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South Weymouth Naval Air Station

Plymouth and Norfolk Counties, Massachusetts
CERCLIS #MA2170022022

Site Exposure Potential

South Weymouth Naval Air Station (NAS SOWEY) occupies approximately 580 hectares in Plymouth and Norfolk counties in eastern Massachusetts approximately 24 km south of Boston and 10 km from the Atlantic coast (Halliburton NUS 1994; Figure 1). The station is situated approximately 4 km upstream from Whitmans Pond, and 16 km upstream from Indian Head River, both NOAA trust habitats. The station consists of the main station and four smaller remote areas. The main station, the focus of site investigations, was developed during the 1940s as a Lighter-than-Air facility for dirigible aircraft used to patrol the North Atlantic during World War II. The four remote areas associated with the site are not discussed in site-related documents. The station was closed at the end of the war, and reopened in 1953 as a Naval Air Station aviation training facility. Since that time, the facility has operated continuously. The station currently provides administrative coordination and logistical support for the Naval Air Reserve Training Detachment South Weymouth and performs functions directed by the Chief of Naval Operations (Halliburton NUS 1994).

As part of the Installation Restoration Program (IRP), the U.S. Navy's environmental program, Site Investigations were conducted at eight NAS

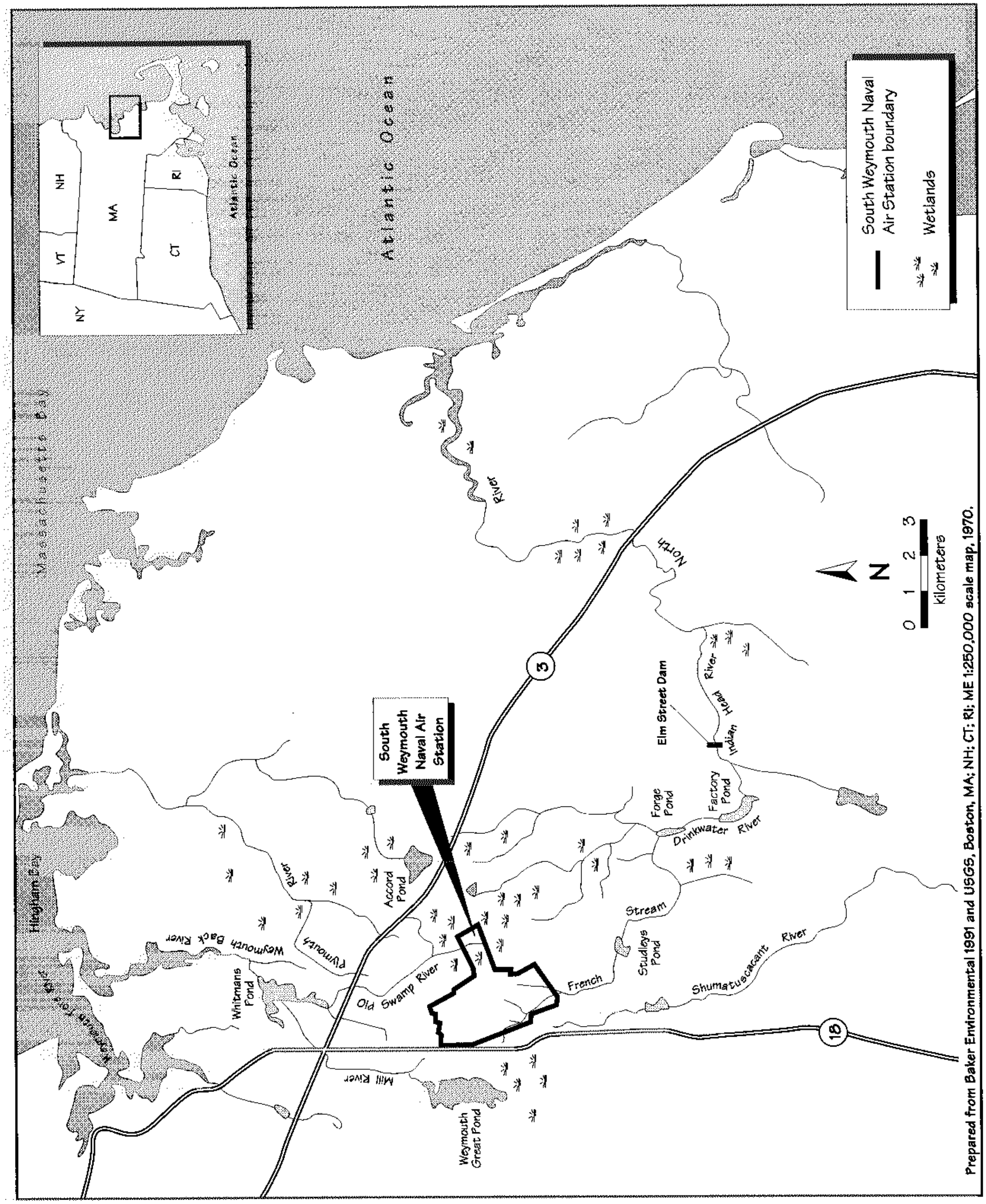

Figure 1. Location of the South Weymouth Naval Air Station in Massachusetts.

SOWEY sites previously identified as potential sources of contamination (Baker 1991). Primary wastes generated at the station throughout its operation included domestic waste, oils and hazardous materials, and sewage. The period of operation, types of waste disposed, and the chemicals of concern at each of these sites are presented in Table 1. Based on the operating history of the Sewage Treatment Plant, only a file review was conducted during the Site Investigation and no samples were collected. Sampling of environmental media at the Sewage Treatment Plant is proposed for future investigations at the site (Halliburton NUS 1994).

