	10,000	2, p. B-2
Indeno(1,2,3-CD)pyrene	1, 3	NL <sup>a</sup>	1.0	NA <sup>b</sup>	2, p. B-12
Dibenzo(a,h)anthracene	1	NL	1.0	NA <sup>b</sup>	2, p. B-7
Benzo(g,h,i)perylene	1, 3	NL <sup>a</sup>	1.0	NA <sup>b</sup>	2, p. B-3
Benzo(b)fluoranthene	1, 3	NL <sup>a</sup>	1.0	NA <sup>b</sup>	2, p. B-3
Aroclor-1260	1, 2	10,000	1.0	10,000	2, p. B-16
Antimony	1, 3	100	1.0	100	2, p. B-2
Arsenic	3, 4, 5, 6, 7, 8	10	1.0	10	2, p. B-2
Barium	5, 6, 7, 8	1	1.0	1	2, p. B-2
Beryllium	4, 6, 8	NL <sup>a</sup>	1.0	NA <sup>b</sup>	2, p. B-3
Cadmium	1, 3, 5, 8	1,000	1.0	1,000	2, p. B-4
Chromium	1, 3, 4, 6, 7, 8	100	1.0	100	2, p. B-5
Cobalt	3, 4, 5, 6, 7, 8	NL <sup>a</sup>	1.0	NA <sup>b</sup>	2, p. B-6
Copper	1, 7	100	1.0	100	2, p. B-6
Iron	4	10	1.0	10	2, p. B-12
Lead	1, 3, 5, 6, 7	1,000	1.0	1,000	2, p. B-13

<sup>a</sup> No value listed in the SCDM.

<sup>b</sup> Not applicable.

**SWOF/Environment-Toxicity/Persistence/Bioaccumulation**

<b>Hazardous Substance</b>	<b>Source No</b>	<b>Ecosystem Toxicity Factor Value</b>	<b>Persistence Factor Value</b>	<b>Ecosystem Toxicity/ Persistence Factor Value</b>	<b>Reference</b>
Magnesium	5, 6, 7, 8	NL <sup>a</sup>	1.0	NA <sup>b</sup>	2, p. B-13
Manganese	1, 3, 5, 7, 8	NL <sup>a</sup>	1.0	NA <sup>b</sup>	2, p. B-13
Mercury	1, 3, 4, 5, 6, 7	10,000	1.0	10,000	2, p. B-13
Nickel	1, 3, 4, 5, 6, 7, 8	10	1.0	10	2, p. B-14
Selenium	5, 7, 8	1,000	1.0	1,000	2, p. B-17
Silver	1, 3, 5, 6, 7, 8	10,000	1.0	10,000	2, p. B-18
Vanadium	3, 4, 5, 6, 8	NA <sup>a</sup>	1.0	NA <sup>b</sup>	2, p. B-18
Zinc	1, 3, 5, 6, 7, 8	10	1.0	10	2, p. B-20
Cyanide	5,6,7	1,000	.07	400	2, p. B-20
Naphthalene	3,	1,000	0.4	400	2, p. B-14
Di-n-octylphthalate	3	NL <sup>a</sup>	1.0	NA <sup>b</sup>	2, p. B-14
Fluorene	3	1,000	1.0	1,000	2, p. B-7
Pyrene	3, 6	10,000	1.0	10,000	2, p. B-10
Acenaphtylene	3	NL <sup>a</sup>	1.0	NA <sup>b</sup>	2, p. B-12
Dibenzofuran	3	100	1.0	100	2, p. B-20
Carbazole	3	NL <sup>a</sup>	0.07	NA <sup>b</sup>	2, p. B-7
2,4,6-Trinitrotoluene	5	100	0.07	7	2, p. B-18

<sup>a</sup> No value listed in the SCDM.

<sup>b</sup> Not applicable.

