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Raymark Industries, Inc.

Stratford, Connecticut
CERCLIS #CTD001186618

Site Exposure Potential

The Raymark Industries, Inc. site covers about 13 hectares in Stratford, Connecticut, and is approximately 360 m from the Housatonic River (Figure 1). Until recently, surface runoff from the site flowed south into an underground culvert, which discharged into Ferry Creek. Ferry Creek enters the Housatonic River approximately 1.5 km from the site.

Raymark Industries produced brake linings, gasket material, sheet packing, clutch facing, transmission parts, and other friction-based products from 1919 to 1989. These products contained asbestos, metals, phenol-formaldehyde resins, and various adhesives. Wastes from this manufacturing process included wastewater, waste asbestos, lead solids, waste acids, cutting oils, and caustics.

During peak production at the facility in the 1970s, about 2.8 million liters per day of clarified wastewater were discharged into a series of on-site lagoons that ultimately discharged to Ferry Creek. An unknown quantity of solids accumulated in the lagoons during the early years of operation. During peak production, about 7,650 m^3 per year of dewatered asbestos and lead solids accumulated in the lagoons (Roy F. Weston 1993).

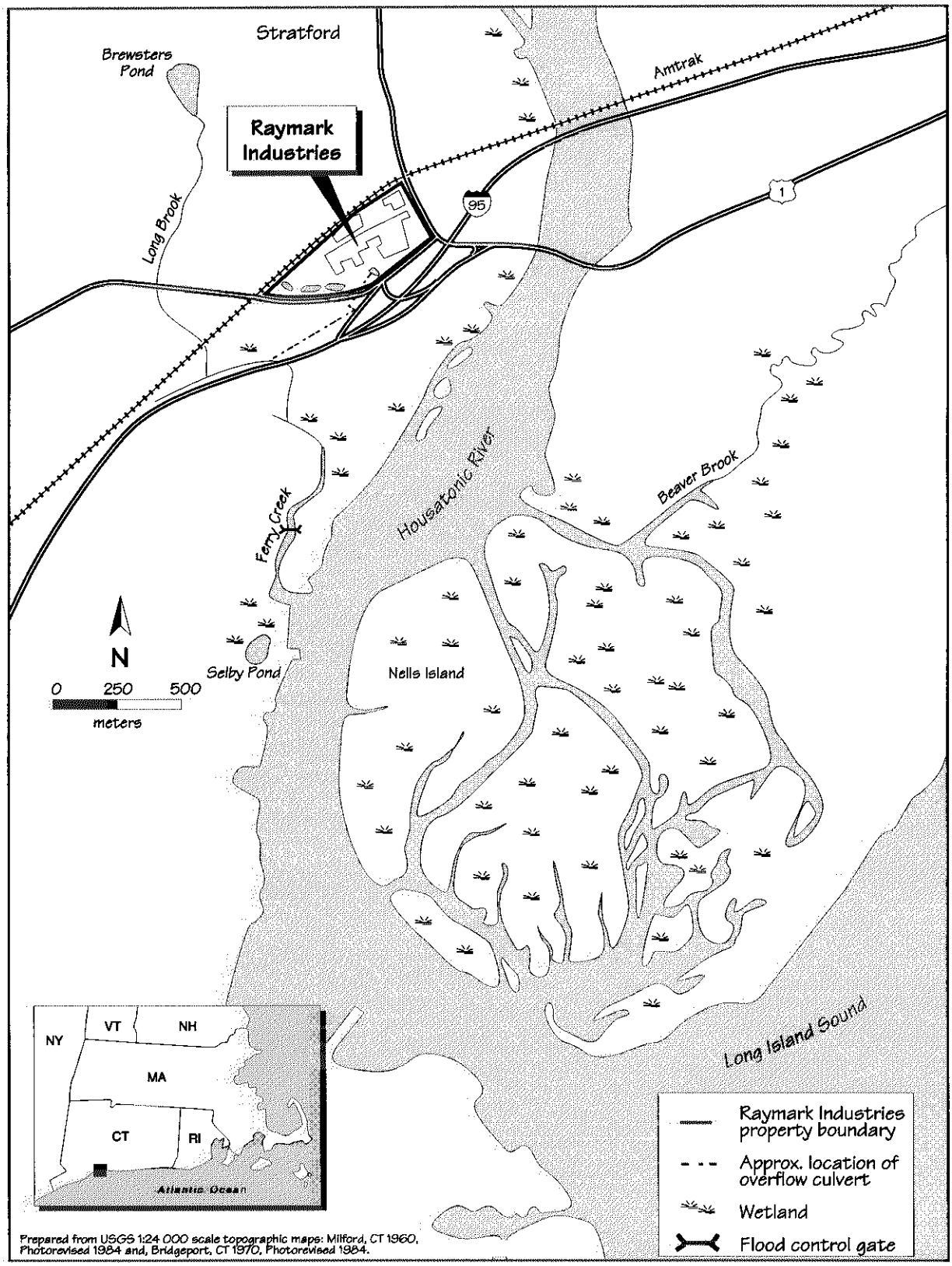

Figure 1. Location of the Raymark Industries site in Stratford, Connecticut.

Before 1970, the accumulated asbestos and lead solids were annually dredged from the lagoons and placed as on-site fill material to support land development at the facility (Roy F. Weston 1993). From at least the 1970s through the early 1980s, these solids were also disposed off-site in various locations throughout Stratford, including areas along Ferry Creek and the Housatonic River, and Raybestos Memorial Field north of the site (Roy F. Weston 1993).