The station produces between 100 and 1,000 kg of hazardous waste per month. The station annually generates 12,000 l of waste engine oil, 4,100 l of waste hydraulic fluid, 12,000 l of waste solvents, and 630 l of waste transmission fluids, which are stored temporarily on site and later transported offsite to a hazardous waste disposal facility. There are no active landfills at the station. Since 1972, all solid, non-hazardous waste and garbage have been disposed offsite at a sanitary landfill (Baker 1991).

Several releases of hazardous materials have been documented at the station. In 1986, approximately 22,700 l of JP-5 jet fuel were spilled at an unidentified on-site location. In addition, oil containing PCBs was released from a transformer in 1986. PCB-contaminated soil was collected in the area of the spill and removed to an offsite disposal facility (Baker 1991).

The surface terrain around the station varies from relatively flat to rolling land and is characterized by bedrock outcrops, wetlands, and small stream channels. The station contains both urban and forested areas (Halliburton NUS 1994). Station elevation ranges from approximately 4 to 55 m above sea level, with a slope of usually less than 5 percent (Argonne National Laboratories 1988).

Surface runoff and groundwater migration are the potential pathways of contaminant transport from the station to NOAA trust resources and habitats. A surface water divide at NAS SOWEY directs runoff into two drainage basins. Surface and storm drainage water on western portions of the station enter a ditch system that flows southward into French Stream. Surface and storm drainage water on the northern and eastern portions of the station enter a ditch system that flows northward into Old Swamp River, and subsequently into the Weymouth Back River. Only shallow groundwater movement was discussed in the site-related documents; its movement at the station is complex and multidirectional. In general, shallow groundwater in the western part of the station probably discharges to Old Swamp River, while shallow groundwater in eastern portions of the station discharges to French Stream (Halliburton NUS 1994).

Table 1. Site description and associated wastes for eight sites evaluated at NAS SOWEY.

Site Name	Period of Operation	Waste Type	Size of Area (ha)	Chemicals of Concern
West Gate Landfill (WGL)	1969-1972	Domestic waste and debris	2	Trace elements, PAHs
Rubble Disposal Area (RDA)	c.1972-1980s	Building debris	1.5	Trace elements, PAHs, aldrin
Small Landfill (SL)	c.1972-1980's	Concrete rubble, tree stumps	0.8	Trace elements, PAHs
Fire Fighting Training Area (FFTA)	1950s-1986 1988-present	Jet fuels, waste oils	1.5	Trace elements, PAHs
Tile Leach Field (TLF)	1945-1968	Sanitary waste, battery acid	0.3	Trace elements, PAHs, aldrin
Fuel Tank Farm (FTF)	unknown	Oil and hazardous materials (OHM)	1.6	Trace elements, PAHs, aldrin
Sewage Treatment Plant	1956-1978	Sewage	0.04	Unknown
Abandoned Bladder-Tank Fuel Storage Area (ABTFS)	until 1987	JP-5 jet fuel	0.5	Trace elements, PAHs, aldrin

NOAA Trust Habitats and Species

Habitats of concern to NOAA are surface water and associated bottom substrates of the Indian Head River, North River, Old Swamp River, Whitmans Pond, and the Weymouth Back River, all used by anadromous species. Secondary habitats of concern to NOAA include surface water and associated bottom substrates of Hingham Bay.

Surface water associated with the station flows into two drainage basins (Figures 1 and 2). Northern and eastern portions of the station drain into the Old Swamp River, which discharges into Whitmans Pond. The Weymouth Back River, the drainage outlet of Whitmans Pond, discharges into Hingham Bay further downstream, which adjoins Massachusetts Bay. Southern and western portions of the station are drained by French Stream, which subsequently joins the Drinkwater River, and later the Indian Head River. The Indian Head River joins the North River. Lower portions of the Weymouth Back River and the North River are estuarine habitats.

Several anadromous species ascend the Weymouth Back River and North River for spawning. Runs of alewife, American shad, blueback herring, rainbow smelt, white perch,

