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Horseshoe Road Industrial Complex

Middlesex County, New Jersey
CERCLIS #NJD980663678

Site Exposure Potential

The seven-hectare Horseshoe Road Industrial Complex site is in northern Sayreville, Middlesex County, New Jersey within 12 m of the Raritan River, which ultimately discharges into Raritan Bay 8 km downstream (Figure 1). The general area around the site, which is about 30 km from the Atlantic Ocean, is moderately developed and populated.

The site includes four distinct areas: the Horseshoe Road Drum Dump (HRDD), Sayreville Pesticide Dump (SPD), Atlantic Resources Corporation (ARC), and Atlantic Development Corporation (ADC) (Figure 2). The period of operation and types of waste disposed at each of these areas are listed in Table 1. Most of the wastes stored in the drums dumped at the two dump areas are unknown. The Horseshoe Road Dump area was discovered in 1981 when a marsh fire uncovered about 70 drums, a few of which were labeled ethyl acetate and silver cyanide. As part of an EPA Removal Action in 1985, the exposed drums were relocated inside a fence on the ADC property (NUS Corporation 1992). Another EPA removal action is underway to excavate and remove buried drums and contaminated debris from the dump areas (Osolin personal communication 1995.)

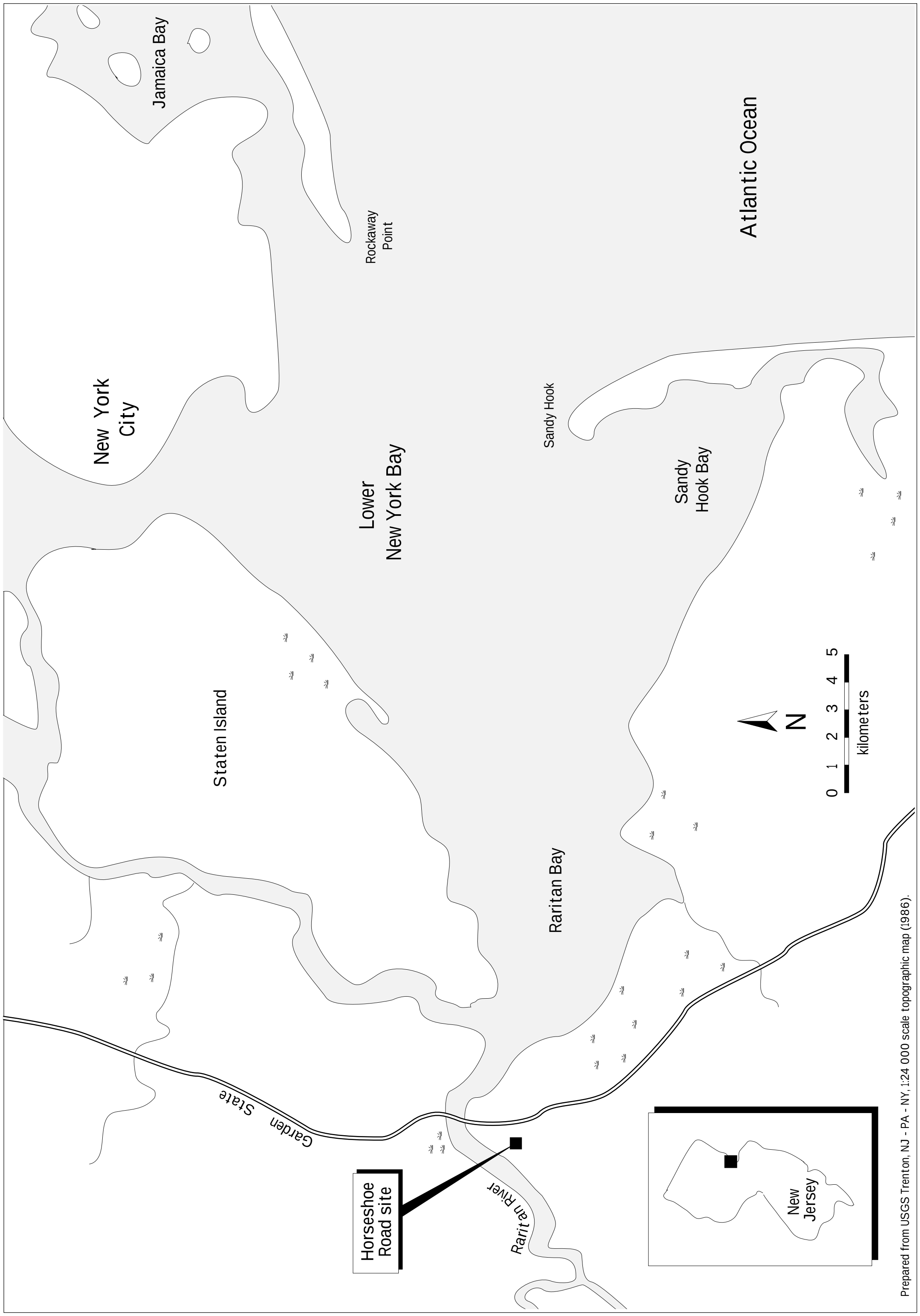

Figure 1. Location of Horseshoe Road site in Sayreville, N.J.

Table 1. Wastes disposed at the Horseshoe Road site.

Site	Period of Operation	Types of Waste Activities
Horseshoe Road Drum Dump	Unknown	About 70 drums were discovered in 1981. In 1985, exposed drums were relocated inside the fenced area of the ADC site, and subsequently removed.
Sayreville Pesticide Dump	Early 1960s to unknown	About 240 drums with unknown contents were disposed. No firm documentation was made of pesticide dumping. Reports were made of unauthorized dumping of potassium cyanide, nitric, sulfuric, and hydrochloric acids. EPA removed drums and contaminated soil in 1994.
