10

McCormick & Baxter Creosoting Company

Portland, Oregon
CERCLIS #ORD009020603

Site Exposure Potential

The McCormick & Baxter Creosoting Company site occupies approximately 23 hectares in a highly industrialized area of Portland, Oregon (Figure 1). The site is situated on the bank of the Willamette River, approximately 11.3 km upstream from the confluence of the Willamette and Columbia rivers. The Columbia River enters the Pacific Ocean 160 km downstream from the confluence of the Willamette River.

Wood products were treated at the site from 1944 to 1991. The chemicals used for pressure-treating included creosote, PCP, chrome, ammoniacal copper arsenate, ammoniacal copper zinc arsenate, and Cellon (PCP, liquid butane, and isopropyl ether). Wood was treated in a central processing area that had four retorts (Figure 2). Various mixtures of creosote, PCP, and oil were stored in a tank farm next to the central processing area. Between 1950 and 1965, waste oil containing creosote and PCP was used to stabilize soils on the site. Between 1945 and 1971, process wastewater and non-contact cooling water were discharged directly to the Willamette River via four outfalls, while boiler water, stormwater, and oily wastes were directed or discharged to a former waste disposal trench in the southern portion of the site. In 1971, an evaporator was installed to treat process wastewaters.

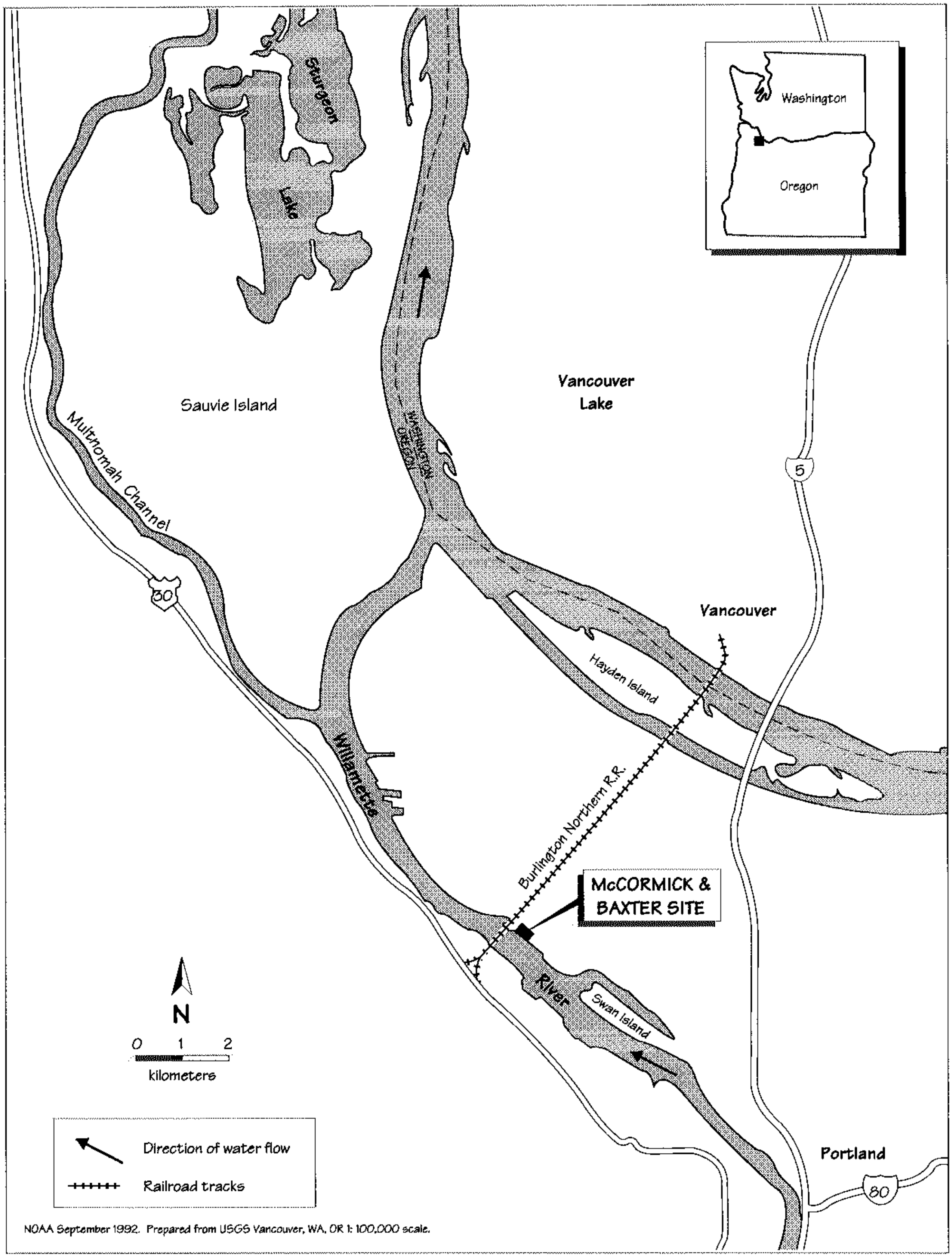

Figure 1. The McCormick & Baxter site in Portland, Oregon.

