Coastal Hazardous Waste Site Review: Site Reports September 1990

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Introduction

This report identifies uncontrolled hazardous waste sites that could pose a threat to natural resources for which the National Oceanic and Atmospheric Administration (NOAA) acts as a trustee. NOAA carries out responsibilities as a Federal trustee for natural resources under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the National Oil and Hazardous Substances Pollution Contingency Plan. As a trustee, NOAA is responsible for identifying sites that could affect natural resources, determining the potential for injury to the resources, evaluating cleanup alternatives, and carrying out restoration actions. NOAA works with the U.S. Environmental Protection Agency (EPA) when identifying and assessing risks to coastal resources from hazardous waste sites and developing strategies to minimize those risks.

NOAA regularly conducts evaluations of hazardous waste sites proposed for addition to the National Priorities List[1] (NPL) by EPA. The waste sites evaluated in this report are drawn from the list of all sites, including Federal facilities, proposed for inclusion on the NPL. The sites covered in this report were either proposed for inclusion on the National Priorities List by EPA in Update #8, 9, or 10, or listed in earlier NPL updates but not covered in previous NOAA reports.

The sites of concern to NOAA are located in counties bordering the Atlantic Ocean, Pacific Ocean, and Gulf of Mexico, or are near inland water bodies that support anadromous fish populations. Not all sites in coastal states will affect NOAA trust resources. To select sites on the National Priorities List for initial investigation, only sites in coastal counties or sites bordering important anadromous fish habitat are considered to have potential to affect trust resources. This initial selection criteria works better in some states than in others. It is dependent on topography, hydrography, and the nature of political subdivisions.

The information in the hazardous waste site reports provides an overall guide to the potential for injury to NOAA trust resources resulting from a site. This information is used by NOAA to establish priorities for investigating sites. Sites that appear to pose ongoing problems will be followed by a NOAA Coastal Resource Coordinator (CRC) in the appropriate region. The CRC communicates concerns about ecological impact to EPA, reviews sampling and monitoring plans for the site, and participates in planning and setting objectives for remedial actions to clean up the site. NOAA works with other trustees to plan a coordinated approach for remedial action that protects all natural resources. Other Federal and state trustees can use the hazardous waste site reports to help determine the risk of injury to their trust resources. EPA uses the site reports to help identify the types of information that may be necessary to complete an environmental assessment of the site.

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[1]National Oil and Hazardous Substances Pollution Contingency Plan, 40 CFR Part 300.

Coastal site reports are often NOAA's first examination of a site. Sites with potential to impact NOAA resources may be followed by a more in-depth Preliminary Natural Resource Survey.

Thirty-one coastal sites were identified in 1990 using this selection method. Further investigation showed that seven of these sites were not likely to affect NOAA trust resources. Coastal hazardous waste site reports were completed for the remaining 24 sites. A total of 238 coastal hazardous waste sites have been reviewed by NOAA since 1984. Two hundred fourteen sites identified as potentially affecting NOAA trustee resources were reported in April 1984,[2] June 1985,[3] April 1986,[4] June 1987,[5] and March 1989[6] The 24 sites in this report bring the total number of sites identified by NOAA as having the potential to affect trust resources to 238.

The 1990 coastal hazardous waste site reports contain three major sections. The "Site Exposure Potential" section describes activities at the site that resulted in the release of contaminants, local topography, and contaminant migration pathways. The "Site-Related Contamination" section identifies contaminants of concern to NOAA, the partitioning of the contaminants in the environment, and the concentrations at which the contaminants are found. The "NOAA Trust Habitats and Species" section describes the types of habitats and species potentially injured by releases from the site. The life stages of organisms using habitats near the site, and commercial and recreational fisheries, are discussed.

Tables and Screening Values

Most of these reports contain tables of contaminants measured at the site. These tables were formulated to highlight contaminants that represent a potential problem, and to focus our concerns on only a few of the many contaminants normally present at a waste site. Data presented in tables were screened against standard comparison values, depending on the media of the sample. Screening values used are ambient water quality criteria[7], selected soil averages[8], and Effective Range-Low (ER-L) values[9]. Because releases to the environment from hazardous waste sites can span many years, we are concerned about chronic

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[2]Ocean Assessments Division. 1984. Coastal Hazardous Waste Site Review April 13, 1984. NOAA/OAD, Seattle, Washington.
[3]Pavia, R., et al. 1985. Coastal Hazardous Waste Site Review June 1985. NOAA/OAD, Seattle, Washington.
[4]Pavia, R., et al. 1986. Coastal Hazardous Waste Site Review April 1986. NOAA/OAD, Seattle, Washington.
[5]Pavia, R., et al. 1987. Coastal Hazardous Waste Site Review June 1987. NOAA/OAD, Seattle, Washington.
[6]Pavia, R., et al. 1989 Coastal Hazardous Waste Site Review March 1989. NOAA/OAD, Seattle, Washington.
[7]U.S. Environmental Protection Agency. 1986. Quality criteria for water. Washington, D.C.
[8]Lindsay, W.L. 1979. Chemical Equilibria in Soils. John Wiley & Sons, New York.
[9]Long, E.R. and L.G. Morgan. 1990. The potential for biological effects of sediment-sorbed contaminants tested in the National Status and Trends Program. NOAA/OAD, Seattle, Washington.

impacts. Therefore, we typically make comparisons with the lower standard value (i.e., chronic AWQC).

Tables and Screening Values, *cont.*
Very little information exists regarding the toxicity of contaminated soil or sediment. No criteria similar to the AWQC are available. Sediment concentrations were screened by comparison with the ER-L reported by Long and Morgan[9]. The ER-L value is the concentration equivalent to that reported at the lower 10 percentile of the screened sediment toxicity data. As such, it represents the low end of the range of concentrations at which effects were observed in the studies compiled by those authors. Although freshwater studies were included, predominantly marine and estuarine toxicity studies were used for generating ER-L values.

Soil samples were compared to selected average levels from Lindsay (1979) as reported by EPA in 1983 in Hazardous Waste Land Treatment. These values were averaged from a data set selected by Lindsay to represent background levels from soil throughout the entire U.S. Ideally, reference values for soil would be calculated on a regional basis, from a data set large enough to give a value representative of the area. In the absence of such data, the values from Lindsay were used as a reference for comparison purposes only.

All of the hazardous waste sites considered by NOAA in this review are contained in the Table of Contents, including the name and location of the site and the beginning page number of the site report. Table 1 lists all the sites at which NOAA has been involved that have the potential to affect trust resources (488), as of September 1990. Table 2 lists acronyms, abbreviations, and terms commonly used in these waste site reports.

Table 1. Sites at which NOAA has been involved in remedial operations (488) as of September 1990, including those sites for which a Coastal Hazardous Waste Site Review (238) or Preliminary Natural Resource Survey (PNRS) (79) have been completed.

State	Cerclis	Site Name	Report Date	PNRS
Federal Region 1				
CT	CTD980732333	Barkhamsted-New Hartford Landfill	1989	
CT	CTD072122062	Beacon Heights, Inc.	1984	
CT	CTD108960972	Gallup's Quarry	1989	
CT	CTD980670814	Kellogg-Deering Well Field	1987	
CT	CTD980521165	Laural Park, Inc.		1988
CT	CTD001153923	Linemaster Switch		

State	Cerclis	Site Name	Report Date	PNRS
CT	CTD982747933	New London Submarine Base		
CT	CTD980669261	Nutmeg Valley Road		
CT	CTD980667992	O'Sullivans Island	1984	
CT	CTD980670806	Old Southington Landfill		
CT	CTD004532610	Revere Textile Prints Corps		
CT	CTD009717604	Solvents Recovery Service		
CT	CTD980906515	US Naval Submarine Base, New London	1990	
CT	CTD009774969	Yaworski Waste Lagoon	1985	1989
MA	MAD001026319	Atlas Tack Corp	1989	

Federal Region 1, *cont.*

State	Cerclis	Site Name	Report Date	PNRS
MA	MAD001041987	Baird & McGuire, Inc.		
MA	MAD079510780	CE Bridgewater		1988
MA	MAD980525232	CE Plymouth	1984	1990
MA	MAD003809266	Charles George Land Reclamation	1987	1988
MA	MAD980732317	Groveland Wells 1&2	1987	1988
MA	MAD980523336	Haverhill Municipal Landfill	1985	
MA	MAD980732341	Hocomonco Pond		
MA	MAD076580950	Industriplex	1987	1988
MA	MAD051787323	Iron Horse Park		
MA	MAD980731335	New Bedford	1984	
MA	MAD980670566	Norwood PCB's		
MA	MAD990685422	Nyanza Chemical	1987	
MA	MAD980731483	PSC		
MA	MAD980520621	Resolve, Inc.		
MA	MAD980524169	Rose Disposal Pit		
MA	MAD980525240	Salem Acres		
MA	MAD980503973	Shpack Dump		
MA	MAD000192393	Silresim Chemical Corp.		
MA	MAD980731343	Sullivan's Ledge	1987	1989
MA	MAD001002252	W. R. Grace and Co.		
MA	MAD980732168	Well G & H		1990
ME	MED980524078	Mckin Company	1984	
ME	MED980731475	O'Connor Company	1984	
ME	MED980732291	Pinettes Salvage Yard		
ME	MED980504393	Saco Municipal Landfill	1989	
ME	MED980520241	Saco Tannery Waste Pits		
ME	ME8170022018	U.S. Navy Brunswick NAS	1987	
ME	MED042143883	Union Chemical Company, Inc.		
ME	MED980504435	Winthrop Town Landfill		
N H	NHD980524086	Auburn Road Landfill		1989
N H	NHD064424153	Coakley Landfill	1985	1989
N H	NHD980520191	Dover Municipal Landfill	1987	1990
N H	NHD001079649	Fletcher's Paint Works and Storage	1989	
N H	NHD069911030	Grugnale Waste Disposal Site	1985	
N H	NHD981063860	Holton Circle Ground Water Contamination		
N H	NHD062002001	Kearsarge Metallurgical		
N H	NHD092059112	Keefe Environmental Services		
N H	NHD980503361	Mottolo Pig Farm		
N H	NHD990717647	Ottati & Goss Great Lakes Container Corp		
N H	NH7570024847	Pease Air Force Base	1990	

NH	NHD980671002	Savage Municipal Water Supply	1985	
NH	NHD980520225	Somersworth Sanitary Landfill		
NH	NHD980671069	South Municipal Water Supply		
NH	NHD099363541	Sylvester's	1985	
NH	NHD989090469	Tibbetts Road		
NH	NHD062004569	Tinkham Garage		
RI	RID980520183	Central Landfill (Johnston Site)		
RI	RID980731459	Davis GSR Landfill		
RI	RID980523070	Davis Liquid Waste Site	1987	
RI	RI6170022036	Davisville Naval Construction Battalion Ctr	1990	
RI	RID093212439	Landfill and Resource Recovery (L&RR)		
RI	RI6170085470	Newport Naval Education/Training Center	1990	
RI	RID055176283	Peterson/Puritan, Inc.	1987	1990
RI	RID980579056	Picillo Farm	1987	1988

State	Cerclis	Site Name	Report Date	PNRS

Federal Region 1, *cont.*

RI	RID980521025	Rose Hill Regional Landfill	1989	
RI	RID980731442	Stamina Mills	1987	1990
RI	RID009764929	Western Sand and Gravel	1987	
VT	VTD981064223	Bennington Municipal Landfill		
VT	VTD980520092	BFI Sanitary Landfill	1989	
VT	VTD003965415	Burgess Brothers Landfill		
VT	VTD980520118	Darling Hill Dump		
VT	VTD000860239	Old Springfield Landfill	1987	1988
VT	VTD981062441	Parker Sanitary Landfill		
VT	VTD980523062	Pine Street Canal		
VT	VTD000509174	Tansitor Electronics, Inc		

Federal Region 2

NJ	NJD000525154	Albert Steel Drum	1984	
NJ	NJD002173276	American Cyanamid	1985	
NJ	NJD980654149	Asbestos Site		
NJ	NYD980768675	BEC Trucking		1990
NJ	NJD063157150	Bog Creek Farm	1984	
NJ	NJD980505176	Brick Township Landfill	1984	
NJ	NJD053292652	Bridgeport Rental & Oil Services (BROS)		1990
NJ	NJD078251675	Brook Industrial Park	1989	
NJ	NJD980504997	Burnt Fly Bog		
NJ	NJD000607481	Chemical Control	1984	
NJ	NJD980484653	CHEMICAL INSECTICIDE CORP	1990	
NJ	NJD047321443	Chemical Leaman	1989	
NJ	NJD980528897	Chipman Chemical	1985	
NJ	NJD001502517	Ciba-Geigy Corp.	1984	1989
NJ	NJD980785638	Cinnaminson		
NJ	NJD000565531	Cosden Chemical	1987	
NJ	NJD002141190	CPS Chemical/Madison Industries		1990
NJ	NJD011717584	Curcio Scrap Metal	1987	
NJ	NJD980761373	De Rewal Chemical Co.	1985	
NJ	NJD980529002	Delilah Landfill		
NJ	NJD046644407	Denzer and Schafer X-Ray	1984	
NJ	NJD980528996	Diamond Alkali/Diamond Shamrock	1984	

NJ	NJD980529085	Ellis Property		
NJ	NJD980761365	EWAN		
NJ	NJ9690510020	FAA Tech Center	1990	
NJ	NJ2210020275	Fort Dix		
NJ	NJD041828906	Fried Industries		
NJ	NJD053280160	Garden State Cleaners	1989	
NJ	NJD980529192	GEMS Landfill		
NJ	NJD063160667	Global Sanitary Landfill	1989	
NJ	NJD980530109	Goose Farm		
NJ	NJD980505366	Helen Kramer Landfill	1990	
NJ	NJD002349058	Hercules, Inc.	1984	
NJ	NJD053102232	Higgins Disposal	1989	
NJ	NJD981490261	Higgins Farm	1989	
NJ	NJD980663678	Horseshoe Road Dump	1984	
NJ	NJD980532907	Ideal Cooperage	1984	
NJ	NJD981178411	Industrial Latex	1989	
NJ	NJD980505283	Jackson Township Landfill	1984	
NJ	NJ0141790006	Jamaica Bay		
NJ	NJD002493054	Kauffman and Minteet	1989	

State	Cerclis	Site Name	Report Date	PNRS

Federal Region 2, *cont.*

State	Cerclis	Site Name	Report Date	PNRS
NJ	NJD049860836	Kin-Buc Landfill	1984	1990
NJ	NJD980505341	King of Prussia		
NJ	NJD002445112	Koppers Company	1984	
NJ	NJD980529838	Krycowaty Farm	1985	
NJ	NJ7170023744	Lakehurst NAEC		
NJ	NJD980505416	Lipari Landfill		
NJ	NJD085632164	M&T Delisa		
NJ	NJD980654180	Manheim Avenue Site		
NJ	NJD002517472	Metaltec		
NJ	NJ0210022752	Military Ocean Terminal		
NJ	NJD000606756	Mobil Chemical Company	1984	
NJ	NJD980654198	Myers property		
NJ	NJD061843249	N.L. Industries	1984	
NJ	NJD002362705	Nascolite		
NJ	NJ0170022172	Naval Weapons Station, Earl		
NJ	NJD980529598	Pepe Field		
NJ	NJD980653901	Perth Amboy's PCB's	1984	
NJ	NJD980505648	PJP landfill	1984	1990
NJ	NJD981179047	Pohatcong Valley Groundwater Cont.		
NJ	NJD980769350	Pomona Oaks		
NJ	NJD070281175	Price Landfill	1984	
NJ	NJD980582142	Pulverizing Services Inc.		
NJ	NJD000606442	Quanta Resources (Allied, Shady Side)		
NJ	NJD980529713	Reich Farm		
NJ	NJD070415005	Renora		
NJ	NJD980529739	Ringwood Site		
NJ	NJD073732257	Roebling Steel Company	1984	1990
NJ	NJD030250484	Roosevelt Drive-In	1984	
NJ	NJD980754733	Sayerville Pesticide	1984	
NJ	NJD980505754	Sayreville Landfill	1984	1990

State	Cerclis	Site Name	Report Date	PNRS
NJ	NJD070565403	Scientific Chemical Processing, Inc.	1984	1989
NJ	NJD980505762	Sharkey Landfill	1990	
NJ	NJD980766828	South Jersey Clothing Co.	1989	
NJ	NJD064263817	Syncon Resins	1984	
NJ	NJD980769475	T. Fiore Demolition, Inc.	1984	
NJ	NJD980761357	Tabernacle Drum		
NJ	NJD002005106	Universal Oil Products, Inc.	1984	
NJ	NJD980529879	Ventron / Velsicol	1984	
NJ	NJD002385664	Vineland Chemical	1990	
NJ	NJD054981337	Waldick Aerospace Devices		1990
NJ	NJD001239185	White Chemical Company	1984	
NJ	NJD980529945	Williams Property	1984	
NJ	NJD045653854	Witco Chemical Corporation		
NJ	NJD980505887	Woodlands Route 532		
NJ	NJD980505879	Woodlands Route 72		
NY	NYD072366453	Action Anodizing Site	1989	
NY	NYD002066330	American Thermostat		
NY	NYD001485226	Anchor Chemical		
NY	NYD980535652	Applied Environmental Services	1985	
NY	NYD980768683	Bioclinical Laboratories		
NY	NYD980652275	Brewster Wellfield		
NY	NY7890008975	Brookhaven National Lab	1990	
NY	NYD980780670	Byron Barrel and Drum		
NY	NYD981561954	C and J Disposal Site	1989	

Federal Region 2, *cont.*

State	Cerclis	Site Name	Report Date	PNRS
NY	NYD010968014	Carrol and Dubies	1989	
NY	NYD981184229	Circuitron Corp. Site		
NY	NYD000511576	Clothier Disposal		
NY	NYD980508048	Croton Point Sanitary Landfill		
NY	NYD980780746	Endicott Village Wellfield		
NY	NYD002050110	Genzale Plating Site		
NY	NYD091972554	GM Foundry	1989	
NY	NYD980768717	Goldisc Site		
NY	NY4571924451	Griffiss AFB		
NY	NYD980785661	Haviland		
NY	NYD980780779	Hertel Landfill		
NY	NYD002920312	Hooker / Ruco		
NY	NYD980763841	Hudson River PCBs (GE)	1989	
NY	NYD980534556	Jones Sanitation	1987	
NY	NYD980780795	Katonah Municipal Well		
NY	NYD000337295	Liberty Industrial Finishing	1985	
NY	NYD013468939	Ludlow Sanitary Landfill		
NY	NYD980535124	MALTA Rocket Fuel Site		
NY	NYD010959757	Marathon Battery	1984	1989
NY	NYD000512459	Mattiace Petrochemical	1989	1990
NY	NYD980763742	MEK		
NY	NYD002014595	Nepera Site		
NY	NYD980506810	Niagara 102nd Street		
NY	NYD000514257	Niagara County Refuse		
NY	NYD980664361	Niagara Mohawk Power Corp.		

