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Naval Surface Weapons Center, Dahlgren Laboratory

Dahlgren, Virginia

CERCLIS #VA7170024684

Site Exposure Potential

The Naval Surface Weapons Center, Dahlgren Laboratory (NSWC Dahlgren) is on the west bank of the Potomac River in Dahlgren, Virginia, about 70 km south of Washington, D.C. (Figure 1). The 17-km^2 site is bisected by Upper Machodoc Creek, which flows to the east into the Potomac River (Figure 2). The northern portion of the site (the Main Site) is drained by Gambo Creek, a tidal estuary with 90 hectares of associated wetlands. Gambo Creek flows into the Potomac River, which enters the Chesapeake Bay approximately 75 km from the site.

NSWC Dahlgren was established in 1918 as a proving ground for naval ordnance. Waste materials have been produced throughout the site as a result of both ordnance and non-ordnance activities. During the Initial Assessment Study, 36 potentially contaminated sites were identified on both the Main Site and on the Explosives Experimental Area south of Machodoc Creek. Based on

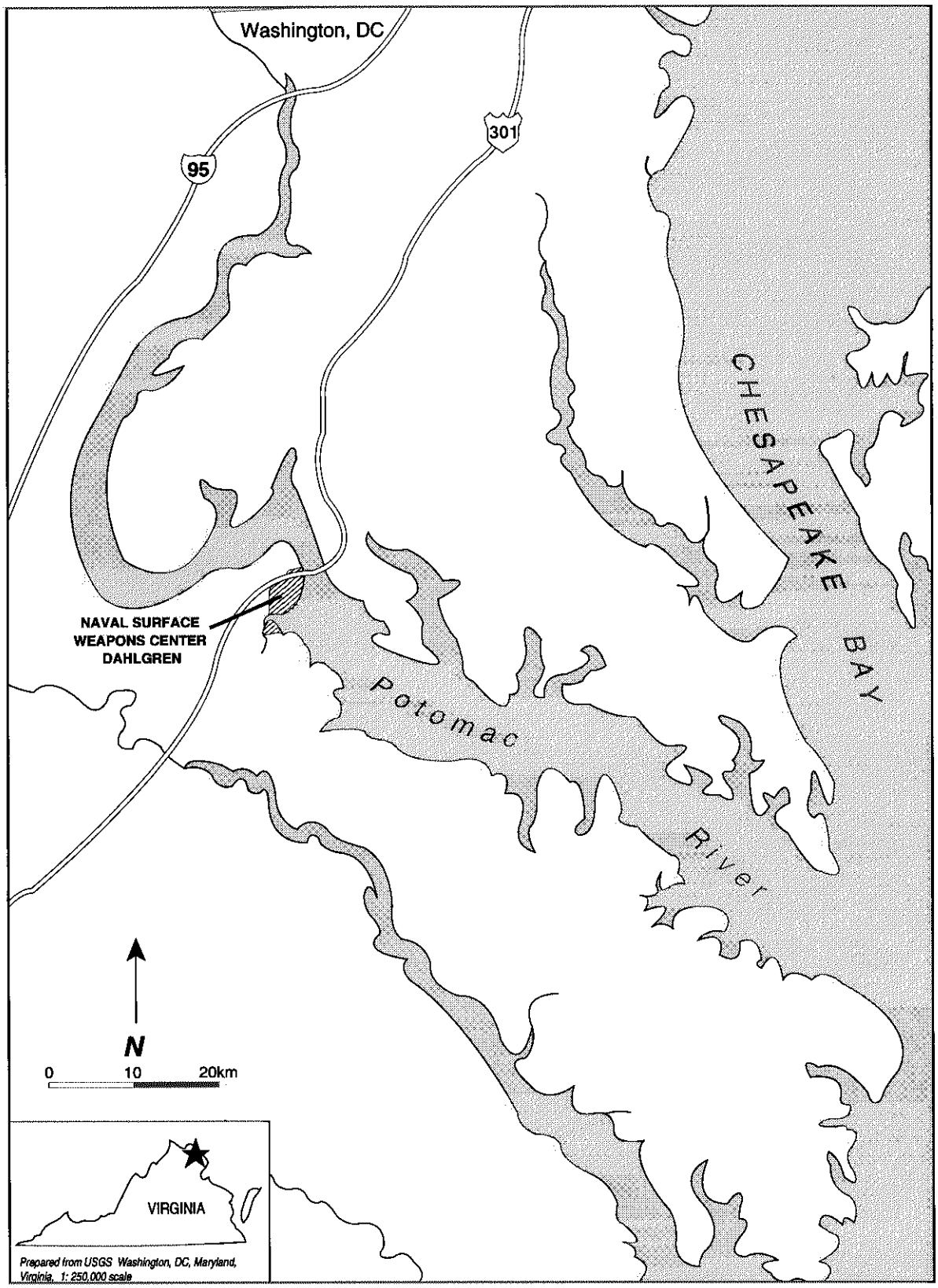

Figure 1. General vicinity of the Naval Surface Weapons Center site, Dahlgren, Virginia.

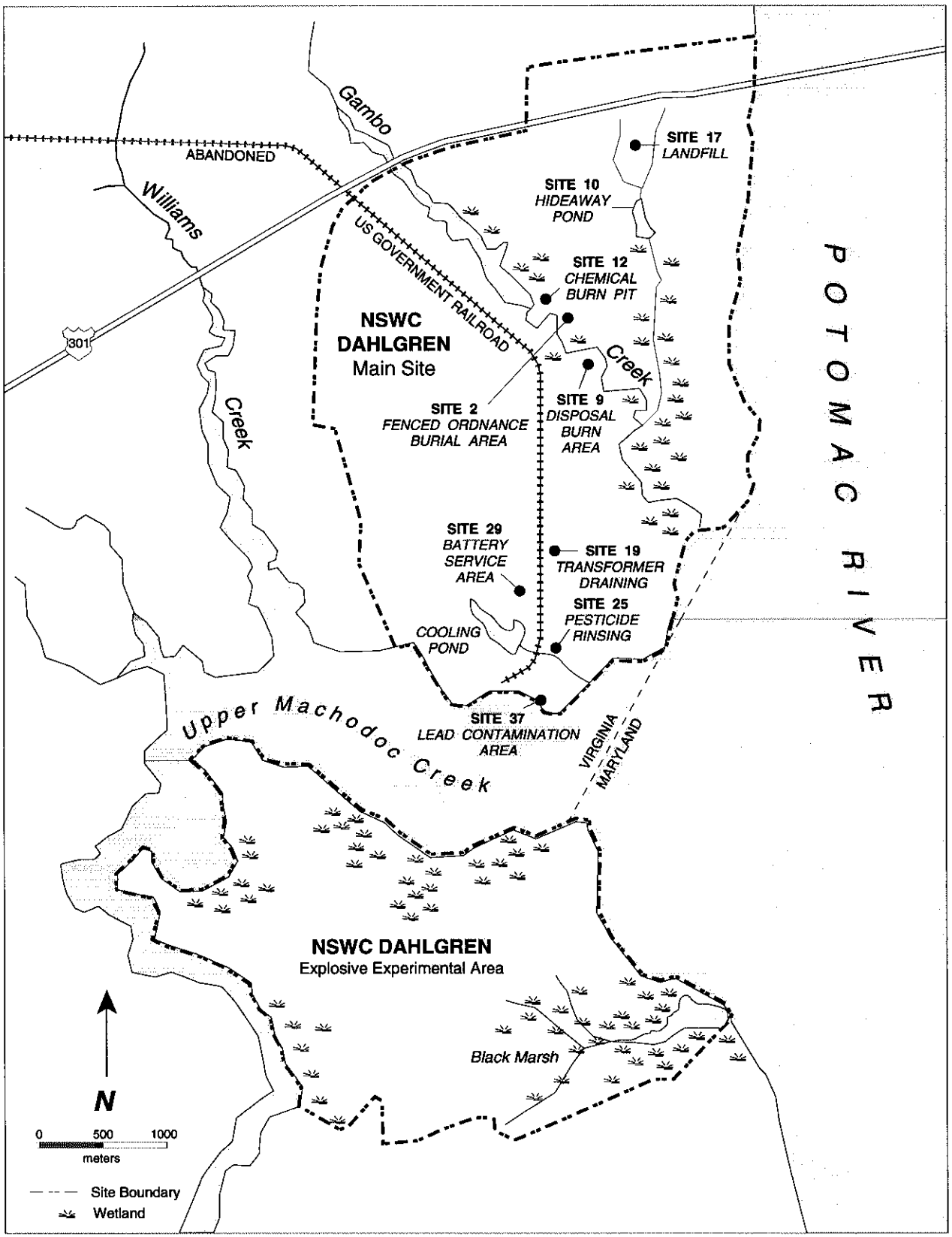

Figure 2. Detail of the Naval Surface Weapons Center, including the location of the waste disposal sites.

the study, six sites were investigated during the subsequent Confirmation Study. Plans for a remedial investigation at NSWC Dahlgren include the six sites previously investigated and three more sites (Figure 2; NUS 1992). Table 1 describes the past waste disposal practices at these sites.