Before 1968, residues from site processes were disposed at an unknown off-site location. From 1968 to 1971, processing wastes were disposed in the former waste disposal area. Between 1972 and 1978, the residues were stored in metal containers and accumulated in the former waste disposal area. After 1978, wastes were shipped to an off-site hazardous waste disposal facility. Numerous areas of contamination have been observed on the site, primarily in the Central Process Area, Tank Farm, and at the Former Waste Disposal Area (PTI 1992).

Groundwater migration and surface water runoff discharged via outfalls to the Willamette River are the potential pathways of contaminant transport from the site to NOAA trust resources and associated habitats. Groundwater beneath the site occurs in three aquifers: an unconfined water table aquifer found between 6 and 9 m bgs, a semi-confined, intermediate aquifer between 12 and 16 m bgs, and a confined, deep aquifer below 45 m. Silt-sand aquitards separate the three aquifers, although the water table and intermediate aquifers are continuous in some areas beneath the site. Groundwater in the water-table aquifer generally flows to the southwest and discharges into the Willamette River. Surface water runoff from the site drains to the Willamette River through a series of drainage ditches, storm drains, and culverts that lead to four outfalls (Figure 2). Only Outfall 002 is authorized for stormwater discharge under a NPDES permit. The site is outside the one hundred-year floodplain (PTI 1992).

NOAA Trust Habitats and Species

The surface water and associated bottom substrates of the Willamette River are the habitats of most concern to NOAA. Anadromous fish species that use the Willamette River are the resources of concern to NOAA (Table 1). Surface water near the site is tidal fresh water (Ward personal communication 1992). Water averages 12 to 14 m deep near the site, with a maximum depth of 24 m. Habitat in the Willamette River near the site has been altered to accommodate urban development and a growing shipping industry. Artificial structures such as piers and wharves have changed the natural shoreline to riprap, bulkheads, and sand-beached lagoons. The river bottom is composed of silt and sand, with steep sides due to dredging (PTI 1992).

Five salmonid species inhabit the river near the site during different portions of the year. These salmonids include chinook (two races, spring and fall), coho, and sockeye, steelhead trout (two races, winter and summer), and cutthroat trout. Salmonids use habitat near the site as a migratory corridor to upstream spawning grounds and as a nursery for juveniles. In general, chinook and steelhead populations are the largest and most widespread of the salmonids in the river. There are few cutthroat trout in the Willamette River (Bennett and Foster 1991; Melcher personal communication 1994).

Other anadromous fish in the Willamette River near the site include American shad and white