State	Cerclis	Site Name	Report Date	PNRS
NY	NYD980780829	Ninety-Third Street School		
NY	NYD980762520	North Sea Municipal Landfill	1985	1989
NY	NYD991292004	Pasley Solvents		
NY	NYD980641047	Pennsylvania Ave. Landfill		
NY	NYD000511659	Pollution Abatement Services		
NY	NYD980654206	Port Washington Landfill	1984	1989
NY	NYD980768774	Preferred Plating Corp.		
NY	NYD980507735	Richardson Landfill		
NY	NYD981486954	Rowe industries	1987	
NY	NYD980507677	Sidney Landfill	1989	
NY	NYD980535215	Sinclair Refinery Site		
NY	NYD980421176	Solvent Savers		
NY	NYD980780878	Suffern Wellfield Site		
NY	NYD000511360	Syosset Landfill		
NY	NYD002059517	Tronic Plating		
NY	NYD980509376	Volney		
NY	NYD980535496	Wallkill Wellfield		
NY	NYD980506679	Warwick Landfill Site		
NY	NYD000511733	York Oil		
PR	PRD090416132	Clear Ambient Service	1984	
PR	PRD980640965	Frontera Creek	1984	
PR	PRD090282757	GE Wiring		
PR	PR4170027383	Naval Security Group Activity Sabana Sec	1989	
PR	PRD980301154	UpJohn		
PR	PRD980763775	Vega Alta		
Federal Region 3				
DE	DED980494496	Army Creek Landfill	1984	
DE	DED980714141	Chem-Solv, Inc.		
Federal Region 3, *cont.*				
DE	DED980704860	Cokers Sanitation Services Landfills	1986	1990
DE	DED980551667	Delaware City PVC	1984	
DE	DED000605972	Delaware Sand & Gravel Landfill	1984	
DE	DE8570024010	Dover Air Force Base	1987	1989
DE	DED980693550	Dover Gas and Light Company	1987	
DE	DED980555122	Du Pont Newport Landfill	1987	1990
DE	DED980830954	Halby Chemical Company	1986	1990
DE	DED980713093	Harvey & Knott Drum		
DE	DED980705727	Kent Co. Landfill	1989	
DE	DED980552244	Koppers Company Facilities site	1990	
DE	DED043958388	National Cash Register Corp.	1986	
DE	DED058980442	New Castle Spill Site	1984	1989
DE	DED980705255	New Castle Steel	1984	
DE	DED980704894	Old Brine Sludge	1984	
DE	DED980494603	Pigeon Point Landfill	1987	
DE	DED981035520	Sealand	1989	
DE	DED041212473	Standard Chlorine of Delaware, Inc.	1986	
DE	DED980494637	Sussex Co. Landfill	1989	
DE	DED000606079	Tybouts Corner Landfill	1984	
DE	DED980705545	Tyler Refrigeration Pit Site		

DE	DED980704951	Wildcat Landfill	1984	
MD	MD2210020036	Aberdeen Proving Ground	1986	
MD	MDD980504187	Aberdeen, Michaelsville Landfill	1986	
MD	MDD980705057	Anne Arundel County Landfill	1989	
MD	MDD980504195	Bush Valley Landfill	1989	
MD	MDD030321178	Joy Reclamation Co.	1984	
MD	MDD980705164	Maryland Sand/Gravel/Stone	1984	1990
MD	MDD064882889	Mid-Atlantic Wood		
MD	MDD980704852	Southern Maryland Wood	1987	
MD	MDD980504344	Woodlawn Co Landfill	1987	
PA	PAD004351003	A.I.W. Frank/Mid-County Mustang		
PA	PAD000436436	Ambler Asbestos Piles		
PA	PAD009224981	American Electronics		
PA	PAD980693048	AMP, Inc.		
PA	PAD061105128	Bally Township		
PA	PAD980705107	Bell Landfill		
PA	PAD003047974	Bendix Flight Systems Site		
PA	PAD980538649	Berkley Products Dump		
PA	PAD000651810	Berks Landfill		
PA	PAD047726161	Boarhead Farms	1989	
PA	PAD980508402	Bridesburg Dump	1984	
PA	PAD980831812	Brown's Battery		1990
PA	PAD980508451	Butler Mine Tunnel	1987	
PA	PAD981034705	Butz Landfill		
PA	PAD093730174	Commodore Semiconductor Group		
PA	PAD981035009	Croydon TCE	1986	
PA	PAD981038052	Delta Quarries/Stotler		
PA	PAD002384865	Douglassville Disposal Site	1987	
PA	PAD003058047	Drake		
PA	PAD980830533	Eastern Diversified		
PA	PAD980539712	Elizabethtown Landfill	1989	
PA	PAD980552913	Enterprise Avenue	1984	
PA	PAD002338010	Havertown PCP		
PA	PAD980829329	Hebelka Auto Salvage		

State	Cerclis	Site Name	Report Date	PNRS

Federal Region 3, *cont.*

PA	PAD002390748	Hellertown Manufacturing Company	1987	
PA	PAD009862939	Henderson Road	1989	
PA	PAD980829493	Jacks Creek/Sitkin Smelting & Refining	1989	
PA	PAD981036049	Keyser Ave. Borehole	1989	
PA	PAD980508667	Lackawanna Refuse		
PA	PA2210090054	Letterkenny-Property Disposal Area		
PA	PA6213820503	Letterkenny-Southeast Industrial Area		
PA	PAD046557096	Metal Bank of America	1984	1990
PA	PAD980538763	Middletown Air Field		
PA	PA6170024545	Naval Air Develop.		
PA	PAD096834494	North Penn		
PA	PAD980229298	Occidental Chemical/Firestone	1989	
PA	PAD002395887	Palmerton Zinc Pile		
PA	PAD980692594	Paoli Railyard	1987	1990
PA	PAD063766828	Picco Resins		

PA	PAD981939200	Publicker Industries	1990	
PA	PAD039017694	Raymark		
PA	PAD002353969	Recticon / Allied Steel	1989	
PA	PAD980829261	Reeser's		
PA	PAD051395499	Revere Chemical Company	1986	
PA	PAD091637975	Rohm and Haas Landfill	1986	
PA	PAD980692487	Saegertown Industrial Area		
PA	PAD002498632	Spra-Fin, Inc.		
PA	PAD000441337	Strasburg Landfill		
PA		Textron-Lycoming		
PA	PA6143515447	Tinicum National Environmental Center	1986	
PA	PAD073613663	Tonolli Corp.		
PA	PAD980692024	Tysons Dump	1985	
PA	PAD980539407	Wade (ABM) Site	1984	
PA	PAD980829527	Welsh / Barkman Landfill		
PA	PAD980537773	William Dick Lagoons		
VA	VAD980551683	Abex Corp.	1989	
VA	VAD042916361	Arrowhead Assoc / Scovill Corp	1989	
VA	VAD990710410	Atlantic Wood Industries	1987	1990
VA	VAD049957913	C&R Battery Co., Inc.	1987	
VA	VAD980712913	Chisman Creek	1984	
VA	VA3971520751	Defence General Supply Center		
VA	VAD003125374	Greenwood Chemical Site		
VA	VAD980539878	H & H Inc.		
VA	VAD007972482	L.A. Clarke		
VA	VAD071040752	Rentokil Inc.		
VA	VAD980831796	Rhinehart tire fire		
VA	VAD003127578	Saltville		
VA	VAD003117389	Saunders Supply Co.	1987	
VA	VAD980917983	Suffolk City Landfill		
VA	VAD980705404	U.S. Titanium		
WV	WVD004336749	Follansbee		
AL	ALD001221902	Ciba-Geigy Corp	1990	
AL	ALD008188708	Olin Corp. McIntosh Plant	1990	
AL	ALD980844385	Redwing Carriers Inc. / Sara.	1989	
AL	ALD095688875	Stauffer Chemical Co. Cold Creek Plt.		1990
AL	ALD008161176	Stauffer Chemical Co. Lemoyne Plant		1990
FL	FLD980728877	62nd Street Dump	1984	1989
FL	FLD980221857	Agrico Chemical Site	1989	

State	Cerclis	Site Name	Report Date	PNRS

Federal Region 4, *cont.*

FL	FLD008161994	American Creosote Works	1984	1989
FL	FLD088783865	Bay Drum / Tampa		
FL	FLD980494660	Beulah Landfill		
FL	FL5170022474	Cecil Field Naval Air Station	1990	
FL	FLD080174402	Chem-Form Inc.	1990	
FL	FLD080174402	Chemform Inc.		
FL	FLD050432251	Florida Steel Corporation		
FL	FLD000827428	Gardinier, Inc.		
FL	FLD000602334	Harris Corporation / General Development U	1986	1990
FL	FLD980709802	Hipps Road Landfill		

FL	FLD004119681	Hollingsworth Solderless Terminal Co.		
FL	FL7570024037	Homestead AFB		
FL	FL6170024412	Jacksonville Naval Air Station	1990	
FL	FLD980727820	Kassouf-Kimerling	1984	1989
FL	FLD084535442	Munisport Landfill	1984	
FL	FL9170024567	Naval Air Station Pensacola	1990	
FL	FLD004091807	Peak Oil Co.		
FL	FLD980556351	Pickettville Landfill	1984	1990
FL	FLD004054284	Piper Aircraft Corp Vero Beach		
FL	FLD000824888	Reeves SE Corp		
FL	FLD980602882	Sapp Battery Salvage		1989
FL	FLD062794003	Schuylkill Metal Corp		
FL	FLD004126520	Standard Auto Bumper Corp.	1989	
FL	FLD010596013	Stauffer Chemical Co.	1990	
FL	FLD000648055	Sydney Mine Sludge Ponds	1989	1989
FL	FLD004146346	Woodbury Chemical Co.	1989	
FL	FLD980844179	Yellow Water Road		
GA	GAD980556906	Hercules 009 Landfill		
GA	GAD099303182	LCP Chemicals - Georgia, Inc.		
GA	GA1570024330	Robins Air Force Base		
GA	GAD003269578	Woolfolk Chemical Works, Inc.		
MS	MSD098596489	Gautier Oil Co. Inc.	1989	
NC	NCD024644494	ABC One Hour Cleaners	1989	
NC	NCD981475932	FCX Washington Dist. Inc.	1989	
NC	NC1170027261	MCAS, Cherry Point		
NC	NCD981021157	New Hanover Cty Airport Burn Pit	1989	
NC	NCD981023260	Potter's Septic Tank Ser. Pits	1989	
NC	NC6170022580	USMC Camp Lejuene, Site 21	1989	
SC	SCD980844260	Beaufort County Landfill		
SC	SCD980711279	Geiger (C&M Oil)	1984	
SC	SCD058753971	Helena Chemical Co.	1989	
SC	SCD055915086	International Paper/Sampit River		
SC	SCD980310239	Koppers Ashley River		
SC	SC1890008989	Savannah River Plant	1990	
SC	SCD037405362	WamChem	1984	

Federal Region 6

LA	LAD980745632	Bayou Bonfouca		
LA	LAD980745541	Bayou Sorrell	1984	
LA	LAD980501423	Calcasieu Lake		
LA	LAD057482713	Petro-Processors of Louisiana, Inc.		
TX	TXD980864649	Bailey Waste Disposal	1985	1989
TX	TXD980625453	Brio Refining , Inc.	1989	1989
TX	TXD990707010	Crystal Chemical Company	1989	1989

State	Cerclis	Site Name	Report Date	PNRS

Federal Region 6, *cont.*

TX	TXD089793046	Dixie Oil Processors	1989	1989
TX	TXD980514814	French Limited	1989	1989
TX	TXD980748453	Geneva Industries/Fuhrmann Energy Corp		
TX	TXD980745582	Harris (Farley Street)		
TX	TXD980514996	Highlands Acid Pit	1989	

TX	TXD008123168	Lavaca Bay		
TX	TXD980629851	Motco Corp.	1984	
TX	TXD980873343	North Cavalcade		
TX	TXD980873350	Petro-Chemical Systems, Inc.		
TX	TXD980513956	Sikes Disposal Pits	1989	
TX	TXD980873327	Sol Lynn/Industrial Transf		
TX	TXD980810386	South Cavalcade		
TX	TXD062113329	Tex-Tin Corporation	1989	
TX	TXD055143705	Triangle Chemical Company		

Federal Region 9

AS	ASD980637656	Taputimu Farm, Tutuila Isl.	1984	
CA	CA2170023236	Alameda Naval Air Station	1989	
CA	CAD052384021	Brown & Bryant, Inc. (Arvin Plant)		
CA	CA2170023533	Camp Pendleton Marine Corps Base	1990	
CA	CAD009114919	Chevron USA Richmond Refinery		
CA	CAD063015887	Coast Wood Preserving	1984	
CA	CAD980498455	Crazy Horse Sanitary Landfill		
CA	CAD009212838	CTS Printex, Inc.	1989	
CA	CAD000626176	Del Norte County Pesticide Storage Area	1984	
CA	CA6170023208	El Toro Marine Corps Air Station	1989	
CA	CAD981159585	Farallon Islands Radioactive Waste Dumps		1990
CA	CAD980636914	Fresno Municipal Sanitary Landfill		
CA	CA7210020676	Fort Ord	1990	
CA	CAD980498562	GBF and Pittsburg Dumps	1989	
CA	CA3570024288	Hamilton Air Force Base		
CA	CAD980884209	Hewlett-Packard (620-40 Page Mill Rd)	1989	
CA	CAD058783952	Hexcel Corp. - Livermore		
CA	CA1170090087	Hunters Point Annex	1989	1989
CA	CAD041472341	Intersil Inc./Siemens Components	1989	
CA	CAD980498612	Iron Mountain Mine	1989	1989
CA	CAD000625731	J.H. Baxter		
CA	CAD009103318	Jasco Chemical Corp.	1989	
CA	CAD008274938	Kaiser Steel Corp. (Fontana Plant)		
CA	CAD981429715	Kearney - KPF		
CA	CAD981436363	Levin Richmond Terminal Corp.		
CA	CAT000646208	Liquid Gold	1984	
CA	CAD000074120	MGM Brakes	1984	
CA	CAD982463812	Middlefield-Ellis-Whisman		
CA	CAD981997752	Modesto Ground Water Contamination		
CA	CA2170090078	Moffett Field Naval Air Station	1986	
CA	CAD008242711	Montrose Chemical Corp.	1985	
CA	CA7170024528	Naval Weapons Station, Concord	1989	1990
CA	CAD981434517	Newmark Ground Water Contamination		
CA	CAD980636781	Pacific Coast Pipelines	1989	
CA	CA9170027271	Pacific Missile Test Center		
CA	CA1170090236	Point Loma Naval Complex		
CA	CAD982462343	Redwood Shore Landfill		
CA	CAT000611350	Rhone-Poulenc, Inc. - Zoecon	1985	

State	Cerclis	Site Name	Report Date	PNRS
Federal Region 9, *cont.*				
CA	CA7210020759	Riverbank Army Ammunition Plant	1989	
CA	CAD009164021	Shell Oil Co., Martinez Manufact. Complex		
CA	CAD980637482	Simpson Paper		
CA	CAD981171523	Sola Optical USA, Inc.	1989	
CA	CAD059494310	Solvent Service, Inc.		
CA	CAD980894885	South Bay Asbestos Area - Alviso	1985	
CA	CAD009138488	Spectra-Physics, Inc.		
CA	CAD980893275	Sulphur Bank Mercury Mine		
CA	CAD990832735	Synertek, Inc. - Building 1		
CA	CA5570024575	Travis Air Force Base	1990	
CA	CAD009159088	TRW Microwave, Inc. - Building 825		
GU	GU7170027323	Naval Station Guam		
HI	HID980497184	Kailua Landfill		
HI	HID980497226	Kakaako Landfill/Kewalo Incinerator		
HI	HI6170022762	Kanehoe MCAS, Skeet Range		
HI	HID980497176	Kapaa Landfill		
HI		Kapalama Canal/Honolulu Harbor		
HI	HID980585178	Pearl City LDFL	1984	
HI	HID982400475	Waiakea Pond/Hawaiian Cane Products		1990
Federal Region 10				
AK	AK8570028649	Elmendorf AFB	1990	1990
AK	AKD980978787	Standard Steel	1990	1990
OR	ORD009051442	Allied Plating	1987	1988
OR	ORD095003687	Gould Inc.	1984	1988
OR	ORD052221025	Martin Marietta Corp	1987	1988
OR	ORD009025347	Stauffer Chemical Co	1984	
OR	ORD050955848	Teledyne Wah Chang Albany	1985	1988
OR	ORD009049412	Union Pacific, The Dalles	1990	1990
WA	WAD009045279	ALCOA- Vancouver	1989	1989
WA	WAD057311094	American Crossarm & Conduit Co.	1989	1988
WA	WA5170090059	Ault Field - NAS Whidbey Is. - U.S. Navy	1986	1989
WA	WA7170027265	Bangor Ordnance Disposal(Site A)		1990
WA	WA1891406349	BPA Ross	1990	1990
WA	WAD980836662	Centralia Landfill	1989	1989
WA	WAD980726301	Commencement Bay - South Tacoma Channel	1984	
WA	WAD980726368	Commencement Bay Nearshore/Tideflats	1984	1988
WA	WA5210890096	Hamilton Island		
WA	WA7890008967	Hanford	1989	1988
WA	WAD980722839	Harbor Island	1984	1989
WA	WA4170090001	Indian Is.-NUWES-USNavy	1989	
WA	WAD980639462	Kent Highlands Landfill	1989	1988
WA	WA1170023419	Keyport- NUWES-USNavy		
WA	WA2170023426	Manchester Naval Supply Center		
WA	WAD027315621	NW Transformer - Harkness	1989	1988
WA	WAD980639215	Quendall Terminals	1985	
WA	WA6170090058	Seaplane Base, NAS Whidbey Is., USNAVY	1986	1989
WA	WA5170027291	Subase Bangor	1990	
WA	WAD009487513	Western Processing	1984	

WA	WAD009248295	Wyckoff Company, Eagle Harbor	1986	1988

Table 2. Acronyms and abbreviations used in Coastal Hazardous Waste Site Reviews

Acronyms

CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Information System
CRC	Coastal Resource Coordinator
DOD	U.S. Department of Defense
DOI	U.S. Department of the Interior
EPA	U.S. Environmental Protection Agency
HRS	Hazard Ranking System
IRM	Immediate Removal Measure
NATO	North Atlantic Treaty Organization
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
OU	Operable Unit
PRP	Potential Responsible Party
RCRA	Resource Conservation and Recovery Act
RD/RA	Remedial Design/Remedial Action
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
SARA	Superfund Amendments and Reauthorization Act
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey

Abbreviations

µg/g	micrograms per gram
µg/l	micrograms per liter
mg/kg	milligrams per kilogram
mg/l	milligrams per liter
mR/hr	milliroentgens per hour
PCB	polychlorinated biphenyl
pCi/l	pico Curies per liter (1 pico Curie=10^{-12} Curie)
PCP	pentachlorophenol
PNA, PAH	polynuclear aromatic hydrocarbon
ppb	parts per billion
ppm	parts per million
ppt	parts per thousand
PVC	polyvinyl chloride
TPH	total petroleum hydrocarbons
VOC	volatile organic compound

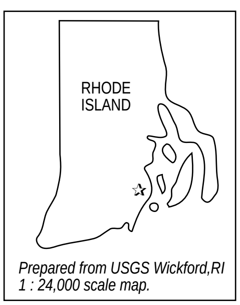
Naval Construction Battalion Center

North Kingston, Rhode Island
Region 1
RI6170022036

Site Exposure Potential

The Davisville Naval Construction Battalion Center (NCBC) is located in North Kingston, Rhode Island, 16 km south of Providence (Figure 1). The site consists of four areas: the main center, the West Davisville storage area, Camp Fogherty, and a decommissioned naval air station at Quonset Point. The Navy acquired the property in 1939 and constructed Naval Air Station (NAS) Quonset Point for training, overhauling and supplying aircraft, and coastal defense. In 1942, other properties were developed for naval construction battalion training. After World War II, the NAS remained in operation but the NCBC was inactive until 1951 when the site was designated Headquarters NCBC. The NAS was decommissioned in 1974, and activities at the NCBC were reduced to the current low level of operation (TRC 1988).

During NAS operations, waste materials, including battery acid, paint thinners, solvents, degreasers, transformer oils, jet fuels, and sewage sludge were disposed on the NCBC property. From 1946 to 1972, wastes generated from activities at the NCBC and the NAS were either burned or disposed at the



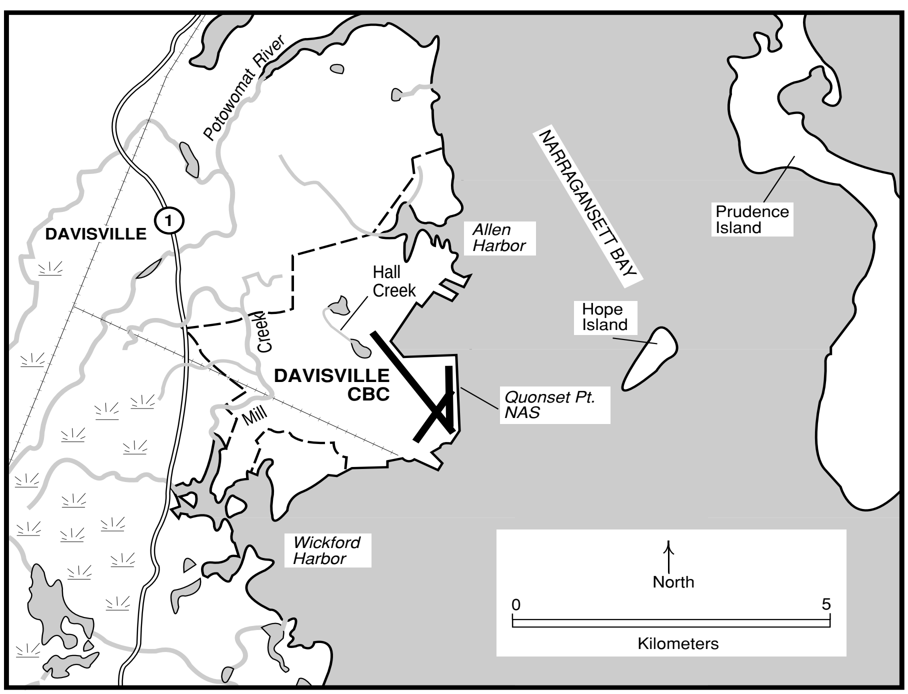


Figure 1. Naval Construction Battalion Center, North Kingston, Rhode Island.

Site Exposure Potential, *cont.*

Allen Harbor landfill, on the western shore of Allen Harbor. Much of the NCBC-Davisville site is contiguous with Narragansett Bay. The site contains several low-lying marshy areas and is transected by several streams that discharge to the bay, including Mill Creek and Hall Creek. Local groundwater is unconfined and the water table is often within 0 to 3 m of the ground surface. The flow of groundwater reflects surface topography and is from the higher lands in the west towards Narragansett Bay. Locally, groundwater may flow downgradient to the nearest surface water drainage, but all surface water on the site ultimately discharges to Narragansett Bay. Groundwater is a significant source of recharge for local streams, contributing approximately 50 percent of the average annual stream flow (TRC 1988).

Both surface water and groundwater transport are potential pathways of contamination to NOAA resources.

Site-Related Contamination

An initial assessment of the site identified 14 potentially contaminated areas. Following agency review, ten of those areas were judged to represent a potential threat to human health or the environment and a verification study was conducted (TRC 1988). With the exception of the Allen Harbor landfill, most sites were found to pose a minimal risk to aquatic resources. An additional investigation of the levels of contamination in various media was performed as part of a detailed risk assessment for this area (EPA 1988a; EPA 1988b). Contaminants detected in soil, sediment, surface water, and biota included total petroleum hydrocarbons (TPH), PCBs, DDT, and inorganic substances. Maximum concentrations of contaminants in various matrices sampled are presented in Table 1 (EPA 1988a; EPA 1988b; TRC 1988) with available screening levels.

Concentrations of inorganic substances were high in surface water and sediment collected from Allen Harbor. Copper, lead, mercury, and zinc exceeded their screening criteria for sediments; lead, mercury, silver, and zinc exceeded their AWQC. All inorganic substances shown in Table 1 were above background levels in soil collected from the landfill. DDT and PCBs were elevated in sediment and soil from this same area. Most of these substances were present in tissues of quahog

Site-Related Contamination, *cont.*

collected from Allen Harbor.
Additional measures of sediment toxicity were made as part of the 1988 risk assessment (EPA 1988a). Amphipod bioassays using sediment from the Allen Harbor landfill resulted in mortalities ranging from 22.7 to 97.3 percent. Histopathological examinations of clam tissues showed an incidence of neoplasms in softshell clams that ranged from 8 to 23 percent. Results from an index of physiological response for mussels placed in Allen Harbor indicated that the mussels were experiencing some type of stress, possibly related to poor water quality. An additional source of contamination to Allen Harbor is boat traffic from two marinas in the harbor (Munns personal communication 1990).

