Mohawk Tannery

Nashua, New Hampshire

EPA Facility ID: NHD981889629

Basin: Nashua

HUC: 01070004

Executive Summary

The Mohawk Tannery site, also known as Granite State Leathers, is in Nashua, Hillsborough County, New Hampshire. The Mohawk Tannery operated along the Nashua River from 1924 to 1984, producing tanned hides for leather. It is assumed that effluent was discharged directly into the Nashua River before the settling lagoons were constructed in the 1960s. The primary contaminants of concern to NOAA at the site are metals and pentachlorophenol. The habitats of primary concern to NOAA are the Nashua River and associated wetlands. NOAA trust resources that use the Nashua River for spawning, nursery, and/or adult habitat are alewife, American shad, Atlantic salmon, blueback herring, white perch, yellow perch, and American eel. Surface water runoff and groundwater are the primary pathways for the migration of contaminants from the site to NOAA trust resources.

Site Background

The Mohawk Tannery site, also known as Granite State Leathers, is in Hillsborough County, New Hampshire, approximately 1.6 km (1 mi) west of Nashua (Figure 1). The site is approximately 12 ha (30 acres) in area. The tannery facilities are on the northern 6 ha (15 acres) of the site. Ten buildings and seven unlined settling lagoons remain at the site. The southern six ha (15 acres) of the site is undeveloped and characterized as woods, fields, and wetlands. The site is bordered to the north by a landfill, to the east by a residential area, and to the west by the Nashua River (Figure 2).

The Mohawk Tannery operated along the Nashua River from 1924 to 1984, producing tanned hides for leather (USEPA 2000). Numerous metals and organic chemicals are used in the tanning process including chromium, sodium chloride, sodium sulfate, chlorinated phenols, dyes, toluene, chlorobenzene, and trichloroethylene. The tannery operations produced approximately 567,812 L (150,000 gal) of effluent daily. The effluent was composed of approximately 189,271 L (50,000 gal) of alkaline waste and approximately 378,541 L (100,000 gal) of acidic waste. The alkaline waste was composed of undissolved lime and solids containing protein such as hair, flesh, and hide scraps. The acid waste was composed of chromium tanning materials as well as some hide residue, retanning materials, and alkaline water from pre-tanning processes (NHDES 1996).

Information on waste treatment between 1924 and 1960 is not available. It is assumed that before construction of the settling lagoons in the 1960s, effluent was discharged directly into the Nashua River. During the 1960s, the alkaline and acid effluent streams were combined and deposited into unlined settling lagoons known as Areas I and II (Figure 2). Areas I and II are approximately six to nine m (20 to 30 ft) east of the Nashua River, and overflow from Areas I and II was deposited into the Nashua River (NHDES 1996). Areas I and II lie within the 100-year flood zone.