Above- and below-ground storage tanks around the facility were used to store raw materials, process wastewater, and fuels. Several spills and leaks from these tanks have been documented, including a 22,700-liter phenol leak in 1983 and a 284,000-liter asbestos/phenol tank release in 1984 (Roy F. Weston 1993). About 80 percent of the hazardous materials in these tanks has been removed from the site. Hazardous wastes were also stored in drums at the site. Leaking drums were observed during EPA inspections of the site between 1980 and 1991. An unknown number of these drums have since been removed. Discarded cutting oils are the suspected source of low levels of dioxins. A temporary soil-and-gravel cap was placed over Lagoons 1, 2, and 3, and a temporary soil cap was placed over the Raybestos Memorial Field (Figure 2).

Migration of sediments contaminated by erosion of fill areas next to Ferry Creek and the Housatonic River is considered the primary pathway of contaminant transport to NOAA trust resources. Direct discharge from on-site lagoons, surface water runoff, and groundwater migration are secondary pathways of concern. Until 1993, overland flow at the site was directed into the lagoons, which then discharged to Ferry Creek via a 610-m underground culvert. In September 1993, Raymark rerouted site drainage around Lagoon 4. There may be other, unknown surface runoff pathways from the site to the Housatonic River.

Substrate immediately beneath the site generally consists of artificial fill, stratified outwash, peat, and swamp deposits. Surficial materials range from 6 to 9 m thick in the central portion of the site to more than 27 m thick in the northwest corner of the facility (Roy F. Weston 1993). The Derby Hill Schist, which underlies the surficial materials at the site, acts as a separate hydrologic unit. Groundwater occurs in fractures up to 60 m below the overburden-bedrock contact. Localized groundwater flows from northwest to southeast across the site towards the Housatonic River. There may be slight reversals in this flow caused by the tidal influence of the Housatonic River.

NOAA Trust Habitats and Species

Habitats of concern to NOAA are surface waters, bottom substrates, and estuarine marsh areas associated with Ferry Creek, Selby Pond, and the Housatonic River. A flapper tidegate about 1 km downstream from the site is believed to restrict

