Olin Chemical

Wilmington, Massachusetts
EPA Facility ID: MAD001403104
Basin: Charles
HUC: 01090001

Executive Summary

The Olin Chemical site is a former chemical manufacturing facility in an industrial area of Wilmington, Massachusetts. The site is located within the headwaters of both the Aberjona River Basin and the Ipswich River Basin. Although the site is close to the headwaters of the Ipswich River the site is not hydraulically connected to the drainage. Surface water runoff from the site is collected in a series of ditches, which ultimately flow into Halls Brook and then into the Aberjona River. Sources of contamination at the site are a tank storage farm, buried drums, and residues from former waste disposal practices. Several investigations have detected elevated concentrations of inorganic and organic compounds in sediment, surface water, groundwater, and soil samples collected from and adjacent to the Olin Chemical property. Metals and SVOCs are the primary contaminants of concern to NOAA. The primary pathways for the migration of contaminants from the site to NOAA trust resources are surface water and groundwater discharge to surface water. The lower Mystic River provides habitat to NOAA trust resources, including anadromous blueback herring and alewife. Currently, dams downstream of the site impede the migration of anadromous species to the section of the river near the site. Small numbers of the catadromous American eel have been found in the lower Mystic River downstream of the site.

Site Background

The Olin Chemical site is a 21-ha (53-acre) former chemical manufacturing facility in an industrial area of Wilmington, Middlesex County, Massachusetts (Figure 1). The site is approximately 0.5 km (0.3 mi) east of Maple Meadow Brook, a headwater tributary of the Ipswich River and 1.5 km (0.9 mi) north of Halls Brook, which ultimately drains to the Aberjona River. Wetlands associated with Maple Meadow Brook are present on and adjacent to the property.

From 1953 to 1986, the Olin Chemical facility produced stabilizers, antioxidants, and other chemicals for the plastics and rubber industries. Wastewater disposal practices conducted by a series of owners have contributed to contamination at the site. Prior to 1970, liquid wastes from manufacturing processes were discharged into unlined waste pits and ponds, including the Lake Poly Liquid Waste Disposal Area (Lake Poly) (Figure 2). In 1970, an acid treatment and neutralization system and several lined settling lagoons were installed (Figure 2) (USEPA 2005). After the waste was treated and neutralized, wastewater was discharged into the lined settling lagoons, where calcium sulfate was allowed to settle out of the waste. The remaining liquid portion of the waste was discharged into an unlined drainage ditch system on the property consisting of the south ditch, east ditch, west ditch, and an ephemeral drainage (Figure 2). After 1972, treated wastewater was routed into the municipal sewer system (USEPA 2005). Calcium sulfate sludge from the lagoons was periodically dredged and transferred to an unlined landfill in the southwest corner of the property. That landfill was capped by the property owners in 1986.