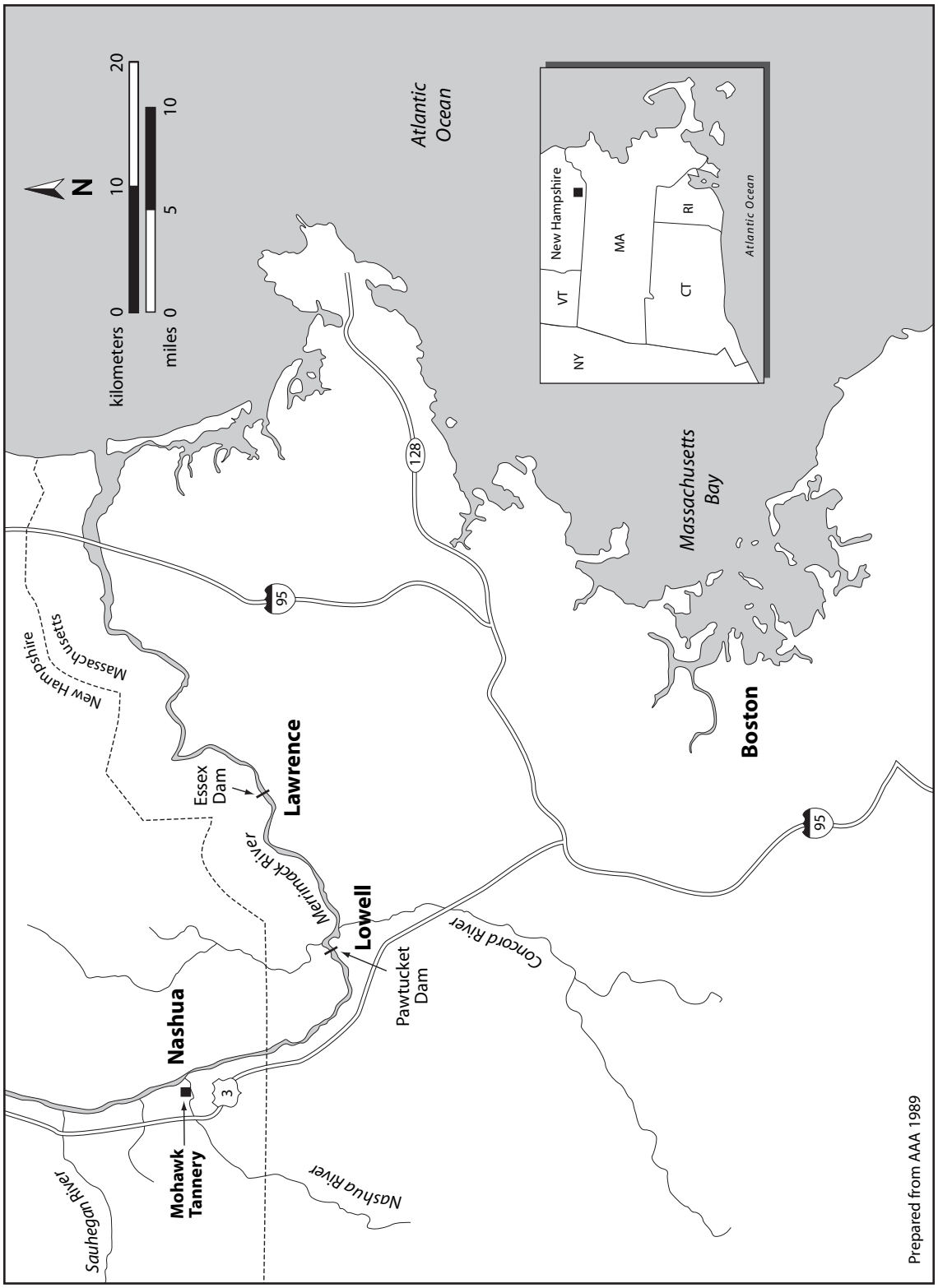

Figure 1. Location of the Mohawk Tannery site, Nashua, New Hampshire.