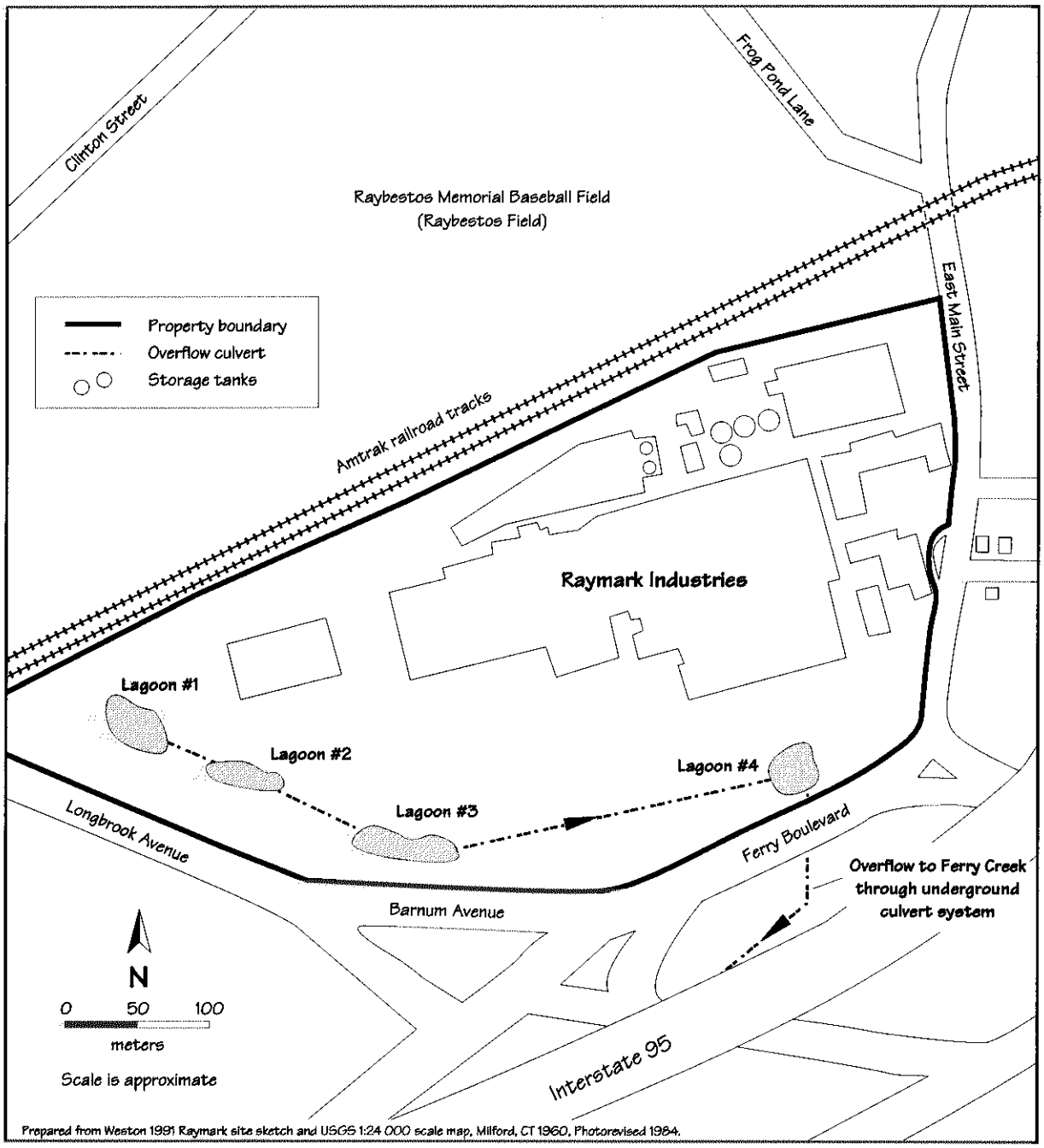

Figure 2. Detail of Raymark Industries in Stratford, Connecticut.

fish passage upstream, while allowing tidal influence to extend to Interstate 95. Ferry Creek near the site is less than 2 m wide and less than 1 m deep. Near the tidegate, the creek increases to 5 or 6 m wide. Bottom substrates of Ferry Creek are composed largely of silt and mud. Portions of the Housatonic River near the site range from 0.5 to 3.0 m deep and 0.25 to 0.75 km wide.

A dredged navigational channel is maintained in the lower portions of the Housatonic River. Substrates within this channel consist primarily of medium sands, with finer silts characteristically found in low-velocity areas (Aarestad personal communication 1995; Volk personal communication 1995).

Eiver discharge, depth, and tidal cycle vary salinities in the lower reach of the Housatonic River. Salinities range from 0 ppt on the surface during spring freshets, to 25 ppt at the bottom during flood tides in the low-flow summer season (Aarestad personal communication 1995). Tidal amplitude in this reach of the river averages 2.0 m (USGS 1984).