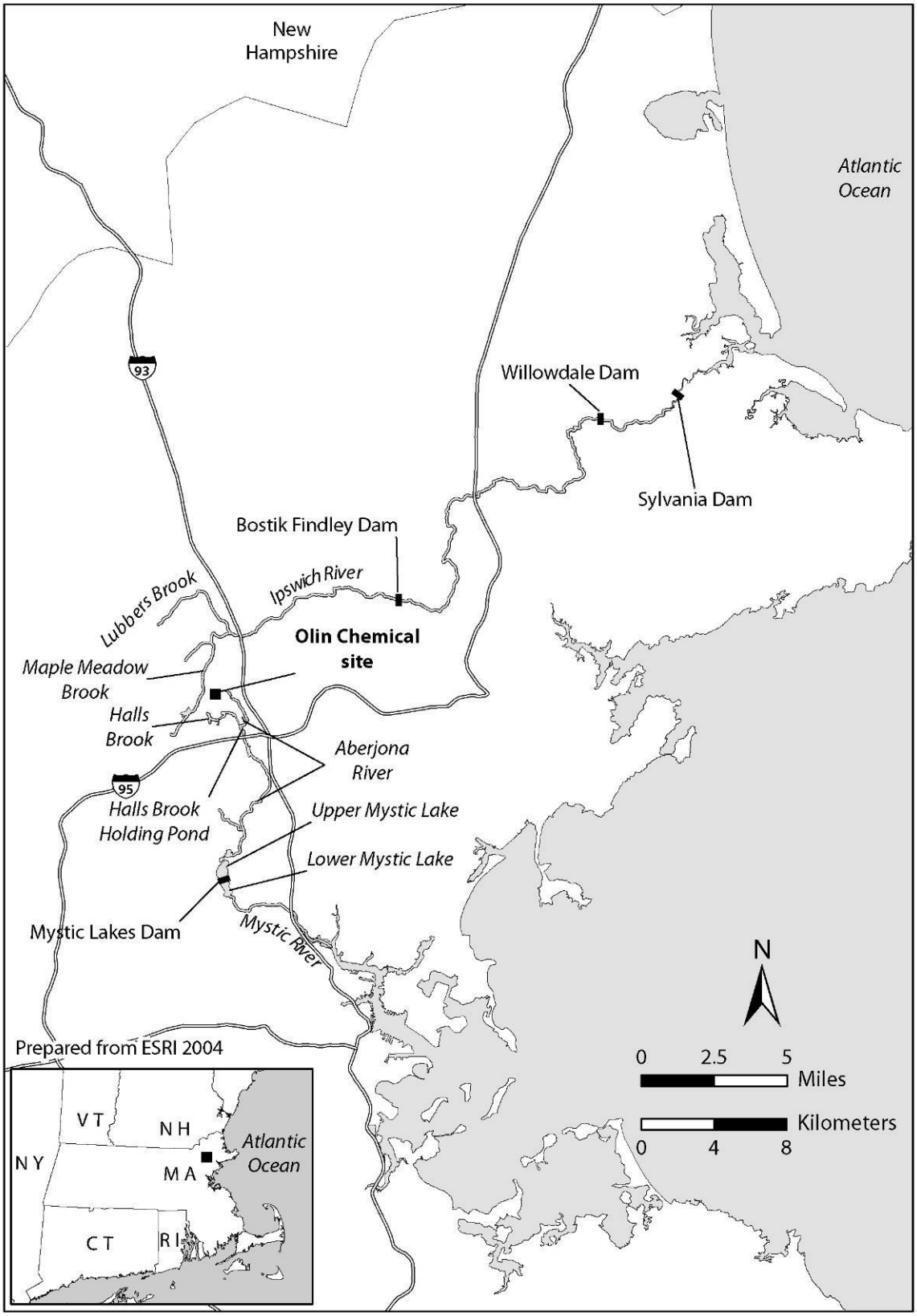

Figure 1. Location of the Olin Chemical site, Wilmington, Massachusetts.