Atlantic Resources Corp.	About 1972-1985. Occupied by International Recycling Corp. from 1972 to 1978, when ARC assumed control.	The primary activity on the site was precious metal recycling. Eight burners incinerated metal foils, film, coated papers, circuit boards, casting sweeps, and fines. EPA action to remove wastes at site occurred from 1987-1988. A second EPA action removed 773 drums of mixed organic waste in 1993.
Atlantic Development Corp.	1965-1983. Complex series of 15 different owners and leasees.	Primary activity was manufacture, processing, and blending of various chemicals. Exact nature of wastes unknown. About 1,000 drums were removed from site in mid-1980s. Fire in 1982 burned more than 700 19-liter chemical containers. EPA removed contaminated debris in 1993.

A former employee of International Recycling Corporation, which occupied the ARC site for a period, anonymously reported that it was common practice for employees to dump drums of potassium cyanide; nitric, sulfuric, and hydrochloric acids; and 30-percent hydrogen peroxide at the HRDD (NUS Corporation 1992). The two companies that occupied the ARC area were primarily engaged in precious-metal recycling, although ARC may have operated a solvent recovery facility between 1976 and 1978. In 1985, 0.015 mg/kg of dioxin was detected in one of five soil samples collected from the area. An EPA-approved waste removal action was completed at the ARC site in 1989. The action included cleaning up a mercury spill and mercury-contaminated soils, stabilizing a leaky acid vat, and transporting off-site all wastes for disposal/treatment/reuse. Three drums of zinc powder were treated and left on site (NUS 1992).

The ADC Area was occupied by various companies from 1965 to 1982. The companies that operated in the area were reportedly engaged in the manufacture, processing, and blending of various chemicals though the exact nature of the activities is unknown. The site was abandoned in 1982 and a fire in 1983 burned more than 700 19-liter chemical containers and possibly other wastes. In the mid-1980s, the New Jersey Department of Environmental Protection removed about 1,000 drums from the site (NUS 1992). EPA removed 773 more drums and visibly contaminated soil from this area during the winter of 1992-93 (Roy F. Weston, Inc. 1993c).