## SWOF/Environment-Toxicity/Persistence/Bioaccumulation

### 4.1.4.2.1 Ecosystem Toxicity/Persistence/Bioaccumulation

Summarized below are the hazardous substances that have been documented at a source that has a surface water containment factor value greater than zero. The ecosystem bioaccumulation factor values were obtained from the SCDM (Ref. 2). The ecosystem toxicity/persistence/bioaccumulation factor value was obtained from HRS Table 4-21 (Ref. 1, p. 51623).

Hazardous Substance	Source No.	Ecosystem Toxicity/ Persistence Factor Value	Ecosystem Bioaccumulation Factor Value	Ecosystem Toxicity/ Persistence/ Bioaccumulation Factor Value
Bis(2-ethylhexyl)phthalate	1, 3	1,000	50,000	$5 \times 10^7$
Phenanthrene	1, 3	1,000	5,000	$5 \times 10^6$
Anthracene	1, 3	10,000	5,000	$5 \times 10^7$
Fluoranthene	1, 3	10,000	500	$5 \times 10^6$
Benzo(a)anthracene	1, 3	10,000	50,000	$5 \times 10^8$
Chrysene	1, 3	1,000	5,000	$5 \times 10^6$
Benzo(k)fluoranthene	1, 3	NA <sup>b</sup>	50,000	NA <sup>b</sup>
Benzo(a)pyrene	1, 3	10,000	50,000	$5 \times 10^8$
Indeno(1,2,3-CD)pyrene	1, 3	NA <sup>b</sup>	50,000	NA <sup>b</sup>
Dibenzo(a,h)anthracene	1	NA <sup>b</sup>	50,000	NA <sup>b</sup>
Benzo(g,h,i)perylene	1, 3	NA <sup>b</sup>	50,000	NA <sup>b</sup>
Benzo(b)fluoranthene	1, 3	NA <sup>b</sup>	50,000	NA <sup>b</sup>
Aroclor-1260	1, 2	10,000	50,000	$5 \times 10^8$
Antimony	1, 3	100	5	500
Arsenic	3, 4, 5, 6, 7, 8	10	500	5,000
Barium	5, 6, 7, 8	1	0.5	0.5
Beryllium	4, 6, 8	NA <sup>b</sup>	50	NA <sup>b</sup>
Cadmium	1, 3, 5, 8	1,000	5,000	$5 \times 10^6$
Chromium	1, 3, 4, 6, 7, 8	100	5	500
Cobalt	3, 4, 5, 6, 7, 8	NA <sup>b</sup>	5,000	NA <sup>b</sup>
Copper	1, 7	100	50,000	$5 \times 10^6$
Iron	4	10	0.5	5
Lead	1, 3, 5, 6, 7	1,000	5,000	$5 \times 10^6$

<sup>a</sup> No value listed in the SCDM.

<sup>b</sup> The ecosystem toxicity/persistence/bioaccumulation factor value could not be calculated.

**SWOF/Environment-Toxicity/Persistence/Bioaccumulation**

<b>Hazardous Substance</b>	<b>Source No.</b>	<b>Ecosystem Toxicity/ Persistence Factor Value</b>	<b>Ecosystem Bioaccumulation Factor Value</b>	<b>Ecosystem Toxicity/ Persistence/ Bioaccumulation Factor Value</b>
Magnesium	5, 6, 7, 8	NA <sup>b</sup>	0.5	NA <sup>b</sup>
Manganese	1, 3, 5, 7, 8	NA <sup>b</sup>	50,000	NA <sup>b</sup>
Mercury	1, 3, 4, 5, 6, 7	10,000	50,000	5 × 10 <sup>8</sup>
Nickel	1, 3, 4, 5, 6, 7, 8	10	500	5,000
Selenium	5, 7, 8	1,000	5,000	5 × 10 <sup>6</sup>
Silver	1, 3, 5, 6, 7, 8	10,000	50	5 × 10 <sup>5</sup>
Vanadium	3, 4, 5, 6, 8	NA <sup>b</sup>	0.5	NA <sup>b</sup>
Zinc	1, 3, 5, 6, 7, 8	10	500	5,000
Cyanide	5,6,7	400	0.5	200
Naphthalene	3,	400	500	2 × 10 <sup>5</sup>
Di-n-octylphthalate	3	NA <sup>b</sup>	500	NA <sup>b</sup>
Fluorene	3	1,000	5,000	5 × 10 <sup>6</sup>
Pyrene	3, 6	10,000	50	5 × 10 <sup>5</sup>
Acenaphthylene	3	NA <sup>b</sup>	500	NA <sup>b</sup>
Dibenzofuran	3	100	500	5 × 10 <sup>4</sup>
Carbazole	3	NA <sup>b</sup>	500	NA <sup>b</sup>
2,4,6-Trinitrotoluene	5	7	5	35