Table 1. Maximum concentrations of contaminants of concern at the site.

	Water		Soil		Sediment		Tissue
	Surface Water µg/l	AWQC[1] Marine µg/l	Soil mg/kg	Average[2] U.S. Soil mg/kg	Sediment mg/kg	ER-L[3] mg/kg	Tissue mg/kg
INORGANIC SUBSTANCES							
arsenic	ND	36	21	5	4.1	33	
cadmium	8.4	9.3	26	0.06	2.2	5	1.9
chromium	9.1	50	100	100	62	80	4.5
copper	ND	2.9	1300	30	97	70	56
lead	12.7	5.6	34000	10	87	35	2.8
mercury	.23	0.025	3.5	0.03	0.77	0.15	0.068
nickel	ND	8.3	250	40	30	30	13
silver	100	[a]2.3	7.5	0.05	1.4	1	1.2
zinc	180	86	3000	50	210	120	34
ORGANIC COMPOUNDS							
DDT	ND	0.001	690	NA	0.007	0.001	ND
DDE	ND	[a]14	39	NA	0.036	0.002	0.006
DDD	ND	NA	55	NA	0.006	0.002	0.004
PCBs	NT	0.03	1.3	NA	0.498	0.050	0.204
TPH[4]	800	NA	7800	NA	4020	NA	NT

1: Ambient water quality criteria for the protection of aquatic life, marine chronic criteria presented (EPA 1986).
2: Lindsay (1979).
3: Effective 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 Morgan (1990).
4: Total Petroleum Hydrocarbons
a AWQC marine acute criteria, no chronic criteria available (EPA 1986).
NA: Screening level not available
ND: Not detected at method detection limit
NT: Not analyzed

NOAA Trust Habitats and Species

Habitats of concern to NOAA in the vicinity of NCBC include Allen Harbor, two on-site creeks that run into Allen Harbor, and the nearshore areas of Narragansett Bay north and south of the harbor. Narragansett Bay in the vicinity of the site

NOAA Trust Habitats and Species, *cont.*

provides habitat for numerous species of bottomfish, pelagic fish, and invertebrates (Table 2; Oviatt and Nixon 1973; Johnston et al. 1989; Munns personal communication 1990). Allen Harbor is a

Table 2. Species and habitat use in Narragansett Bay, including Allen Harbor.

Species		Habitat		
Common Name	Scientific Name	Spawning	Nursery	Adult Forage
ANADROMOUS/CATADROMOUS FISH				
American shad	*Alosa sapidissma*		◆	◆
alewife	*Alosa pseudoharengus*		◆	◆
striped bass	*Morone saxatilis*		◆	◆
MARINE/ESTUARINE				
Fish				
Atlantic menhaden	*Brevoortia tyrannus*		◆	◆
Atlantic herring	*Clupea harengus*			◆
Atlantic tomcod	*Microgadus tomcod*		◆	◆
butterfish	*Peprilus triacanthus*			◆
bluefish	*Pomatomus saltatrix*		◆	◆
winter flounder	*Pseudopleuronectes americanus*		◆	◆
windowpane	*Scophthalmus aquosus*			◆
scup	*Stenotomus chrysops*			◆
Invertebrates				
blue crab	*Callinectes sapidus*			
American oyster	*Crassostrea virginica*	◆	◆	◆
ribbed mussel	*Geukensia demissa*	◆	◆	◆
American lobster	*Homarus americanus*			◆
quahog	*Mercenaria mercenaria*	◆	◆	◆
softshell clam	*Mya arenaria*	◆	◆	◆

soft-bottom environment with especially rich invertebrate resources. The city would like to expand the municipal marina located in the harbor, but these plans conflict with fishermen who wish to reopen the area for harvesting of quahog and softshell clams (Oviatt and Nixon 1973; Munns personal communication 1990).

Invertebrate resources of considerable commercial and recreational value are found in Allen Harbor, including quahog, softshell clams, oysters, and ribbed mussels. In recent years, closures by the Rhode Island Department of Environmental Management have restricted shellfish harvesting in most of the areas around the NCBC. Allen Harbor, formerly the site of a major commercial and recreational quahog fishery, has been closed since 1983 because of contaminants detected in quahog tissue. This closure

NOAA Trust Habitats and Species, *cont.*

will be reevaluated after review of the results of ongoing investigations by the Navy. Quahog and softshell clams are harvested in areas outside of and to the north of Allen Harbor. To the south, the Quonset Point area and Wickford Harbor are closed for shellfish harvesting because of high levels of fecal coliform bacteria (Johnston et al. 1989; Migliori personal communication 1990).

Information on fish resources in Allen Harbor and the on-site creeks is limited, but several marine species use the area seasonally, including winter flounder, bluefish, striped bass, and alewife. It is possible that alewife may spawn in the creeks (Munns personal communication 1990).

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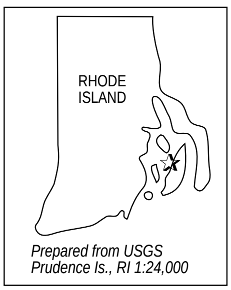
Naval Education Training Center

Newport, Rhode Island
Region 1
RI6170085470

Site Exposure Potential

The Naval Education Training Center (NETC) is located in Middletown, on the western shore of Aquidneck Island in Narragansett Bay (Figure 1). The U.S. Navy has used this site since the 1860s for training, as a fuel depot, as a warfare research and development facility, and as a home port for the Atlantic cruiser and destroyer fleet. Torpedoes and other explosives were manufactured here from 1869 to 1951. In 1973, many of the facilities were moved to other sites or closed, and many of the original properties were sold. Wastes



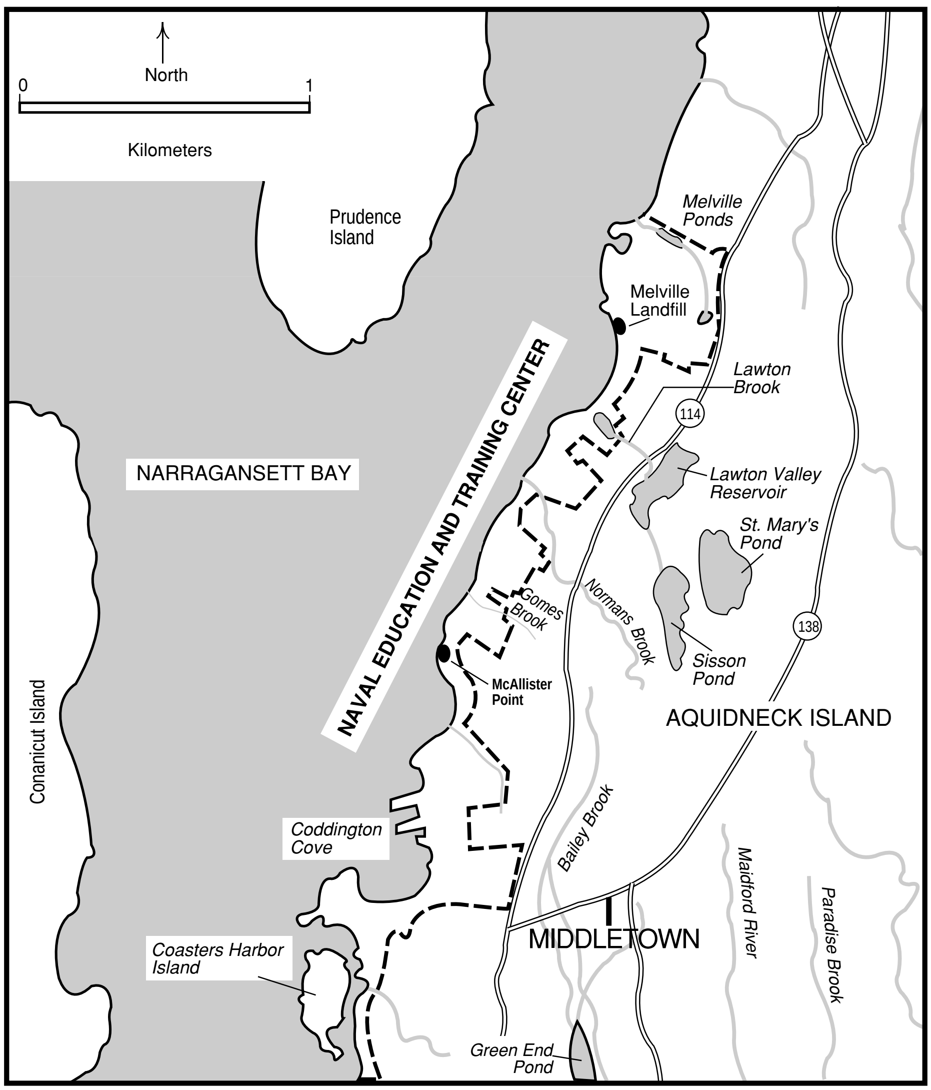


Figure 1.
Naval Education Training Center, Middletown, Rhode Island.

Site Exposure Potential, *cont.*

generated at the site were disposed in two landfills: McAllister Point landfill and Melville North landfill. McAllister Point landfill has received all wastes generated at the facility since 1955. In addition, fuels and oils have been stored in five areas at the site (TRC 1989).

The NETC lies within the Narragansett drainage basin and includes 14.5 km of beach. Surface water on the site includes Normans, Lawton, and Gomes brooks, and several ponds and reservoirs. Most of this surface water discharges to Narragansett Bay. Surface runoff during storms tends to infiltrate the soil or run directly to the bay before reaching any other surface water body. Soil on the site is primarily unconsolidated glacial tills and is moderately permeable. Groundwater tends to be shallow (within 3 m of the surface) and generally flows from east to west.

Because of the site's characteristics and local hydrogeological features, there is a high potential for surface water transport of contaminants. Groundwater transport may also contribute to the migration of contaminants to habitats and species of concern to NOAA, but data to evaluate the significance of this pathway are limited.

Site-Related Contamination

Previous investigations (TRC 1989) at the site focused on contaminant levels in sediment and tissue. Groundwater, leachate, and soil samples were collected as part of an investigation of the landfills. No surface water samples were collected. Most samples were analyzed for inorganic substances and a limited number of organic compounds, including PCBs and total petroleum hydrocarbons. The maximum concentrations of contaminants found in the various matrices are summarized in Table 1 (TRC 1989), along with applicable screening levels.

Inorganic substances were present in groundwater, landfill leachate, sediment, and mussel tissue. Concentrations of chromium, copper, lead, mercury, nickel, and zinc were elevated in groundwater near the McAllister Point landfill and in sediment along the beach adjacent to the site. It should be noted that fill materials were used to extend McAllister Point

Site-Related Contamination, *cont.*

landfill into the bay. Concentrations of inorganic substances were below average U.S. soil levels (Lindsay 1979) in the few soil samples collected, but only capping material from the top of the landfill was sampled. Total petroleum hydrocarbons

Table 1. Maximum concentrations of contaminants of concern at the NETC site.

	Water			Sediment		Tissue
	Landfill Leachate µg/l	Groundwater µg/l	AWQC Marine[1] µg/l	Sediment mg/kg	ER-L[2] mg/kg	Mussel Tissue mg/kg
INORGANIC SUBSTANCES						
cadmium	58	7	9.3	11	5	ND
chromium	32	220	50	2200	80	3.5
copper	ND	1000	2.9	25000	70	28
cyanide	870	13	1	ND	NA	NT
lead	ND	1600	5.6	4400	35	20
mercury	ND	1.2	0.025	ND	0.15	ND
nickel	ND	300	8.3	1300	30	7
zinc	ND	500	86	2400	120	ND
ORGANIC COMPOUNDS						
PCBs	ND	ND	0.03	2.03	0.05	0.38
TPH[3]	ND	12300	NA	1100	NA	ND

1: Ambient water quality criteria for the protection of aquatic organisms. Marine chronic criteria presented (EPA 1986).
2: Effective 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 Morgan (1990).
3: Total Petroleum Hydrocarbons
NA: Screening level not available
ND: Not detected at method detection limit
NT: Not analyzed

were present at high levels in some groundwater and sediment samples collected from the site. Concentrations of PCBs were moderately high in beach sediment and mussels collected at the same sites.

NOAA Trust Habitats and Species

Narragansett Bay provides habitat for several species of bottom-fish, pelagic fish, and invertebrates and supports commercial and sport fisheries valued at several million dollars (Table 2; Oviatt and Nixon 1973; TRC 1989; Sisson personal communication 1990). The site's 14.5 km of shoreline along the eastern passage between Conanicut and Aquidneck islands in the southern part of Narragansett Bay includes eelgrass beds that are important for lobster and fish habitat (Sisson personal communication 1990).

Fish populations in Narragansett Bay vary seasonally. Commercial fisheries that operate seasonally in the vicinity of NETC catch herring, bay anchovy, bluefish, menhaden, silver

Table 2. Species and habitat use in the eastern passage of Narragansett Bay in the vicinity of the NETC.

Table available in hardcopy

NOAA Trust Habitats and Species, *cont.*

hake, and scup (Oviatt and Nixon 1973; Sisson personal communication 1990). Winter flounder, a commercially fished species, pass through the area to spawning grounds north of the site. Recreational fisheries for striped bass, bluefish, weakfish, tautog, and summer flounder occur in the area (Sisson personal communication 1990).

Invertebrate resources in Narragansett Bay are extensive and commercially and recreationally valuable. Quahog is the most valuable commercial shellfish resource in the bay, though populations along the NETC shoreline are not as great as other areas of the bay, due to the greater depths there. Lobsters are caught in the Coddington Cove area, at the south end of the site. A small squid fishery takes place in Narragansett Bay, with traps located in Coddington Cove (TRC 1989; Sisson, personal communication 1990).

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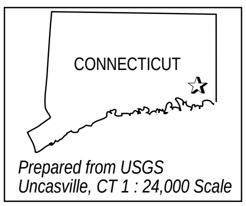
New London Naval Submarine Base

Groton, Connecticut
Region 1
CTD980906515

Site Exposure Potential

The New London Submarine Base (Subase) is located on the eastern bank of the Thames River estuary in southeastern Connecticut (Figure 1). The 220-hectare site includes approximately 3 km of shoreline less than 4 km from Long Island Sound. The Subase was constructed as a moorage facility and coaling station for the Atlantic Fleet in 1886. A permanent Subase was established in 1916; a submarine training facility was added in 1917. The base was greatly expanded during World Wars I and II and is now the base command for the



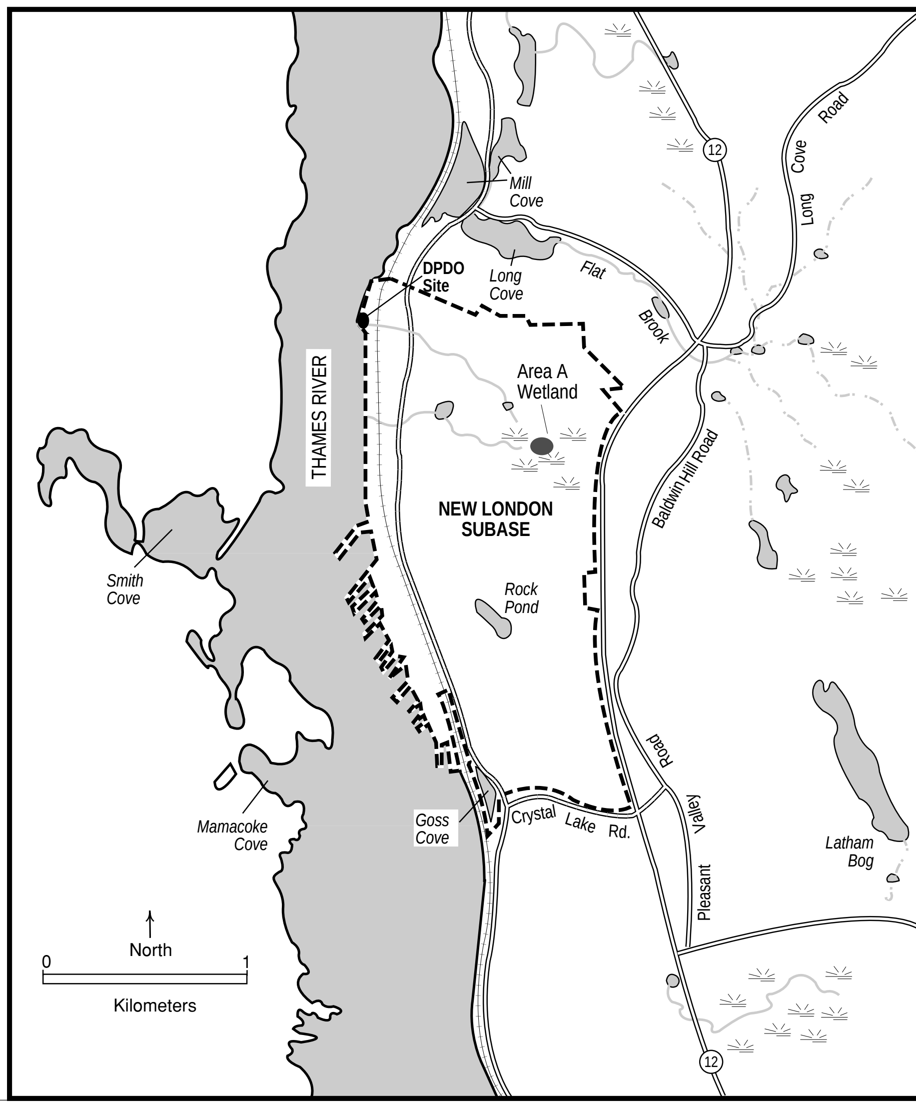


Figure 1.
New London
Naval Submarine
Base, Groton,

Site Exposure Potential, *cont.*

Atlantic Naval Submarine Fleet. The Subase includes housing, training facilities, administrative offices, a hospital, submarine maintenance, repair and overhaul facilities, and torpedo assembly and overhaul shops (Atlantic Environmental Services 1989).

Activities at the base generated a variety of wastes, including waste oils, solvents, contaminated fuels, construction debris, acids, PCBs, and pesticides. The site served as a landfill and burning ground from 1950 to 1969 and waste and cover materials were used to fill the shoreline. Until the early 1970s, most of these materials were disposed of in on-site landfills. Although some liquid materials were stored in drums or underground tanks for off-site reprocessing or disposal, some liquid wastes may have been disposed of in drain fields or storm drain systems. The Area A landfill was used for disposal of all non-recyclable materials from all Subase operations from 1957 to 1973. In addition, drums, transformers, and electrical switches are stored on-site on a concrete pad. Cover material for this landfill consisted of highly porous gravels. The wetland area was used for upland disposal of dredge spoils from the Thames River.

Surface geology at the Subase is characterized by a thin layer of unconsolidated glacial tills overlying bedrock. Outcroppings of bedrock have been mapped throughout the site. The water table is inferred to be close to the soil surface because of the presence of wetlands in several areas of the Subase. Several surface drainages are present at the site, including ponds and streams. Surface water discharges to the Thames at four points along the shoreline; two outlets are located near the northern boundary, one outlet is at Pier 26, and the major outlet is at Goss Cove. Surface water runoff also discharges to the Thames River.

Several potentially contaminated sites are located in shoreline areas, making surface water runoff or groundwater discharge a likely pathway for transport of contaminants. Surface water transport is an important pathway for several major upland sites because they are located near or in wetlands and streams that discharge to the Thames River.

Site-Related Contamination

Preliminary data presented in the Installation Restoration Study (IRS) plan of action (Atlantic Environmental Services 1989) indicated that trace elements, PAHs, pesticides, and some volatile organic compounds were present in soil, surface water, and sediment at elevated levels on the Subase. Activities on the Subase and past disposal practices may have contributed to groundwater contamination, but no data on groundwater were presented in the IRS plan of action. Maximum concentrations of contaminants detected in these matrices are presented in Table 1 (Atlantic Environmental Services 1989) along with applicable screening levels for determining concentrations of concern to NOAA.

Table 1. Maximum concentrations of contaminants at site compared with applicable screening levels.

	Water		Soil		Sediment	
	Surface Water µg/l	AWQC[1] µg/l	Soil mg/kg	Average U.S. Soil[2] mg/kg	Sediment mg/kg	ER-L[3] mg/kg
INORGANIC SUBSTANCES						
antimony	400	1600*	13	1	36	2
cadmium	30	1.1+	4.4	0.06	2.5	5
copper	120	12+	1000	30	33	70
cyanide	175	5.2	0.10	NA	2.5	NA
lead	ND	3.2+	750	10	5960	35
mercury	ND	0.012	ND	0.03	0.28	0.15
nickel	80	160+	130	40	32	30
zinc	152	110+	1100	50	170	120
ORGANIC COMPOUNDS						
benzo(a)anthracene	NT	NA	5.6	NA	1.2	0.23
benzo(a)pyrene	NT	NA	2.6	NA	0.75	0.40
fluoranthene	NT	NA	12	NA	1.85	0.60
phenanthrene	NT	NA	18	NA	0.75	0.225
pyrene	NT	NA	9.3	NA	1.35	0.35
DDD	NT	NA	ND	NA	79	0.002
DDE	NT	NA	ND	NA	7.4	0.002
DDT	NT	0.001	ND	NA	59	0.001

1: Ambient water quality criteria for the protection of aquatic life, freshwater chronic criteria presented (EPA 1986).
2: Lindsay (1979).
3: Effective 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 Morgan (1990).
+ Hardness-dependent criteria; 100 mg/l $CaCO_3$ used.
* Insufficient data to develop criteria. Value presented is the Lowest Observed effect Level (LOEL).
ND: Not detected at method detection limit; detection limit not reported
NT: Not analyzed
NA: Screening level not available

Copper, lead, nickel, and zinc were extremely elevated in soils from the Defense Property Disposal Office (DPDO) area next to the Thames River. Additional trace elements were also present at high concentrations. PAHs were measured in soil at levels shown to have toxic effects in other studies (Long and Morgan 1990).