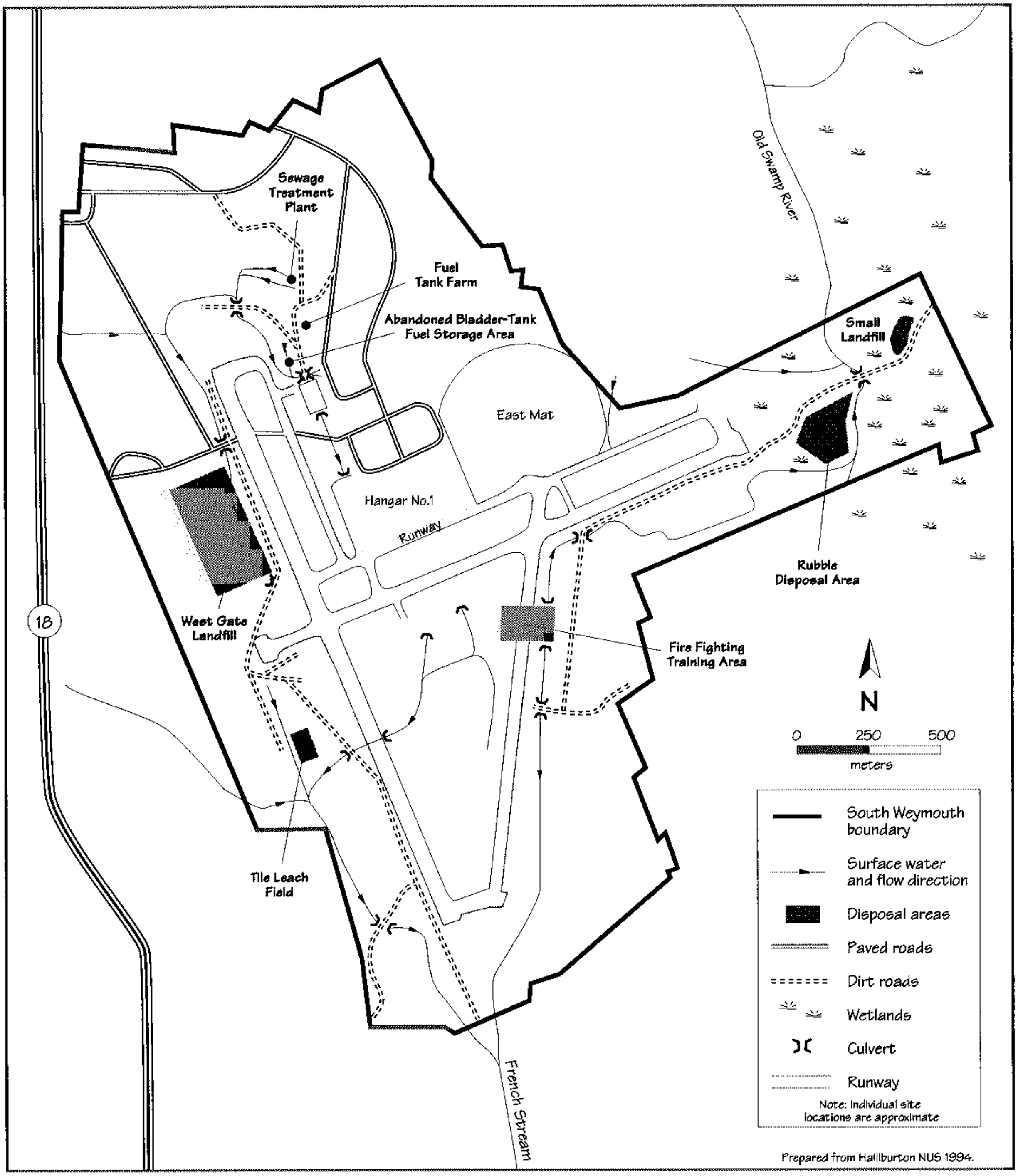

Figure 2. Site features at the South Weymouth Naval Air Station in Massachusetts.

and sea lamprey are present in both systems (Table 2). Alewife migrate the furthest upstream of the anadromous species, but they are restricted by the Elm Street dam in the Indian Head River, approximately 16 km downstream from the station. American shad and blueback herring use habitats further downstream for spawning. In the Weymouth Back River watershed, a large run of alewife returns annually to spawn in Whitmans Pond, approximately 4 km downstream from the station. Although unconfirmed, some adults may migrate upstream from the pond to spawn in the Old Swamp River near the station (Reback personal communication 1994).

Table 2.
Major species that use the Weymouth Back River and North River drainages downstream from the site.

Species		Habitat Use			Fisheries	
Common Name	Scientific Name	Spawning Ground	Nursery Ground	Adult Forage	Comm. Fishery	Recr. Fishery
ANADROMOUS/CATADROMOUS SPECIES						
Blueback herring	*Alosa aestivalis*	♦	♦	♦		
Alewife	*Alosa pseudoharengus*	♦	♦	♦		♦
American shad	*Alosa sapidissima*	♦	♦	♦		♦
American eel	*Anguilla rostrata*		♦	♦		
White perch	*Morone americana*	♦	♦	♦		
Striped bass	*Morone saxatilis*		♦	♦		♦
Rainbow smelt	*Osmerus mordax*	♦	♦	♦		♦
Sea lamprey	*Petromyzon marinus*		♦	♦		
MARINE SPECIES						
4-spine stickleback	*Apeltes quadracus*	♦	♦	♦		
Atlantic menhaden	*Brevoortia tyrannus*	♦	♦	♦		
Mummichog	*Fundulus heteroclitus*	♦	♦	♦		
Striped killifish	*Fundulus majalis*	♦	♦	♦		
3-spine stickleback	*Gasterosteus aculeatus*	♦	♦	♦		
Atlantic silverside	*Menidia menidia*	♦	♦	♦		
Atlantic tomcod	*Microgadus tomcod*	♦	♦	♦		
Longhorn sculpin	*Myoxocephalus octodecemspinosus*	♦	♦	♦		
Bluefish	*Pomatus saltatrix*		♦	♦		1
Northern searobin	*Prionotus carolinus*	♦	♦	♦		
Winter flounder	*Pseudopleuronectes americanus*	♦	♦	♦		
INVERTEBRATE SPECIES						
Green crab	*Carcinus maenas*	♦	♦	♦		
Blue crab	*Callinectes sapidus*	♦	♦	♦		♦
Common spider crab	*Libinia emarginata*	♦	♦	♦		
Quahog	*Mercenaria mercenaria*	♦	♦	♦		2
Soft shell clam	*Mya arenaria*	♦	♦	♦		2
Blue mussel	*Mytilus edulis*	♦	♦	♦		2

1: A general health advisory recommends limited consumption of bluefish inhabiting or originating from water of the mid-Atlantic Bight due to excessive concentrations of PCBs in their tissue (Reback personal communication 1994).
2: Harvesting of bivalves is prohibited due to potential fecal coliform contamination from urban runoff (Churchill personal communication 1994).

Alewife, blueback herring, and American shad generally enter freshwater aquatic habitats associated with the station to spawn in suitable upstream environments from March through May. Juveniles normally return to the ocean by the following fall. Sea lamprey on the northern Atlantic seaboard return to fresh water to spawn in the spring, but spend the majority of their life at sea. Adult rainbow smelt enter the estuarine water of Weymouth Back River and North River in October for overwintering, then later spawn in small freshwater brooks and streams above the head of tide during the spring. Smelt commonly migrate to offshore areas by May (Reback personal communication 1994).