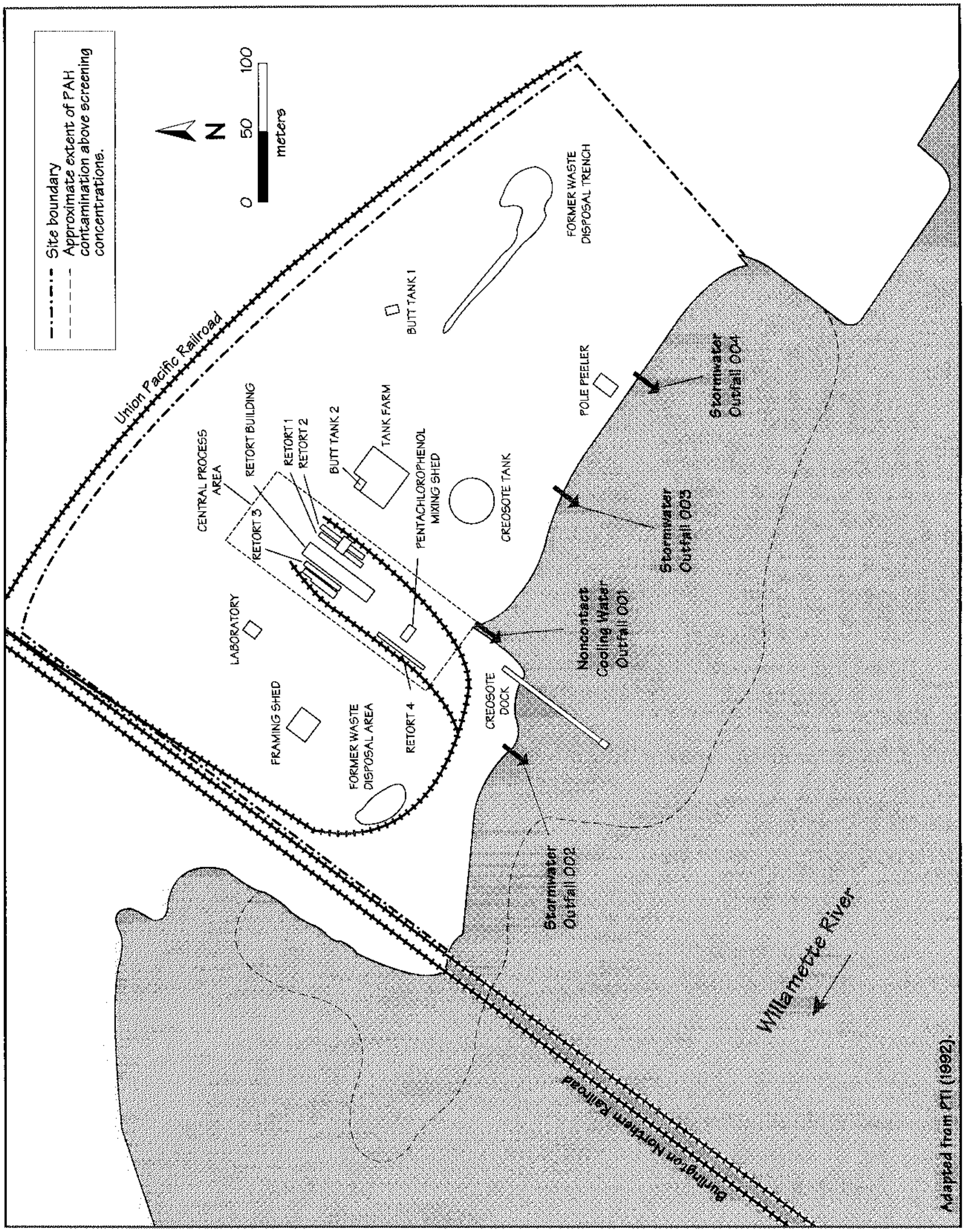

Figure 2. The McCormick & Baxter site in Portland, Oregon and approximate area of sediment contamination.

Table 1. Anadromous fish species in the Willamette River near the McCormick & Baxter site (Bennett and Foster 1991; Farr et al. 1991; Ward personal communication 1992; Melcher personal communication 1994).

Anadromous Species		Habitat			Fisheries	
Common Name	Scientific Name	Spawning Ground	Nursery Ground	Adult Forage	Comm. Fishery	Recr. Fishery
White sturgeon	*Acipenser transmontanus*		♦	♦		♦
American shad	*Alosa sapidissima*		♦	♦		♦
Cutthroat trout	*Oncorhynchus clarki*					♦
Coho salmon	*Oncorhynchus kisutch*		♦			♦
Steelhead trout[1]	*Oncorhynchus mykiss*		♦			♦
Sockeye salmon	*Oncorhynchus nerka*		♦			♦
Chinook salmon[1]	*Oncorhynchus tshawytscha*		♦			♦

[1]Species are supplemented by a stocking program.

sturgeon, both of which are plentiful (Bennett and Foster 1991; Melcher personal communication 1994). American shad spawn about 25 km upstream of the site, but use areas next to the site for adult migration and foraging, and for juvenile rearing grounds (Melcher personal communication 1994). White sturgeon spawning in the Willamette River has not been documented, but it is suspected that they spawn in the same location as American shad. White sturgeon are known to forage freely throughout the river (Melcher personal communication 1994).

Chinook and steelhead runs are both supplemented by hatchery stocks. Five large hatcheries produce approximately 5 million smolt-size spring chinook for release into the Willamette River each year, plus additional fingerling salmon to seed under-used reservoir and tributary streams. Fall chinook runs are supplemented by the addition of 5 to 7 million smolts each year.

Steelhead runs have been supplemented by hatchery stocks since the 1960s. Since 1991 approximately 565,000 winter and 750,000 summer steelhead smolts have been released each year in the Willamette River basin (Massey personal communications 1992, 1994).