Site-Related Contamination, *cont.*

Surface water samples in the vicinity of the Area A Landfill and the associated wetland in the northern Subase had high concentrations of cadmium, copper, zinc, cyanide, and several phthalate esters. Sediment from these same areas had extremely high levels of lead, DDT, other trace elements, and PAHs. Surface waters and groundwater from this area discharge into several streams that flow past other sites under investigation and enter the Thames River at the DPDO site.

Table 2. Species and habitat use in the lower Thames River near the site.

Table available in hardcopy

NOAA Trust Habitats and Species

The lower Thames River is an important estuarine habitat used by anadromous and marine species for spawning, nursery grounds, and adult forage (Table 2; Minta personal communication 1990). Commercial and recreational fisheries are active in the area.

NOAA Trust Habitats and Species, *cont.*

The Thames River is a major corridor for anadromous species, including sea-run brown trout, American shad, hickory shad, alewife, striped bass, and blueback herring. Blueback herring, alewife, and American shad spawn approximately 24 km upstream of the site. The Connecticut Department of Environmental Protection is attempting to restore the historical Atlantic salmon run in the Thames River watershed. Currently, eggs are stocked in upstream tributaries, and fish passageways are being planned for several upstream dams (Minta personal communication 1990).

The section of the river near the Subase is used as a spawning ground for winter flounder, and as a seasonal nursery ground for bluefish and young striped bass. Major recreational fisheries in the area include those for striped bass, bluefish, and eel (Minta personal communication 1990).

Invertebrate resources include quahog, blue crab, and lobster; quahog and lobster are fished commercially and blue crab recreationally. Commercial harvests of quahog must undergo depuration before sale, and recreational harvesting of bivalves is restricted because of unsafe levels of fecal coliform in tissue.

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Pease Air Force Base

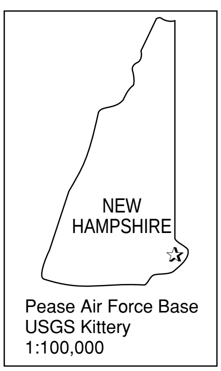
Portsmouth, New Hampshire
Region 1
NH7570024847

Site Exposure Potential

Pease Air Force Base (Pease AFB) is located on a peninsula in the Piscataqua River drainage basin near the city of Portsmouth, New Hampshire (Figure 1). The base is bordered by Great Bay to the west and Little Bay to the northwest. The Piscataqua River is less than 1 km east of the base.

Past activities at Pease AFB supported aircraft maintenance operations and generated hazardous wastes, including degreasers, solvents, paint strippers, and jet fuels. Historically, these liquid wastes were burned during fire department training exercises or hauled off site by contractors. Since 1982, jet fuel has typically been reclaimed and returned to bulk storage on-site. Solid wastes generated from housing, administration, and maintenance activities were either hauled off-base by contractors, or disposed of at six landfills and two construction waste dumps located on the base (Weston 1989).

The site is transected by numerous small streams, ditches, and storm sewers that drain radially from the base's central plateau. These surface waters drain three main areas on the base and are defined by the receiving water body: Great Bay, Little Bay, and the Piscataqua River. Peverly and McIntyre brooks



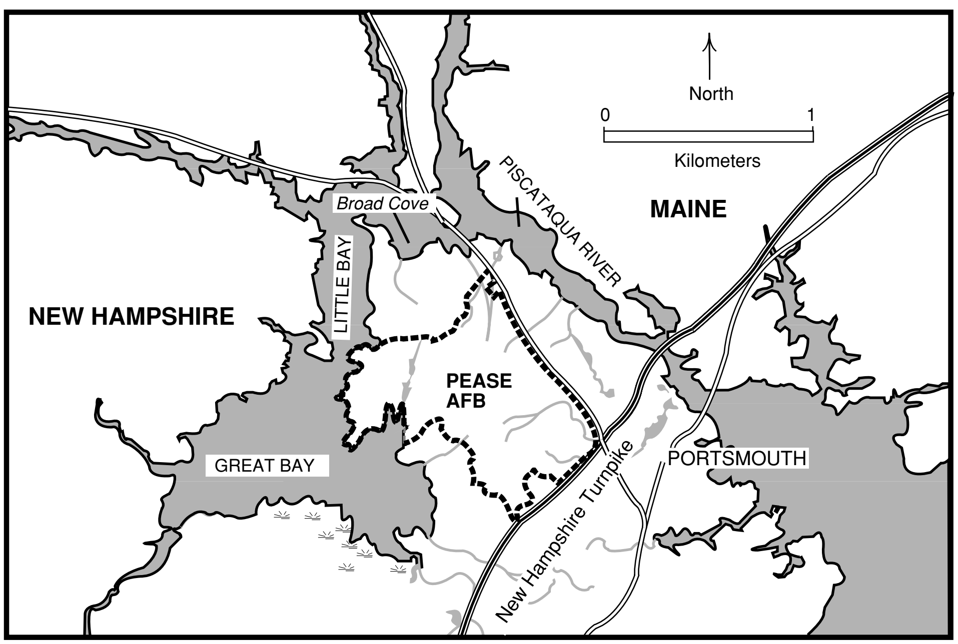


Figure 1. Pease Air Force Base, Portsmouth, New Hampshire.

Site Exposure Potential, *cont.*

drain into Great Bay. Pickering Brook and Railway Ditch enter Flagstone Brook, which discharges to Little Bay near its confluence with the Piscataqua River. Newfields and Grafton ditches and Harveys Creek enter Hodgson Brook, which flows into the North Mill Pond and, ultimately, the Piscataqua River. Pauls Brook drains directly to the Piscataqua River.

Regional groundwater hydrology is also defined by the maximum land elevation. Hydraulic low points are represented by Great Bay, Little Bay, and the Piscataqua River. Groundwater movement on the site reflects surface topography and flows towards the nearest downgradient surface water.

Based on site characteristics and historical practices, both surface water and groundwater movement represent potential pathways of contamination to NOAA resources and associated habitats.

Site-Related Contamination

Surface water, groundwater, soil, and sediment were analyzed during Stages I and II of the Installation Restoration Program (Weston 1989). Trace elements, cyanide, PAHs, DDT and its metabolites, total petroleum hydrocarbons, and some volatile organic compounds were detected in the matrices sampled. Contaminants found in surface water and groundwater that were considered a risk to NOAA resources are presented in Table 1 with applicable screening criteria (Weston 1989).

Trace elements were the major contaminants found in surface water samples. Copper, lead, mercury, nickel, and zinc concentrations exceeded their AWQC (EPA 1986) in all three major drainage areas. The highest levels of trace elements occurred in Harveys Creek and Newfields Ditch; cyanide levels were extremely high. Organic compounds were detected in few surface water samples with the exception of samples from Newfields Ditch. Concentrations of several semi-volatile organic compounds in these samples were measured at levels exceeding the lowest observed effect level. Bis(2-ethylhexyl)phthalate was also measured at high concentrations in samples from Newfields Ditch. DDT, DDD, and other pesticides were detected in surface water samples from the Little Bay and Piscataqua drainage areas at concentrations shown to be toxic in other studies.

Site-Related Contamination, *cont.*

Table 1. Maximum concentrations of major contaminants in surface water and ground-water samples from drainage areas on the site.

	Surface Water			Groundwater			Criteria
	Great Bay µg/l	Little Bay µg/l	Piscataqua River µg/l	Great Bay µg/l	Little Bay µg/l	Piscataqua River µg/l	AWQC[1] Marine µg/l
INORGANIC SUBSTANCES							
arsenic	5.4	<5	<5	180	NR	500	36
copper	<30	34	79	63	NR	NR	2.9
cyanide	<20	<20	440	NR	NR	NR	1
lead	<5	400	19	NR	NR	NR	5.6
mercury	0.3	<1	<1	0.3	<0.2	NR	0.025
nickel	29	150	220	72	45	33	8.3
zinc	110	130	180	220	100	170	86
ORGANIC COMPOUNDS							
benzene	NR	NR	2,800	NR	NR	1,100	700
ethylbenzene	NR	NR	480	1,400	NR	600	430
xylenes	NR	NR	2,600	5,500	NR	600	NA
bis(2-ethyl hexyl) phthalate	NR	NR	360	150	NR	1,300	NA
trichloro-ethylene	NR	NR	NR	NR	NR	10,000	[a]2,000*
toluene	NR	NR	4,300	NR	NR	NR	2,130*
DDD	NR	0.13	0.19	NR	NR	NR	NA
DDT	NR	0.14	<0.10	NR	NR	NR	0.001
lindane	NR	NR	0.25	NR	NR	NR	[a]0.16
chlordane	NR	NR	0.12	NR	NR	NR	0.004

1: Ambient water quality criteria for the protection of aquatic organisms. marine chronic criteria presented (EPA 1986).
a: AWQC marine acute criteria, no chronic criteria available (EPA 1986).
*: Insufficient data to develop criteria. Value presented is the Lowest Observed Effect Level (LOEL).
NR: Results not reported
NA: Criteria not available

Arsenic, copper, and mercury concentrations measured in groundwater samples were high. These substances are of concern because groundwater discharges to habitats supporting NOAA resources. Copper, lead, mercury, nickel, and zinc in surface water exceeded their respective AWQC. Ethylbenzene, xylenes, bis-(2-ethylhexyl)phthalate, and trichloroethylene were detected in groundwater at levels greater than those measured in surface water.

Contaminants of concern occurring in sediments and soils are presented together with applicable comparison values in Table 2 (Weston 1989). Cadmium, mercury, and zinc were detected in soil at concentrations exceeding background levels in U.S. soil (Lindsay 1979). Organic compounds were also detected in on-site soil samples. PAHs and other semi-volatile organic compounds were above background levels in soil samples from the Piscataqua drainage area.

Site-Related Contamination, *cont.*

Several inorganic substances, including arsenic, cadmium, mercury, nickel, and zinc, were measured in stream sediments at levels shown to be associated with deleterious biological effects (Long and Morgan 1990). Elevated concentrations of PAHs and several semi-volatile organic compounds were also found in sediment samples. Concentrations of DDT and its metabolites were high in sediment from all areas sampled.

Table 2. Maximum concentrations of contami-nants in soil and sediment from drainage areas at the site. (No results were reported for soil in Great Bay drainage).

	Soil			Sediment			
	Little Bay	Piscataqua River	Average[1] U.S. Soil	Great Bay	Little Bay	Piscataqua River	ER-L[2] Levels
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
INORGANIC SUBSTANCES							
antimony	NR	NR	1	NR	35	NR	2
arsenic	NR	NR	5	15	56	16	33
cadmium	5.2	8.7	0.06	NR	NR	<26	5
mercury	2.5	NR	0.03	NR	NR	<0.18	0.15
nickel	NR	NR	40	52	31	70	30
zinc	140	NR	50	190	120	203	120
ORGANIC COMPOUNDS							
4,4 DDT	NR	NR	ND	4.2	0.09	<1.8	0.001
4,4 DDE	NR	NR	ND	<0.05	0.12	<1.8	0.002
4,4 DDD	NR	0.02	ND	0.10	0.21	NR	0.002

1: Lindsay (1979).
2: Effective 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 Morgan (1990).
NR: Results not reported
ND: Not detected at the method detection limit

NOAA Trust Habitats and Species

The marine and estuarine habitats surrounding the site harbor numerous species of finfish and invertebrates (Table 3; New Hampshire Fish and Game 1981). Fifty-two species of marine finfish were identified in the Great Bay estuary by the New Hampshire Department of Fish and Game, including residents, anadromous species, and migrants. Of these, the most abundant species were Atlantic silverside, rainbow smelt, killifish, river herring, Atlantic tomcod, white perch, and smooth flounder (New Hampshire Fish and Game 1981). Great Bay is a planned National Estuarine Reserve (Fawcett personal communication 1990).

There is limited commercial fishing in the area for river herring, eel, smelt, and sea scallop. Striped bass, smelt, winter flounder, alewife, and coho salmon are important recreational fisheries. The Great Bay area also contains valuable invertebrate resources. Lobster and rock crab are harvested commer-

NOAA Trust Habitats and Species, *cont.*

cially, and soft-shell clams, mussels, and oysters are harvested in recreational fisheries. Major oyster beds are found in Great Bay, the Oyster River, the Bellamy River, and the Piscataqua River (Weston 1989).

Table 3. Species and habitat use in the Piscataqua River, Great Bay, and Little Bay.

Table available in hardcopy

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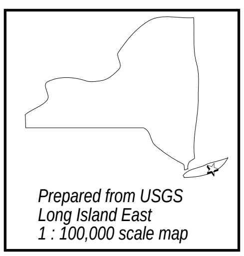
Brookhaven National Laboratory

Upton, New York
Region 2
NY7890008975

Site Exposure Potential

Brookhaven National Laboratory (BNL) is located on Long Island, New York, 97 km east of New York City (Figure 1). Lab facilities occupy a 680-hectare site within the 2,130-hectare BNL properties. BNL conducts research and development programs in high-energy, nuclear, and solid-state physics; fundamental material structure properties and interactions of matter; nuclear medicine; and the biological and chemical effects of radiation (U.S. Department of Energy 1988; Burns and Roe 1989).

Three hydraulically connected aquifer units make up a single zone of saturation located between 14 and 460 meters below the surface at the BNL site. This unconfined, composite aquifer is the primary drinking water source for Nassau and Suffolk counties, and has been designated by EPA as a sole-source aquifer. The groundwater from the BNL site generally



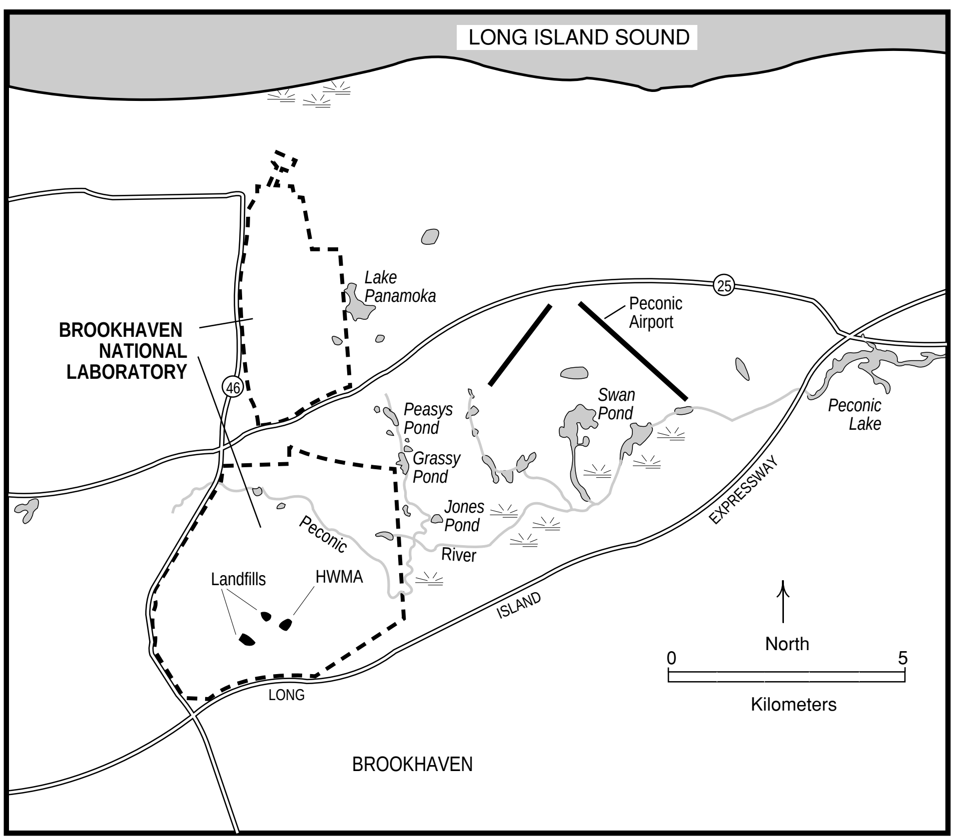


Figure 1. Brookhaven National Laboratory, Upton, New York.

Site Exposure Potential, *cont.*

flows east-southeast towards the Peconic River and its tributaries.

Areas of actual and potential soil, surface water, and groundwater contamination at BNL include active and inactive disposal areas, cesspools, abandoned drum sites, and areas with stained soil. Sources of contamination include the Hazardous Waste Management Area (HWMA), the central receiving and storage area for BNL hazardous, radioactive, mixed, and PCB wastes; landfills that have received hazardous and radioactive substances; and the former incinerator ash disposal area.

Other areas of concern include the Meadow Marsh Study Area / Uplands Recharge Experiment where sewage effluent was disposed by land application; sewage treatment plant and sludge beds; an area where radionuclide-contaminated groundwater was pumped to a surface drainage course; an area where unidentified chemical containers were found; underground oil tanks; a detonation / burn area formerly used for burning and detonating highly explosive and reactive chemicals; underground radioactive wastewater storage tanks; and an oil and solvent spill area.

BNL is at the headwaters of the Peconic River watershed. Wetlands north and east of BNL drain to the tributaries of the Peconic River. The Peconic River flows to Flanders Bay, part of Great Peconic Bay in the New York Bight, approximately 27 km below the site.

Groundwater discharge to surface water and surface water runoff are the primary pathways of contaminant transport.

Site-Related Contamination

Soil, sediment, and surface water were not routinely monitored at BNL for chemical contaminants when the referenced reports were prepared. Trace elements detected in the groundwater and sewage effluent are presented in Table 1 (U.S. Department of Energy 1988; Burns and Roe 1989) along with AWQC.

Organic compounds were found at low levels in groundwater at BNL. Chloroethane, 1,1-dichloroethane, benzene, toluene,

Site-Related Contamination, *cont.*

and ethylbenzene were detected at the HWMA area. Contaminants found in building cesspools included 1,1,1-trichloroethane, tetrachloroethane, toluene, and methyl chloride (U.S. Department of Energy 1988).

Radionuclides have been detected in both soil and groundwater at the BNL site. As a result of the Upland Recharge Experiment at the Meadow Marsh Study Area, groundwater was

Table 1. Maximum concentrations of major contaminants in groundwater and the sewage treatment plant effluent at the site.

	Groundwater µg/l	Sewage Treatment Plant Effluent µg/l	AWQC[1] µg/l
INORGANIC SUBSTANCE			
cadmium	25.6	NT	1.1+
chromium	24	NT	11
copper	125	400	12+
iron	131,500	600	1,000
lead	520	67	3.2+
mercury	< 0.2	NT	0.012
silver	10	50	0.12
zinc	8,150	300	110+

1: Ambient water quality criteria for the protection of aquatic organisms. Freshwater chronic criteria presented (EPA 1986)
+ Hardness-dependent criteria; 100 mg/l $CaCO_3$ used.
NT Not analyzed

contaminated with tritium (U.S. Department of Energy 1988). Maximum radionuclide concentrations found in wells near the landfills in the west-central part of the site are presented as follows: Gross alpha: 19,460 pCi/l; cesium 137: 9,300 pCi/l; tritium: 49,000 pCi/l (Burns and Roe 1989).
Radionuclide data reported in soil, sediment, vegetation, and fish are shown in Table 2 (U.S. Energy Research and De-

Table 2. Maximum concentrations of radionuclides found in vegetation, soil, sediment, and fish on-site and in the Peconic River near the site.

	Peconic River			On-Site		
	Plants (unspecified)	Sediment	Fish (catfish)	Plants (grass)	Soil	Fish (Ponds)*
Year Collected	1973 pCi/kg	1973 pCi/kg	1973 pCi/kg	1985 pCi/kg	1985 pCi/kg	1985 pCi/kg
Radionuclide						
Be-7	879	NR	NR	2,030	740	NR
Co-60	274	< 50	< 50	NR	NR	NR
Sr-90	703	166	NR	NR	NR	3,328
Cs-137	1,109	1,907	1,355	111	924	581
U-238	NR	812	NR	NR	NR	NR
Th-232	NR	446	NR	NR	NR	NR
K-40	NR	NR	NR	4,960	6,100	NR
Th-228	NR	NR	NR	72	873	NR
Ra-226	NR	NR	NR	NR	657	NR
Hg-203	NR	NR	NR	NR	70	NR
Tritium	NR	NR	NR	NR	NR	1,742

NR: Not reported
* Brown bullhead and yellow perch were sampled

NOAA Trust Habitats and Species

velopment Administration 1977; U.S. Department of Energy 1988). Although no criteria for the protection of aquatic organisms are available for radionuclides, sublethal effects have been established at levels ranging from 100 pCi/l to 1,000,000 pCi/l (Blaylock and Trablaka 1978).

Habitats with species of concern to NOAA include the Peconic River, Flanders Bay at the mouth of the Peconic River, and Great Peconic Bay (Table 3; Energy Research and Development Administration 1977; Weber personal communication 1990; Young personal communication 1990). Anadromous

Table 3. Species and habitat use in the Peconic River near the mouth and in Flanders Bay.

Table available in hardcopy

species, with the exception of the American eel, cannot migrate upstream in the Peconic River because of a low-level dam located at Riverhead, approximately 1.6 km upstream from the river mouth. A remnant of an alewife run still spawns at the base of the dam. Numerous estuarine and marine species occur in Flanders Bay near the mouth of the Peconic River and in Great Peconic Bay.

NOAA Habitats and Species, *cont.*

Flanders Bay is a nursery area for many species of recreational and commercial importance, including winter flounder, tautog, scup, weakfish, Atlantic mackerel, bluefish, and butterfish (Weber personal communication 1990). Alewife, juvenile bluefish, and white perch are fished commercially at the mouth of the Peconic River.

The New York State Department of Environmental Conservation is considering the possibility of restoring the alewife run in the Peconic River. Freshwater species that have been sampled in streams on the site include catfish, little pickerel, largemouth bass, bluegill sunfish, and banded sunfish.