Wetlands in Ferry Creek above the tidegate are largely disturbed and are predominantly reed grass (*Phragmites communis*), jewelweed (*Impatiens capensis*), bindweed (*Polygonum* spp.), seabeach orach (*Atriplex arenaria*), and poison ivy (*Rhus radicans*). Smooth cord grass (*Spartina alterniflora*) and salt meadow hay (*Spartina patens*) dominate estuarine intertidal wetlands in the Housatonic River. Nells Island, a 245-hectare, estuarine, intertidal wetland complex of the lower Housatonic River, is opposite the mouth of Ferry Creek.

The Housatonic River is habitat for numerous migratory and estuarine-dependent fish and invertebrate species of interest to NOAA (Table 1; Aarestad personal communication 1995; Volk personal communication 1995). NOAA trust species most abundant throughout the year include four-spine stickleback, killifish, naked goby, Atlantic silverside, white perch, winter flounder, little skate, and northern pipefish. Other seasonally prevalent trust species in the lower Housatonic estuary include bay anchovy, Atlantic menhaden, black sea bass, smallmouth flounder, Atlantic tomcod, summer flounder, bluefish, striped searobin, northern puffer, tautog, and blue crab. Anadromous runs of alewife, blueback herring, American and hickory shad, and rainbow smelt commonly enter the Housatonic River during the spring to access suitable freshwater spawning habitats farther upstream. Juveniles generally return to the ocean by the following fall (Aarestad personal communication 1995).

Bluefish and striped bass migrate into the river during the summer to forage on alewife, blueback herring, American shad, Atlantic menhaden, killifish, and Atlantic silverside. Juvenile and adult Atlantic menhaden also migrate into the Housatonic estuary during the summer. Atlantic tomcod overwinter in the river from the late fall through the spring and later migrate to coastal and offshore areas during the summer months. Scup and tautog generally use nearshore waters and lower portions of the estuary (Aarestad personal communication 1995). NOAA trust resources are not believed to frequent Ferry Creek habitats because of the creek's restricted hydraulic input and small dimensions. Killifish (*Fundulus* spp.) and several unidentified macrobenthic invertebrates represent the only aquatic species identified during recent field investigations in Ferry Creek.

Table 1. NOAA trust species using habitats associated with the Housatonic estuary.

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*		♦	♦		
Hickory shad	*Alosa mediocris*		♦	♦		
Alewife	*Alosa pseudoharengus*		♦	♦		
American eel	*Anguilla rostrata*		♦	♦		
American shad	*Alosa sapidissima*		♦	♦		
Striped bass	*Morone saxatilis*			♦		
Rainbow smelt	*Osmerus mordax*		♦	♦		
Sea lamprey	*Petromyzon marinus*			♦		
MARINE/ESTUARINE SPECIES						
American sandlance	*Ammodytes americanus*	♦	♦	♦		
Bay anchovy	*Anchoa mitchilli*		♦	♦		
Four-spine stickleback	*Apeltes quadracus*	♦	♦	♦		
Atlantic menhaden	*Brevoortia tyrannus*		♦	♦		♦
Crevalle jack	*Caranx hippos*		♦	♦		
Black sea bass	*Centropristis striata*		♦	♦		♦
Atlantic herring	*Clupea harengus*		♦	♦		
Weakfish	*Cynoscion regalis*		♦	♦		
Sheepshead minnow	*Cyprinodon variegatus*	♦	♦	♦		
Fourbeard rockling	*Enchelyopus cimbrius*		♦	♦		
Smallmouth flounder	*Etropis microstomas*		♦	♦		
Mummichog	*Fundulus heteroclitus*	♦	♦	♦		
Striped killifish	*Fundulus majalis*	♦	♦	♦		
3-spine stickleback	*Gasterosteus aculeatus*	♦	♦	♦		
Naked goby	*Gobiosoma bosci*	♦	♦	♦		
Spot	*Leiostomus xanthurus*		♦	♦		
Atlantic tomcod	*Microgadus tomcod*	♦	♦	♦		♦
Atlantic croaker	*Micropogonias undulatus*		♦			
Tidewater silverside	*Menidia beryllina*	♦	♦	♦		
Atlantic silversides	*Menidia menidia*	♦	♦	♦		
Northern kingfish	*Menticirrhus saxatilis*		♦			
White perch	*Morone americana*	♦	♦	♦		♦
White mullet	*Mugil curema*			♦		
Oyster toadfish	*Opsanus tau*	♦	♦	♦		
Summer flounder	*Paralichthys dentatus*		♦	♦		♦
Fourspot flounder	*Paralichthys oblongus*		♦			
Butterfish	*Peprilus triacanthus*		♦			
Rock gunnel	*Pholis gunnellus*	♦	♦	♦		
Winter flounder	*Pleuronectes americanus*	♦	♦	♦		♦
Bluefish	*Pomatus saltatrix*		♦	♦		♦
Northern searobin	*Prionotus carolinus*		♦	♦		
Striped searobin	*Prionotus evolans*		♦	♦		
Nine-spine stickleback	*Pungitius pungitius*	♦	♦	♦		
Little skate	*Raja erinacea*		♦	♦		
Spanish mackerel	*Scomberomorus maculatus*		♦			
Windowpane	*Scophthalmus aquosus*		♦	♦		
Northern puffer	*Sphaeroides maculatus*		♦	♦		
Scup	*Stenotomus chrysops*		♦	♦		♦
Northern pipefish	*Syngnathus fuscus*	♦	♦	♦		
Inshore lizardfish	*Synodus foetens*		♦	♦		