There are no commercial fisheries for anadromous salmonids on the Willamette River, although the Columbia River supports a valuable commercial fishery. Due to sharp declines in stocks, stock preservation activities, competing fishing gears, and conflicting uses (e.g., hydropower and shipping), commercial fisheries are highly regulated in the Columbia River. Recreational fishing is extremely popular throughout the lower Willamette basin. Species most desired are spring chinook, steelhead, coho, American shad, and white sturgeon (Haxton personal communication 1991; Melcher personal communication 1994). Spring chinook contribute substantially to the mainstem Columbia River sport fishery and consistently support the largest recreational fishery in the lower Willamette River.

Site-Related Contamination

The primary contaminants of concern to NOAA are several PAHs associated with creosote, PCP, polychlorinated dibenzodioxins (PCDDs), polychlorinated dibenzofurans (PCDFs), and trace elements. These substances were detected at elevated concentrations in the soils and groundwater on the site, in surface water discharging to the Willamette River, and within the sediments of the Willamette River. In addition, elevated concentrations of the above contaminants have been detected in floating and sinking product layers in both the shallow and intermediate aquifers beneath the site (PTI 1992). The maximum concentrations of contaminants detected in various media types are presented in Tables 2 and 3 along with their respective screening guidelines.

Sources of PAHs on the site were primarily associated with the Central Process Area, the Former Waste Disposal Area, and the Tank Farm. Concentrations of total PAHs consistently exceeded 1,000 mg/kg in surface soils collected from these areas. In the product layers, concentrations of PAHs were at percent concentrations, well above groundwater screening concentrations. In the dissolved phase of groundwater, PAH concentrations were also very high, generally only an order of magnitude lower than the concentrations observed in product layers. PAHs were not observed in water samples collected from the stormwater outfalls (PTI 1992). All of the PAH compounds found on the site were detected in river sediment at concentrations exceeding screening guidelines. PAH-contaminated sediments extend along the entire shoreline of the site and into an embayment northwest of the site. The most contaminated sediments were found near the creosote dock and in the embayment. Preliminary results of sediment core studies indicate that there are PAHs in sediments above screening concentrations as deep as 2 m below the sediment surface (PTI 1992).

PCP was widespread in surface and subsurface soils, with a distribution similar to the PAHs. Elevated concentrations in surface soils were measured in the Central Process Area with the highest concentrations near Retort 4, in which PCP was the primary substance used. PCP was also a substantial component of the product layer observed within the groundwater. In water samples from the outfalls, PCP was detected at concentrations exceeding screening guidelines in six of seven samples collected. Relatively low concentrations of PCP were observed in river sediment compared to the PAHs. However, concentrations exceeding the screening guideline were observed in sediment downgradient of the Central Process Area, around the creosote dock, and downgradient of the Former Waste Disposal Area (PTI 1992).

Table 2. Maximum concentrations (µg/l) of contaminants of concern in groundwater, product layers, and outfall surface water compared with freshwater chronic AWQC.

Contaminant	Groundwater	Groundwater Product Layers	Outfalls	AWQC[1]
ORGANIC COMPOUNDS				
PAHs				
Naphthalene	2,400,000	90,000,000	NA	620*
Acenaphthalene	150,000	490,000	NA	520*
Acenaphthene	2,000,000	30,000,000	NA	21*
Fluorene	1,800,000	36,000,000	NA	NA
Phenanthrene	3,900,000	88,000,000	NA	NA
Anthracene	620,000	8,200,000	NA	NA
Fluoranthene	2,000,000	32,000,000	4	NA
Pyrene	1,100,000	30,000,000	2	NA
Chrysene	190,000	4,500,000	NA	NA
Benzofluoranthenes	160,000	1,700,000	NA	NA
Benzo(a)pyrene	100,000	100,000	NA	NA
Benzo(e)pyrene	5,300	100,000	NA	NA
Other Organic Compounds				
Pentachlorophenol	1,200,000	8,200,000	1,700	NA
PCDDs/PCDFs[2]	NA	0.20	0.24	<0.00001
TRACE ELEMENTS				
Arsenic	9,000	NT	7,600	190
Chromium	12,000	NT	780	210
Chromium $^{+6}$	120	NT	19	11
Copper	5,400	NT	15,000	12+
Zinc	260,000	NT	8,200	110+

1: Ambient water quality criteria for the protection of aquatic organisms. Freshwater chronic criteria presented (U.S. EPA 1993).
2: Toxicity equivalent concentrations of 2,3,7,8-TCDD.
NA: Screening guidelines not available.
NT: Not tested.
*: Value is Lowest Observed Effects Level (LOEL).
+: Hardness-dependent criteria (100 mg/l $CaCO_3$ used).

