MacKenzie Chemical Works

Central Islip, New York

EPA Facility ID: NYD980753420

Basin: Southern Long Island

HUC: 02030202

Executive Summary

The MacKenzie Chemical Works site was a chemical manufacturing facility that operated in a residential and light commercial area of Central Islip, New York, from 1948 to 1987. Various chemicals, including fuel additives and metal acetylacetonates, were manufactured at the site. Spills, releases, and a fire have occurred at the site, including a methyl ethyl ketone spill in 1977, a nitrous oxide release in 1978, and a methyl ethyl ketone spill followed by a fire in 1979. Several buildings, waste lagoons, sanitary cesspools, and aboveground storage tanks remain at the site. The primary contaminants of concern at the MacKenzie site are VOCs, which have been detected in soil and groundwater. The primary pathway of contaminant migration from the site to NOAA trust resources is groundwater. The NOAA trust habitats of concern are Connetquot Brook, Champlin Creek, and West Brook. American eel and steelhead are NOAA trust resources in the vicinity of the site.

Site Background

The MacKenzie Chemical Works (MacKenzie) site is a former chemical manufacturing facility in Central Islip, Suffolk County, New York (Figure 1). The site, which encompasses approximately 0.57 ha (1.4 acres) is in an area where the predominant land uses are residential and light commercial. The facility was operated between 1948 and 1987. Buildings on the site include a manufacturing building, a storage warehouse, a dimethyl glycine (DMG) building, and a warehouse and laboratory where chemical products, including fuel additives and metal acetylacetonates, were manufactured (Figure 2). Chemicals were stored in aboveground storage tanks (Weston 2001). Three documented contaminant releases have occurred on the site: a release of 2-butanone, commonly known as methyl ethyl ketone (MEK), in June 1977; a nitrous oxide release in April 1978 that resulted in a local neighborhood evacuation; and a second MEK release in April 1979 that resulted in a fire.

During operations at the site, sanitary and laboratory wastes were discharged at a permitted outfall located between the storage warehouse and the laboratory. The exact location of the outfall is not identified in the documents reviewed for this report. Two covered lagoons were also used for the disposal of other wastes (USEPA 2001).

Investigations at the site have documented improper waste management practices. Inspections conducted by the Suffolk County Department of Health Services and the New York State Department of Environmental Conservation (NYSDEC) identified leaking drums, spills, and overflowing acid tanks. During a preliminary assessment in 1983, 55 drums containing flammable alcohols, acids, caustic solutions, and contaminated concrete and soil were documented at the MacKenzie site (Weston 2001).