Table 1., cont.

Species		Habitat Use			Fisheries	
Common Name	Scientific Name	Spawning Ground	Nursery Ground	Adult Forage	Comm. Fishery	Recr. Fishery
MARINE/ESTUARINE SPECIES						
Tautog	*Tautoga onitis*		♦	♦		♦
Cunner	*Tautogolabrus adspersus*		♦	♦		
Hogchoker	*Trinectes maculatus*	♦	♦	♦		
Spotted hake	*Urophycis regia*		♦			
INVERTEBRATE SPECIES						
Whelk	*Busycon spp.*	♦	♦	♦		
Blue crab	*Callinectes sapidus*	♦	♦	♦		♦
Atlantic rock crab	*Cancer irroratus*	♦	♦	♦		
Green crab	*Carcinus maenas*	♦	♦	♦		
Sand shrimp	*Crangon septemspinosa*	♦	♦	♦		
Eastern oyster	*Crassostrea virginica*	♦	♦	♦	♦	
Spider crab	*Libinia spp.*	♦	♦	♦		
Horseshoe crab	*Limulus polyphemus*			♦		
Hard-shelled clam	*Mercenaria mercenaria*			♦		
Soft-shelled clam	*Mya arenaria*			♦		
Blue mussel	*Mytilis edulis*	♦	♦	♦		
Lady crab	*Ovalipes ocellatus*	♦	♦	♦		
Shore shrimp	*Palaemonetes spp.*	♦	♦	♦		
Mud crab	*Panopeus spp.*	♦	♦	♦		
MARINE MAMMALS						
Minke whale	*Balaenoptera acutorostrata*	♦	♦	♦		
Fin whale*	*Balaenoptera physalus*	♦	♦	♦		
Hooded seal	*Crytophora cristata*	♦	♦			
Common dolphin	*Delphinus delphis*	♦	♦	♦		
Northern right whale*	*Eubalaena glacialis*	♦	♦	♦		
Atlantic pilot whale	*Globicephala melaena*	♦	♦	♦		
Gray seal	*Halichoerus grypus*	♦	♦			
Atlantic white-sided dolphin	*Lagenorhynchus acutus*	♦	♦	♦		
Humpback whale*	*Megaptera noveangliae*	♦	♦	♦		
Harp seal	*Pagophilus groenlandicus*	♦	♦			
Harbor porpoise	*Phocoenna phocoena*	♦	♦	♦		
Harbor seal[b]	*Phoca vitulina concolor*	♦	♦			
Atlantic bottlenosed dolphin	*Tursiops truncatus*	♦	♦	♦		
Striped dolphin	*Stenella coeruleoalba*	♦	♦	♦		

a: This migratory area refers to the Atlantic Ocean and offshore portions of Long Island Sound.
b: The harbor seal is the most frequent visitor to the region and represents the only marine mammal known to use aquatic environments of the Housatonic River.
* Federally listed endangered species

Adult and juvenile blue crab use surface waters near the site as rearing, mating, and foraging habitat (Aarestad personal communication 1995). Males and juvenile females often reside in lower-salinity habitats, while gravid females migrate to higher-salinity areas and the coastal continental shelf for egg dispersal (Van Den Avyle and Fowler 1984.) Female blue crabs mate only once, but blue crab mating season occurs twice annually in the early spring and late fall. There are oyster beds throughout the lower portion of the Housatonic estuary with denser beds found in subtidal areas with firm, hard-packed substrates. No oysters have been observed in Ferry Creek (Svirsky personal communication 1995; Volk personal communication 1995).