Contamination by PCDDs and PCDFs was not as widespread as by PAHs and PCP. These substances appeared at the most contaminated areas, particularly those with the highest concentrations of PCP. However, since analyses for PCDDs and PCDFs were not conducted in surface soils away from the Central Process Area, it is not known how seriously other areas are contaminated. PCDDs and PCDFs were observed in the product layer collected from the shallow aquifer downgradient of the Central Process Area near the river and the Former Waste Disposal Area in

Table 3. Maximum concentrations of contaminants of concern detected in soil and sediment from the McCormick & Baxter site compared with screening guidelines.

	Soil (mg/kg)		Sediment (mg/kg)	
Contaminant	On-site Surface Soil	Average U.S. Soil[1]	Willamette River	ERL[2]
ORGANIC COMPOUNDS				
PAHs				
Naphthalene	42	NA	3,500	0.16
Acenaphthalene	50	NA	17	1.3
Acenaphthene	940	NA	1,300	0.016
Fluorene	1,300	NA	1,100	0.019
Phenanthrene	4,900	NA	1,900	0.29
Anthracene	2,600	NA	290	0.085
Fluoranthene	2,900	NA	960	0.60
Pyrene	1,600	NA	610	0.67
Chrysene	1,900	NA	170	0.38
Benzofluoranthenes	1,000	NA	170	3.2
Benzo(a)pyrene	210	NA	58	0.43
Benzo(e)pyrene	620	NA	50	NA
Other Organic Compounds				
Pentachlorophenol	4,800	NA	7.2	0.69*
CDDs/CDFs[3]	0.38	NA	0.0027	NA
TRACE ELEMENTS				
Arsenic	5,100	5.0	18	8.2
Chromium	720	100	48	81
Chromium $^{+6}$	11	NA	0.99	NA
Copper	3,600	30	330	34
Zinc	4,200	50	350	150

1: Lindsay (1979).
2: Effects range-low; the concentration representing the lowest 10-percentile value for the data in which effects were observed or predicted in studies compiled by Long and MacDonald (1992).
3: Toxicity equivalent concentrations of 2,3,7,8-TCDD.
NA: Screening guidelines not available.
*: ERL concentration not available; the concentration presented is the maximum Apparent Effects Threshold (AET; PTI 1988).

samples that contained the highest concentrations of PCP. Concentrations in the product layers exceeded groundwater screening concentrations by up to three orders of magnitude. In water samples from three outfalls, PCDDs and PCDFs exceeded screening guidelines. The highest concentrations of PCDDs and PCDFs detected in sediment next to the site were found near the creosote dock and downgradient of the former Waste Disposal Area (PTI 1992).

Elevated concentrations of arsenic, chromium, copper, and zinc were generally limited to the Central Process Area and Tank Farm. The highest concentrations of trace elements in soil were observed in surface samples collected from the Central Process Area where ammoniacal copper zinc arsenate was used. Concentrations of trace elements in groundwater greatly exceeded screening concentrations in the Central Process Area, downgradient near the river, and beneath the Former Waste Disposal Area. Trace elements exceeded screening guidelines in water samples collected from Outfalls 002 and 003. In river sediments, copper and zinc were detected at concentrations exceeding their screening guidelines at three of the 48 stations that were sampled. Two of these stations were upstream of the Central Process Area and one was downstream of the railroad bridge (PTI 1992).

Bioassays using the freshwater amphipod *Hyalella azteca* and the Microtox test were conducted with sediments collected from the Willamette River next to the site. Significant adverse effects were observed with both tests. Stations where bioassays showed toxicity to test species were in an area next to the site extending from the Central Process Area to below the railroad bridge. These data indicate the possibility that other benthic organisms, some of which may be ecologically important to NOAA trust resources, may be adversely impacted in areas of the river near the site. In addition, bioaccumulation and histopathology studies indicated that the PAHs discharged from the site are bioavailable and that uptake is occurring to resident freshwater organisms. PCDDs and PCDFs did not appear to be as available (PTI 1992).

Summary

The primary contaminants of concern are PAHs, PCP, PCDDs, PCDFs, and trace elements. These contaminants were detected at elevated concentrations in environmental media collected throughout the site. Data indicate that these contaminants have migrated off-site to trust resource habitat in the Willamette River. In particular, PAHs were detected in sediment collected from the river at concentrations greatly exceeding screening guidelines for the protection of aquatic life. These sediments were toxic to aquatic organisms in laboratory bioassays. Contamination in the Willamette River near the site poses a threat to populations of anadromous fish that are NOAA trust resources, including five salmonid species, American shad, and white sturgeon.

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