<sup>a</sup> No value listed in the SCDM.

<sup>b</sup> The ecosystem toxicity/persistence/bioaccumulation factor value could not be calculated.

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**Ecosystem Toxicity/Persistence/Bioaccumulation  
Potential Factor Value: 5×10<sup>8</sup>**

## SWOF/Environment-Hazardous Waste Quantity

### 4.1.4.2.2 Hazardous Waste Quantity

The HWQ values have been assigned to each surface-water body that receives runoff from a source.

Source No.	Source Name	Source Hazardous Waste Quantity Value (Section 2.4.2.1.5)	Is Source Hazardous Constituent Quantity Data Complete? (Yes/No)
1	Landfill Near Incinerator (Site 1)	13.8	No
2	Transformer Storage Area (Site 9)	0.206	No
3	Bone Yard (Site 11)	102.5	No
4	Ammonia Settling Pits	18.12	No
5	TNT Graining House Sump	1.38	No
6	TNT Catch Box Ruins	6.9	No
7	Waste Slag Material	19.23	No
8	1918 Drum Storage Drum	0.29	No
	<b>TOTAL</b>	<b>162.43</b>	

## SWOF/Environment-Hazardous Waste Quantity

### 4.1.4.2.3 Waste Characteristics Factor Category Value

A waste characteristics product is calculated by multiplying the ecosystem toxicity/persistence factor value by the hazardous waste quantity factor value. The product (subject to a maximum of  $1 \times 10^6$ ) is multiplied by the ecosystem bioaccumulation potential factor value. That product (subject to a maximum product of  $1 \times 10^{12}$ ) is then entered into HRS Table 2-7 (Ref. 1, p. 51592) to obtain the environmental threat waste characterization factor category value. The calculations are presented below.

Ecosystem Toxicity/Persistence Value = 10,000

Ecosystem Bioaccumulation Potential Factor Value = 50,000

HWQ Factor Value = 100

Ecosystem Toxicity/Persistence x HWQ =  $1 \times 10^6$

(Ecosystem Toxicity/Persistence x HWQ) x

(Ecosystem Bioaccumulation Potential Factor Value) =  $5 \times 10^{10}$

**Hazardous Waste Quantity Factor Value: 100**

**Waste Characteristics Factor Category Value: 320**

**4.1.4.3 Environmental Threat-Targets**

Several sensitive environments are located along the 15-mile upstream and downstream target distance limit.

**4.1.4.3.1 Sensitive Environments**

**4.1.4.3.1.1 Level I Concentrations**

No Level I concentrations of sensitive environments has been documented within the 15-mile upstream or downstream target distance limit.

**4.1.4.3.1.2 Level II Concentrations**

No Level II concentrations of sensitive environments has been documented within the 15-mile upstream or downstream target distance limit.

**SWOF/Environment - Targets**

**4.1.4.3.1.3 Potential Contamination**

The sensitive environments identified within the 15-mile downstream target distance limit are shown below. The habitat known to be used by endangered or threatened species may include all of the surface waters in the area of the facility, therefore the surface water body type (King Creek - moderate to large stream) having the lowest dilution weight value has been assigned (Ref. 1, pp. 51613 and 51625).