During the winter, several pinnipeds inhabit the coastal waters of Long Island Sound, including the harbor, gray, harp, and hooded seals. The harbor seal, the most frequent visitor to the region, has been observed in the Housatonic River. Numerous cetaceans also use areas offshore of the site. The federally endangered humpback, northern right, and fin whales; and the minke and Atlantic pilot whales periodically migrate into Long Island Sound. Atlantic white-sided dolphin, harbor porpoise, striped dolphin, common dolphin, and Atlantic bottlenose dolphin also periodically migrate into Long Island Sound marine waters (Nowojchik personal communication 1995).

There is some recreational fishing and crabbing in the Housatonic River near the site. Recreational fisheries typically target black sea bass, Atlantic tomcod, white perch, summer flounder, bluefish, winter flounder, scup, and tautog. Sportfishing occurs primarily during warm-weather months when species of interest concentrate in the lower Housatonic River (Aarestad personal communication 1995).

The only commercial fishing-related activity in the lower Housatonic River is seed oyster production. The National Shellfish Sanitation Program prohibits fishing in river surface waters because of the threat of fecal coliform contamination. Oysters are seeded annually for reproduction and subsequently transplanted (relayed) to offshore certified areas in Long Island Sound, where they depurate and grow to maturity (in approximately three to four years) before being harvested for commercial use. Approximately 30,000 to 130,000 bushels of seed oyster are harvested from the lower Housatonic River and transplanted offshore each year (Volk personal communication 1995).

A statewide health advisory recommends limited consumption of bluefish and striped bass taken from state waters because of elevated PCB concentrations in edible tissue (Aarestad personal communication 1995).

Site-Related Contamination

Investigations at the site indicate that trace elements, PCBs, dioxins, and PAHs are the primary contaminants of concern to NOAA (Roy F. Weston 1993). Table 2 lists the maximum concentrations of selected contaminants detected around the Raymark site.

The trace elements arsenic, cadmium, chromium, copper, lead, mercury, nickel, silver, and zinc were detected in soil on-site and nearby at concentrations that exceed average U.S. soil concentrations by several orders of magnitude (Roy F. Weston 1993). The same trace elements were detected in groundwater at concentrations that exceed freshwater chronic AWQC by several orders of magnitude (Roy F. Weston 1993). These trace elements were also detected in sediments in Ferry Creek or the Housatonic River at concentrations above ERM screening guidelines (Long and MacDonald 1992). Copper was detected at a maximum concentration of 7,000 mg/kg in sediments of Upper Ferry Creek, exceeding by an order of magnitude the ERM screening guideline of 270 mg/kg (Long and MacDonald 1992). Lead was detected in sediments at Lagoon 4 at a maximum concentration of 14,000 mg/kg (Roy F. Weston 1993).

Several PAH compounds were detected in on-site soils, but there are no screening guidelines for these constituents in soil. Anthracene, dibenz(a,h)anthracene, fluoranthene, naphthalene, phenanthrene, pyrene, benz(a)anthracene, chrysene, and benzo(a)pyrene were detected in sediments of Ferry Creek or the Housatonic River at concentrations above ERM screening guidelines (Long and MacDonald 1992; Chemtech 1993, 1994; Skinner and Sherman 1993).

Although pesticides and PCBs were detected in surface soil, there are no screening guidelines for these contaminants in soil. PCBs were detected in groundwater at concentrations that exceed the freshwater chronic AWQC by several orders of magnitude (EPA 1993a). PCBs were detected in sediment at concentrations that exceed the ERM screening guideline for total PCBs by several orders of magnitude (Long and MacDonald 1992; Roy F. Weston 1993). Aroclor 1260 was detected at 150 mg/kg in sediment in the culvert inlet to Ferry Creek. DDD and DDE were also detected. There is no screening guideline for DDD in sediment but DDE exceeded the ERL screening guideline (Long and MacDonald 1992).