Surface water runoff and groundwater migration are the potential pathways of contaminant transport from the site to NOAA trust resources and associated habitats. Sites 2, 9, and 12 are near wetlands that border Gambo Creek. Site 12, the Chemical Burn Pit, is about 180 m from the creek in a depression that collects precipitation. The pit overflows during heavy rains, and before burning, the water in the pit was pumped out and deposited onto the ground surface near the pit. Site 17 is about 90 m upgradient from Site 10, Hideaway Pond, between two unnamed tributaries that lead to the pond. Site 10 is drained by an

Table 1. Types and quantities of wastes disposed of at eight sites at NSWC Dahlgren.[1]

Site	Dates of Operation	Types and Quantities of Wastes
Site 2 Fenced Ordnance Burial Area	From 1970 to an unknown date	Unknown quantities of scrap metal with explosives residues were disposed of, along with triple-rinsed pesticide containers, and asbestos pipe wrappings. Drums containing misch metal, composed of radioactive thorium and magnesium, were stored and possibly disposed of at this site.
Site 9 Disposal/Burn Area	Approximately 1951 to 1984	Various chemical and municipal wastes were dumped and burned. The actual type and quantity of wastes were unknown.
Site 12 Chemical Burn Pit	Approximately 1970 to 1980	Small metered quantities of decontaminated chemical warfare agents were disposed of in plastic quart containers and burned every 3 to 4 weeks. An estimate of the total number of containers disposed of was not given.
Site 17 Old Sanitary Landfill	For 3 to 4 years during the early 1970s	Municipal wastes were disposed of at this site. An anonymous phone call reported that unknown quantities of mercury were buried in canisters at the site.
Site 19 Transformer Draining Area	During the 1950s	Transformer oil containing unknown concentrations of PCBs was drained onto the ground. It was estimated that approximately 3,800 liters of oil were dumped at this site.
Site 25 Pesticide Rinsing Area	Dates were not available	Pesticide containers were rinsed and wash water was dumped onto a paved area where it was channeled to a french drain.
Site 29 Battery Service Area	An unknown date until 1985	Unknown quantities of waste acids from lead-acid storage batteries were drained into an unlined pit containing limestone.
Site 37 Lead Contamination Area	Dates were not available	Unknown quantities of sand from machine gun range traps were placed along the shoreline as fill. This sand may have been contaminated with lead and trace elements.

1 Since no wastes were disposed of at Site 10, Hideaway Pond, it is not included in this table.

unnamed stream that flows for about 1.5 km and then joins Gambo Creek. Site 19 is 1 km from the Potomac River. Surface drainage from Site 29 ultimately reaches the cooling pond about 75 m south of the site. At Site 25, a french drain was historically used for draining pesticide waste from the site. The drain is approximately 100 m upgradient from an unnamed creek that flows for about 500 m before entering the Potomac River. Site 37, on the banks of Machodoc Creek near the Potomac River, is subject to washout during flooding.

Three principal geologic units underlie the site. The surficial unit, the Nanjemoy Formation, is about 45 m thick and consists of silty fine sands and clays with low permeability. The surficial aquifer is separated from the underlying Aquia Greensand Formation and Potomac Group by a clay aquiclude that restricts downward movement of groundwater. Groundwater from Sites 12, 9, and 19 flows towards Gambo Creek, while groundwater below Sites 17 and 25 flows towards the nearest creek or tributary.

NOAA Trust Habitats and Species

Habitats of concern to NOAA are the surface water, associated bottom substrates, and estuarine emergent wetlands of Gambo Creek, the unnamed creek draining Hideaway Pond, and the Potomac River. Salinities in the Potomac River near the site range from 3 to 9 ppt throughout the year depending on rainfall, saltwater intrusion, and surficial runoff. Gambo Creek is tidally influenced as far inland as the northern border of the site. The substrate composition of Gambo Creek is primarily sand and hard clay (Swihart personal communication 1992).