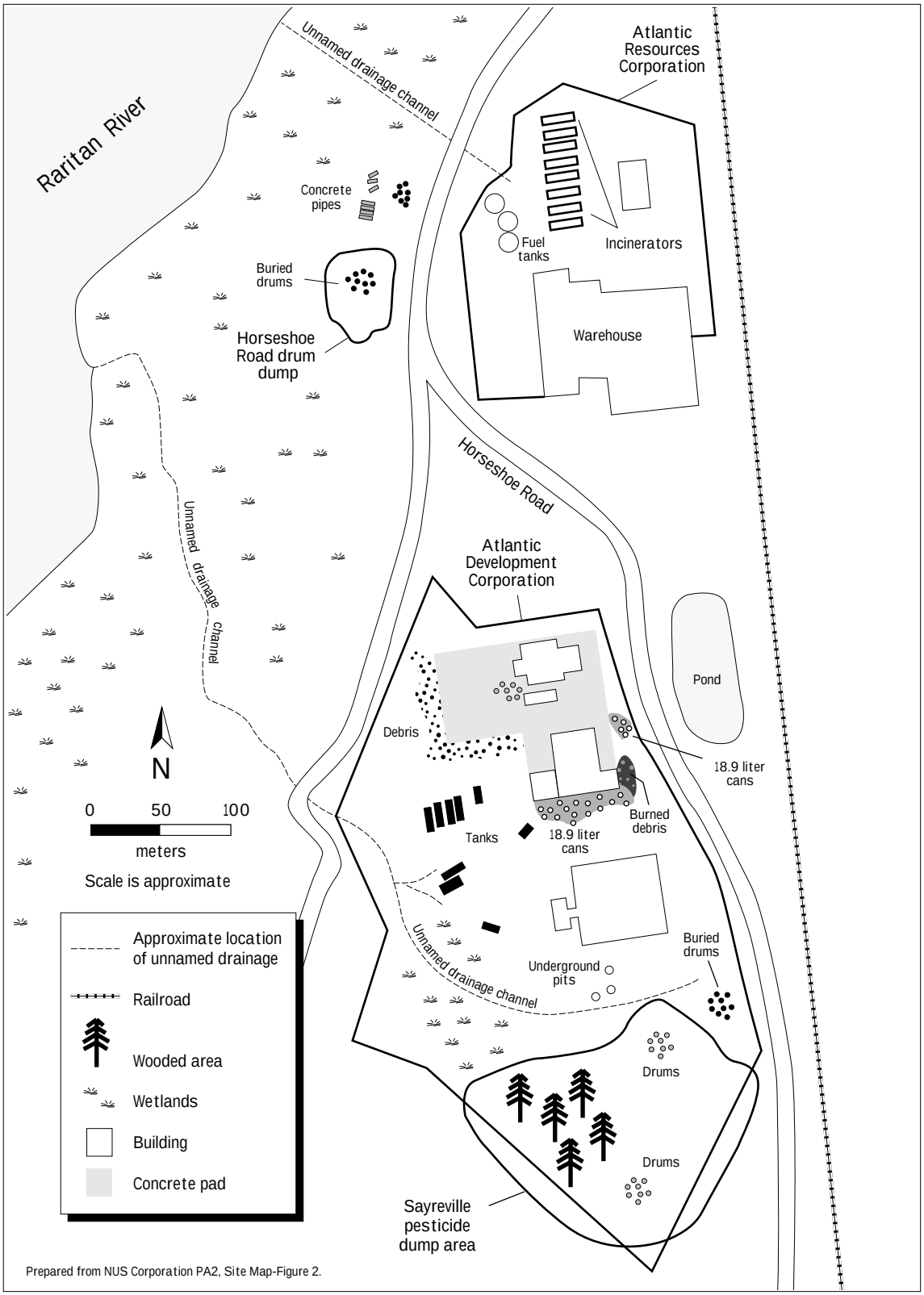

Figure 2. Detail of Horseshoe Road site in Sayreville, New Jersey (NUS 1992).

EPA collected soil samples on 15-meter centers over the entire complex in 1993. These samples indicated widespread contamination by trace elements, pesticides, PAHs, and PCBs at the site. No sampling of surface waterways, groundwater, or sediment is reported. Maximum concentrations are reported in Table 3 (Roy F. Weston, Inc. 1993a and b). Arsenic, chromium, copper, lead, and zinc contamination were found close to the Raritan River (Roy F. Weston, Inc. 1993a). Several pesticides, including DDT and its degradation products DDE and DDD, were also found in soil samples taken near the river (Roy F. Weston, Inc. 1993b).

Surface water runoff and groundwater are the potential pathways of contaminant transport from the site to NOAA trust resources and associated habitats. The Horseshoe Road site is generally flat and is surrounded by wooded knolls to the east and south. About 90 to 150 m of undeveloped marshland lie between the northern site boundary and the Raritan River. An unnamed drainage channel flows from immediately north of the SPD area for about 350 m before discharging into the Raritan River. Another unnamed ditch flows from the ARC site through the marsh for about 200 m before it enters the Raritan River. Oil was observed in the ditch on many occasions while the site was active (NUS 1992).