**King Creek:**

Sensitive Environment	Distance from Probable Point of Entry to Nearest Point of Sensitive Environment (PPE8)	Reference	Sensitive Environment Value(s)
<b>National Park:</b>			
Colonial National Historical Park	0	Figure 3	100
Habitat known to be used by Federal designated or proposed endangered or threatened species:			
Bald Eagle	0	18; 10, p. 9 and Exhibit 10	75
Red-cockaded Woodpecker	0	18; 10, p. 9 and Exhibit 10	75
Piping Plover	0	18; 10, p. 9 and Exhibit 10	75
Northeastern Beach Tiger Beetle	0	18; 10, p. 9 and Exhibit 10	75
Peregrine Falcon ( <i>falco peregrinus</i> )	0	18; 10, p. 9 and Exhibit 10	75
Bachman's warbler ( <i>vermivora bachmanii</i> )	0	18; 10, p. 9 and Exhibit 10	75
Kirtland's warbler ( <i>idendrocia kirmandii</i> )	0	18; 10, p. 9 and Exhibit 10	75

**TOTAL: 625**

**SWOF/Environment - Targets**

**York River:**

Sensitive Environment	Distance from Probable Point of Entry to Nearest Point of Sensitive Environment (PPE2)	Reference	Sensitive Environment Value(s)
Sensitive areas identified under National Estuarine Research Reserves:			
Catlett Islands	3 miles	18; 10, p. 9	100
Habitat known to be used by Federal designated or proposed endangered or threatened species:			
Green Turtle <i>(chelonia mydas)</i>	0	18; 10, p. 9 and Exhibit 10	75
Hawksbill Turtle <i>(rerectmochelys inbricata)</i>	0	18; 10, p. 9 and Exhibit 10	75
Leather back Turtle <i>(dermochelys conacia)</i>	0	18; 10, p. 9 and Exhibit 10	75
Loggerhead Turtle <i>(caretia caretta)</i>	0	18; 10, p. 9 and Exhibit 10	75
Spawning areas critical for the maintenance of fish:			
Bay Anchovy ( <i>anchoa mitchille</i> )	0	18; 10, p. 9 and Exhibit 10	75
Striped Bass ( <i>morone saxatilis</i> )	0	18; 10, p. 9 and Exhibit 10	75

**TOTAL: 550**

**Chesapeake Bay:**

Sensitive Environment	Distance from Probable Point of Entry to Nearest Point of Sensitive Environment (PPE4, 5, 6)	Reference	Sensitive Environment Value(s)
Area Identified under Coastal Zone Management Act:			
Chesapeake Bay	14.8	18; 10, p. 9	100

**TOTAL: 100**

**Wetlands**

Documented wetlands occur along three surface-water bodies within the 15-mile upstream and downstream target distance limit. The length of these wetlands are provided below.

**King Creek**

The total length of wetlands subject to potential contamination located along King Creek within the target distance limit is 4,000 feet (0.76 mile) (Ref. 4).

**York River**

The total length of wetlands subject to potential contamination located upstream and downstream along the York River within the target distance limit is greater than 20 miles, therefore the wetlands assigned value is 500 (Ref. 1, p. 51625, Ref. 10, p. 15, Ref. 18).

**Chesapeake Bay**

The total length of wetlands subject to potential contamination located downstream along the Chesapeake Bay within the target distance limit is between 0.1 to 1 mile, therefore the wetlands assigned value is 25 (Ref. 1, p. 51625 and Ref. 18).

The potential contamination factor value (SP) is calculated as follows:

$$SP = \frac{(W + S) D}{10}$$

W = Value assigned for wetlands from HRS Table 4-24.

S = Value assigned for the sensitive environment from HRS Table 4-23.

D = Dilution weight assigned from HRS Table 4-13.

$$SP_{King\ Creek} = \frac{(25 + 100) .01}{10} = 0.13$$

$$SP_{Chesapeake\ Bay} = \frac{(25 + 100) .0001}{10} = 0.0013$$

$$SP_{York\ River} = \frac{(500 + 500) 0.0001}{10} = 0.01$$

$$SP_{Total} = 0.13 + .0013 + 0.01 = 0.14$$

**Potential Contamination Factor Value (SP) = 0.14**