Surface water near the site provides spawning, nursery, and adult habitat for numerous species (Table 2; Swihart personal communication 1992). Six species of anadromous fish use the Potomac River for migratory and adult habitat: blueback herring, hickory shad, alewife, American shad, white perch, and striped bass. Extensive wetlands containing saltmarsh cordgrass (*Spartina alterniflora*) border Gambo Creek and provide nursery habitat for these species. White perch use the creek and its associated wetlands for spawning, nursery, and adult habitat (Swihart personal communication 1992). Information was not available on the accessibility of Hideaway Pond to NOAA trust resources. Estuarine and marine species that are likely to use Gambo Creek and the Potomac River include anchovy, menhaden, gizzard shad, killifish, spot, silverside, croaker, bluefish, hogchoker, and mummichog. There are catadromous American eel throughout the area. There are oyster beds offshore of the site in the Potomac River (O'Brien & Gere Engineers Inc. 1986). Blue crab are abundant near NSWC Dahlgren in the Potomac River and the associated wetlands (Swihart personal communication 1992).

were only conducted at Sites 9, 10, 12, 17, 19, and 25. The types of media samples collected and chemical parameters analyzed at these sites were based on the source and type of contamination at each site. Table 3 gives the maximum concentrations of contaminants measured.

Leachate and groundwater samples were collected from Site 9 and analyzed for several parameters, but analyses did not include pesticides, PCBs, PAHs, or trace elements.

Groundwater, surface water, soil, sediment, and fish tissue samples were collected near Site 17, including Hideaway Pond and its two tributaries. The samples were analyzed for mercury only. Mercury was not detected in any of the surface water samples; however, the detection limit (0.10 µg/l) was an order of magnitude above the chronic freshwater AWQC of 0.025 µg/l (U.S. EPA 1986). Half of the sediment samples contained mercury concentrations greater than or equal to 0.01 mg/kg (wet weight). These concentrations of mercury in sediments are not directly comparable to the screening guideline, which is expressed in mg/kg on a dry weight basis (higher mercury concentrations would be expected if expressed on a dry weight basis). Although mercury was not detected in any of the five soil samples collected from Site 17, the detection limit of 0.5 mg/kg (wet weight) is higher than the average mercury concentration of 0.03 mg/kg (dry weight) in U.S. soils (Lindsay 1979). During past studies, mercury was detected at a maximum concentration of 1.9 mg/kg in fish tissues collected from Hideaway Pond. The action level set by the U.S. Food and Drug Administration for protection of human health is 1 mg/kg (Fred C. Hart Associates, Inc. 1983).

Soil, groundwater, and pit water samples were collected from Site 12 and analyzed for several parameters, but tests did not include pesticides, PCBs, or trace elements. Base-neutral extractable organic compounds were measured in one sample of each media type from Site 12. The only contaminant detected was di-n-octylphlalate in the soil sample at a concentration of 280 ug/kg (wet weight).

At Site 19, 52 soil samples from 28 locations and three groundwater samples were collected and analyzed for PCBs. The samples were not tested for pesticides or trace elements. PCBs were detected in soils at a maximum concentration of 84 mg/kg (wet weight) from nine sampling locations, but were not detected in groundwater samples. However, the detection limit of 10 µg/l was much higher than the screening guideline, which is ten times the AWQC of 0.03 µg/l.

At Site 25, soil samples were collected from 34 locations and groundwater samples were collected from four monitoring wells; the maximum concentrations of pesticides found in soil and groundwater were measured in these samples (Table 3). Pesticides were found in soils throughout the site; over half the sampling locations contained detectable concentrations of DDT, DDD, DDE, and dieldrin. Screening guidelines for these pesticides in soils were not available. DDT, DDD, and DDE were detected in one

Table 2. Major species inhabiting the surface waters and tidal marshes of Gambo Creek and the Potomac River near NWSC Dahlgren.