Groundwater flow from the site is most likely northwest towards the Raritan River, and is probably tidally influenced. Depth to groundwater is only 1 m in some portions of the site. Bedrock in the area of the site consists of the sandstones and shales of the Passaic Formation. Three strata have been identified as lying above this bedrock, in descending order: 1) the alluvial deposits associated with the Raritan River at a thickness ranging from 0 to 15 m; 2) the silts and clays of the Woodbridge Clay, which range from 6 to 12 m in thickness beneath the site; and 3) the Farrington Sand aquifer, which is confined near the site (NUS 1992).

NOAA Trust Resources and Habitat

Primary habitats of concern to NOAA are surface water, substrates, and associated wetlands of the Raritan River, and surface water and associated bottom substrates of Raritan Bay. The Raritan River provides habitat for numerous migratory and estuarine-dependent fish and invertebrate species of interest to NOAA (Table 2; Boriek personal communication 1991 and 1992; Stuart personal communication 1991; Byrne personal communications 1994). The Raritan River is included in the New York / New Jersey Harbor management area under the National Estuary Program, a Federal program designed to create management plans for estuaries of national significance (Gastrich personal communication 1990; Byrne personal communication 1994). Although water quality has improved in the Raritan River over the past 15 years, it remains a stressed urban watershed (Byrne personal communication 1994).

Table 2. Predominant NOAA trust resources using surface water associated with the Raritan River near the Horseshoe Road site.

Species		Habitat			Fisheries	
Common Name	Scientific Name	Spawning	Nursery	Adult Forage	Comm.	Recr.
ANADROMOUS /CATADROMOUS SPECIES						
Atlantic sturgeon	*Acipenser oxyrhynchus*			♦		
Blueback herring	*Alosa aestivalis*		♦	♦		
Alewife	*Alosa pseudoharengus*		♦	♦		
American shad	*Alosa sapidissima*		♦	♦		
American eel	*Anguilla rostrata*		♦	♦		
Striped bass	*Morone saxatilis*		♦			♦
Rainbow smelt	*Osmerus mordax*			♦		
ESTUARINE /MARINE FISH						
Bay anchovy	*Anchoa mitchilli*	♦	♦	♦		
Atlantic menhaden	*Brevoortia tyrannus*		♦	♦		
Atlantic herring	*Clupea harengus*		♦			
Weakfish	*Cynoscion regalis*		♦			
Killifishes	*Fundulus* spp.	♦	♦	♦		
Gobies	*Gobiosoma* spp.	♦	♦	♦		
Spot	*Leiostomus xanthurus*		♦			
Silversides	*Menidia* spp.	♦	♦	♦		
Atlantic tomcod	*Microgadus tomcod*		♦	♦		
Atlantic croaker	*Micropongonias undulatus*		♦			
White perch	*Morone americanus*			♦		
Mullets	*Mugil* spp.		♦			
Oyster toadfish	*Opsanus tau*	♦	♦	♦		
Summer flounder	*Paralichthys dentatus*		♦			♦
Butterfish	*Peprilus triacanthus*		♦			
Winter flounder	*Pleuronectes americanus*	♦	♦	♦		♦
Black drum	*Pogonias cromis*		♦			
Bluefish	*Pomatomus saltatrix*		♦	♦		♦
Northern searobin	*Prionotus carolinus*		♦			
Windowpane flounder	*Scophthalmus aquosus*		♦			
Northern pipefish	*Syngnathus fuscus*	♦	♦	♦		
Tautog	*Tautoga onitis*		♦			
Hogchoker	*Trinectes maculatus*		♦			
Red hake	*Urophycis chuss*		♦			
INVERTEBRATE SPECIES						
Blue crab	*Callinectes sapidus*		♦	♦		♦
Sand shrimp	*Crangon septemspinosa*	♦	♦	♦		
Northern quahog	*Mercenaria mercenaria*	♦	♦	♦		
Softshell clam	*Mya arenaria*	♦	♦	♦		
Grass shrimp	*Palaemonetes pugio*	♦	♦	♦		
Brown shrimp	*Penaeus aztecus*			♦		

The Raritan River flows approximately 8 km from the area of the site before joining Raritan Bay. The Raritan River next to the site is generally 2.5 to 7.5 m deep and 0.75 to 1.0 km wide, with bottom substrates composed largely of mud. Surface water is mesohaline, typically ranging from 5 to 20 ppt with averages of 10 to 15 ppt, depending on rainfall, tidal phase, saltwater intrusion, and urban runoff (Byrne personal communication 1994a). Tidal amplitude in this portion of the Raritan River commonly averages 1.6 m (U.S. Geological Survey 1981; Byrne personal communication 1994a).