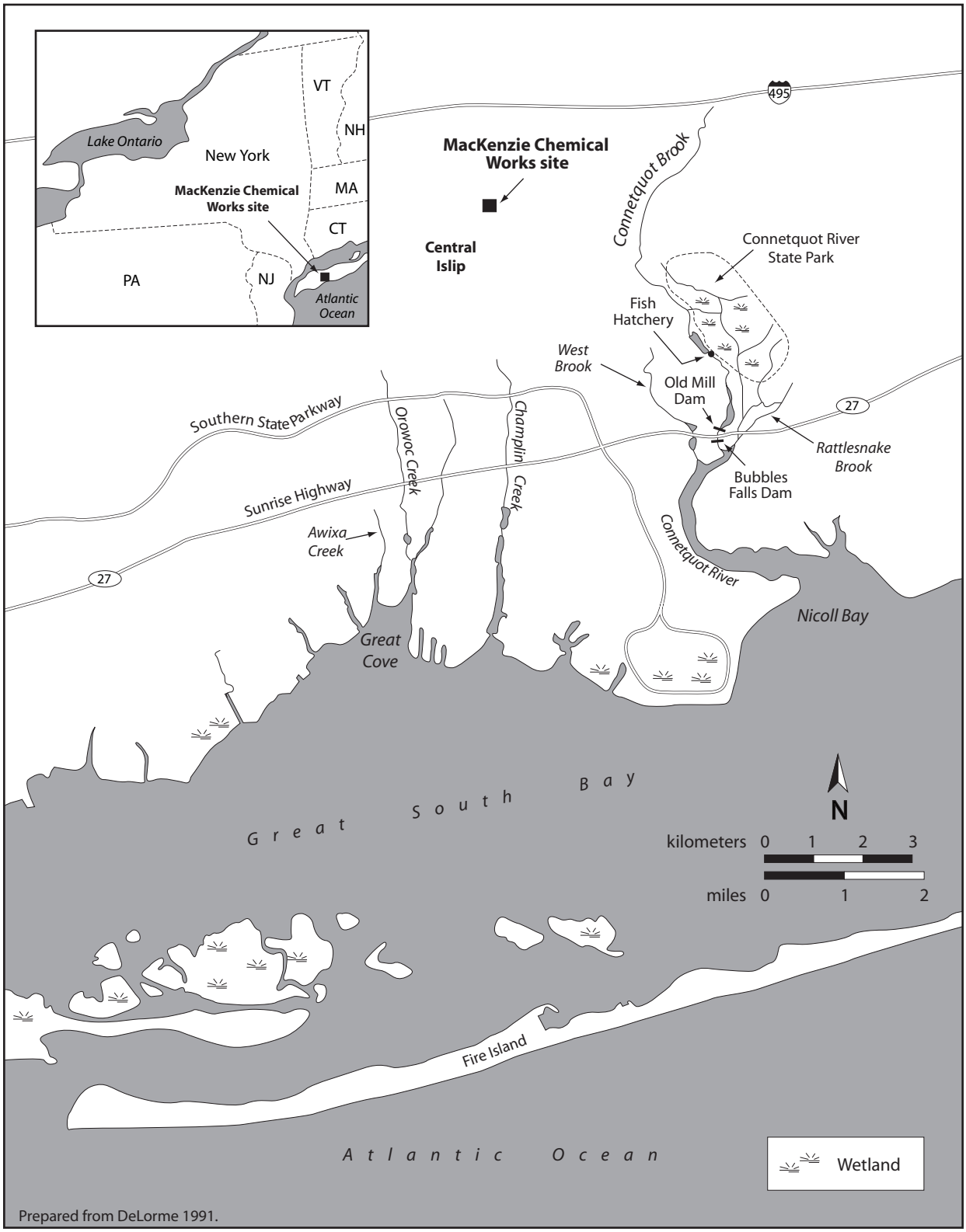

Figure 1. Location of MacKenzie Chemical Works site, Central Islip, New York.