Dioxin was detected in surface soil at a maximum concentration of 7.2 µg/kg (expressed as 2,3,7,8-TCDD toxicity equivalents). Groundwater samples from the site were not analyzed for dioxin. Dioxin was detected at a maximum concentration of 3.9 µg/kg toxicity equivalents in sediment collected at Lagoon 4. A 2,3,7,8-TCDD concentration of 0.06 µg/kg in sediment has been shown to be a low risk to fish (EPA 1993b).

Numerous SVOCs and VOCs were detected in surface soil samples collected at or near the site,

Table 2. Maximum concentrations of selected contaminants detected at the Raymark site (Roy F. Weston 1993).

	Soil (mg/kg)		Water (ug/l)			Ferry Creek and Housatonic River Sediment (mg/kg)		
Contaminants	On-Site	Avg. U.S.[1]	Surface Water	Ground water	AWQC[2]	Sediment	ERL[3]	ERM[4]
Trace Elements								
Arsenic	130	5	93.4	930	NA	24	8.2	70
Cadmium	39	0.06	2.3	440	1.1+	16.2	1.2	9.6
Chromium	800	100	59.2	39,000	NA	1,060	81	370
Copper	164,000	30	138	25,000	12.0+	7,000	34	270
Lead	57,000	10	147	1,260	3.2+	6,150	46.7	218
Mercury	1.0	0.03	3.5	2.3	0.01	2.7	0.15	0.71
Nickel	1,600	40	11.7	32,000	160.0+	270	20.9	51.6
Silver	7.0	0.05	NA	4.0	0.12	6.8	1.0	3.7
Zinc	42,000	50	127	15,000	110.0+	1,420	150	410
Pesticides/PCBs								
DDD		NA	0.004	ND	NA	0.028	NA	NA
DDE	NA	NA	NA	ND	NA	0.004	0.0022	0.027
DDT	NA	NA	NA	ND	0.001	16	0.0016t	0.46t
Total PCBs	9,200	NA	NA	0.6	0.014x	18.2	0.023x	0.18x
Total Dioxins (2,3,7,8 TCDD TEQs[5])						0.0011		
PAHs								
Anthracene	37	NA	NA	NA	NA	1.1	0.09	0.5
Dibenz(a,h)anthracene	NA	NA	NA	NA	NA	2.0	0.063	0.26
Fluoranthene	170	NA	NA	NA	NA	17	0.016‡	0.6
Naphthalene	5.3	NA	NA	49	620‡	1.1	0.16	2.1
Benzo(k)fluoranthene	48	NA	NA	ND	NA	4.3	NA	NA
Phenanthrene	150	NA	NA	14	6.3p	5.8	0.24	1.5
Pyrene	140	NA	NA	2.0	NA	18	0.665	2.6
Benz(a)anthracene	62	NA	NA	ND	NA	7.0	0.26	1.6
Chrysene	54	NA	NA	ND	NA	10	0.38	2.8
Benzo(b)fluoranthene	35	NA	NA	ND	NA	14	NA	NA
Benzo(a)pyrene	26	NA	NA	ND	NA	6.8	0.43	1.6

1: EPA (1983).
2: Ambient water quality criteria for the protection of aquatic organisms. Freshwater chronic criteria presented (EPA 1993a).
3: Effects range-low; Long and MacDonald (1992).
4: Effects range-medium; Long and MacDonald (1992).
5: Toxic Equivalency Quotient
NA: Not available.
ND: Not detected; detection limits not available.
+: Hardness-dependent criterion.
‡: Lowest observed effect level (EPA 1993a).
t: Total DDT.
p: Proposed criteria.
x: Total PCBs

but no screening guidelines exist for these contaminants in soil. Although many of these same contaminants were detected in groundwater, no concentrations exceeded freshwater chronic AWQC, where criteria exist. Several SVOCs and VOCs were also detected in sediment.

Summary

Trace elements, PAHs, and PCBs were detected at elevated concentrations in soil, groundwater, and sediment associated with the Raymark site. Migration of site-related contaminants from fill areas next to Ferry Creek and the Housatonic River, and the historic discharge of these contaminants from Lagoon 4 to Ferry Creek, are the primary sources of potential risk to NOAA trust resources. The Housatonic River and associated wetlands downstream from Ferry Creek serve as habitat for numerous migratory and estuarine-dependent fish and invertebrate species of interest to NOAA.

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