Species using estuarine habitats of the Weymouth Back River and the North River on a year-round basis in greatest densities include Atlantic silverside, threespine and fourspine stickleback, killifish, longhorn sculpin, and northern searobin. Atlantic menhaden, bluefish, and striped bass frequently enter the estuaries to forage. Winter flounder and Atlantic tomcod spawn in the estuaries and later migrate into more saline water. The catadromous American eel is found throughout the area (Reback personal communication 1994). This is the only NOAA trust species capable of migrating upstream of the Elm Street Dam on the Indian Head River. There are populations of blue crab, blue mussel, green crab, quahog, and soft-shell clam in lower portions of the Weymouth Back River and North River (Churchill personal communication 1994).

There are no commercial fisheries in the Weymouth Back River and North River drainages. There is some recreational fishing directed primarily toward American shad, bluefish, and striped bass in these rivers. Alewife and rainbow smelt are also commonly harvested during seasonal migratory runs in the spring. There is also moderate recreational fishing for blue crab. Harvesting bivalves from the Weymouth Back River and North River systems is prohibited because of the potential threat of fecal coliform contamination associated with urban runoff (Churchill personal communication 1994).

A general health advisory recommends limited consumption of bluefish inhabiting or originating from the Mid-Atlantic Bight because of excessive concentrations of PCBs in their tissue.

Site-Related Contamination

In 1991, 12 sediment, 39 soil, 20 groundwater, and 12 surface water samples were collected from on-site locations as part of the IRP Site Investigations (Baker 1991). Environmental samples were collected from seven of the potential source areas: the West Gate Landfill, Rubble Disposal Area, Small Landfill, Fire Fighting Training Area, Tile Leach Field, Fuel Tank Farm, and the Abandoned Bladder-Tank Fuel Storage Area.

All sediment, soil, groundwater, and surface water samples were analyzed for all parameters on EPA's Target Compound List/Target Analyte List. In addition, groundwater samples were analyzed for dissolved metals and surface water samples were analyzed for total metals. Samples from selected sites were analyzed for TPH, oil and grease, and sulfate.

Trace elements and PAHs are the primary contaminants of concern to NOAA. Aldrin, a pesticide, was detected at three of the six waste sites sampled. PCBs and numerous additional VOCs and SVOCS are also known to have been used and handled at the station. VOCs and SVOCS detected at concentrations exceeding screening guidelines are presented in Table 3. No PCBs were detected in on-site media; detection limits were not provided in documentation reviewed.

Trace elements were detected in some areas at elevated concentrations in soils, sediments, surface water, and groundwater. Lead was detected in soil samples collected from the Rubble Disposal Area (31 mg/kg) and the Fire Fighting Training Area (29 mg/kg), but concentrations were only slightly above average U.S. soil concentrations for this trace element (16 mg/kg). Zinc was detected in soil samples collected from the Small Landfill (75 mg/kg); the highest measured concentrations of zinc exceeded the average U.S. soil screening guidelines (48 mg/kg). Silver (in samples collected from the Small Landfill and the Fire Fighting Training Area) was the only trace element detected in groundwater at a concentration above its freshwater chronic AWQC (U.S. EPA 1993) by a factor greater than ten. Lead (in samples collected from the Rubble Disposal Area and the Fire Fighting Training Area) and zinc (in samples collected from the Fire Fighting Training Area) were the only trace elements detected in sediment samples at concentrations exceeding their respective ERL screening guidelines (Long and MacDonald 1992; Table 3). The concentration of zinc also exceeded its ERM screening guideline (Long and MacDonald 1992). Lead, silver, and zinc were detected in surface water samples collected from the Fire Fighting Training Area at concentrations exceeding their respective AWQC screening guidelines (Table 4).

Acenaphthene, anthracene, benz(a)anthracene, chrysene, fluoranthene, phenanthrene, pyrene, and 2-methylnaphthalene were detected in sediment samples collected from the Abandoned Bladder-Tank Fuel Storage Area and Fuel Tank Farm at concentrations exceeding their respective ERL screening guidelines (Table 3). The Rubble Disposal Area was the only on-site area that contained a PAH (phenanthrene) at a concentration (260 μg/kg) exceeding the ERL screening guideline. PAHs were detected infrequently in groundwater samples and did not exceed the AWQC screening guideline by a factor greater than ten. Only a limited distribution of PAHs was detected in on-site soil samples. The highest concentrations of PAHs in soils were measured in one sample collected from the Rubble Disposal Area. Maximum soil concentrations of PAHs in this area included acenaphthene (110 μg/kg), anthracene (210 μg/kg), benz(a)anthracene

(750 µg/kg), chrysene (1,100 µg/kg), fluoranthene (1,900 µg/kg), phenanthrene (1,200 µg/kg), and pyrene (1,200 µg/kg).

Aldrin, the only pesticide reportedly detected in on-site media, was found only in the sediment samples collected from the West Gate Landfill (48 µg/kg), Tile Leach Field (48 µg/kg), and Abandoned Bladder-Tank Fuel Storage Area-Fuel Tank Farm (130 µg/kg). No sediment concentration screening guidelines have been developed for this pesticide.

Table 3. Maximum concentrations of contaminants of concern detected in sediment samples collected from waste sites located at NAS SOWEY.

	Sediment						Screening Guidelines	
Contaminants	WGL	RDA	SL	FFTA	TLF	ABTFS-FTF[1]	ERL[2]	ERM[3]
INORGANIC SUBSTANCES (mg/kg)								
Lead	10	70	NS	150	NR	10	46.7	218
Silver	NR	ND	NS	NR	NR	NR	1.0	3.7
Zinc	NR	NR	NS	810	NR	NR	150	410
ORGANIC COMPOUNDS (µg/kg)								
PAHs								
Acenaphthene	NR	NR	NS	NR	NR	150	16	500
Anthracene	NR	NR	NS	NR	NR	240	85.3	1,100
Benz(a)anthracene	NR	NR	NS	NR	NR	530	260	1,600
Chrysene	NR	NR	NS	NR	NR	550	380	2,800
Fluoranthene	NR	280	NS	NR	NR	1,300	600	5,100
Naphthalene	NR	NR	NS	ND	NR	100	160	2,100
Phenanthrene	NR	260	NS	NR	NR	1,400	240	1,500
Pyrene	NR	260	NS	NR	NR	1,400	670	2,600
2-Methylnaphthalene	NR	NR	NS	NR	NR	790	70	670
ORGANOCHLORINE COMPOUNDS								
Aldrin (µg/kg)	NR	48	NS	NR	48	130	NA	NA

1: Although the ABTFS and the FTF are separate waste sites, contaminant information for these areas was provided in the site-related documents as combined data sets.
2: 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 MacDonald (1992).
3: Effects range-median (Long and MacDonald 1992).
NA: Screening guidelines not available.
ND: Not detected; detection limit not available.
NR: Not reported.
NS: Not sampled.