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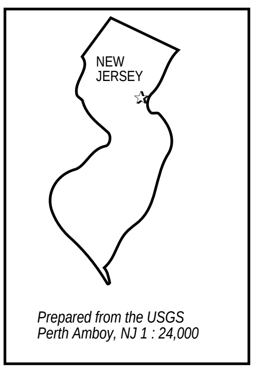
Chemical Insecticide Corporation

Edison Township, New Jersey
Region 2
NJD980484653

Site Exposure Potential

Chemical Insecticide Corporation (CIC) is an abandoned, 2.3-hectare pesticide manufacturing facility in Edison Township, New Jersey (Figure 1). From 1958 to 1970, CIC produced insecticides, fungicides, rodenticides, and herbicides, including 2,4,5-trichlorophenoxy-acetic acid (2,4,5-T), noted for being contaminated with dioxins and related compounds. Improper manufacturing and product handling resulted in numerous complaints and citations against the company during the period of operation. The company went bankrupt in 1970 and in 1975 all buildings were demolished, leaving only concrete building pads, residual roadways, buried drums, and debris on the site (Ebasco 1990).

On-site surface water includes small amounts of standing water and numerous erosional drainage channels. The erosion channels flow eastward and discharge into a drainage ditch adjacent to the eastern site boundary. The ditch leads to a subsurface storm drain system that discharges to an unnamed creek. This unnamed creek flows for about 450 m before



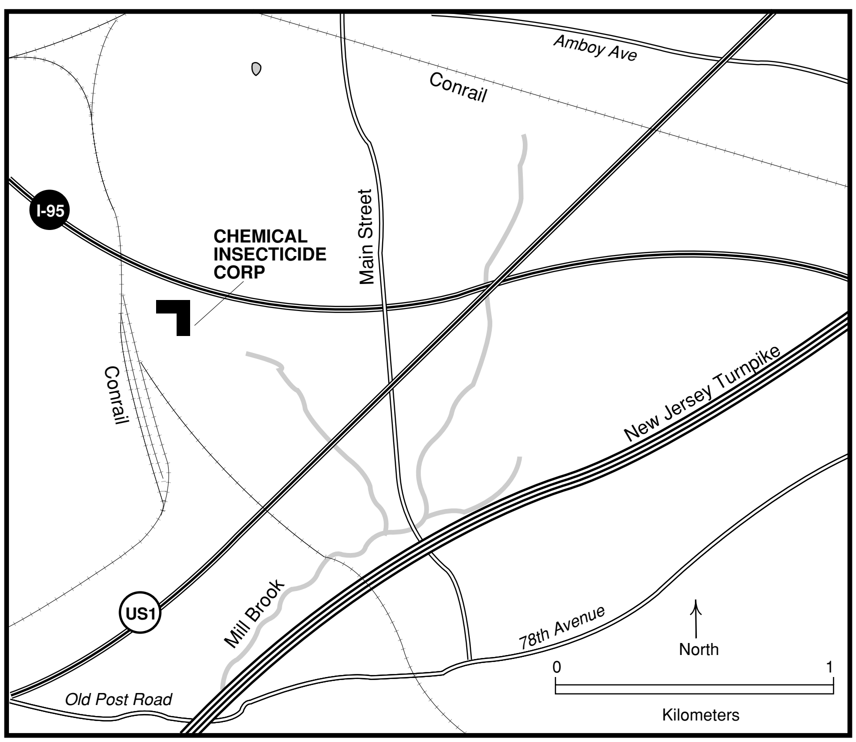


Figure 1. The Chemical Insecticide Corporation, Edison Township, New Jersey.

Site Exposure Potential, *cont.*

discharging into Mill Brook, which enters the Raritan River 3.5 km downstream.

The CIC site is underlain by several aquifers. Measurements from both on-site and nearby wells have indicated that groundwater in both shallow and deep aquifers generally flows to the east.

Surface drainage, remnant floor drains, and exposed sewer lines suggest the presence of an on-site sewer system. Chemicals used on the site may have been disposed of into this system.

Based on site characteristics and historical practices, surface water transport through the storm water collection system that discharged into the unnamed creek is the major pathway of contamination to NOAA resources. Groundwater in the shallow aquifer may contribute some contaminants if it enters the surface drainage to the east of the site (unnamed tributary). Contaminated sediment and soil represent secondary sources of contamination and may be transported off-site by surface or subsurface drainages.

Site-Related Contamination

Results from the RI (Ebasco 1990) confirmed that surface water, groundwater, soil, and sediment from the CIC site and nearby areas are contaminated with a variety of chemicals, including inorganic substances, pesticides, PCBs, and dioxin/furans. Low concentrations of numerous volatile and semi-volatile organic compounds were detected at the site. Tables 1 and 2 (Ebasco 1990) show contaminant concentrations that are of major concern to NOAA.

On-site groundwater was contaminated with eight trace elements, with arsenic and mercury present at exceptionally high levels. Concentrations of these substances were substantially lower in off-site groundwater. Maximum concentrations of inorganic contaminants in surface water were substantially lower than the concentrations in groundwater. Arsenic, cadmium, copper, nickel, and zinc exceeded their respective chronic AWQC in on-site surface water while only chromium,

Site-Related Contamination, *cont.*

copper, and zinc exceeded their respective AWQC in surface water off-site.

Polychlorinated dibenzodioxins (dioxins) and related compounds were measured in groundwater, surface water, sediment, and soil at the CIC site. The maximum concentration of

Table 1. Maximum concentrations (µg/l) of contaminants of concern at the Chemical Insecticide site.

	Groundwater On Site	Groundwater Off Site	Surface Water On Site	Surface Water Off Site	AWQC[1] Marine Chronic
INORGANIC SUBSTANCES					
arsenic	89200	63	1680	6.4	36
cadmium	1840	13	10	3	9.3
chromium	855	277	31	90	50
copper	2600	117	19	11	2.9
lead	543	136	<6.7	NR	5.6
mercury	47	ND	ND	NR	0.025
nickel	1560	414	46	NR	8.3
zinc	3890	1420	287	428	86
ORGANIC COMPOUNDS					
Pesticides					
alpha BHC	3400	0.2	<1.8	0.2	NA
gamma BHC	1400	NR			0.16**
dieldrin	55	NR	<0.3	<0.1	0.0019
endrin	230	ND	<0.3	<0.1	0.0023
DDT	2100	0.3	2.5	<0.1	0.001
chlordane	88	ND	ND	ND	0.004
Total Dioxins	.0004	ND	ND	ND	NA

1: Ambient water quality criteria for the protection of aquatic organisms. Marine chronic criteria presented (EPA 1986).
**: Marine acute criteria presented, no chronic criteria available.
ND: Not detected at method detection limit.
NR: Not reported.
NA: Screenling level not available.

total dioxins in groundwater on-site was 0.0004 µg/l, 40 times greater than the chronic freshwater AWQC (there are no marine AWQC). No dioxins were detected in off-site groundwater samples. Total polychlorinated dibenzofurans (furans) were detected in one on-site surface water sample at 0.00024 µg/l. No dioxins or furans were detected in off-site surface water but were detected in on-site sediment and soil at very high levels.
Contaminants in the soil showed a pattern similar to the contamination in the sediment with both on-site and off-site concentrations exceeding the average levels observed in U.S. soil. Chromium was the only element that was present in soil at higher concentrations off-site than on-site.

Site-Related Contamination, *cont.*

Table 2. Maximum concentrations (mg/kg) of contaminants in sediment and soil from the CIC site.

	Soil			Sediment		
	On-Site	Off-Site	Average U.S. Soil[1]	On -Site	Off-Site	ER-L[2]
INORGANIC SUBSTANCES						
arsenic	8010	24	5	2660	79	33
cadmium	177	6	0.06	21	9.4	5
chromium	128	196	100	39	133	80
copper	4410	83	30	150	216	70
lead	1980	80	10	1170	1130	35
mercury	72	0.6	0.03	0.7	0.2	0.15
nickel	119	108	40	143	38	30
zinc	1040	226	50	552	1840	120
ORGANIC COMPOUNDS						
alpha BHC	45000	0.031	NA	590	.012	NA
gamma BHC	23000		NA	0.25	ND	NA
dieldrin	17.0	ND	NA	1.9	0.063	0.0004
DDT	6900	0.240	NA	820	0.074	3
chlordane	39	ND	NA	ND	ND	NA
PCBs	ND	ND	NA	0.42	10	50
Total Dioxins	0.0073	0.000022	NA	0.00079	ND	NA
TCDD	0.0018	ND	NA	0.00076	ND	NA
Total Furans	0.079	ND	NA	0.0091	ND	NA

1: Lindsay (1979).
2: Effective 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 Morgan (1990)
ND: Not detected at method detection limit
NA: Screening level not available

Trace elements were detected in sediment on- and off the site at concentrations above ER-L values (Long and Morgan 1990). Arsenic concentrations were greatly elevated on-site. Arsenic (15 mg/kg), cadmium (1.5 mg/kg), and lead (59 mg/kg) were detected in sediment from Mill Brook. Concentrations of other trace elements were not reported for Mill Brook sediment. Chromium, copper, and zinc had higher concentrations off-site than on-site.

Elevated concentrations of several pesticides were observed in groundwater on-site (Table 2). Pesticides were reported to be substantially lower in off-site groundwater samples, although results were not presented for all pesticides. Pesticide concentrations in surface water were reported to be less than the detection limits. However, the detection limits used for dieldrin, endrin, and DDT were much higher than their chronic marine AWQC. Pesticides were measured at high concentrations in sediment on site, particularly for a-BHC, dieldrin, and DDT, but sediment cores were lower off-site (Table 2). Pesticide concentrations were also high in soil on the site, but were

Site-Related Contamination, *cont.*

lower in off-site soil. PCBs were not detected in surface water or groundwater samples from the CIC site or adjacent areas.

NOAA Trust Habitats and Species

Mill Brook is in a heavily industrialized area and has had chronic pollution problems. The New Jersey Department of Environmental Protection has not surveyed the stream since 1980; it is not known whether pollution abatement efforts have since restored anadromous species use of the stream. Blueback herring, alewife, blue crab, silverside, American eel, and mummichog may have used the stream, especially in the lower reaches near its confluence with the Raritan River (Stuart personal communication 1990).

Table 3. Species and habitat use in the lower Raritan River.

Table available in hardcopy

The Raritan River serves as habitat for migratory and estuarine-dependent marine fish (Table 3; Boriek personal communication 1990; Stuart personal communication 1990). The Raritan River is a major crabbing and fishing area, though

NOAA Trust Habitats and Species, *cont.*

only blue crab are harvested commercially. Recreational fisheries exist for blue crab, bluefish, striped bass, American shad, American eel, white perch, and summer flounder. American shad have been stocked in the upper Raritan River to encourage the restoration of a fishery upriver, but spawning has yet to occur (Boriek personal communication 1990).

Fishing advisories are in effect in the Raritan River for American shad, striped bass, bluefish, and white perch due to high levels of PCB contamination (Boriek personal communication 1990).

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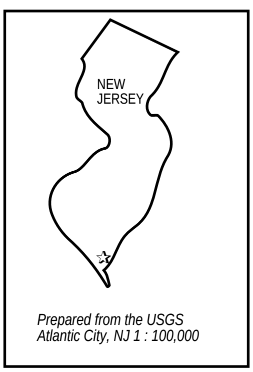
FAA Technical Center
Atlantic City Airport

Absecon, New Jersey
Region 2
NJ9690510020

Site Exposure Potential

The Federal Aviation Administration (FAA) Technical Center site covers 2,023 hectares and is approximately 13 km northwest of Atlantic City in southeastern New Jersey (Figure 1). There are several major installations on the site, including the Atlantic City International Airport, New Jersey Air National Guard, and the National Aviation Facilities Experimental Center (NAFEC). The site was constructed as a naval air station in 1942. The NAFEC was added in 1957, and administration of all facilities was transferred to the FAA in 1958. Activities on the site have involved use and storage of toxic materials, including jet fuels, solvents, pesticides, and photoprocessing chemicals. Improper storage, handling, and disposal practices contributed to contamination of on-site groundwater and soils (TRC 1988).

The FAA site is within the Absecon Creek drainage area. Both the north and south branches of Doughty's Mill Stream flow across the site into the Atlantic City Reservoir, formed by damming the south branch of the stream. This reservoir flows into another reservoir off the site, eventually becoming Absecon Creek, which discharges to Absecon Bay approxi-



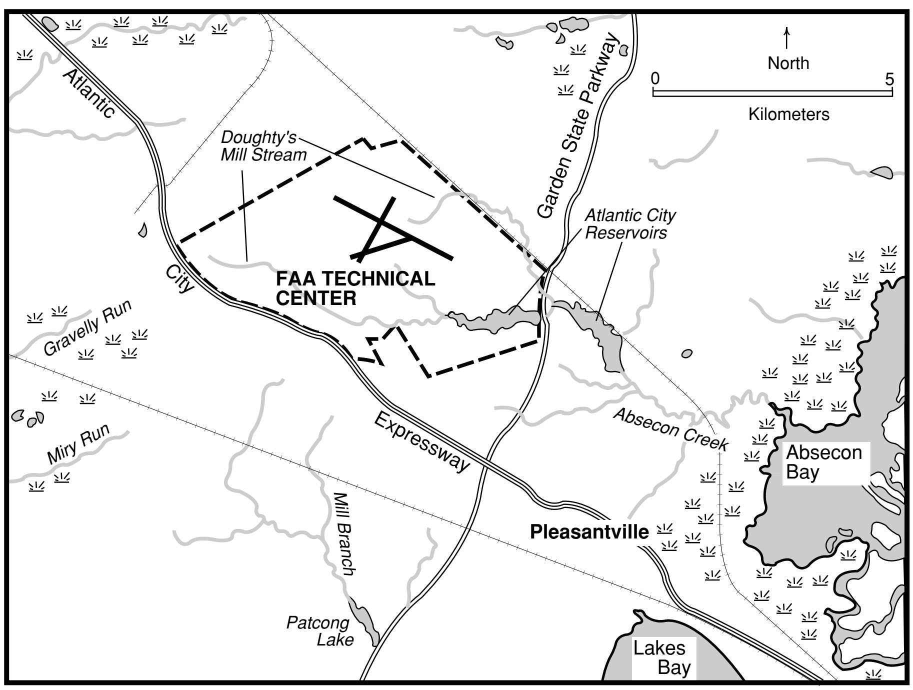


Figure 1. The FAA Technical Center Atlantic City Airport, Absecon, New Jersey.

Site Exposure Potential, *cont.*

mately 4 km downstream of the outlet of the lower Atlantic City reservoir.

The water table in the area of the FAA site is extremely shallow and may be within 1 m of the surface at different times of the year. The water table lies within a sand aquifer that is defined by a deeper, discontinuous clay layer. Groundwater typically follows topographical features, with the majority of the groundwater flowing towards the streams or reservoirs (TRC 1988).

Based on site characteristics and historical practices, surface water transport is considered a major pathway of contamination to NOAA resources. Groundwater in the shallow aquifer may contribute some contaminants as it enters the surface drainages. Contaminated sediments and soils represent secondary sources of contamination and may be transported off-site.

Site-Related Contamination

During an investigation of groundwater quality in Atlantic City municipal wells, Weston (1984) identified five major areas on the FAA site that may have contributed contaminants to the Atlantic City municipal water supply. A remedial investigation/feasibility study (RI/FS) was conducted at the five sites to characterize the type and extent of contamination at the FAA Technical Center. Preliminary sampling of surface water, groundwater, soils, and sediments was also conducted at 17 additional sites.

Results from the RI/FS report (TRC 1988) indicated that most matrices were contaminated with inorganic substances, PCBs, and DDT. The maximum concentrations of contaminants that were observed are summarized in Table 1, along with applicable screening levels (TRC 1988).

Levels of contamination varied among the sites investigated. Trace elements, found in most groundwater samples, were more than ten times the AWQC for the protection of aquatic life. The highest concentrations of copper and zinc occurred in drinking water supply wells on-site. Trace element levels in soils often exceeded average levels found in uncontami-

Site-Related Contamination, *cont.*

Table 1. Maximum concentrations of contaminants of concern at the FAA Technical Center.

	Water			Soil		Sediment	
	Ground-water µg/l	Surface Water µg/l	AWQC[1] µg/l	Surface Soil mg/kg	Average[2] U.S. Soil mg/kg	Sediment mg/kg	ER-L[3] mg/kg
INORGANIC SUBSTANCES							
cadmium	40	ND	1.1+	4.2	0.06	1.7	5
chromium	406	ND	11	21	100	16.5	80
copper	227	ND	12+	30.9	30	14	70
lead	204	11.7	3.2+	99	10	45.1	35
mercury	3.2	ND	0.012	0.3	0.03	2.2	0.15
zinc	4190	35	110+	75	50	33.8	120
ORGANIC COMPOUNDS							
DDT	0.9	0.15	0.001	56	NA	0.16	0.001
PCBs	0.83	ND	0.014	49	NA	1.04	0.05
TPH[4]	8000	ND	NA	43900	NA	ND	NA
ethyl-benzene	1,800,000	ND	a32000	0.16	NA	ND	NA
benzene	1,800,000	ND	a5300	0.16	NA	0.067	NA
toluene	6,000,000	ND	a17500	0.15	NA	ND	NA

1: Ambient water quality criteria for the protection of aquatic organisms. Freshwater chronic criteria presented (EPA, 1986)
2: Lindsay (1979).
3: Effective 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 Morgan (1990).
4: Total Petroleum Hydrocarbons
+ Hardness-dependent criteria; 100 mg/l $CaCO_3$ used.
a Freshwater acute criteria, no chronic criteria available
NA Screening level not available
ND Not detected at method detection limit

nated soils in the United States. The concentrations of the trace elements in sediments were compared to Effective Range-Low (ER-L) values of Long and Morgan (1990). Only lead and mercury in sediments exceeded their ER-L values.

In areas where jet fuels were stored or burned, soils and groundwater had elevated concentrations of volatile organic compounds. Several of these sites were near surface drainages and there was some evidence that fuel had migrated to the adjacent surface water.

PCBs were detected at high concentrations in groundwater, soils, and sediments. The highest concentrations were measured in soil samples from the salvage yard and the transformer storage area. DDT was detected in all media sampled, including surface waters draining areas of the FAA site. DDT concentrations in soils were high at three of the five major sites.

NOAA Trust Habitats and Species

Surface water and sediment samples were taken largely from the south branch of Mill Stream with a few samples from the north branch. No sampling was done in the Atlantic City reservoirs, so it is not known if contamination is migrating below the reservoirs into Absecon Creek.

Anadromous and marine species use the tidally influenced portion of Absecon Creek up to the impassable dam at the base of the Lower Atlantic City Reservoir (Table 2; Boriek personal communication 1990; McClain personal communication 1990). There was once a spawning ground for alewife near the base of the dam, but studies in the early 1970s found no evidence of spawning fish (Boriek personal communication 1990). Anadromous species may also be able to access Jarrets Run or the unnamed stream southeast of the site (TRC 1988). The New Jersey Department of Fish, Game, and Wildlife has no restoration plans that would allow anadromous species access to areas above the dam.

Table 2. Species and habitat use in the tidally influenced portion of Absecon Creek up to the lower Atlantic City Reservoir dam.

Table available in hardcopy

A number of marine and estuarine species use the lower portions of Absecon Creek for foraging, including blue crab. Men-

FAA Technical Center Atlantic City Airport

NOAA Trust Habitats and Species, *cont.*

haden, alewife, herring, and spot are fished commercially along the coast. Bluefish are an important offshore recreational fishery.

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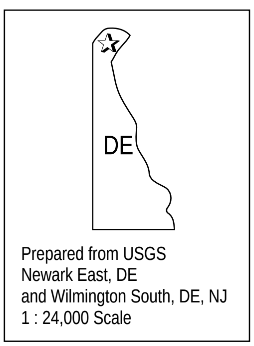
Koppers Company Facilities

Newport, Delaware
Region 3
DED980552244

Site Exposure Potential

From 1921 to 1971, the 130-hectare Koppers Company Facilities site in Newport, Delaware was operated as a wood-preserving facility (Figure 1). Telephone poles and railroad ties were pressure-treated with creosote, although pentachlorophenol was used for approximately three years during the period of operations (Silar 1987). In 1971, the property was sold to E.I. DuPont de Nemours Company and most of the existing structures were removed. Currently, only the locations of the fire pond, waste treatment lagoon, and drying areas are evident at the site. The DuPont facility borders the northeastern side of the site.

Koppers is located within the 100-year floodplain of the Christina River. Much of the site is bordered by low-lying freshwater wetlands, and several tributaries of the Christina River. Hershey Run, a small, tidally influenced stream, meanders across the northwestern portion of the site. This stream shortly joins White Clay Creek, which forms the southern



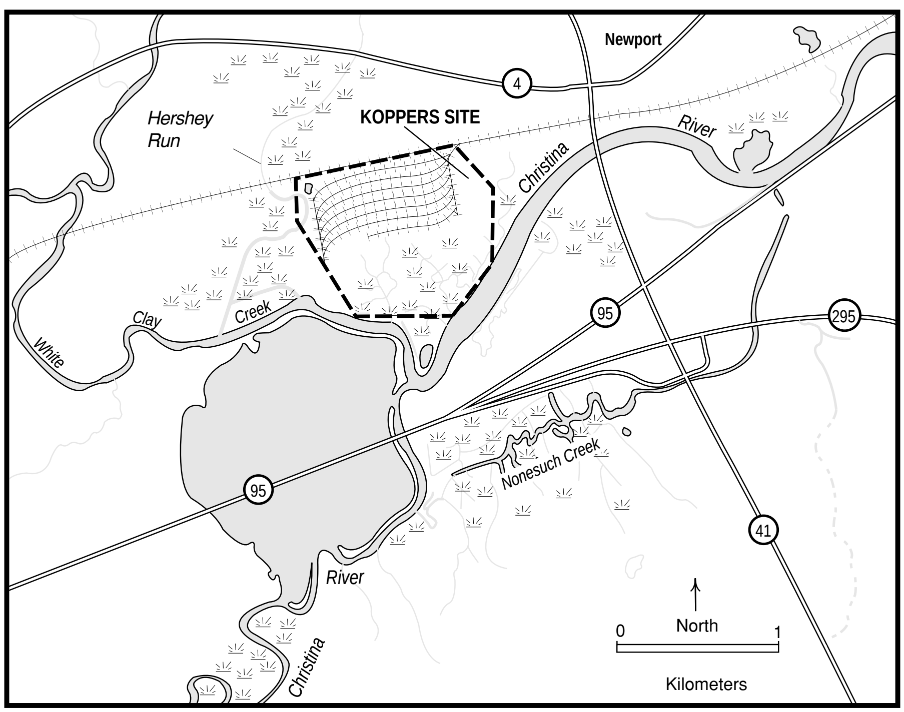


Figure 1.
Koppers Company site, Newport, Delaware.