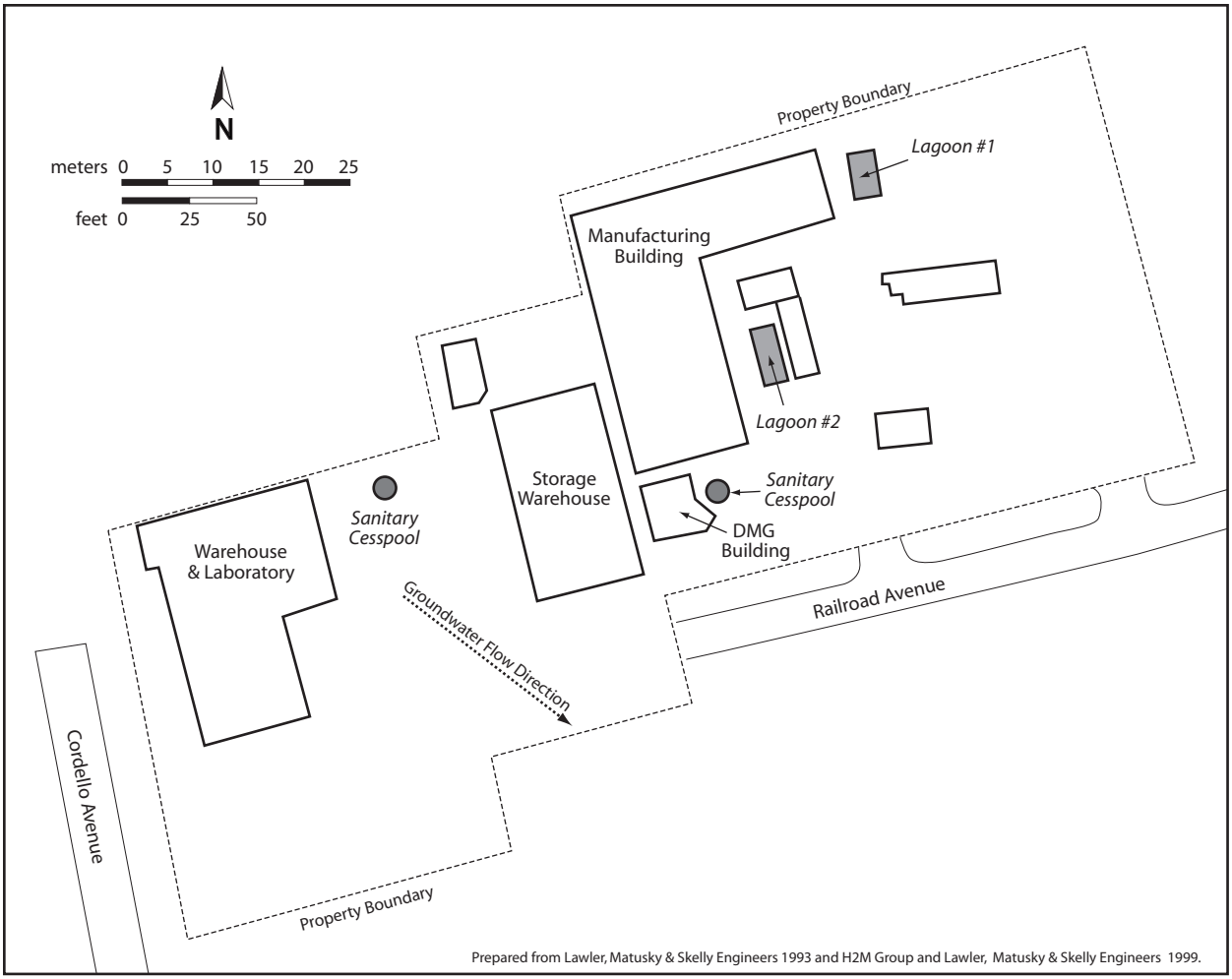

Figure 2. Detail of MacKenzie Chemical Works property.

Volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), pesticides, polychlorinated biphenyls (PCBs), and metals have been detected at the site (Weston 2001). In March 1985, several VOCs were detected in nearby residential wells at concentrations that exceeded the NYSDEC groundwater standard. In 1986, VOCs were detected in on-site monitoring wells installed by MacKenzie Chemical at the request of the NYSDEC. In December 1993, a site inspection established that groundwater contamination was attributable to the MacKenzie Chemical Works (Weston 2001). In 2000, a remedial investigation/feasibility study and a removal site evaluation were conducted. The MacKenzie site was proposed for placement on the National Priorities List on September 13, 2001 (USEPA 2001; Weston 2001). A record of decision (ROD) was issued by the USEPA for the MacKenzie site in March 2003. The ROD outlines the methods that were selected for removing contaminants from the site and monitoring the site to assure the removal was successful (USEPA 2003).

Groundwater is the primary pathway for the migration of contaminants from the site to NOAA trust resources (Weston 2001). Three primary water-bearing aquifers underlie the site (H2M Group 1999). The upper aquifer, which consists of sand and gravel with very little interstitial clay and silt, is the most permeable aquifer on Long Island (H2M Group and Lawler, Matusky & Skelly Engineers

1999; Lawler, Matusky & Skelly Engineers 1993). Local groundwater flow at the MacKenzie site is south to southeast toward Great South Bay (H2M Group and Lawler, Matusky & Skelly Engineers 1999; Weston 2001). It is possible that contaminants are discharged from the groundwater into Connetquot Brook, Champlin Creek, and West Brook, which are 3.2 km (2 mi) east and 3.2 km (2 mi) south and 4.8 km (3 mi) southeast of the site respectively.