Table 4. Maximum concentrations of contaminants of concern detected in surface water (µg/l) samples collected from waste sites located at NAS SOWEY.

Contaminants	Surface Water						Freshwater AWQC[1]	
	WGL	RDA	SL	FFTA	TLF	ABTFS FTF	Chronic	Acute
INORGANIC SUBSTANCES								
Lead	6.1	5.4	NR	11	ND	5.8	3.2+	83+
Silver	ND	23	NR	ND	ND	ND	0.12	4.1+
Zinc	ND	ND	NR	154	ND	ND	110+	120+
ORGANIC COMPOUNDS								
PAHs								
Naphthalene	ND	ND	NR	2[2]	ND	ND	620[2]	2300[2]

1: Ambient water quality criteria for the protection of aquatic organisms (U.S. EPA 1993).
2: Lowest observed effects levels.
ND: Not detected; detection limit not available.
NR: Not reported.
+: Value is dependent on hardness (100 mg/l $CaCO_3$ assumed).

Summary

Trace elements and PAHs have been detected in soil, surface water, sediment, and groundwater samples collected from seven of the hazardous waste sites associated with NAS SOWEY. Preliminary data show that contaminants are present at concentrations marginally exceeding those shown to be toxic to NOAA trust resources. Anadromous trust resources are known to use Whitmans Pond and the Indian Head River, approximately 4 km and 16 km downstream from the station, respectively. In addition, American eel may inhabit on-site surface water of French Stream and the Old Swamp River. No conclusions about the overall risk posed by the facility to resources of concern to NOAA can be made until the extent of contaminant migration from the station is known.

References

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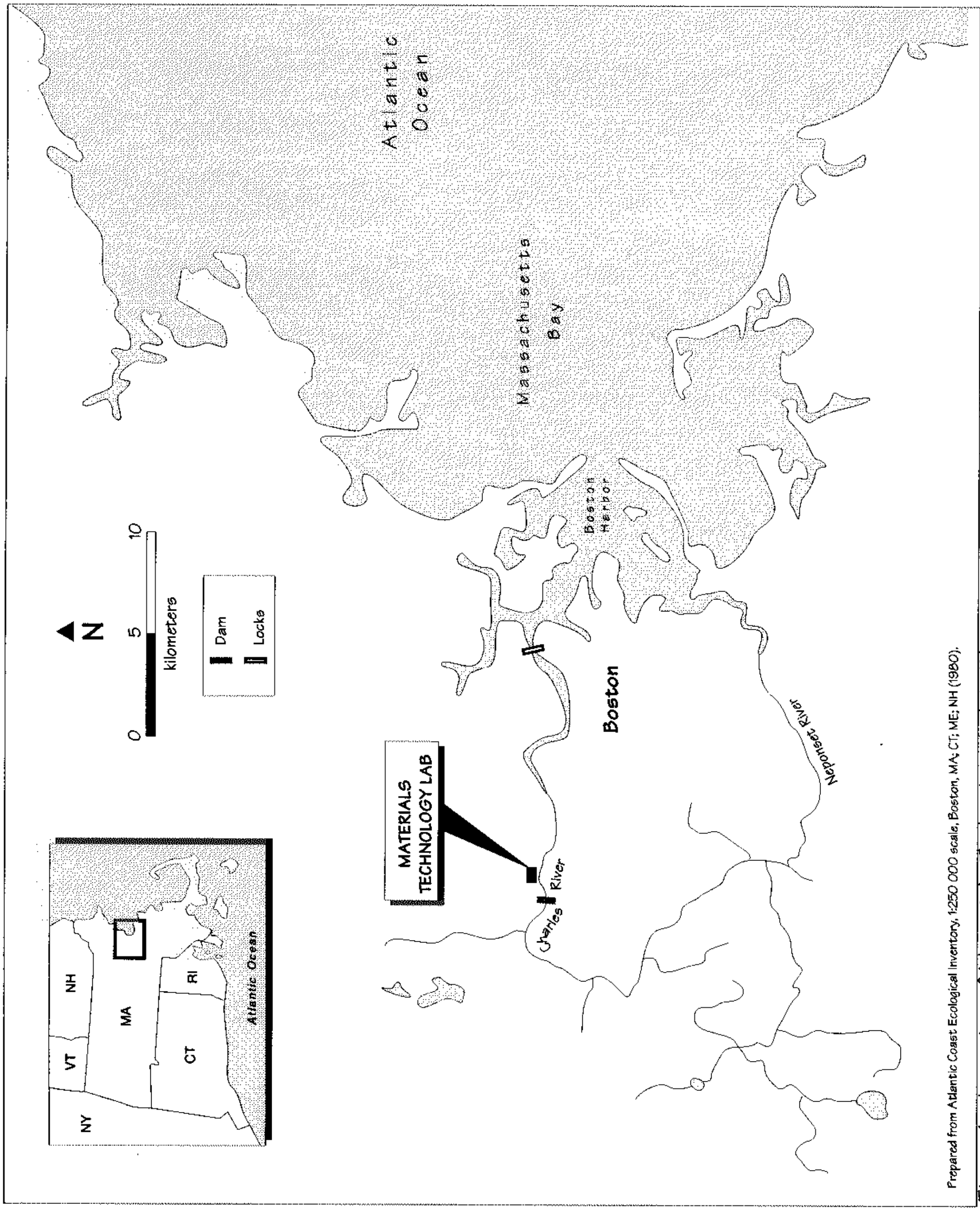
U.S. Army Materials Technology Laboratory