Estuarine intertidal wetlands in this reach of the Raritan River are largely disturbed and commonly dominated by reed grass (*Phragmites communis*). Wetland areas in this portion of the Raritan River are fringed by isolated stands of salt meadow hay (*Spartina patens*), salt marsh cord grass (*Spartina alterniflora*), saltwater sedges (*Scripus* spp.), and salt grass (*Distichlis spicata*; Byrne personal communication 1994a).

The NOAA trust species that are most abundant near the site include bay anchovy, killifish, silversides, and grass shrimp (Table 2). Atlantic menhaden, weakfish, spot, Atlantic tomcod, bluefish, blue crab, and sand shrimp are common in the lower Raritan River estuary. Anadromous runs of alewife, blueback herring, and American shad commonly enter the Raritan River drainage during the spring to access suitable freshwater spawning habitats farther upstream. Juveniles generally return to the ocean and the lower Raritan Bay by the following fall (Byrne personal communication 1994a). Bluefish seasonally migrate into the Raritan River to forage on alewife, blueback herring, American shad, Atlantic menhaden, and killifishes (Pottern et al. 1989). Weakfish and spot use surface water near the site exclusively as a juvenile rearing habitat. American shad and Atlantic tomcod, both threatened species in New Jersey, use the Raritan River as an adult forage area and nursery habitat. It is generally assumed that tomcod in the Raritan River are strays originating from the Hudson River stock and do not represent a distinct population. American eel are found throughout the Raritan River drainage. Blue crab use the river as a seasonal juvenile and adult foraging area (Byrne personal communication 1994a and 1994b).

There is some recreational fishing and crabbing near the site, with striped bass, summer and winter flounder, and bluefish the most commonly captured species (Byrne personal communications 1994a and 1994b). There is sport fishing primarily during warm weather months when species of interest migrate into the Raritan River watershed (Stuart personal communication 1991). Commercial activities exclusively target the blue crab fishery in the Raritan River. There is regular commercial and recreational crabbing at Crab Island, 3.0 km upstream from the site. Gear restrictions to protect spawning fish stocks limit other forms of commercial harvesting of finfish in the river (Byrne personal communication 1994a).

A state-wide consumption advisory is in effect for striped bass, bluefish (exceeding 2.7 kg), white perch, white catfish, and blue crab due to PCB, dioxin, and chlordane contamination (Byrne personal communication 1994). Limits are imposed for the recreational landings of American shad, striped bass, white perch and several warm-water species (Boriek personal communication 1992). No federally protected species are known to frequent nearby habitats of concern (Pyle personal communication 1991).

There are no stocking, enhancement, or restoration programs for trust species in the Raritan River although American shad from the Delaware River were stocked in the upper Raritan for a limited period in the early 1980s (Stuart personal communication 1991; Byrne personal communication 1994). Stocking to encourage the restoration of the shad fishery upriver was discontinued and spawning has not been observed. In 1988, state authorities released approximately 160,000 chinook salmon and 1,100 steelhead trout into the Raritan River. No returns have been made to date, but low-level monitoring continues (Lupine personal communication 1991).

Site-Related Contamination

Trace elements, pesticides, and PAHs are the primary contaminants of concern to NOAA. Elevated concentrations of these contaminants were found in on-site soil, surface water, and sediments during previous site investigations. The maximum concentrations of trace elements, PAHs, PCBs, and pesticides detected in soil, surface water, and sediment are presented in Table 3. No surface water data was available from the Raritan River near the site, the marsh areas near the site, or from the drainage ditch out of the ARC area. Surface water and sediment data were collected only from the drainage ditch that flows from the SPD and ADC areas. No groundwater data have been collected at the site.

Maximum concentrations of pesticides in on-site soils exceeded available ecological screening levels by six orders of magnitude (Table 3). DDT and its metabolites DDD and DDE, aldrin, and heptachlor, were widespread in on-site soils and were found near the Raritan River. Sediments and surface water were not sampled for pesticides, PCBs, or PAHs (Roy F. Weston, Inc. 1993b).

Maximum concentrations of trace elements detected in on-site soils in the ARC or ADC areas far exceeded average concentrations for U.S. soils, in some cases by more than two orders of magnitude. Copper, lead, mercury, and zinc were each detected in surface water from an on-site ditch at concentrations exceeding freshwater chronic AWQC. None of the trace elements detected in sediments from the ditch exceeded ERL or ERM concentrations.