Site Exposure Potential, *cont.*

boundary of the site. White Clay Creek enters the Christina River 1 km downstream of the river's confluence with Hersey Run. From its confluence with White Clay Creek, the Christina River flows north along a tidally influenced wetlands area and continues 15 km downstream to join the Delaware River.

Soil in the vicinity of the site is primarily sand and gravel (Lee 1980). The groundwater exists within 3 m of the ground surface. Groundwater movement tends to be toward the streams and the associated wetlands, but high groundwater withdrawal from water supply wells may alter this pattern.

Based on existing data, contaminant transport from the Koppers site to the adjacent surface waters is primarily a function of surface water runoff and associated soil erosion and deposition.

Site-Related Contamination

Surface water, soil, and sediment samples were collected from only four locations during a site inspection conducted in May 1980. PAHs were detected at elevated levels in the soil and sediment collected. No contaminants were detected in surface waters. Maximum concentrations of PAHs detected at the site are shown in Table 1 (Glenn and Lee 1980). (No average U.S. soil values were available for these compounds (Lindsay 1979)).

Table 1. Maximum concentrations of PAHs in surface water, soil, and sediment collected at the site.

	Soil	Sediment	
	Soil mg/kg	Sediment mg/kg	ER-L[1] mg/kg
ORGANIC COMPOUNDS			
benzo(a)anthracene	42	3.9	0.230
anthracene	25	7.4	0.085
benzo(a)pyrene	63	11.0	0.400
pyrene	76	1.8	0.350
benzo(b)fluoranthene	91	8.5	NA
fluoranthene	76	1.9	0.600
fluorene	ND	0.9	0.035
phenanthrene	11	2.5	0.225
chrysene	55	6.3	0.400
Total PAH	440	44.0	4.0

1: Effective 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 Morgan (1990).
NA Screening level not available
ND Not detected at method detection limit, detection limit not available

Site-Related Contamination, *cont.*

The highest concentrations of individual PAHs were found in soil sampled from the old wastewater treatment pond. The maximum total PAH concentrations in soil exceeded 400 mg/kg. PAHs were elevated in sediment collected from areas upstream and downstream from the Koppers site, at levels approximately one tenth those found in soil. Based on the limited sampling conducted, PAH contamination of sediment may not be solely due to past wood-treating operations at the site.

NOAA Trust Habitats and Species

The Christina River supports a wide variety of anadromous, catadromous, and estuarine species (Table 2; Miller personal communication 1990; Saveikis personal communication 1990; Shirey personal communication 1990). Blueback herring, alewife, white perch, striped bass, American eel, Atlantic menhaden, bay anchovy, and spot are species of particular interest to NOAA in the Christina and Delaware rivers due to their commercial importance or abundance. Alewife, blueback herring, and white perch spawn in the Christina River, and striped bass use it as a nursery area (Miller personal communication 1990).

Table 2. Species and habitat use in the Christina River near the site.

Table available in hardcopy

Juvenile life stages of estuarine-dependent species such as Atlantic menhaden, bay anchovy, and spot use the Christina River seasonally. The catadromous American eel is present throughout the entire Delaware basin, and uses a variety of habitats as adult foraging grounds (Shirey personal communication 1990). Blue crab are common in the Christina and Delaware rivers.

NOAA Trust Habitats and Species, *cont.*

Blue crab, American shad, and striped bass are fished commercially in the Delaware River near its confluence with the Christina River. Important recreational fisheries for blue crab, American shad, striped bass, and white perch occur in the Christina River and in the lower reaches of the Delaware River (Miller personal communication 1990). In addition, large freshwater fisheries on both rivers harvest channel catfish, largemouth bass, yellow perch, black crappie, and sunfish.

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Publicker Industries

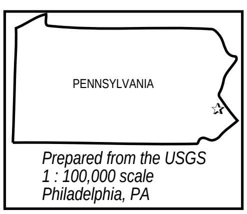
Philadelphia, Pennsylvania
Region 3
PAD981939200

Site Exposure Potential

Publicker Industries, a former alcohol distillery in southeast Philadelphia, Pennsylvania, covers 15 hectares in a highly industrialized area along the Delaware River adjacent to the Walt Whitman Bridge (Figure 1). Between 1912 and 1985, distilled alcohols were used in the on-site production of liquor, solvents, cleaners, antifreeze, and rubbing alcohol. The site was also used for storing petroleum products in the late 1970s and early 1980s before being abandoned in November 1986 (Tetra Tech 1990).

The site contains storage tanks and drums, reaction vessels, product stock, chemical laboratories, production buildings, and warehouses, and is criss-crossed with above- and below-ground process lines. Spills of unknown quantity and content occurred in the past. In addition, wastes have been improperly stored; leaking drums and process lines have been documented. Oil sheens coming from the site have been observed on the Delaware River (Tetra Tech 1990).

The site is built on construction rubble and backfill, including concrete, bricks, and railroad ties. A shallow, unconfined



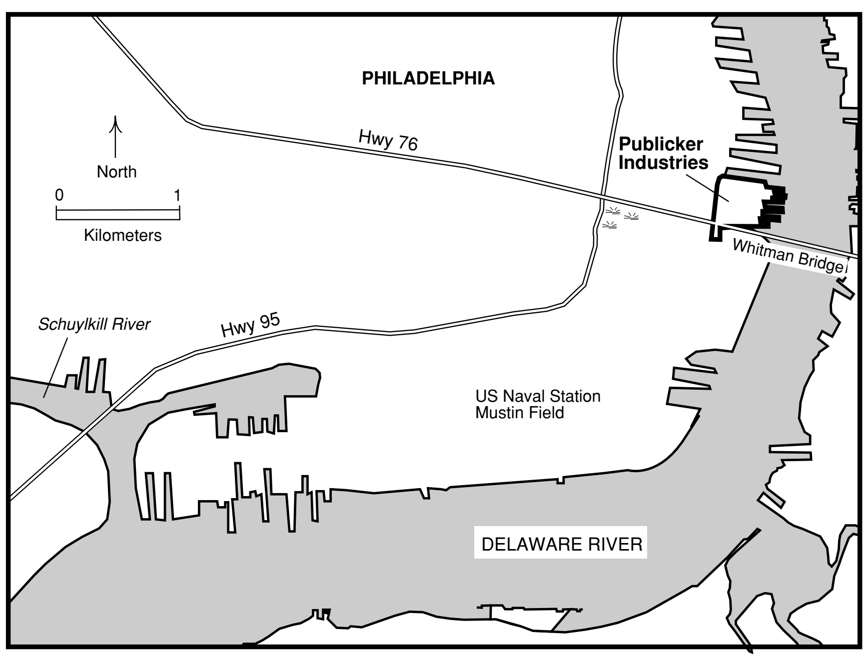


Figure 1. Publicker Industries, Philadelphia, Pennsylvania.

Site Exposure Potential, *cont.*

aquifer and a deep, confined aquifer occur beneath the site. The shallow aquifer is recharged by surface infiltration and leakage from sewer and water lines. The recharge area for the deep aquifer is west of the Publicker site. Groundwater in the shallow aquifer flows radially to the north, south, and east from an area of high elevation near the center of the site.

Both surface water and groundwater discharge represent potential pathways of contamination from the site to NOAA resources and associated habitats. Contaminated sediments represent a secondary source of contamination for aquatic biota.

Site-Related Contamination

In 1986, Dames and Moore collected groundwater and soil samples as part of an environmental evaluation of the site. Results indicated the presence of several volatile and semi-volatile organic compounds and inorganic substances in these matrices at elevated concentrations. Most organic and inorganic compounds detected in soil exceeded background concentrations established for eastern U.S. soil. Toluene was present in groundwater at concentrations 10 times greater than ambient water quality criteria for the protection of freshwater or marine organisms (Dames and Moore 1986; EPA 1986).

In 1988, the Pennsylvania Department of Environmental Resources conducted additional, limited sampling of soil, groundwater, surface water, and sediment to evaluate risks to human health and the environment (Table 1; Tetra Tech 1990). Study results, similar to the 1986 Dames and Moore evaluation, confirmed the patchy distribution of contaminants at the Publicker site. The levels of toluene and lead in groundwater were very high. PAHs, PCBs (Aroclor 1254), and other organic compounds were detected in soil and sediment at concentrations exceeding background or low effect range values

Publicker Industries

Site-Related Contamination, *cont.*

Table 1. Maximum concentrations of contaminants of concern at the Publicker site.

	Water			Soil		Sediment	
	Ground water	Surface Water	AWQC[1]	Soil	Average[2] U.S. Soil	Storm Drain Sediment	ER-L[3]
	µg/l	µg/l	µg/l	mg/kg	mg/kg	mg/kg	mg/kg
INORGANIC SUBSTANCES							
cadmium	ND	ND	1.1+	10.4	0.06	2.3	5
chromium	40	ND	11	176	100	60	80
copper	27	38	12+	3070	30	880	70
lead	45,000	205	3.2+	655	10	370	35
mercury	ND	ND	0.012	5.3	0.03	1.2	0.15
zinc	110	120	110+	691	50	390	120
ORGANIC COMPOUNDS							
toluene	120000	ND	a17500*	110	NA	350	NA
benzo(a) pyrene	ND	ND	NA	3500	NA	1400	0.4
naphthalene	ND	ND	620*	110	NA	230	0.34
anthracene	ND	ND	NA	350	NA	420	0.15
fluoranthene	ND	ND	a3,980*	1700	NA	2300	0.60
phenanthrene	ND	ND	NA	630	NA	1500	0.225
pyrene	ND	ND	NA	1500	NA	1800	0.35
benzo(a) anthracene	ND	ND	NA	1300	NA	1300	0.23
chrysene	ND	ND	NA	1600	NA	1500	0.40
PCBs	ND	ND	0.014	1800	NA	ND	0.05

1: Ambient water quality criteria for the protection of aquatic life, freshwater chronic criteria presented (EPA 1986).
2: Lindsay (1979).
3: Effective 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 Morgan (1990).
+ Hardness-dependent criteria; 100 mg/l $CaCO_3$ used
* Insufficient data to develop criteria, value presented is the Lowest Observed Effects Level (LOEL)
a AWQC freshwater acute criteria, no chronic criteria available (EPA 1986).
NA Comparison value not available
ND Not detected at method detection limit

(ER-L) for these substances (Long and Morgan 1990). Soil and sediment values for copper, lead, mercury, and zinc greatly exceeded their screening values.

NOAA Trust Habitats and Species

The Delaware River near the site provides seasonal habitat for several anadromous, catadromous, and estuarine species (Table 2; Delaware River Basin Commission 1988; Kauffman personal communication 1989). An endangered species, the shortnose sturgeon, forages in the region during its juvenile years and migrates through the area to its upstream spawning grounds.

Species of special interest to NOAA because of their commercial importance or abundance in the area include striped bass, American shad, alewife, herring, anchovy, white perch, Atlantic and shortnose sturgeon, American eel, and blue crab.

NOAA Trust Habitats and Species, *cont.*

American shad, alewife, herring, and striped bass are commercially fished on the Atlantic coast and are currently managed by the National Marine Fisheries Service. There are also local sport

Table 2. Habitat and species use in the Delaware River near the site.

Table available in hardcopy

fisheries for several of these species, although an advisory is in effect for human consumption of white perch, blue crab, and channel catfish in this section of the river due to high levels of PCBs (Delaware River Basin Commission 1988; Kauffman personal communication 1989).

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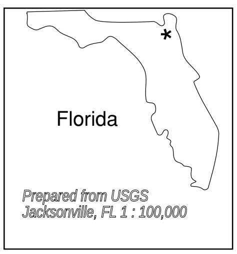
Naval Air Station Cecil Field

Jacksonville, Florida
Region 4
FL5170022474

Site Exposure Potential

The Naval Air Station (NAS) Cecil Field occupies 8,094 hectares, approximately 22 km southwest of Jacksonville, Florida (Figure 1). NAS Cecil Field was constructed in 1941 and currently supports the operation and maintenance of naval weapons and aircraft under the command of the Sea Strike Wings Atlantic. The site comprises four separate facilities: the main station (Cecil Field), the Outlying Field Whitehouse, and the Yellow Water Weapons Department and the Pinecastle Warfare Range, which are outside the area shown in Figure 1. The area surrounding these facilities is rural and land use is primarily for forestry and agriculture (Brown and Caldwell 1989).



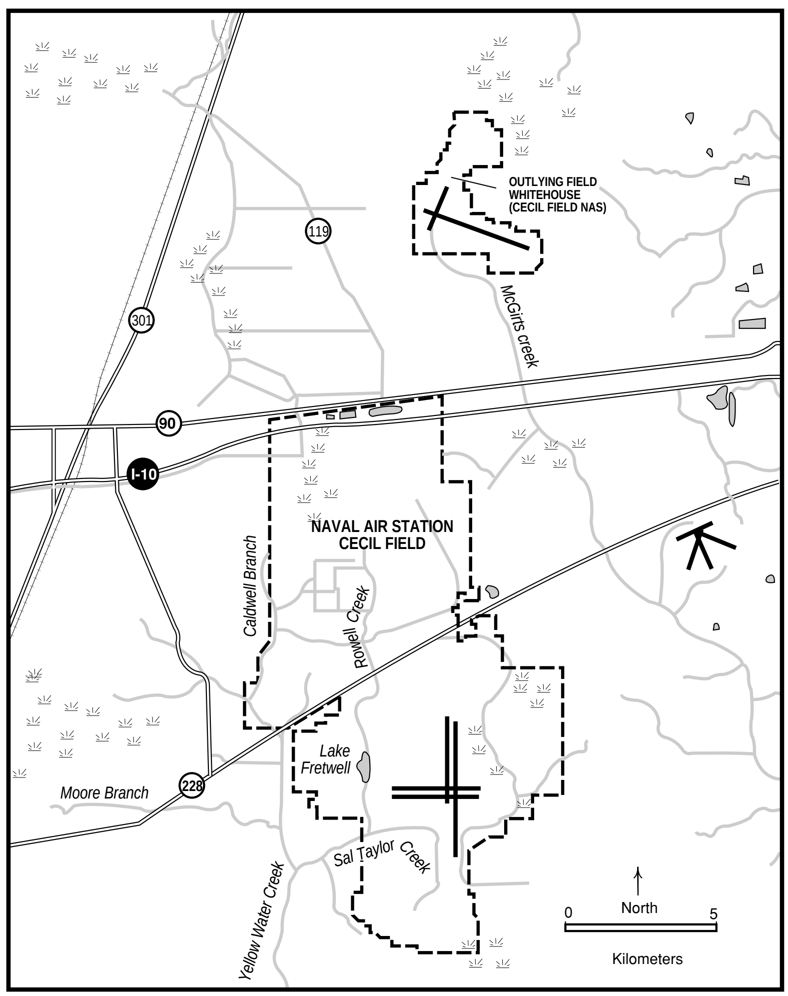


Figure 1.
Naval Air Station
Cecil Field,
Jacksonville, Florida.

Site Exposure Potential, *cont.*

A variety of wastes have been generated as a result of activities at NAS Cecil Field. Oils, fuels, solvents, paints and thinners, pesticides, and sewage sludge have been buried or burned at two on-site landfills and fourteen disposal areas. In addition, three sites have been used for ordnance disposal. Handling, storage, and disposal practices of these materials have contributed to contamination of groundwater, soil, and sediment at NAS Cecil Field.

Surface water runoff from the site is conveyed to local streams, including Yellow Water Creek, Rowell Creek, and Sal Taylor Creek, by a system of storm sewers and unlined ditches. The confluence of Rowell and Sal Taylor creeks lies on the western edge of the main station boundary. Sal Taylor continues southwest for 3 km before meeting Yellow Water Creek, the receiving stream of all surface waters leaving the site. Yellow Water Creek flows south from the Sal Taylor Creek tributary for 13 km to join Black Creek. Black Creek then flows southeast for 27 km to the St. Johns River, which drains to the Atlantic Ocean. The distance from the NAS Cecil Field to the St. Johns River is about 40 km.

Three groundwater aquifers underlie the Cecil Field site: the surficial aquifer, the secondary artesian aquifer, and the Floridan aquifer. The surficial aquifer is very shallow and exists in unconsolidated sand. This aquifer discharges to surface water bodies and is the primary source of base flow for many streams in the area. The other aquifers are much deeper and are isolated from the surficial aquifer by low permeability geological features.

Both surface water and groundwater movement represent potential pathways of contamination from NAS Cecil Field to nearby streams. The majority of the contaminated areas identified at Cecil Field are close to Rowell Creek and Lake Fretwell. Both of these surface waters serve as the receiving points for groundwater discharge and surface water flow emanating from the sites. Known sites of contamination are also situated along the other creeks.

Site-Related Contamination

Only contaminants at the main station of NAS Cecil Field and the Yellow Water Weapons Department have been investi-

Site-Related Contamination, *cont.*

gated to date and are addressed here (Brown and Caldwell 1989). Preliminary data indicate contaminated groundwater, surface water, soil, and sediment (Table 1; Brown and Caldwell 1989). The major contaminants of concern are cadmium, chromium, lead, and mercury, which were detected in groundwater at high concentrations. Groundwater from the landfills had some of the highest concentrations, and the most frequent occurrences of trace elements. Surface water collected from a rubble disposal area had high concentrations of mercury. Soil and sediment from a number of areas showed elevated concentrations of cadmium and lead. Low levels of

Table 1. Maximum concentrations of major contaminants in the vicinity of the site compared with applicable screening levels.

	Water			Soil		Sediment	
	Ground-water µg/l	Surface Water µg/l	AWQC[1] µg/l	Soil mg/kg	Average[2] U.S. Soil mg/kg	Sediment mg/kg	ER-L[3] mg/kg
INORGANIC SUBSTANCES							
cadmium	12	ND	1.1+	17	0.06	20	5
chromium	425	ND	11	16	100	9	80
lead	573	ND	3.2+	599	10	14	35
mercury	0.8	0.3	0.012	NT	0.03	NT	0.15
ORGANIC COMPOUNDS							
PCBs	NT	NT	0.014	0.58	NA	ND	0.05

1: Ambient water quality criteria for the protection of aquatic organisms. Freshwater chronic criteria presented (EPA 1986).
2: Lindsay (1979)
3: Effective 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 Morgan (1990).
+ Hardness-dependent criteria; 100 mg/l $CaCO_3$ used.
NT Not analyzed
ND Not detected at method detection limit, detection limit not available

volatile organic and semi-volatile organic compounds were detected in groundwater and soil sampled from a number of areas.

NOAA Trust Habitats and Species

Black Creek and the St. Johns River support numerous habitats for marine, estuarine, and anadromous fish and invertebrates, including several commercially important species and one endangered species (Table 2; Brown and Caldwell 1989; Wodall personal communication 1990). It is not known to what extent these species utilize the tributary streams leading from the site to Black Creek. Striped bass and blue crab spawn throughout Black Creek. The West Indian manatee, a

NOAA Trust Habitats and Species, *cont.*

federally endangered species, occurs in the St. Johns River and has been reported in Black Creek on several occasions, as far upstream as Middleburg, 16 km upstream of the site.

Table 2. Species and habitat use of Black Creek and the lower St. Johns River estuary.

Table available in hardcopy

Black Creek is a very popular area for recreational fisheries and water-related sports, including swimming, boating, and water skiing. Recreational fisheries in the creek include those for blue crab, striped bass, and red drum. Blue crab are also fished commercially in Black Creek and eels are fished commercially in its lower reaches near the St. Johns River.

The lower St. Johns River near the confluence of Black Creek is tidally influenced and provides estuarine habitat for many marine and estuarine species, including nursery grounds for shrimp, spotted seatrout, weakfish, spot, Atlantic croaker, and red drum (Brown and Caldwell 1989; Wodall personal communication 1990).

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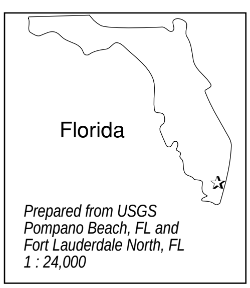
Chem-Form, Inc.

Pompano Beach, Florida
Region 4
FLD080174402

Site Exposure Potential

The 1.6-hectare Chem-Form site is located in a heavily industrialized area of Pompano Beach, Florida (Figure 1). Chem-Form, Inc. began operations in 1967 manufacturing precision metal parts for electro-chemical milling machinery and for the aerospace industry. Wastes generated at the site from manufacturing processes included spent oils, lubricants, organic solvents and acids. Oil and solvent wastes were stored in stainless steel tanks for off-site disposal. Process wastewater was discharged into a septic tank and associated drain field, or into an open trench in a field west of the main shop (NUS 1986; Westinghouse 1990).