Watertown, Massachusetts
CERCLIS #MA0213820939

Site Exposure Potential

The U.S. Army Materials Technology Laboratory (MTL) covers 19 hectares along the northern bank of the Charles River in Watertown, Massachusetts, a suburb of Boston. The Charles River flows through Boston before discharging into Boston Harbor, approximately 14 km from the site. Boston Harbor is a coastal embayment of Massachusetts Bay, the region in the Atlantic Ocean located north of Cape Cod (Figure 1).

The MTL facility engaged in ammunition and pyrotechnics production, material testing, and experimentation with paint, lubricants, and cartridges from 1816 until World War II. At the height of its activity, the facility encompassed 53 hectares, contained 53 buildings, and employed 10,000 people. The site was also the location of a research nuclear reactor from 1960 until 1970. Today MTL's mission is materials research and development, weapons and ammunition development and production, solid mechanics, testing technology, and lightweight armor development. Sources of contamination are improper handling, storage, and disposal of hazardous materials related to past site activities (no specific activities were addressed in the documents reviewed). Although a portion of the site was allegedly used for landfilling (Site 2, Figure 2), the amount and types of materials



Prepared from Atlantic Coast Ecological Inventory, 1:250 000 scale, Boston, MA; CT; ME; NH (1980).

Figure 1. Location of Materials Technology Lab in Watertown, Massachusetts.

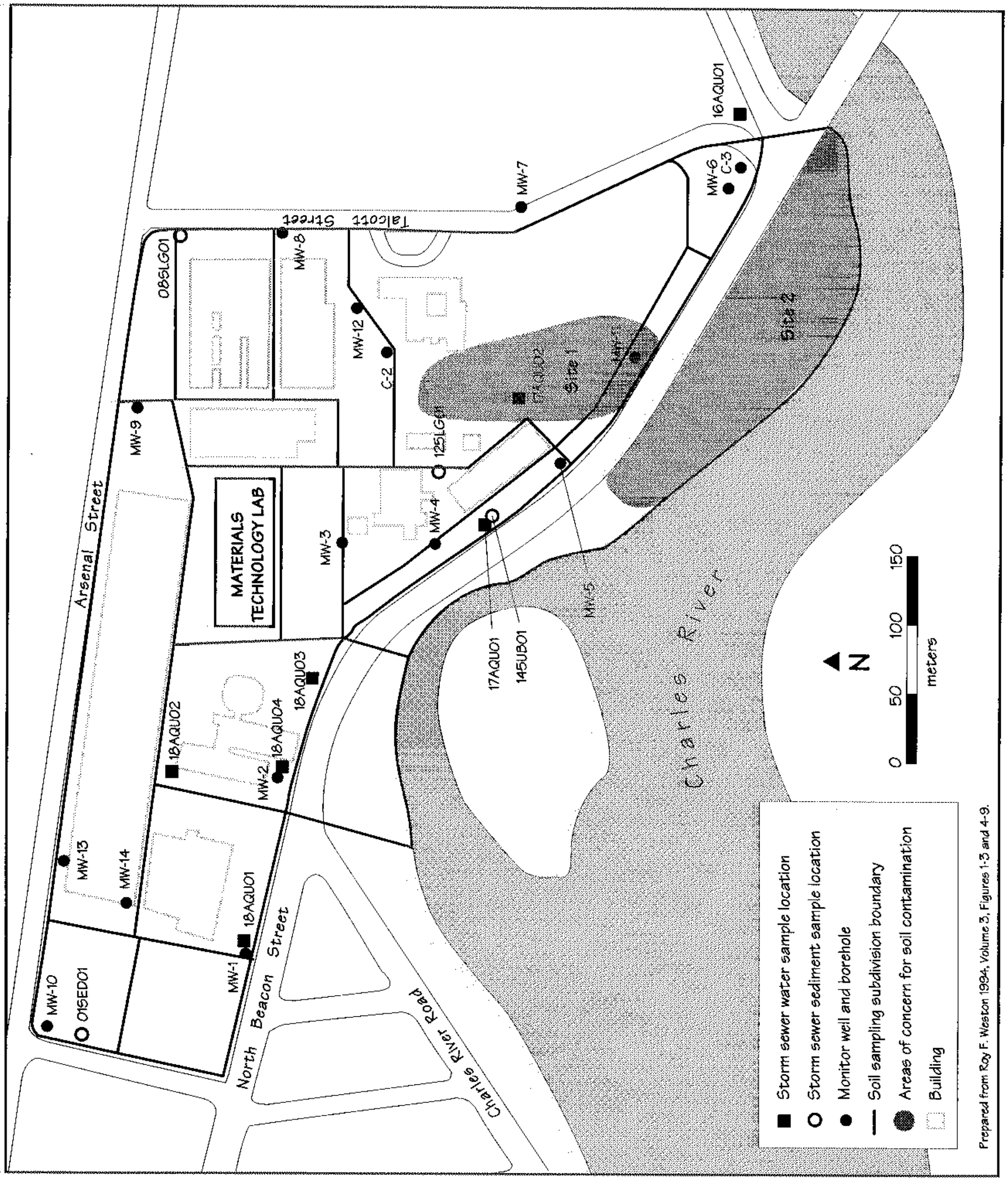


Figure 2. Detail of Materials Technology Lab site.

disposed are unknown (Halliburton NUS Environmental Corporation, 1993). Congress recommended closing the facility in October 1988. Closure procedures (i.e, RI/FS and remedial actions) continue at this time.