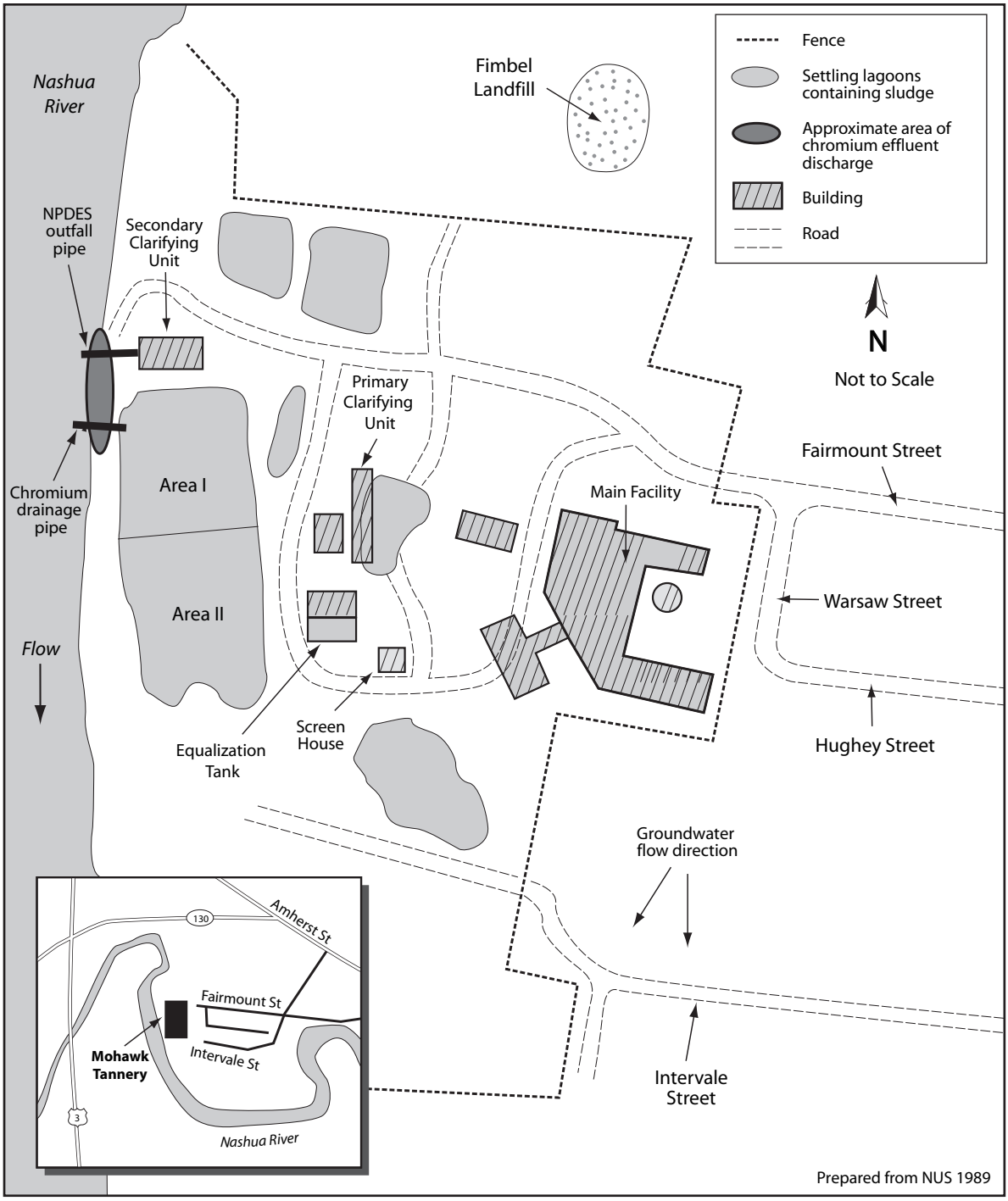

Figure 2. Detail of the Mohawk Tannery property, Nashua, New Hampshire.

During the early 1970s, separate treatment processes were installed for alkaline and acid effluents. The alkaline effluent was pumped underground from the main facility to an elevated wooden sluiceway, which transported the effluent to the screen house, where solids were removed. After the solids were removed the alkaline effluent was transported through a second wooden sluice-

way to Areas I and II for long-term deposition, after which the remaining liquid was discharged into the Nashua River (NHDES 1996; Tyler 2000). The acid effluent was also pumped from the main facility in an underground pipe to an elevated sluiceway and passed through five unlined settling lagoons before discharging into the Nashua River via an open ditch. Sludge was periodically dredged from the ditch and placed in unlined settling lagoons to dry (NHDES 1996; Tyler 2000).

During the early 1980s, an on-site treatment facility was completed. The alkaline waste stream was screened and treated with manganese sulfate and then transported to the sulfide oxidation tank. The acid waste stream was treated with lime and then transported to the equalization tank. After treatment, the alkaline waste stream was combined with the acid waste stream in the equalization tank. The combined effluent was first sent to the primary clarifier, next to Area I for sedimentation, and then to a secondary clarifier. Liquid remaining in the secondary clarifier was pumped into the Nashua River under a National Pollutant Discharge Elimination System (NPDES) permit. Area I remains open and contains liquid and sludge. The secondary clarifier contains sludge, as do the remaining unlined settling lagoons, which have been covered with fill, logs, and sand (USEPA 2000). Sludge was also deposited in the Fimbel Landfill north of the site, which was leased by the Mohawk Tannery while it was in operation (GZA 1985).

Nine potential contaminant source areas have been identified in relation to the Mohawk Tannery site: seven unlined settling lagoons, Fimbel Landfill, and the location where chromium drainage pipes discharged effluent directly into the Nashua River (Tyler 2000). Several 208 L (55 gal) drums, originally from Amoskeag Leather Company, were transported to the Mohawk Tannery site and dumped into the lined Fimbel Landfill. Two accidental discharges of sodium hydrosulfate, the first approximately 379 L (100 gal) and the second approximately 4,921 L (1,300 gal), may also have contributed to contamination in the area (Tyler 2000).

In 1985, a site investigation found metals and volatile organic compounds (VOCs) in groundwater, surface water, and soil. During a 1993 expanded site inspection conducted by the New Hampshire Department of Environmental Services (NHDES), metals were found in sediment and soil samples taken from the Nashua River. Fieldwork for a remedial investigation/feasibility study of the site was completed in 2003; however, data from that investigation were not available for review at the time of this report (USEPA 2004). The Mohawk Tannery site was proposed for placement on the National Priorities List on May 11, 2000.