The Chem-Form site is in an area that was once a low-lying wetland that is now filled with sand and crushed limestone to an elevation of 3 m above mean sea level. Groundwater occurs near the natural surface and exists in a highly permeable, sandy limestone aquifer that extends to a depth of 60 m. Natural groundwater flows from west to east. However, extensive groundwater withdrawal associated with development in the area has resulted in a reversal of the natural gradients. Though no surface waters traverse the site, Cypress Creek Canal flows within 0.8 km of the southern site bound-



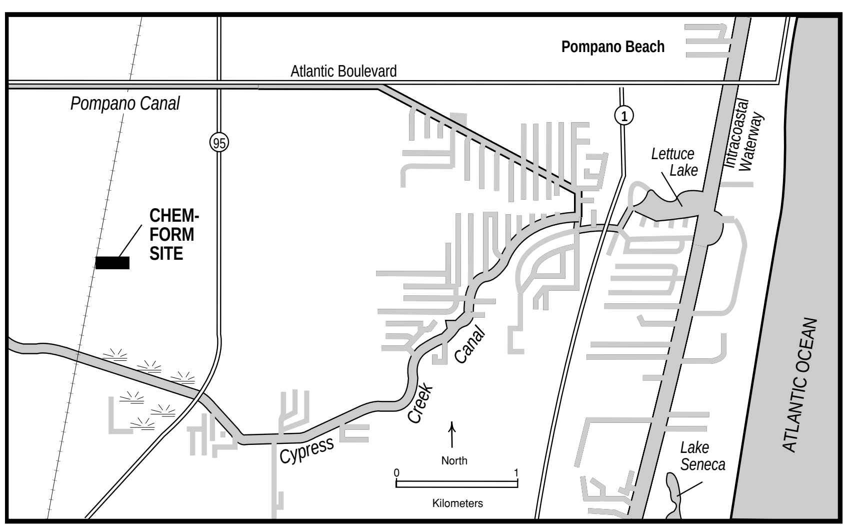


Figure 1. The Chem-Form site, Pompano Beach, Florida.

Site Exposure Potential, *cont.*

ary. Cypress Creek Canal flows into the Intracoastal Waterway approximately 7 km from the site.

Groundwater discharge to nearby canals and waterways is the primary pathway of contaminant migration to NOAA resources.

Site-Related Contamination

Results from preliminary surveys of contamination in soil and groundwater indicate the presence of trace elements in these media (NUS 1986). Low levels of organic compounds, including PCBs, were found in soils in one area of the site in the 1986 survey. Maximum concentrations of contaminants in the matrices sampled are presented in Table 1 along with applicable screening levels (NUS 1986; Westinghouse 1990).

Table 1. Maximum concentrations of major contaminants detected in groundwater and soil collected at the Chem-Form site.

	Water		Soil	
	Ground-water µg/l	AWQC[1] µg/l	Soil mg/kg	Average[2] U.S. Soil mg/kg
INORGANIC SUBSTANCES				
antimony	ND	1600*	181	1
cadmium	40	1.1+	71	0.06
chromium	725	11	23400	100
cobalt	280	NA	36000	8
copper	269	12+	955	30
cyanide	15	5.2	1100	NA
lead	ND	3.2+	782	10
mercury	6.7	0.012	195	0.03
nickel	550	160+	49500	40
silver	7	0.12	12	0.05
ORGANIC COMPOUNDS				
PCBs	ND	0.014	4.6	NA
2,4-dinitro phenol	ND	NA	100	NA
2-methyl-4,6-dinitrophenol	ND	NA	100	NA
pentachlorophenol	ND	NA	100	NA
4-nitrophenol	ND	NA	100	NA

1: Ambient water quality criteria for the protection of aquatic organisms. Freshwater chronic criteria presented (EPA 1986).
2: Lindsay (1979).
ND: Not detected at method detection limit, detection limit not available
*: Insufficient data to develop criteria. Value presented is the Lowest Observed Effect Level (LOEL).
+: Hardness-dependent criteria; 100 mg/l $CaCO_3$ used.
NA: Screening level not available

Chem-Form, Inc.

Site-Related Contamination, *cont.*

Mercury was present at very high concentrations in groundwater samples from the Chem-Form site. Elevated concentrations of cadmium, chromium, copper, nickel, silver, and cyanide were also measured in groundwater samples collected at the site. No organic compounds were found in groundwater.

Trace elements were also detected at elevated levels in soils collected from the Chem-Form site. Chromium and nickel were present in most samples at very high concentrations. Antimony, cadmium, cobalt, copper, lead, mercury, and cyanide were also measured at elevated levels. Several phenolic compounds and PCBs were also detected in soils at elevated levels.

NOAA Trust Habitats and Species

The habitats of potential interest to NOAA are the Cypress Creek Canal and the Intracoastal Waterway. The canal is essentially fresh water at its closest point to the site (less than one kilometer). Canals in this region have been heavily impacted by water management practices, and no commercial or recreational fisheries are present in the canal (Conklin personal communication 1990). No anadromous fish are known to occur in the canal. Some freshwater species have been observed, including catfish, mosquito fish, and freshwater bass (Conklin personal communication 1990; Ferril personal communication 1990). At this time, there are insufficient data on contamination to indicate a direct pathway to the Intracoastal Waterway.

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Ciba-Geigy Corporation

McIntosh, Alabama
Region 4
ALD001221902

Site Exposure Potential

The Ciba-Geigy site, 1.3 km northeast of McIntosh, Alabama on the Tombigbee River, is adjacent to and north of the Olin Chemical Corporation site (Figure 1; see page 75 in this report). Ciba-Geigy manufactured only DDT when it began operations in 1952 but has since manufactured pesticides, plastic resins and additives, and water treatment chemicals. Solid wastes generated from manufacturing, construction, and other activities were disposed of on the site in many different areas. Process wastewater was stored in ponds (BCM 1990).

Surface water associated with the Ciba-Geigy site include Johnson Creek, which traverses the property in closed culverts, a reservoir, and a series of drainage ditches. Most of the surface water discharges to the Tombigbee River.

There are two separate aquifers at the site, alluvial and Miocene. The shallow, alluvial aquifer exists under semi-confined conditions and is recharged by infiltration from rainfall,

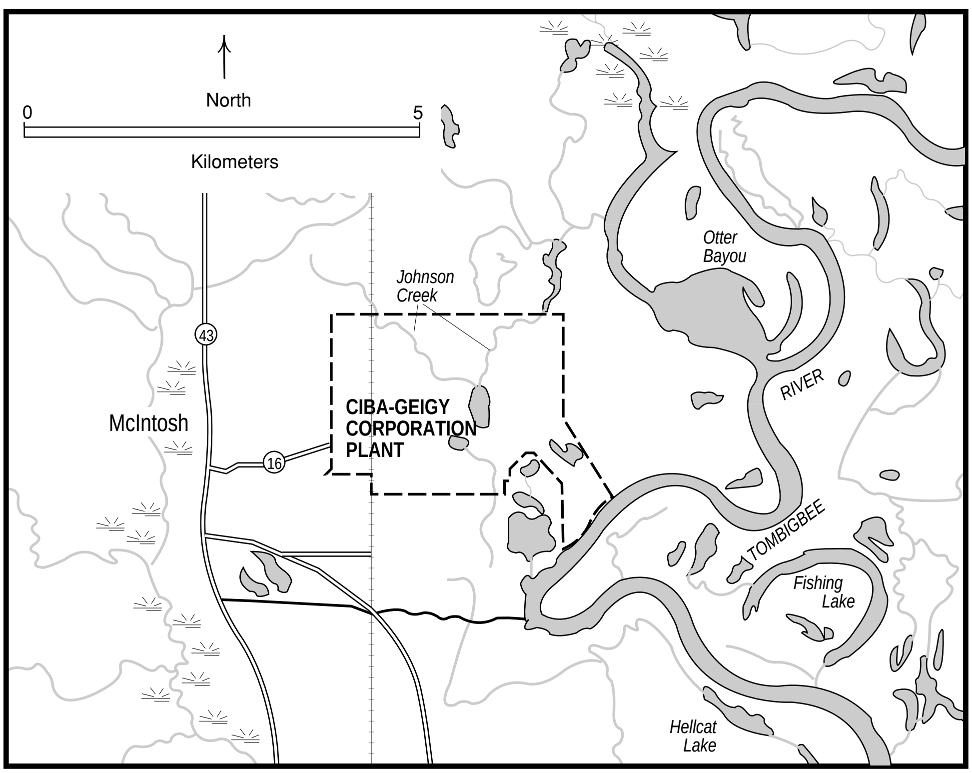

Figure 1.
The Ciba-Geigy site, McIntosh, Alabama.

Site Exposure Potential, *cont.*

streams, lakes, and marshes. Groundwater flow is generally to the southeast. Hydrogeologic investigations have established that the deeper aquifer is isolated from the shallow aquifer (USFWS 1986).

Surface water runoff or discharge and groundwater transport represent the primary pathways of contaminant transport from the Ciba-Geigy site. Contaminated sediments may act as a secondary source of toxic chemicals.

Site-Related Contamination

Past studies indicate that soil and groundwater at the site are contaminated with pesticides. Contaminants in surface water, soil, and sediment were analyzed as part of the RI/FS; maximum values reported are presented in Table 1 (BCM 1990). Although few data were presented in the final reports to characterize groundwater quality, corrective actions are being

Table 1. Maximum concentrations of major contaminants found in groundwater, surface water, soil, and sediment collected at the site.

	Water			Soil		Sediment	
	Ground-water µg/l	Surface Water µg/l	AWQC[1] µg/l	Soil mg/kg	Average U.S. Soil[2] mg/kg	Sediment mg/kg	ER-L[3] mg/kg
INORGANIC SUBSTANCES							
chromium	<18	40	11	1500	100	78	80
copper	<12	29	12+	131000	30	30	70
lead	ND	27	3.2+	920	10	23	35
mercury	ND	ND	0.012	3.9	0.03	0.31	0.15
nickel	23	37	160+	670	40	32	30
zinc	91	250	110+	130	50	140	120
ORGANIC COMPOUNDS							
DDD	NT	ND	NA	26000	NA	40	NA
DDE	NT	ND	NA	30000	NA	26	0.002
DDT	NT	ND	0.001	24000	NA	40	0.001
α-BHC	NT	ND	NA	910000	NA	7.0	NA
β-BHC	NT	ND	NA	140000	NA	1.8	NA
δ-BHC	NT	ND	NA	15000	NA	0.52	NA
lindane	NT	ND	0.08	63000	NA	1.2	NA
endrin	NT	ND	0.002	ND	NA	0.03	0.00002
chloroform	240	0.02	NA	17000	NA	0.007	NA
chloro-benzene	590	0.12	50	12000	NA	0.22	NA

1: Ambient water quality criteria for the protection of aquatic organisms. Freshwater chronic criteria presented (EPA 1986).
2: Lindsay (1979).
3: Effective 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 Morgan (1990).
+ Hardness-dependent criteria; 100 mg/l $CaCO_3$ used.
NA Screening level not available
NT Not analyzed
ND Not detected at method detection limit, detection limit not available

Site-Related Contamination, *cont.*

conducted to treat groundwater contamination at the site. The majority of the pesticides contaminating the site were DDT and its metabolites and s-triazine herbicides. DDT and its metabolites were measured at extremely high concentrations in soils and were elevated in sediments above levels found to be associated with deleterious effects in aquatic organisms (Long and Morgan 1990).

Other contaminants present at the Ciba-Geigy site include trace elements and volatile organic compounds that were elevated in soils in areas associated with landfills or effluent ponds. Several metals measured in surface waters exceeded their freshwater chronic AWQC, including chromium, copper, lead, and zinc.

Herbicidal compounds were present at extremely high concentrations in soils throughout the site, but were not highly elevated in other matrices. No criteria or screening levels are available for evaluation of the potential impacts to aquatic resources by this class of herbicide. To determine concentrations of biological significance, levels of these herbicides in surface water, soils, and sediments are presented in Table 2 (BCM 1990). To provide some comparison values for surface water, values from the Chemical Information System database (CIS 1986) are presented. This database has compiled current

Table 2. Herbicides and insecticides at the site, and the lowest concentrations of these chemicals reported by CIS to result in either acute or chronic toxicity to aquatic organisms.

	Water		Soil	Sediment
	Surface water µg/l	Effects µg/l	mg/kg	mg/kg
HERBICIDES/INSECTICIDES				
ametryn	35.5	1,000	68,000	4.7
atrazine	8.4	5,700	86,000	15.7
bladex	5.5	2,000	1,200	0.22
chlorobenzilate	ND	550	1,500	3.6
chloropropylate	91.7	NA	520	1.52
diazinon	58.1	0.3	37,000	0.4
galecron	3.5	13,200	750	2.4
methidathion	ND	14	47	ND
metolachlor	ND	NA	960	26.7
prometon	14.8	12,000	750	107
prometryn	14.0	1,000	4,300	0.13
propazine	12.7	NA	120,000	ND
simazine	5.1	10	3,000	27.1
simetryn	12.9	5,000	850	7.6
terbumeton	10.6	14,000	8,700	33
terbutryn	8.3	NA	40,000	0.19
terbutylazine	90.5	NA	12,000	5.2
tolban	105	NA	15,000	37.2

NA Screening level not available
ND Not detected at method detection limit, detection limit not available

NOAA Trust Habitats and Species

studies for particular compounds, and provides values for acute or chronic toxicity to aquatic organisms. No comparison values were available for soil or sediment.

The habitat of primary interest to NOAA is the Tombigbee River, which provides essential habitat for many freshwater and anadromous species (Table 3; USFWS 1986; Mettee et al. 1987; Mettee personal communication 1990). The site is approximately 96 km upstream from the river mouth. Although the river is usually freshwater at this point, during periods of low flow (August through September), saltwater intrusion along the river bottom may extend at least as far as the site (Mettee personal communication 1990).

Table 3. Species and habitat use in the Tombigbee River near the site.

Table available in hardcopy

The Tombigbee River near the site is within the Mobile River delta zone and historically has served as habitat for at least four anadromous or catadromous species: Atlantic sturgeon, Alabama shad, American eel, and striped bass. Alabama shad were common in the 1940s, but have not been observed inland in the Mobile River system since the early 1970s (Mettee personal communication 1990). Sturgeon also used the river for spawning and nursery habitat, but have not been observed in

NOAA Habitats and Species, *cont.*

upstream areas of the river in decades, although dead specimens have been found at the mouth of the Mobile River within the last year (Mettee personal communication 1990). Striped bass have been observed upstream of the mouth of the Mobile, but it is unclear whether they currently occur near the site. The Alabama Department of Natural Resources stocks the Mobile River with approximately 20,000 bass each year, below its confluence with the Tombigbee.

Estuarine species, such as the bay anchovy, have been observed in the Tombigbee near the site. The inland occurrence record for bay anchovy (434 km) was set in the Mobile system, and suggests a reproductive, freshwater stock somewhere within the system (Mettee personal communication 1990). Blue crab support a recreational fishery. Saltwater species have been reported by locals during periods of low river flow, including southern flounder, hogchoker, and Atlantic needlefish.

Several freshwater fish species have been sampled near the site, including largemouth bass, rock bass, bluegill, freshwater mullet, and channel catfish (USFWS 1986). Channel catfish is the most important commercial species in the lower Tombigbee. An extremely rare, as yet undescribed, freshwater species of shovelnose sturgeon has been sampled within the Mobile River system (Mettee personal communication 1990).

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Naval Air Station Jacksonville

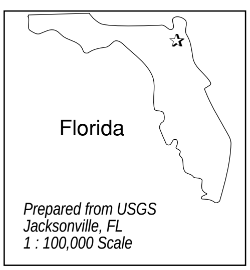
Jacksonville, Florida
Region 4
FL6170024412

Site Exposure Potential

The Naval Air Station (NAS) Jacksonville is located approximately 14.5 km south of Jacksonville, Florida on the St. Johns River (Figure 1). The 1,354-hectare NAS site provides housing, training, and aircraft support facilities, including the Naval Air Rework Facility (NARF), an industrial complex of 45 buildings. The NAS maintains, repairs, and reworks aircraft engines and frames (Geraghty & Miller, Inc. 1985).

Surface drainage from the NAS flows eastward to the St. Johns River and westward towards the Ortega River. It is possible that the Ortega River also receives shallow groundwater discharge (base flow) from the NAS. Much of the NAS is covered by storm sewers that discharge into the St. Johns River.

Areas of concern at the NAS include sites where solvents from NARF operations were dumped over a 40-year period; areas where deteriorating industrial sewer lines have leaked waste



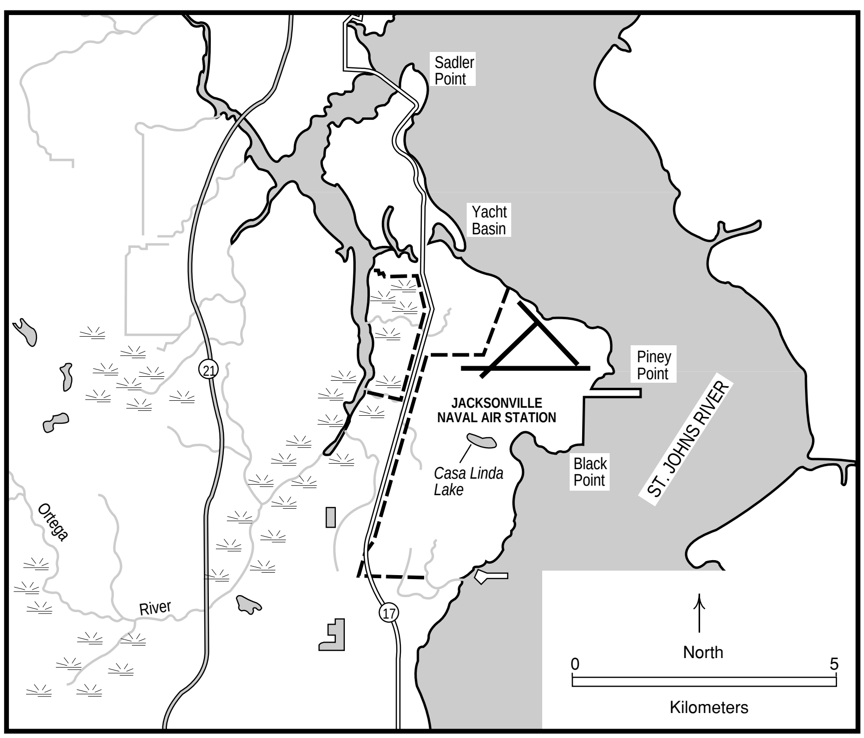


Figure 1. Naval Air Station Jacksonville.

Site Exposure Potential, *cont.*

solvents and other contaminants; storage areas where chemical leaks and spills have occurred; a disposal site for lead-acid batteries; a disposal site for radium waste paint; a former fire-fighting training area; an old landfill; areas used for overflow of oil and fuel tanks; and an oil disposal pond. Before 1981, spent glass beads used for removal of paint from aircraft were disposed of along the St. Johns River. Currently, one wastewater treatment plant at the NAS discharges to the St. Johns River, and receives both domestic and industrial wastes not designated for off-site disposal. Industrial wastes have been pre-treated since 1981.

There is a shallow aquifer less than 3 m below most of the disposal sites at the NAS. The Hawthorne Formation, an impermeable barrier between aquifers, is a confining bed to the deeper Floridan aquifer and prevents downward percolation of contaminants from the shallow aquifer systems. Contamination of the shallow aquifer is a primary concern at NAS. Highly permeable sandy soil allows contaminants to migrate rapidly to groundwater, and from there to the tidally influenced rivers. The area is subject to yearly tropical storms and occasional hurricanes. Under flood conditions, hazardous materials stored or disposed of in low areas near the St. Johns River would migrate to surrounding areas.

At least two cleanup actions have been taken at the site. Shallow trenches intercept and treat leachate from an abandoned solvent and petroleum waste pit, and approximately 300 drums of PCB-contaminated soil were taken from an area formerly used to store transformers.

Primary pathways of contaminant transport to habitats of concern to NOAA are surface water runoff and groundwater discharge to the St. Johns River.

Site-Related Contamination

Maximum concentrations for groundwater, soil, and sediment samples collected throughout the NAS site are shown in Table 1, along with applicable screening levels (Geraghty & Miller, Inc. 1985; 1986a,b; 1988). Concentrations from sediment samples are limited to those from the waste pile for spent glass

Site -Related Contamination, *cont.*

Table 1. Maximum concentrations of major contaminants in groundwater, soil, and sediment collected at the NAS site.

	Water		Soil		Sediment	
	Ground-water µg/l	AWQC[1] µg/l	Soil mg/kg	Average[2] U.S. Soil mg/kg	Sediment mg/kg	ER-L[3] mg/kg
INORGANIC SUBSTANCES						
cadmium	< 2.0	9.3	NT	0.06	35	5
chromium	425	50	NT	100	50	80
copper	23	2.9	NT	30	320	70
lead	573	5.6	NT	10	570	35
mercury	0.8	0.025	NT	0.03	0.2	0.15
zinc	66	86	NT	50	200	120
ORGANIC COMPOUNDS						
PCBs	< 1	0.03	103	NA	NT	0.05

1: Ambient water quality criteria for the protection of aquatic organisms. Marine chronic criteria presented (EPA 1986).
2: Lindsay (1979)
3: Effective 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 Morgan (1990)
NT Not analyzed or analysis not usable for comparison
NA Screening level not available.

beads, since soil and other sediment samples were analyzed in a non-standard manner.

Groundwater sample analyses at the NARF also indicate a maximum total of volatile organic compounds of 242,780 µg/l, including 155,300 µg/l trichloroethene and 25,500 µg/l 1,1,1-trichloroethane. Vinyl chloride was reported at a maximum level of 700,000 µg/l in groundwater. Elevated levels of barium were also found in both groundwater and soil samples. High levels of PCBS were detected in soil.

Radionuclides were found in NAS groundwater at maximum levels of 54±7 piC/l gross alpha and 35±9 piC/l gross beta. Radium 226 was reported at 6±2 piC/l. Pesticides were below detection limits in groundwater, but detection limits were well above screening levels for water quality (0.01 µg/l for DDT compared with freshwater AWQC for DDT of 0.001 µg/l).

NOAA Trust Habitats and Species

The St. Johns River is a tidal estuary near the site and provides habitat for marine, estuarine, and anadromous fish and invertebrates, including several endangered species (Table 2; Fred C. Hart 1983; Irby personal communication 1990; Snider personal communication 1990). The estuary is also an important nursery ground for numerous species of marine fish and invertebrates.