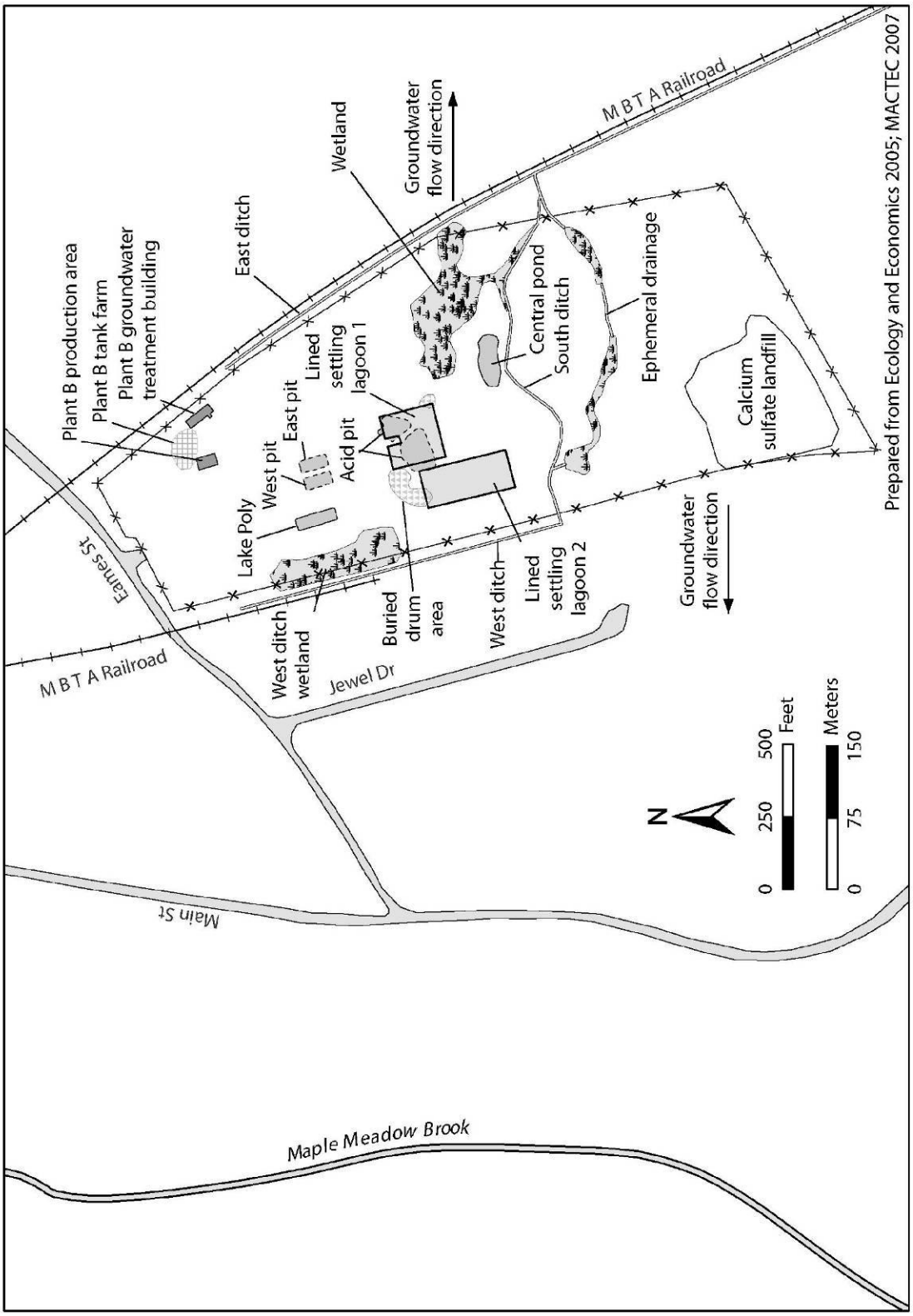

Figure 2. Detail of the Olin Chemical property.

Other potential sources of contamination at the site are a former tank farm associated with Plant B and several areas where drums and other debris were buried (Figure 2) (USEPA 2005). At the Plant B tank farm, raw materials used in the chemical production process were stored in large tanks. Before 1980, these tanks were in direct contact with the ground surface and had no spill-containment mechanism (USEPA 2005). Since 1982, groundwater containing contaminants associated with the tank farm, which include bis(2-ethylhexyl)phthalate, N-nitrosodiphenylamine (NDPA), di-n-octylphthalate, and trimethylpentenes, has been pumped from underneath the tanks and treated. In 2000, the buried drums and associated contaminated soil were excavated and removed from the site. Contaminants associated with the drums include NDPA, chromium, bis(2-ethylhexyl)phthalate, and trimethylpentenes (USEPA 2005).

Several investigations conducted at the site have detected elevated concentrations of inorganic compounds, such as ammonia, chloride, chromium, and sulfate, in surface water, sediment, groundwater, and soil samples collected from and adjacent to the Olin Chemical property. Several organic compounds, including N-nitrosodimethylamine (NDMA) and bis(2-ethylhexyl)phthalate, have also been detected at the site (USEPA 2007).

The site was placed on the U.S. Environmental Protection Agency's (USEPA) National Priorities list on April 18, 2006 (USEPA 2007). In June 2007, the USEPA reached an agreement with the potentially responsible parties for completion of a remedial investigation and feasibility study at the site (USEPA 2007). A focused remedial investigation was completed at the site in 2007 (MACTEC 2007).

The Olin Chemical property is on a groundwater divide that directs groundwater flow to the west, east, and south. East of the divide, groundwater flows east and south toward the ditch system on the property and west of the divide it flows toward Maple Meadow Brook (USEPA 2005). The site is located within the headwaters of both the Aberjona River Basin and the Ipswich River Basin. The site is not hydraulically connected to the Ipswich River Basin and as a result contamination from the site has not been found to have impacted the surface water or sediment in Maple Meadow Brook or the Ipswich River. Surface water runoff from the site is collected in a series of ditches, which ultimately flow into Halls Brook. Halls Brook discharges into the Halls Brook Holding Pond, which then connects to the Aberjona River. The Aberjona River is a tributary to the coastally connected Mystic River.

The primary pathways for the migration of contaminants from the site to NOAA trust resources are surface water and groundwater discharge to surface water.

NOAA Trust Resources

As was mentioned above, the site is located within the headwaters of both the Aberjona River Basin and the Ipswich River Basin. To the west of the site is Maple Meadow Brook, which flows to the northeast approximately 6.4 km (4 mi) before merging with Lubbers Brook to form the Ipswich River. The site is not hydraulically connected to the Ipswich River Basin. Surface water runoff from the site discharges to Halls Brook via the east ditch approximately 1.5 km (0.9 mi) south of the site. Halls Brook then flows into the Halls Brook Holding Pond, which connects to the Aberjona River. The Aberjona River flows into the Mystic River at the north end of Upper Mystic Lake. From its confluence with the Aberjona River, the Mystic River flows approximately 16 km (10 mi) before discharging into Boston Harbor.