Concentrations of PAHs were detected in on-site soils, but no screening guidelines are available for these contaminants in soils. No PAHs were detected in on-site surface water. The PAHs

Table 3. Maximum concentrations of selected contaminants at the site (NUS Corporation 1992 and Roy F. Weston, Inc. 1993 a and b).

Contaminants	Soil (mg/kg) On-site Soil	Soil (mg/kg) Ave. U.S.[1]	Water (ug/l) Drainage Ditch	Water (ug/l) AWQC[2]	Sediment (mg/kg) Drainage Ditch	Sediment (mg/kg) ERL[3]	Sediment (mg/kg) ERM[4]
Trace Elements							
Arsenic	1,900	5.0	ND	190	ND	8.2	70
Cadmium	1,800	0.06	ND	1.1+	ND	1.2	9.6
Chromium	7,100	100	ND	11	0.053	81	370
Copper	6,200	30	230	12+	0.11	34	270
Lead	37,000	10	84	3.2+	0.048	46.7	223
Mercury	1,440	0.03	10	0.012	0.11	0.15	0.71
Nickel	6,800	40	49	160+	0.019	20.9	51.6
Silver	2,100	0.05	ND	0.12	ND	1.0	3.7
Zinc	9,800	50	430	110+	0.19	150	410
PAHs							
Anthracene	32,000	NA	ND	NA	39	0.085	1.1
Benzo(a)anthracene	30,000	NA	ND	NA	ND	0.26	NA
Benzo(a)pyrene	8,100	NA	ND	NA	1.2	0.43	1.6
Benzo(b/(k)fluoranthene	24,000	NA	ND	NA	1.2	NA	NA
Chrysene	27,000	NA	ND	NA	30	0.38	1.5
Fluoranthene	21,000	NA	ND	NA	ND	0.6	NA
Naphthalene	2,100	NA	ND	620*	ND	0.16	NA
Phenanthrene	26,000	NA	ND	6.3p	ND	0.24	NA
Pyrene	37,000	NA	ND	NA	ND	0.67	NA
Dioxin							
2,3,7,8-TCDD	0.015	NA	ND	$<1X10^{-8}$*	ND	NA	NA
PCBs							
PCB 1254	27,000	NA	ND				
Pesticides							
Aldrin	200	NA				NA	NA
4,4' DDD	12	NA				NA	NA
4,4' DDE	110	NA				0.0022	0.027
4,4' DDT	450	NA				0.016t	0.046
Chlordane	500	NA				NA	NA
Endosulfan	2,240	NA				NA	NA
Endrin	260	NA				NA	NA
gamma BHC (lindane)	46,000	NA				NA	NA
Heptachlor	2,700	NA				NA	NA
Methoxychlor	1,600,000[5]	NA				NA	NA

1: Lindsay (1979).
2: Ambient water quality criteria for the protection of aquatic organisms. Freshwater chronic criteria presented (U.S. EPA 1993).
3: Effects Range Low (Long and MacDonald 1992).
4: Effects Range Median (Long and MacDonald 1992).
5: This concentration was reported by the analytical laboratory with the notation that the sample exceeded the calibration range of the gas chromatograph and the concentration is estimated.
NA: Not available.
ND: Not detected; detection limits not available.
*: Lowest Observed Effect Level (U.S. EPA 1993).
p: Proposed criteria (US EPA 1993).
+: Hardness-dependent criteria (100 mg/l $CaCO_3$ used).
t: Total DDT

anthracene and chrysene were detected in ditch sediments at levels that exceeded ERM concentrations, while benzo(a)pyrene exceeded the ERL concentration (Table 3).

Summary

Elevated concentrations of trace elements, pesticides, and PAHs have been detected in the soil, surface water, and sediments at the Horseshoe Road site. Several of these contaminants were detected at concentrations that far exceeded their screening criteria or guidelines. The lack of available data on the groundwater at the site and on concentrations in sediment and surface water of the Raritan River near the site make it difficult to generate any conclusions about off-site migration of contaminants to NOAA trust resources. The Raritan River and its associated wetlands support numerous migratory and estuarine-dependent fish and invertebrate species of interest to NOAA. Site-related contaminants may pose a risk to NOAA trust resources in the Raritan River. The type of contaminants at the site, the presence of migration pathways to the river via current and historic drainage from the site, and possible groundwater transport suggest a potential risk.

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