NOAA Trust Resources

The NOAA trust habitats of concern are Connetquot Brook, Champlin Creek, and West Brook. Connetquot Brook is in a relatively large, low-lying, well-drained area approximately 3.2 km (2 mi) east of the MacKenzie site. The brook flows south to join the Connetquot River, which empties into Great South Bay approximately 9.7 km (6 mi) downstream of the site. West Brook is a tributary of the Connetquot River approximately 4.8 km (3 mi) southeast of the site. Champlin Creek, which is located 3.2 km (2 mi) south of the site, flows into Great South Bay approximately 8 km (5 mi) downstream of the site. There are no surface water bodies on the MacKenzie site and no evidence of ephemeral streams or stream-cut channels (H2M Group and Lawler, Matusky & Skelly Engineers 1999).

Connetquot River State Park is approximately 4.8 km (3 mi) southeast of the site on the Connetquot River. The park is a wildlife preserve intended for the protection and propagation of birds, fish, and other wildlife. The park is more than 1,200 ha (3,000 acres) in area and includes freshwater wetlands and a fish hatchery (USFWS 1997).

Steelhead and American eel are NOAA trust resources of concern in the vicinity of the site (Table 1). Steelhead and American eel are able to migrate upstream of all dams on Connetquot Brook, the Connetquot River, and Champlin Creek. American eel have been documented upstream of the dam on West Brook. Steelhead spawn in the upper reaches of Connetquot Brook and Champlin Creek. American eel and steelhead use the section of Connetquot Brook and Champlin Creek nearest the site as adults. Alewife, blueback herring, and white perch enter the tidal section of the Connetquot River, which extends approximately 3.2 km (2 mi) upstream of Great South Bay, but are unable to traverse the small dams in the lower reaches of the river (Kozlowski 2002).

Several dams are present along the Connetquot River (Figure 1). Bubbles Falls Dam, on the Connetquot River at Sunrise Highway, is a small dam that is easily passable by fish. Old Mill Dam, a short distance upstream of Bubbles Falls Dam, is passable by fish via a spillway immediately upstream of Sunrise Highway. Several more small dams are upstream of Sunrise Highway, including one at the fish hatchery. These dams are no more than 1.8 m (6 ft) in height, and some migratory fish are able to traverse upstream of them. The same is true for Champlin Creek—all dams on the creek are at most 1.8 m (6 ft) in height and remain passable by certain migratory fish (Kozlowski 2002). A 2.1 m (7 ft) dam on West Brook blocks passage of anadromous fish. The dam does not stop American eel from migrating into the upper reaches of West Brook (Henson 2004).

Recreational fishing for steelhead, as well as brook and brown trout, occurs in Connetquot Brook. No commercial fishing takes place in Connetquot Brook or Champlin Creek (Kozlowski 2002). No fish consumption advisories are in effect for surface waters near the site (NYSDOH 2004).

Table 1. NOAA trust resources in the Connetquot River, Connetquot Brook, and Champlin Creek (Hensen 2004; Kozlowski 2002).

Species		Habitat Use			Fisheries	
Common Name	Scientific Name	Spawning Area	Nursery Area	Adult Habitat	Comm.	Rec.
ANADROMOUS FISH						
Alewife[a]	*Alosa pseudoharengus*			◆		
Blueback herring[a]	*Alosa aestivalis*			◆		
Steelhead	*Oncorhynchus mykiss*	◆		◆		◆
White perch[a]	*Morone americana*			◆		
CATADROMOUS FISH						
American eel	*Aguilla rostrata*			◆		

a: Found only in the tidal portion of Connetquot River.

Site-Related Contamination

The primary contaminants of concern at the MacKenzie site are VOCs. VOCs have been detected in groundwater samples collected from monitoring wells at the site and down-gradient from the site, and in soil samples collected throughout the site. The groundwater and soil samples were analyzed for metals (including selenium), VOCs, SVOCs, pesticides, and PCBs (H2M Group and Lawler, Matusky & Skelly Engineers 1999). Based on a review of the ROD there does not appear to be any plans to collect samples from the habitats of concern (USEPA 2003). The maximum concentrations of contaminants of concern to NOAA are summarized in Table 2. The screening guidelines for groundwater samples are the Ambient Water Quality Criteria (AWQC; USEPA 2002) and the Oak Ridge National Laboratory final preliminary remediation goals (ORNL-PRGs; Efroymson et al. 1997) for soil samples, with exceptions as noted in Table 2.