Surface water runoff and groundwater are the primary pathways for the migration of contaminants from the site to NOAA trust resources. Sediment transport is a secondary pathway. Surface water from the site generally flows west toward the Nashua River. There are numerous wetlands in the vicinity of the site and Areas I and II are classified as wetlands by the NHDES (NHDES 1996). Groundwater beneath the site is encountered at approximately four to seven m (13 to 23 ft) below ground surface and generally flows south to southwesterly to the Nashua River (GZA 1985).

NOAA Trust Resources

The habitats of primary concern to NOAA are the Nashua River and associated wetlands. The Merrimack River, which is farther downstream of the site, is a habitat of secondary concern. The Nashua River joins the Merrimack River approximately 5.6 km (3.5 mi) downstream of the site. The Merrimack River then flows approximately 84 km (52 mi) before draining into the Atlantic Ocean.

NOAA trust resources that use the Nashua River and Merrimack River for spawning, nursery, and/or adult habitat are the anadromous alewife, American shad, Atlantic salmon, blueback herring, white

perch, and yellow perch and the catadromous American eel (Table 1; Greenwood 2004). There are two dams along the Merrimack River: Essex Dam in Lawrence, Massachusetts, and Pawtucket Dam in Lowell, Massachusetts (Figure 1). Historically, both dams blocked fish passage from the Atlantic Ocean upstream to the confluence of the Nashua and Merrimack Rivers. The dams now have fish lifts, allowing fish passage upstream of the dams into the Nashua River (USFWS 2004).

Table 1. NOAA trust species found in the Nashua and Merrimack Rivers in the vicinity of the Mohawk Tannery site (NHDES 1996; Greenwood 2004).

Species		**Habitat Use**			**Fisheries**	
Common Name	Scientific Name	Spawning Area	Nursery Area	Adult Habitat	Comm.	Rec.
ANADROMOUS FISH						
Alewife	*Alosa pseudoharengus*	◆	◆			
American shad	*Alosa sapidissima*	◆	◆			◆
Atlantic salmon	*Salmo salar*		◆			◆
Blueback herring	*Alosa aestivalis*	◆	◆			
White perch	*Morone americana*	◆	◆	◆		◆
Yellow perch	*Perca flavescens*	◆	◆	◆		◆
CATADROMOUS FISH						
American eel	*Anguilla rostrata*			◆		

The New Hampshire Department of Fish and Game stocks the Nashua River annually with American shad and alewife. In 1993, the Department of Fish and Game and the U.S. Fish and Wildlife Service created the Merrimack River Anadromous Fish Restoration Program in an effort to restore Atlantic salmon to the Merrimack River basin (NHFG 2004). Fingerlings, raised in the National Fish Hatchery at Nashua, are stocked in several tributaries of the Merrimack River upstream of its confluence with the Nashua River. Although Atlantic salmon are not stocked in the Nashua River, the confluence of the Nashua and Merrimack Rivers is a migratory route for Atlantic salmon (Greenwood 2004).

No commercial fishing takes place on the Nashua River or the Merrimack River in New Hampshire. However, both rivers are fished recreationally for American shad, Atlantic salmon, white perch, and yellow perch takes place on the Nashua and Merrimack Rivers (Greenwood 2004). Both rivers were listed as recommended fishing waters by the New Hampshire Department of Fish and Game in 1994 (NHDES 1996).

A fish-consumption advisory is currently in effect for all species of fish from inland freshwater bodies in New Hampshire because of elevated mercury concentrations in fish tissue. The advisory suggests limiting fish consumption to one meal per month for all pregnant and nursing women, women who may become pregnant, and children under seven years of age, to four meals per month for all other individuals (NHDES 2004).

Site-Related Contamination

Groundwater, surface water, sediment, and soil samples were collected during sampling events conducted in 1985 and 1993. The samples were analyzed for metals, VOCs, and semivolatile organic compounds. Groundwater samples were collected from on-site monitoring wells. Surface water and sediment samples were collected from the Nashua River adjacent to the site. Soil samples were collected from throughout the site.

The primary contaminants of concern to NOAA are metals and pentachlorophenol. The maximum contaminant concentrations detected during the site investigations are summarized and compared to appropriate screening guidelines in Table 2. The screening guidelines used include the ambient water quality criteria (AWQC; USEPA 2002) for groundwater and surface water, the threshold effects concentrations (TECs; MacDonald et al. 2000) for sediment, and the Oak Ridge National Laboratory final preliminary remediation goals (ORNL-PRGs; Efroymson et al. 1997) and the U.S. Environmental Protection Agency's ecological soil screening guidelines (USEPA 2005), with exceptions as noted on Table 2. Only maximum concentrations that exceeded relevant screening guidelines are discussed below.