Surface water runoff, direct discharge, and groundwater migration are the potential pathways of contaminant transport from the site to NOAA trust resources and associated habitats. Approximately 75 percent of the site is covered with impervious surfaces, and the majority of surface water runoff is directed to an extensive storm sewer system. This on-site storm sewer system discharges directly to the Charles River through several outfalls. Groundwater beneath the site flows generally south and southeast towards the Charles River. Much of the site is overlain by over 3 m of sand and gravel fill, with glacial till deposits and bedrock siltston beneath. The glacial deposits range from 15 m thick on the western boundary to 45 m thick to the east. The current MTL property lies outside the 500-year flood zone, exception for a narrow strip of land along the riverbank (Roy F. Weston, Inc. 1994).

NOAA Trust Habitats and Species

Surface water and associated bottom substrates of the Charles River are habitats of primary concern to NOAA. NOAA trust resources near the site include four anadromous species: blueback herring, rainbow smelt, alewife, and American shad; and the catadromous American eel, which is found throughout the Charles River (Table 1). The surface water near the site is fresh water; the Charles River Dam and Locks 11.5 km downstream, in the lower Charles River basin, restrict the upstream flow of saline water from Boston Harbor. The Watertown Dam, about 2.5 km upstream from the site, is equipped with a functional fish ladder. Immediately below this dam,

Table 1. Major NOAA trust species that use surface water of the Charles River near the Materials Technology Lab site.

Species		Habitat			Fisheries	
Common Name	Scientific Name	Spawning	Nursery	Adult Forage	Comm.	Recr.
ANADROMOUS SPECIES						
Blueback herring	*Alosa aestivalis*	♦	♦	♦		♦
Alewife	*Alosa pseudoharengus*		♦	♦		
American shad	*Alosa sapidissima*		♦	♦		
Rainbow smelt	*Osmerus mordax*	♦	♦	♦		
CATADROMOUS SPECIES						
American eel	*Anguilla rostrata*		♦	♦		

increased water velocity and a bottom substrate of cobbles and larger rocks form a riffle habitat. The water flow decreases approximately 200 m below the dam, creating a slow-moving, meandering river habitat (Chase personal communication 1994). The Charles River receives runoff from combined sewer overflows and is considered eutrophic. Dissolved oxygen concentrations in the river are low, but remain above 5 mg/l. The river near the site is designated Class B (fishable and swimmable; Life Systems, Inc. 1993; Tisa personal communication 1994).

The blueback herring run on the Charles River is considered one of the largest in Massachusetts; densities of this anadromous species are highest near the site. Both blueback herring and rainbow smelt use the riffle habitat below the Watertown Dam for spawning. Blueback herring also spawn upstream from the Watertown Dam. Limited numbers of rainbow smelt migrate above the dam (Brady personal communication 1994).

Alewife and American shad are found in low numbers in the Charles River. Since the late 1970s the State of Massachusetts has conducted a stocking program to restore American shad in the Charles River. However, only a few returns have been documented above the Watertown Dam, and the program is being re-evaluated to determine the most effective stocking methods (e.g., stocking gravid adults versus juveniles). American shad spawn in slower-moving water upstream from the Watertown Dam, and possibly in the lower Charles River basin above the locks (Brady personal communication 1994).

There is a small recreational fishery for blueback herring, which are caught primarily for bait. The State allows herring to be caught only with a small, hand-held dip net and limits the catch to four days per week to protect the resource. However, it has proven difficult for the State to enforce these restrictions (Brady personal communication 1994). Sportfishing for rainbow smelt is prohibited during the smelt spawning season, from March 15 to June 15. The population of American shad is too small to support a recreational fishery, although some fish are caught incidentally. One of the goals of the American shad restoration program is to develop a sport fishery for shad in the Charles River (Brady personal communication 1994).

Site-Related Contamination

Data collected during the 1992 Phase 2 remedial investigation indicate that soils, groundwater, surface water, and sediments at the MTL facility contain elevated concentrations of site-related contaminants (Roy F. Weston, Inc. 1994). The primary contaminants of concern are trace elements, PAHs, and pesticides. Maximum concentrations of inorganic and organic contaminants are summarized in Tables 2 and 3, along with applicable screening guidelines. Maximum concentrations of radiological compounds detected are presented in Table 4.

Soil sampling was completed in November 1992. A total of 176 surface soil and boring samples were collected for laboratory analysis and used to evaluate the nature and extent of soil contamination at the MTL facility. There are two primary pathways by which soil contamination can migrate to other media: erosion and runoff to storm sewers with discharge to the Charles River, and leaching of contaminants to groundwater. Two portions of the MTL site have been identified as areas with contaminated soils (Halliburton NUS Environmental Corporation 1993). These areas, designated as Sites 1 and 2, are situated in the southeastern part of the MTL site near the Charles River (Figure 2). Soils from both sites contain trace elements at concentrations exceeding average U.S. soil concentrations (Table 3). Pesticides and PAHs were detected at both sites, but screening guidelines are not available for organic compounds in soils.

Groundwater samples were collected from 26 on-site wells and five off-site wells in December 1991 to ascertain the extent of groundwater contamination. Concentrations of cadmium and lead exceeded their respective chronic freshwater AWQC by more than a factor of ten. In addition, the pesticides DDT, heptachlor, and dieldrin were present at concentrations exceeding their chronic freshwater AWQCs, as shown in Table 2 (Roy F. Weston, Inc. 1994).

Table 2. Maximum concentrations (µg/l) in water samples collected for the Phase 2 Remedial Investigation Report, Army Materials Technology Laboratory.