Groundwater

VOCs, metals, SVOCs, and the pesticide gamma-BHC (lindane) were detected in groundwater. VOCs were detected in groundwater samples collected as far as 610 m (2,000 ft) down-gradient from the MacKenzie site. Maximum concentrations of trichloroethene (TCE) and 1,2,3-trichloropropane were detected in a monitoring well sample taken approximately 30 m (100 ft) southeast of the site. However, the maximum TCE concentration did not exceed the AWQC and there is currently no AWQC available for comparison to the maximum concentration of 1,2,3-trichloropropane. The maximum concentration of tetrachloroethene (PCE), detected in a sample collected approximately 180 m (600 ft) southeast of the site, exceeded the AWQC by a factor of approximately six.

The maximum concentrations of arsenic, chromium, copper, mercury, and nickel were detected in groundwater samples collected southeast of the site. Cadmium and zinc were detected at maximum concentrations in a sample collected from the southeast corner of the site. The maximum lead concentration was detected in a sample from south of the storage warehouse. Concentrations of cadmium, chromium, copper, lead, and zinc all exceeded the AWQC by at least one order of magnitude. The maximum concentrations of nickel and mercury exceeded the AWQC by factors of approximately five and 2.5, respectively. Because the detection limits for silver were above than the screening guidelines, it is unknown whether silver concentrations exceeded the AWQC (Table 2). Arsenic concentrations did not exceed the AWQC and selenium and was not detected.

Table 2. Maximum concentrations of contaminants of concern to NOAA detected in samples collected from the MacKenzie Chemical Works Inc., site (H2M Group and Lawler, Matusky & Skelly Engineers 1999; Lawler, Matusky & Skelly Engineers 1993). Bold values indicate contaminant exceeded the screening guidelines.

	Soil (mg/kg)		Water (µg/L)	
Contaminant	Soil	ORNL-PRG[a]	Groundwater	AWQC[b]
METALS/INORGANICS				
Arsenic	**12**	9.9	35	150
Cadmium	**1.0**	0.38[c]	**19**	0.25[d]
Chromium[e]	**22**	0.4	**1,500**	11
Copper	24	60	**190**	9[d]
Lead	**500**	40.5	**74**	2.5[d]
Mercury	**1.0**	0.00051	0.29	0.77[f]
Nickel	15	30	**250**	52[d]
Selenium	**0.55**	0.21	<2.1	5.0[f]
Silver	**6.8**	2	<8.6[g]	3.2[d,h]
Zinc	**220**	8.5	**2,400**	120[d]
SVOCs				
Acenaphthene	1.2	20	<15	520[i]
Acenaphthylene	0.19	NA	<15	NA
Anthracene	9.2	NA	<15	NA
Benz(a)anthracene	**20**	0.1[j]	<15	NA
Bis(2-ethylhexyl)phthalate	0.85	NA	40	NA
Chrysene	16	NA	<15	NA
Dibenz(a,h)anthracene	**2.5**	0.1[j]	<15	NA
Fluoranthene	36	NA	<15	NA
Fluorene	1.9	NA	4.0	NA
2-Methylnaphthalene	0.079	NA	20	NA
Naphthalene	0.045	0.1[j]	6.0	620[i]
Phenanthrene	**14**	0.1[j]	<15	NA
Pyrene	**27**	0.1[j]	<15	NA
PESTICIDES/PCBs				
Aldrin	0.0075	NA	<0.071	3.0[h]
4,4′-DDE	0.066	NA	<0.14	NA
4,4′-DDT	0.69	0.7[j]	<0.14[g]	0.001
Dieldrin	0.013	NA	<0.14[g]	0.056
Endosulfan (alpha + beta)	0.017	NA	<0.21[g]	0.056
Endrin	0.017	NA	<0.14[g]	0.036
Gamma-BHC (Lindane)	<0.0018	0.01[j]	0.029	0.95[h]
Heptachlor	0.0043	NA	<0.071[g]	0.0038
Total PCBs	0.22	0.371	<2.8[g]	0.014
VOCs				
2-Butanone (Methyl ethyl ketone or MEK)	0.0040	NA	<10	NA
Tetrachloroethene (PCE)	**2.3**	0.1[j]	**5,600**	840[i]
Trichloroethene (TCE)	0.030	0.1[j]	9.0	21,900[i]
1,2,3-Trichloropropane	680	NA	34,000	NA
Toluene	**0.24**	0.1[j]	2.0	17,500[h,i]