Species		Habitat			Fisheries	
Common Name	Scientific Name	Spawning Ground	Nursery Ground	Adult Forage	Comm. Fishery	Recr. Fishery
ANADROMOUS/CATADROMOUS SPECIES						
Blueback herring	*Alosa aestivalis*		♦	♦	♦	
Hickory shad	*Alosa mediocris*		♦	♦		
Alewife	*Alosa pseudoharengus*		♦	♦	♦	
American shad	*Alosa sapidissima*		♦	♦	♦	
American eel	*Anguilla rostrata*			♦	♦	
White perch	*Morone americana*	♦	♦	♦	♦	♦
Striped bass	*Morone saxatilis*		♦	♦	♦	♦
MARINE/ESTUARINE SPECIES						
Bay anchovy	*Anchoa mitchilli*	♦	♦	♦		
Atlantic menhaden	*Brevoortia tyrannus*		♦	♦		
Gizzard shad	*Dorosoma cepedianum*	♦	♦	♦		
Mummichog	*Fundulus heteroclitus*	♦	♦	♦		
Killifish	*Fundulus* spp.	♦	♦	♦		
Spot	*Leiostomus xanthurus*	♦	♦	♦		♦
Silversides	*Menidia* spp.	♦	♦	♦		
Atlantic croaker	*Micropongonias undalatus*	♦	♦	♦		
Bluefish	*Pomatus saltatrix*			♦	♦	♦
Hogchoker	*Trinectes maculatus*	♦	♦	♦		
INVERTEBRATE SPECIES						
Blue crab	*Callinectus sapidus*	♦	♦	♦	♦	♦
American oyster	*Crassotrea virginica*	♦	♦	♦	♦	♦

The Potomac River supports a diverse commercial fishery. Near the site, blue crab is the most important commercial species, followed by bluefish and American eel. Anadromous species and oysters are also caught near the site, although they are not a significant component of the commercial catch. Striped bass and bluefish are the most popular fish caught recreationally. Oyster beds in areas of the Potomac River may be closed on occasion due to fecal contamination, although all oyster beds on the river are currently open (Holbrook personal communication 1992). Some of the oyster beds in the Upper Machodoc Creek are closed due to sewage effluent that is discharged into Williams Creek (Wright personal communication 1992). There is currently a catch and release advisory posted by the Captain of NWSC Dahlgren for fish caught in Hideaway Pond due to high mercury concentrations that have been measured in fish tissue (Wray personal communication 1992).

Site-Related Contamination

Mercury, pesticides, and PCBs are the major contaminants of concern to NOAA. During the Confirmation Study, contaminant investigations

groundwater sample collected from a monitoring well downgradient of the Pesticide Rinse Area. Dieldrin and endrin were not detected in groundwater samples, but their detection limits were at least two orders of magnitude greater than their respective AWQCs (Table 3).

double the action level set by the U.S. Food and Drug Administration for protection of human health. NOAA is concerned that site contaminants could harm nearby wetlands habitats and finfish species in Gambo Creek, the unnamed creek draining Hideaway Pond, and commercial fisheries for eel, shellfish, and finfish in the Potomac River.

Summary

Mercury, pesticides, and PCBs have been detected in samples taken from various media at six Dahlgren sites. In particular, mercury was detected in one location at concentrations almost

Table 3. Maximum concentrations of contaminants measured in water, soil, and sediments from the NWSC Dahlgren site compared with screening guidelines

Contaminant	Ground-water µg/l	AWQC[1] µg/l	Soil mg/kg*	Average U.S. Soil[2] mg/kg	Sediment mg/kg*	ER-L[3] mg/kg
Trace Elements						
Mercury	0.70	0.025	<0.50	0.03	0.08	0.15
Organic Compounds						
DDT	2.0	0.001	110	NA	NT	0.001
DDD	4.0	NA	92	NA	NT	0.002
DDE	2.0	NA	130	NA	NT	0.002
Dieldrin	<1.0	0.0019	160	NA	NT	0.00002
Aldrin	<1.0	NA	2.4	NA	NT	NA
Endrin	<1.0	0.0023	7.0	NA	NT	0.00002
PCBs	<10	0.03	84	NA	NT	0.05

1: Ambient water quality criteria for the protection of aquatic organisms. Marine chronic criteria presented (EPA 1986).
2: Lindsay (1979).
3: Effects range-low; the concentration representing the lowest 10 percentile value for the data in which effects were observed or predicted in studies compiled by Long and Morgan (1990).
*: Expressed as mg/kg wet weight.
NA: Screening guidelines not available.
NT: Not tested.

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