The lower Mystic River and the Aberjona River provide spawning and rearing habitat for anadromous species, including alewife and blueback herring, and adult habitat for the

catadromous American eel (Table 1). Currently, the Mystic Lake Dam impedes fish passage upstream of Lower Mystic Lake (MRWA 2006). River herring including blueback herring and alewife are present in Lower Mystic River but are not able to migrate past the Mystic Lake Dam. Fish passage options have been evaluated for the dam but it has been determined to not currently be structurally sound enough for a fish ladder to be installed (MRWA 2006). The Massachusetts Department of Conservation and Recreation is in the process of developing plans to rehabilitate the dam, which includes the addition of fish passage facilities. American eel are found in the Mystic River system and may occasionally make it past the Mystic Lake Dam (MADMF 2006).

Table 1. NOAA trust resources present in the Ipswich River near the Olin Chemical site (MADMF 2006; MRWA 2006).

Species		**Habitat Use**			**Fisheries**	
Common Name	Scientific Name	Spawning Area	Nursery Area	Adult Habitat	Comm.	Rec.
ANADROMOUS FISH[1]						
Alewife	*Alosa pseudoharengus*	♦		♦		
Blueback herring	*Alosa aestivalis*	♦		♦		
CATADROMOUS FISH						
American eel	*Anguilla rostrata*			♦		

1: These species are not currently present in the Aberjona River near the site; if fish passage facilities were installed on downstream dams, these species might use habitat near the site.

The Massachusetts Division of Marine Fisheries has placed a moratorium on the harvest, possession, or sale of river herring, including blueback herring and alewife, through 2008 (MDMF 2005), and river herring are therefore not fished commercially or recreationally in Massachusetts waters. Fishing of American eel is permitted, but sufficient numbers of these fish are not likely present near the site to support a recreational or commercial fishery.

No fish consumption advisory is in effect for the Aberjona River or Halls Brook. A fish consumption advisory does exist for the lower Mystic River below Lower Mystic Lake because of polychlorinated biphenyl (PCB), chlordane, and DDT contamination. The advisory recommends that no one eat any fish from this section of the river (MDPH 2008).

Site-Related Contamination

Sediment, surface water, groundwater, and sediment have been collected at the site during several large investigations between 1993 and 2007. The samples were analyzed for a wide range of constituents. Based on the results of these investigations the contaminants of concern to NOAA at this time are metals and semi-volatile organic compounds (SVOCs).

Table 1 summarizes the maximum concentrations of select contaminants of concern to NOAA detected during the site investigations and compares them to relevant screening guidelines. Site-specific or regionally specific screening guidelines are always included when available. In the absence of such guidance, the screening guidelines for surface water are the ambient water quality criteria (AWQC; USEPA 2006); the screening guidelines for sediment in a freshwater environment are the probable effects concentrations (PECs;

MacDonald et al. 2000); and the screening guidelines for soil are the Oak Ridge National Laboratory final preliminary remediation goals (ORNL-PRGs; Efroymson et al. 1997) and the USEPA's ecological soil screening guidelines (USEPA 2008). Exceptions to these screening guidelines, if any, are noted on Table 1. Only maximum concentrations that equaled or exceeded relevant screening guidelines, or for which screening guidelines are not currently available, are discussed below. When known, the general sampling locations are also provided.

Table 2. Maximum concentrations of contaminants of concern to NOAA at the Olin Chemical site MACTEC 2007. Contaminant values in bold exceed screening guidelines.

	Soil (mg/kg)		Water (µg/L)			Sediment (mg/kg)	
Contaminant	Soil	ORNL-PRG[a]	Ground-water	Surface Water	AWQC[b]	Sediment	PEC[c]
METALS/INORGANICS							
Arsenic	89	9.9	1100	230	150	120	33
Chromium	62,000	0.26[d]	2,300,000	11,000	11[f]	10,000	111
Mercury	7	0.00051	3	0.63	0.77[g]	1.8	1.06
Nickel	67	30	10,000	53	52[e]	89	48.6
SVOCs							
Benz(a)anthracene	18	NA	140	2.2	NA	3.1	1.05
Benzo(a)pyrene	23	NA	2.3	2.1	NA	3.1	1.45
Benzo(b)fluoranthene	17	NA	19	2.3	NA	4.1	NA
Bis(2-ethylhexyl)phthalate	6,700	NA	85,000	220	NA	25,000	0.75[h]
Indeno(1,2,3-cd)pyrene	13	NA	2.4	1.9	NA	19	0.330[h]
N-nitrosodimethylamine	ND	NA	26	0.21	NA	ND	NA
N-nitrosodiphenylamine	3,400	NA	5,200	ND	NA	2.6	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 2006). Freshwater chronic criteria presented.
c: Probable Effects Concentration (PEC). Concentration above which harmful effects are likely to be observed (MacDonald et al. 2000).
d: Ecological soil screening guidelines (USEPA 2008).
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: Freshwater upper effects threshold (UET) for bioassays. The UET represents the concentration above which adverse biological impacts would be expected.
NA: Screening guidelines not available.
ND: Not detected.