Table 2. Maximum concentrations of contaminants of concern to NOAA detected in samples collected at the Mohawk Tannery site (GZA 1985; NHDES 1996; Tyler 2000). Contaminant values in bold exceeded screening guidelines.

	Soil (mg/kg)		Water (µg/L)			Sediment (mg/kg)	
Contaminant	Soil	ORNL-PRG[a]	Groundwater	Surface Water	AWQC[b]	Sediment	TEC[c]
METALS/INORGANICS							
Arsenic	ND	9.9	**1000**	2.0	150	ND	9.79
Cadmium	**3.5**	0.36[d]	ND	<1.0	0.25[e]	**19**	0.99
Chromium[f]	**3300**	0.4	4	<1.0	11	**310**	43.4
Lead	22	40.5	**100**	<1.0	2.5[e]	**160**	35.8
Mercury	**0.01**	0.00051	**0.9**	<0.20	0.77[g]	ND	0.18
Selenium	ND	0.21	**58**	<2.0	5.0[h]	ND	NA
Silver	0.04	2	**50**	**60**	3.2[e,i]	ND	4.5[j]
Zinc	ND	8.5	ND	**130**	120[e]	ND	121
PHENOLS							
Pentachlorophenol	**510**	3	ND	ND	15[k]	ND	NA

a: Oak Ridge National Laboratory (ORNL) final preliminary remediation goals (PRG) for ecological endpoints (Efroymson et al. 1997).

b: Ambient water quality criteria for the protection of aquatic organisms (USEPA 2002). Freshwater chronic criteria presented.

c: Threshold Effects Concentration (TEC). Concentration below which harmful effects are unlikely to be observed (MacDonald et al. 2000).

d: Ecological soil screening guidelines (USEPA 2005).

e: Criterion expressed as a function of total hardness; concentrations shown correspond to hardness of 100 mg/L $CaCO_3$.

f: Screening guidelines represent concentrations for Cr^{+6}.

g: Derived from inorganic, but applied to total mercury.

h: Criterion expressed as total recoverable metal.

i: Chronic criterion not available; acute criterion presented.

j: Freshwater upper effects threshold (UET) for bioassays. The UET represents the concentration above which adverse biological impacts would be expected.

k: Chronic criterion is pH dependent; concentration shown above corresponds to pH of 7.8.

NA: Screening guidelines not available.

ND: Not detected.

Groundwater

Metals were detected in groundwater samples taken from on-site monitoring wells. The maximum concentration of arsenic was detected in a sample taken from a monitoring well approximately 6 m (20 ft) from the Nashua River on the western border of Area I. Maximum concentrations of lead and selenium were detected in samples taken from a monitoring well approximately 6 m (20 ft) from the Nashua River on the western border of Area II. The maximum concentration of mercury was detected in a sample taken from a monitoring well approximately 10 m (33 ft) from the Nashua River in the southwestern portion of the site. The maximum concentration of silver was detected in a sample taken from a monitoring well on the northeastern border of the site. The maximum concentrations of lead, selenium, and silver exceeded the AWQC by one order of magnitude. The maximum concentration of arsenic exceeded the AWQC by a factor of approximately six, and the maximum concentration of mercury slightly exceeded the AWQC.

Surface Water

Metals were detected in surface water taken from the Nashua River adjacent to the site. The maximum concentration of silver, which exceeded the AWQC by one order of magnitude, was detected in a sample taken from the river along the northern border of the site. The maximum concentration of zinc slightly exceeded the AWQC; the exact sampling location was not reported in the documents reviewed for this report.

Sediment

Metals were detected in sediment samples taken from the Nashua River adjacent to the site. The maximum concentrations of cadmium, chromium, and lead were detected in samples taken from the area surrounding the NPDES outfall pipe. The maximum concentration of cadmium exceeded the TEC by one order of magnitude. The maximum concentrations of chromium and lead exceeded the TECs by factors of seven and approximately 4.5, respectively.

Soil

Metals and pentachlorophenol were detected in soil samples taken from the site. The maximum concentrations of cadmium and chromium were detected in samples taken from the area surrounding the NPDES outfall pipe. The maximum concentration of mercury was detected in a sample taken approximately 12 m (40 ft) east of Area I. The maximum concentrations of chromium and mercury exceeded the ORNL-PRGs by three orders of magnitude and one order of magnitude, respectively. The maximum concentration of cadmium exceeded the USEPA soil screening guideline by a factor of nine.

The maximum concentration of pentachlorophenol, which exceeded the ORNL-PRG by two orders of magnitude, was detected in a sample taken approximately 61 m (200 ft) east of Area II.

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