Table 2 continued on next page

Table 2 *Continued.*

a: Oak Ridge National Laboratory final preliminary remediation goals (ORNL-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: Ecological soil screening level (USEPA 2004).

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

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

f: Criterion expressed as total recoverable metal.

g: It is unknown whether these contaminants were present at concentrations that exceeded the screening guidelines because the detection limits were above the screening guidelines.

h: Chronic criterion not available; acute criterion presented.

i: Lowest Observable Effects Level (LOEL) (USEPA 1986).

j: Canadian Council of Ministers of the Environment (CCME) environmental quality guidelines for agricultural land uses.

NA: Screening guidelines not available.

Four SVOCs were detected in groundwater samples collected down-gradient from the MacKenzie site. No AWQC are available for comparison to the maximum concentrations of SVOCs except for naphthalene, which did not exceed the AWQC. Gamma-BHC (lindane) was detected in a groundwater sample collected from the southwest corner of the site however the maximum concentration was below the AWQC.

Pesticides and PCBs were detected in groundwater samples collected from monitoring wells in the southwest and southeast portion of the site. Because the detection limits for DDT, dieldrin, endosulphan, endrin, heptachlor, and PCBs were all above the screening guidelines, it is unknown whether these contaminants exceeded the AWQC (Table 2).

Soil

VOCs, metals, SVOCs, pesticides, and PCBs were detected in soil samples collected at the MacKenzie site. The maximum concentration of 1,2,3-trichloropropane was detected in a sample collected southeast of the warehouse and laboratory; the maximum concentration of PCE was detected in a sample collected north of the manufacturing building (Figure 2). The maximum concentrations of SVOCs were detected in samples collected southeast of the manufacturing building. The maximum concentrations of four SVOCs exceeded the screening guidelines for soil by at least one order of magnitude (Table 2). Two VOCs, PCE and toluene, were detected at concentrations that exceeded the screening guidelines for soil by at least one order of magnitude (Table 2).

Several metals were detected in soil samples at elevated concentrations. Table 2 shows the maximum concentrations of metals in soil samples that met quality control criteria and noted those samples that were rejected because of failure to meet quality control criteria (Lawler, Matusky & Skelly Engineers 1993). Concentrations of arsenic, lead, nickel, selenium, and silver were detected in soil samples collected north of the manufacturing building. Chromium, copper, and zinc concentrations were detected in a sample collected southeast of Lagoon #1 (Figure 2). Cadmium and mercury concentrations were detected in samples collected south of the warehouse and laboratory. Mercury concentrations exceeded the screening guidelines for soil by three orders of magnitude; concentrations of chromium, lead, and zinc by one order of magnitude. Maximum

concentrations of selenium and silver exceeded the ORNL-PRG screening guidelines by factors of approximately two and three, respectively; cadmium by a factor of two. Arsenic concentrations just exceeded the ORNL-PRG; copper and nickel concentrations did not exceed the screening guidelines.

Pesticides and PCBs were also detected in soil samples collected at the site. The maximum concentrations of DDE and DDT were detected in samples collected north of the manufacturing building (Figure 2). The remaining maximum concentrations of the pesticides listed in Table 2 were detected in samples from east of the warehouse and laboratory. PCBs were detected in soil collected east of the DMG building however, concentrations were below the ORNL-PRG.

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