Analyte	Groundwater	Stormwater	Charles River downstream from site	Charles River upstream from site	AWQC[1]
TRACE ELEMENTS					
Cadmium	32	NT	4.8	0.18	1.1+
Chromium	60	NT	19	2.5	11*
Copper	48	580	ND	20	12+
Lead	54	74	4.4	9.5	3.2+
Zinc	97	500	44	49	86
PESTICIDES					
DDT	0.28	ND	ND	ND	0.001
Heptachlor	0.19	ND	ND	ND	0.0038
Lindane	0.17	ND	0.0037	0.0034	0.08
Dieldrin	0.031	ND	ND	ND	0.0019

1: Ambient water quality criteria for the protection of aquatic organisms. The lower value of the marine or freshwater chronic criteria is presented (EPA 1993) because waste sites are located near both marine and freshwater environments.
NT: Not tested
ND: Not detected
+: Value dependent on hardness (100 mg/l $CaCO_3$ used)
*: Value is for Cr^{+6}

Table 3. Maximum concentrations (mg/kg) in soil and sediment samples collected for the Phase 2 Remedial Investigation Report, Army Materials Technology Laboratory.

	Soil		Sediment			
Analyte	Soil	Average U.S. soil[1]	Stormdrain	Charles River downstream from site	Charles River upstream from site	ERL[2]
TRACE ELEMENTS						
Cadmium	13	0.06	6.2	25	13	1.2
Chromium	380	100	450	160	120	81
Copper	1400	30	15,000	1000	280	34
Lead	7200	10	560	1,900	780	47
Mercury	4.50	0.03	15	2.2	1.7	0.15
Nickel	1800	40	230	55	39	21
Zinc	1400	50	1000	890	690	150
ORGANIC COMPOUNDS						
Acenaphthene	75	NA	NT	4.7	0.454	0.016
Anthracene	120	NA	NT	10.1	NT	0.085
Benzo(a)anthracene	340	NA	16.3	23	10	0.26
Benzo(a)pyrene	120	NA	NT	29	17	0.430
Chrysene	280	NA	18	22	3.0	0.38
Dibenz(a,h)anthracene	47	NA	NT	4.3	NT	0.063
Fluoranthene	120	NA	26	31	13	0.60
Fluorene	170	NA	1.3	5.6	0.89	0.035
2-Methylnaphthalene	72	NA	NT	1.1	0.53	0.065
Phenanthrene	240	NA	22.5	80	8.9	0.24
Pyrene	120	NA	32	58	22	0.67
PESTICIDES						
DDD	3.5	NA	NT	0.62	0.25	0.002
DDE	6.3	NA	NT	0.38	0.18	0.002
DDT	9.6	NA	NT	0.7	0.31	0.001
Heptachlor	0.032	NA	NT	ND	NT	NA
Lindane	0.26	NA	NT	0.001	NT	NA
Dieldrin	4.0	NA	NT	0.48	1.9	0.00002
Endrin	0.34	NA	NT	0.05	NT	0.00002

1 Lindsay (1979).
2: 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 MacDonald (1992).
NT: Not tested
ND: Not detected
NA: Not available

Fourteen river water samples were collected; nine samples were collected downstream of the site and five samples were collected upstream to provide background data for comparison. Five more water samples were collected from on-site storm sewers that drain directly to the Charles River (Roy F. Weston, Inc. 1994). Cadmium, chromium, and lead were detected at concentrations exceeding chronic freshwater AWQC (Table 2) in the Charles River below the site.

Table 4. Maximum concentrations (pCi/g) for radioactive analytes detected in samples from Army Materials Technology Laboratory.

	Water			Soil	Sediment	
Radioactive Analyte	Charles River	Storm Sewer	Groundwater	On-site	Charles River	Storm Sewer
Alpha gross	2	3	24	38	35	110
Beta gross	10	5	110	39	38	120
Uranium-234	0.9	0.2	1.3	2.4	1.4	7.9
Uranium-235	NT	NT	0.1	0.3	0.2	0.9
Uranium-238	0.5	0.1	1.2	3.4	1.5	55

NT: Not tested

Copper and lead in river water collected upstream of the site exceeded chronic freshwater AWQC (Table 2). Copper, lead, and zinc concentrations in stormwater draining the site also exceeded chronic freshwater AWQC (Table 2).

Sediment samples were collected from the Charles River at 13 locations downstream from the MTL site, five locations upstream, and from four storm sewers located on the site (Roy F. Weston, Inc. 1994). Trace elements, PAHs, and pesticides were found in sediments at concentrations that pose a threat to NOAA trust resources. Sediments sampled from the Charles River (downstream and upstream) and stormdrains draining the site exceeded ERL guidelines for seven trace elements: cadmium, chromium, copper, lead, mercury, nickel, and zinc. Several pesticides and PAH compounds were also detected in sediments at concentrations exceeding screening guidelines (Table 3).

Radiological compounds were detected in surface water, groundwater, soil, and sediment samples (Table 4). Although detected radionuclides at the site exceeded upstream concentrations in both surface water and sediment, the consultant to the U.S. Army advised EPA that remediation of radiological contamination in the environment at MTL was not needed (Roy F. Weston, Inc. 1994). No screening guidelines are available to assess the potential radiological threat to NOAA trust resources. All buildings known or suspected to be contaminated were decontaminated in May 1993 (Roy F. Weston, Inc. 1994).

Summary

Trace element and pesticide concentrations detected in the Army MTL site's groundwater, surface water, soil, and sediments exceeded screening guidelines. PAHs were also detected in soils and sediments. PAH concentrations in sediment exceeded ERL screening guidelines. NOAA trust resources near the site include four anadromous species: blueback herring, rainbow smelt, alewife, and American shad; and the catadromous American eel. The blueback herring run is one of the largest in Massachusetts, with densities highest near the site. Site-related contamination could affect these NOAA trust resources near the site as well as habitat in the Charles River and Boston Harbor downstream from the site.

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