Sediment

Four metals were detected in sediment collected from the Olin Chemical site at concentrations greater than the PEC (Table 2). Maximum arsenic and nickel concentrations were detected in samples collected from the east ditch at a factor of three and two times the PEC, respectively. The maximum concentrations of chromium and mercury were detected in samples collected from the south ditch. Chromium concentrations in the south ditch exceeded the PEC by more than an order of magnitude. The maximum mercury concentration slightly exceeded the PEC.

Concentrations of three SVOCs were detected at concentrations greater than the PEC and three SVOCs were also detected for which no screening guideline is currently available (Table 1). The maximum concentrations of benz(a)anthracene, bis(2-ethylHexyl)phthalate, indeno(1,2,3-cd)pyrene, and N-nitrosodiphenylamine were detected in sediment samples collected from the south ditch. The maximum concentration of indeno(1,2,3-cd)pyrene exceeded the PEC by an order of magnitude. Concentrations of benz(a)anthracene exceeded the PEC by approximately a factor of three. Maximum concentrations of benzo(a)pyrene and benzo(b)fluoranthene were detected in samples from the east ditch. Benzo(a)pyrene concentrations in the east ditch exceeded the PEC by almost a factor of two. No screening guidelines are currently available for comparison to the maximum concentrations of bis(2-ethylhexyl)phthalate, N-nitrosodiphenylamine, and benzo(b)fluoranthene detected in the sediment samples.

Surface Water

Three metals were detected in surface water collected from the Olin Chemical site at concentrations greater than the AWQC (Table 2). Arsenic was detected in the east ditch at a maximum concentration that exceeded the AWQC by a factor of 1.5. Chromium was detected in south ditch at a maximum concentration that exceeded the AWQC by three orders of magnitude. The maximum concentration of nickel slightly exceeded the AWQC in a sample from the west ditch.

Screening guidelines are not currently available for any of the SVOCs detected in surface water at the site. Maximum concentrations of benz(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and indeno(1,2,3-cd)pyrene were detected in surface water samples collected from the east ditch. Maximum concentrations of bis(2-ethylhexyl)phthalate and N-nitrosodiphenylamine were detected in samples collected from the south ditch.

Groundwater

Four metals were detected in samples from near lined lagoon 2 at maximum concentrations that exceeded the AWQC (Table 2). Chromium concentrations near lagoon 2 were more than five orders of magnitude greater than the AWQC. The maximum concentration of nickel exceeded the AWQC by two orders of magnitude. The maximum arsenic and mercury concentrations exceeded the AWQC by factors of seven and three, respectively.

Screening guidelines are not currently available for any of the SVOCs detected in groundwater at the site. The maximum concentrations of benz(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, bis(2-ethylhexyl)phthalate, indeno(1,2,3-cd)pyrene, and N-nitrosodiphenylamine were detected near plant B. The maximum concentration of N-nitrosodimethylamine was detected in a sample collected near the west ditch.

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Soil

The maximum concentrations of four metals were detected at concentrations greater than the screening guidelines (Table 2). The maximum concentration of arsenic was detected in sample collected from near the central pond and exceeded the ORNL-PRG by a factor of eight. Chromium and nickel were detected at maximum concentrations in samples collected from the south ditch. Chromium concentrations from the south ditch exceeded the USEPA's ecological soil screening guidelines by five orders of magnitude and nickel concentrations exceeded the ORNL-PRG by a factor of two. The maximum concentration of mercury was detected in a sample collected near Lake Poly and it exceeded the ORNL-PRG by four orders of magnitude.

Screening guidelines are not currently available for any of the SVOCs detected in soil at the site. The maximum concentrations of benz(a)anthracene, benzo(a)pyrene, and benzo(b)fluoranthene were detected in samples collected near plant B. Maximum concentrations of bis(2-ethylhexyl)phthalate and N-nitrosodiphenylamine were detected in samples collected near Lake Poly. The maximum concentration of indeno(1,2,3-cd)pyrene was detected in a sample from the south ditch.

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