NOAA Trust Habitats and Species, *cont.*

The lower portion of the St. Johns River has been severely impacted by both the diversion of freshwater upstream and by various industries in the Jacksonville area, including several paper mills (Irby personal communication 1990). Shrimp, blue crab, striped mullet, croaker, seatrout, and American shad are caught commercially. Blue crab, redfish, striped bass and spotted seatrout are fished recreationally.

Table 2. Species and habitat use in the lower St. Johns River estuary near the site.

Table available in hardcopy

Federally endangered species in the area include the West Indian manatee, the shortnose sturgeon, and the KempÕ ridley sea turtle.

Naval Air Station Jacksonville

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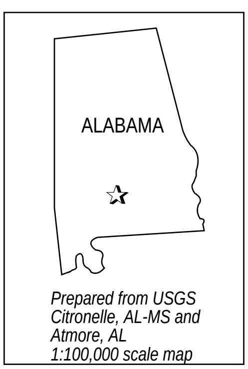
Olin Chemical Corporation

McIntosh, Alabama
Region 4
ALD008188708

Site Exposure Potential

The 600-hectare Olin Chemical Corporation (Olin) site is located 1.6 km southeast of McIntosh, Alabama on the Tombigbee River, adjacent to and south of the Ciba-Geigy site (Figure 1; see page 63 in this report). Olin currently produces chlorine, caustic, sodium hypochlorite, and caustic plant salt using a diaphragm cell, chlor-alkali process. Rocket fuels are also formulated on-site. Predecessors of Olin Chemical first manufactured chlorine and caustic in 1951 using the mercury cell process. Later, products such as chlorinated pesticides were manufactured. These earlier products and processes were discontinued in 1987 (ERM 1989).

Solid wastes and chemicals used in various processes have historically been disposed of on-site. Olin has five permitted discharges for storm water, process and sanitary wastewater, cooling water, and treated groundwater (resulting from a RCRA corrective action). Receiving waters for these discharges include a 26-hectare lake and associated freshwater marshes (Olin Basin) with an outlet to the Tombigbee River. A series of cement-lined canals form a storm water collection system that discharges to Olin Basin. Elsewhere, natural



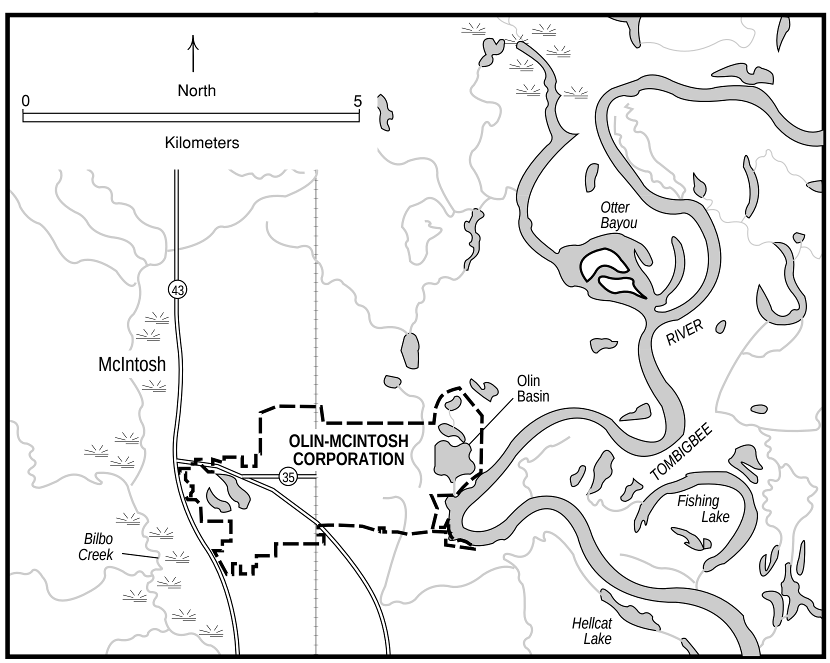


Figure 1.
Olin Chemical Corporation, McIntosh, Alabama.

Site Exposure Potential, *cont.*

surface drainages flow westward to Bilbo Creek or eastward to the Tombigbee River.

The site contains two separate aquifers, one alluvial and one Miocene. The shallow, alluvial aquifer is semi-confined and is recharged by infiltration from rainfall, streams, lakes, and marshes. The groundwater generally flows towards the southeast. Hydrogeologic investigations have established that the deeper aquifer is isolated from the shallow aquifer (USFWS 1986).

Surface water runoff and groundwater transport are the primary pathways of contaminant transport to NOAA resources. Contaminated sediment may act as a secondary source of toxic chemicals.

Site-Related Contamination

Past studies indicate that groundwater, surface water, soil, and sediment are contaminated at the Olin site (Table 1; ERM 1989). The primary contaminants are mercuric compounds and chlorinated benzenes, with chlorinated pesticides also present.

Table 1. Maximum concentrations of major contaminants in groundwater, surface water, soil, and sediment at the site.

	Water			Sediment	
	Ground-water µg/l	Surface Water µg/l	AWQC[1] µg/l	Sediment mg/kg	ER-L[2] mg/kg
INORGANIC SUBSTANCES					
mercury	260	2.0	0.012	60.5	0.15
ORGANIC COMPOUNDS					
lindane	NR	0.6	NA	0.32	NA
endosulfan	NR	0.4	NA	0.11	NA
DDD	NR	<0.1	NA	0.15	0.002
DDE	NR	<0.1	NA	0.15	0.002
DDT	NR	<0.1	0.001	0.25	0.001
endrin	NR	<0.1	NA	0.03	0.00002

1: Ambient water quality criteria for the protection of aquatic organisms. Freshwater chronic criteria presented (EPA 1986).
2: Effective 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 Morgan (1990).
NR Not reported
NA Screening level not available

Site-Related Contamination, *cont.*

Between 1984 and 1985, several remedial programs were implemented at the Olin site, including sediment stabilization, capping, and excavation and disposal. This has removed some areas at the Olin site from acting as sources of contaminants but other areas continue to contribute contaminants to the groundwater, surface water, and sediment.

Groundwater beneath surface water impoundments on the site was contaminated with chromium, lead, and mercury. Groundwater in the historical landfill areas contained a variety of chlorinated aromatic compounds, including elevated levels of chloroform, benzene, chlorobenzene, and dichlorobenzene. Surface water samples contained high levels of mercury (USFWS 1986).

Olin Basin sediment had elevated concentrations of mercury. Studies conducted by the U.S. Fish and Wildlife Service (1986) found low levels of mercury in sediment from the Tombigbee River adjacent to the Olin site. However, largemouth bass tissue from the same area had elevated levels of mercury, ranging from 0.20 µg/g to 0.95 µg/g.

Limited data were presented for groundwater and soil at the Olin site (ERM 1989). Volatile organic compounds (chloroform, benzene, and several chlorinated benzenes) and mercury were the main contaminants reported at elevated levels in these matrices, but only values for mercury were presented in the ERM report.

NOAA Trust Habitats and Species

The Tombigbee River, the habitat of primary interest to NOAA, provides essential habitat for many freshwater and anadromous species (Table 2; USFWS 1986; Mettee et al. 1987; Mettee personal communication 1990). The site is approximately 100 km upstream from the river mouth, and the river is usually fresh water at this point. However, during periods of low flow (August through September), saltwater intrusion along the river bottom may extend at least as far as the site (Mettee personal communication 1990).

The Tombigbee River in the vicinity of the site is within the Mobile River delta zone and historically has served as habitat

NOAA Trust Habitats and Species, *cont.*

for at least four anadromous species: Atlantic sturgeon, Alabama shad, American eel, and striped bass. Alabama shad were common in the 1940s, but have not been observed inland in the Mobile River system since the early 1970s (Mettee personal communication 1990). Sturgeon also used the river for

Table 2. Species and habitat use in the Tombigbee River.

Table available in hardcopy

spawning and nursery habitat, but have not been observed in upstream areas of the river in decades. However, dead specimens have been found at the mouth of the river within the last year (Mettee personal communication 1990). Striped bass have been observed upstream of the mouth of the Mobile, but it is unclear whether they currently occur near the site. The Alabama Department of Natural Resources stocks the Mobile River with approximately 20,000 bass each year below the river's confluence with the Tombigbee.

Estuarine species, such as the bay anchovy, have been observed in the Tombigbee River near the site. The inland occurrence record for bay anchovy (450 km) was set in the Mobile River system, and suggests a reproductive, freshwater stock somewhere within the system (Mettee personal communication 1990). Blue crab support a recreational fishery. Saltwater

NOAA Trust Habitats and Species, *cont.*

species have been reported during periods of low river flow during summer, including southern flounder, hogchoker, and Atlantic needlefish.

Several predatory freshwater fish species have been sampled near the site, including largemouth bass, rock bass, and bluegill. Freshwater mullet and channel catfish have also been sampled from the Tombigbee River for mercury content (USFWS 1986). Channel catfish is the most important commercial species in the lower Tombigbee. An extremely rare, as yet undescribed, freshwater species of shovelnose sturgeon has been sampled within the Mobile River system (Mettee personal communication 1990).

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Pensacola Naval Air Station

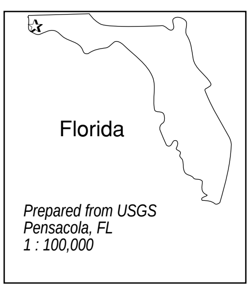
Pensacola, Florida
Region 4
FL9170024567

Site Exposure Potential

The Naval Air Station (NAS) Pensacola is located on a narrow peninsula in Pensacola Bay approximately 3 km southwest of Pensacola, Florida (Figure 1). The NAS occupies 2,260 hectares, bounded by Bayou Grande on the north and Pensacola Bay to the east and south.

Beginning in the 1930s, industrial wastes from operations at the site were discharged directly into Pensacola Bay and Bayou Grande. This continued until 1973 when an industrial waste treatment plant began operation. Wastes included paint, solvents, mercury, radium paint, and concentrated plating wastes containing cadmium, chromium, cyanide, lead, and nickel. The plating wastes were discharged via a drainage ditch to Bayou Grande. Other areas of concern include landfills; materials disposal and storage areas; pesticide storage, handling, and disposal areas; solvent, fuel, and industrial waste pipeline leak and spill areas; radium spill areas; and fire and crash training areas (Ecology and Environment 1989).

The site includes wetlands, large paved areas, sandy tracts vegetated with native grasses, a golf course, buildings, and housing sites. A concrete levee runs along the southeastern



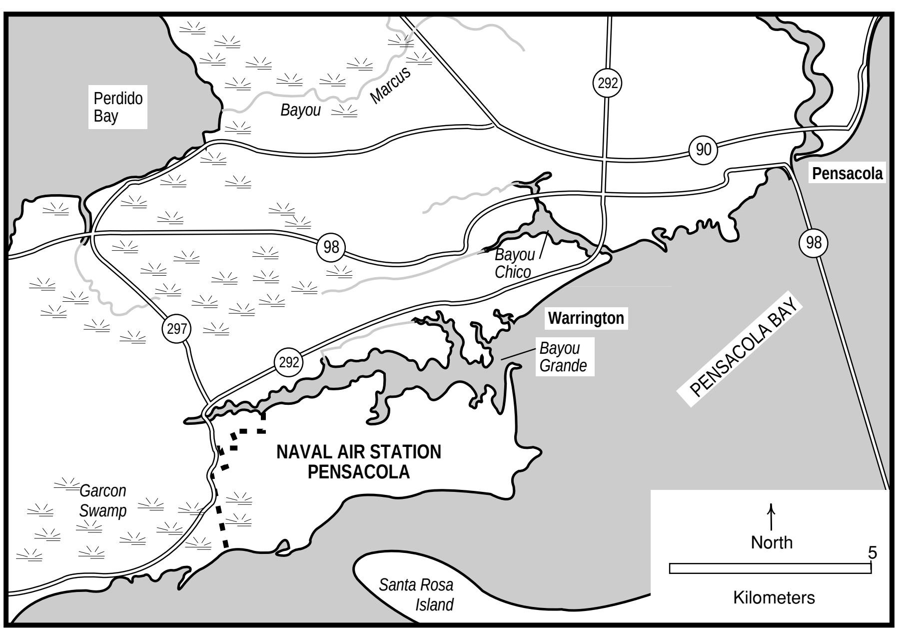


Figure 1.
Naval Air Station
Pensacola,
Pensacola,

Site Exposure Potential, *cont.*

portion of the base and extends into the subtidal zone of Pensacola Bay.

Geology at the site is characterized by fine- to medium-grained quartz sand soil. The water table is generally shallow, but varies between 1.5 m and 4.5 m over much of the site. Groundwater flow is influenced by tides and storms, but there were insufficient data to determine its direction in most areas. In the northern part of the NAS, groundwater moves primarily to the north and northwest toward Bayou Grande. Other studies have suggested that there is a slight gradient to the south (Ecology and Environment 1989).

Surface water runoff and groundwater are potential pathways for transport of contaminants to Pensacola Bay, Bayou Grande, and the coastal wetlands.

Site-Related Contamination

The limited contaminant data for the site are summarized in Table 1 with applicable screening levels (Ecology and Environment 1989). Groundwater samples had low concentrations of a number of substances. Leachate from an inactive landfill

Table 1. Maximum concentrations of major contaminants in groundwater, leachate, soil, and sediment at the site.

	Water			Soil	Sediment	
	Groundwater µg/l	Leachate µg/l	AWQC[1] µg/l	Soil mg/kg	Sediment mg/kg	ER-L[2] mg/kg
INORGANIC SUBSTANCES						
cadmium	10	2,300	9.3	ND	140	5
chromium	5	1,900	50	ND	8,900	80
cyanide	ND	4,560	1	NT	NT	NA
lead	69	51,000	5.6	ND	650	35
mercury	27	200	0.025	ND	2	0.15
nickel	9	4,000	8.3	ND	27	30
zinc	365	25,100	86	ND	103	120
PESTICIDES						
p,p'-DDE	ND	ND	NA	1.2	NT	0.002
p,p'-DDD	ND	ND	NA	0.03	NT	0.002
p,p'-DDT	ND	ND	0.001	1.2	NT	0.001
dieldrin	ND	ND	0.0019	0.44	NT	0.00002
chlordane	ND	ND	NA	21.0	NT	0.0005

1 Ambient water quality criteria for the protection of aquatic organisms. Marine chronic criteria presented (EPA 1986).
2: Effective 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 Morgan (1990).
NT Not analyzed
NA Screening level not available.
ND Not detected at method detection limit; detection limit not given

Site-Related Contamination, *cont.*

adjacent to Bayou Grande contained cadmium, chromium, lead, mercury, nickel, and zinc at levels exceeding their respective AWQC (EPA 1986). Leachate has also been detected in groundwater and surface water adjacent to this landfill. Elevated levels of pesticides were found in soil at the pesticide mixing facility. Elevated levels of radium radiation were also found in soil (1.2 mR/hr compared to a normal background level of 0.02 mR/hr) in addition to methylene chloride and cyanide. Sediment sampled below the storm drain outfalls contained levels of metals that are associated with toxic effects in studies compiled by Long and Morgan (1990).

NOAA Trust Habitats and Species

The habitats of primary interest to NOAA, Pensacola Bay and Bayou Grande, include an estimated 253 hectares of estuarine wetlands, including intertidal and shallow areas and eelgrass beds (USFWS 1987). These environments are part of the Pensacola estuary and serve as estuarine nurseries and adult habitat for numerous marine species. Pensacola Bay is is partially sheltered by barrier islands to the south. Bayou Grande is a shallow protected inlet of Pensacola Bay. Little is known about the aquatic habitats in this embayment, but its physical characteristics are similar to the sheltered, lower-salinity nursery areas in the upper reaches of the Pensacola estuary. Significant amounts of eelgrass habitat have been lost within Bayou Grande since the 1970s (Brown personal communication 1990).

Shallow estuarine environments play an important role in the recruitment of numerous fish species to the Gulf of Mexico. Several species, such as ladyfish, sheepshead, members of the drum family (drums and seatrout), and mullet are dependent upon estuaries during their early life history (Beccasio et al. 1982). Fisheries data collected by Cooley (1978) found high abundances of adult fish in Pensacola Bay, including 180 species (Table 2; Beccasio et al. 1982; RPI 1984; Ecology and Environment 1989). Some of the most abundant were spot, pinfish, Atlantic croaker, gulf menhaden, bay anchovy, longspine porgy, silver perch, southern hake, inshore lizardfish, gafftopsail catfish, sand seatrout, and spotted hake (Ecology and Environment 1989).

NOAA Trust Habitats and Species, *cont.*

Southern and spotted hake, ladyfish, red drum, sheepshead, and Atlantic croaker are among the economically important species common in the bay. Recreational and commercial fisheries are present throughout the Pensacola estuary; primary species caught include Spanish mackerel, seatrout, drum, Atlantic croaker, snapper, amberjack, and porgy (Ecology and Environment 1989). Commercial fisheries for Eastern oyster, blue crab, and mullet also occur in the Pensacola estuary

Table 2. Important fish and invertebrate species, and habitat use in Pensacola Bay and Bayou Grande.

Table available in hardcopy

NOAA Habitats and Species, *cont.*

(Beccasio et al. 1982). Brown shrimp are fished commercially, and though juvenile white shrimp occur in the bay, recruitment to adult populations is too low to support a commercial fishery (Brown personal communication 1990). Recreational and commercial shellfishing is prohibited in Bayou Grande by local ordinance for resource management purposes. Shellfish harvests occur in portions of the bay, but may be periodically restricted due to high coliform counts. Most of these restrictions are associated with high precipitation levels that increase runoff into the bay (Thompson personal communication 1989).

Threatened or endangered species near the site include the Gulf sturgeon, currently being considered for threatened species status by the U.S. Fish and Wildlife Service (USFWS 1987). The State Fisheries Commission is considering a moratorium on fishing of striped mullet. Manatees, an endangered marine mammal, have been sighted adjacent to the site within the last year (Troxel personal communication 1990). Atlantic bottlenose dolphin have also been sighted regularly near the site (Ecology and Environment 1989).

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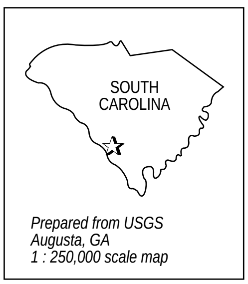
Savannah River Plant

Aiken, South Carolina
Region 4
SC1890008989

Site Exposure Potential

The Savannah River Plant is located in Aiken, South Carolina near the Georgia border (Figure 1). The plant, operated by the U.S. Department of Energy since 1954 with the assistance of numerous contractors, produces nuclear materials for national defense purposes. Currently, there are four active reactor areas. There are extensive current and historical sources of contamination at the site, including both sources of conventional and radioactive contaminants. Pits were used for disposal of chemical wastes, including unlined earthen pits that received dilute sulfuric acid and sodium hydroxide. Paper, wood, plastics, rubber, oil, degreasers, and solvents contained in drums were incinerated in burning and rubble pits. Some basins that collected runoff from coal piles were also used for disposal of contaminated oil. Storage tanks were used for



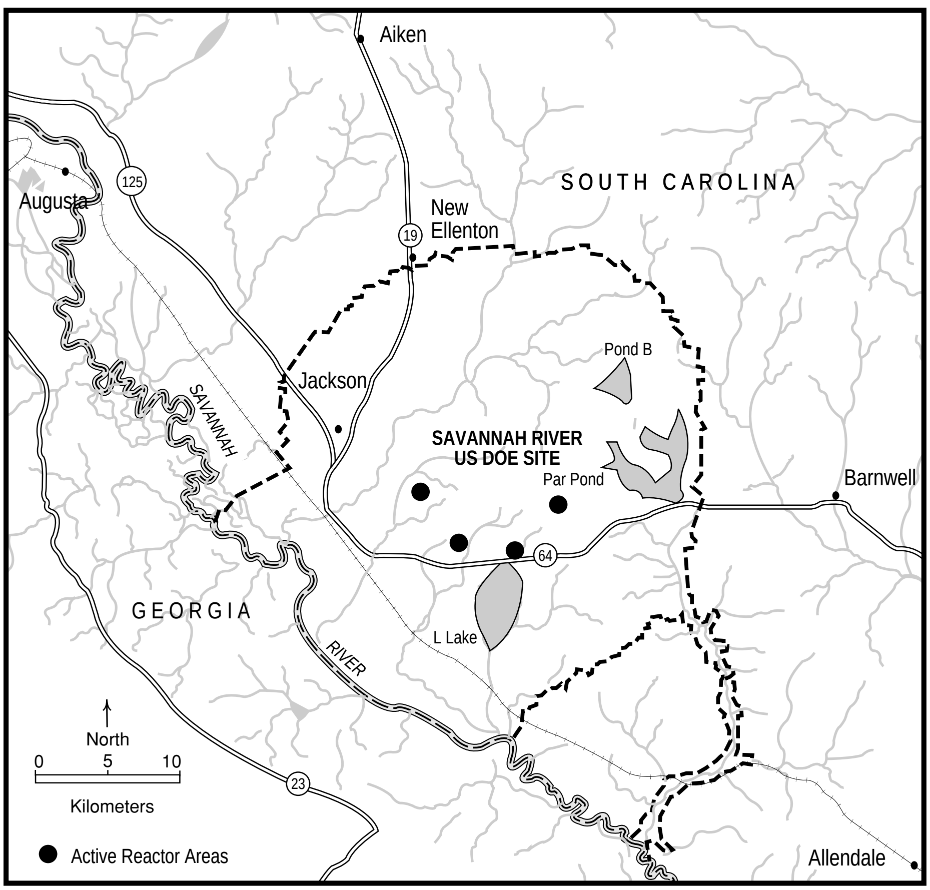


Figure 1.
The Savannah River Plant, Aiken, South Carolina.

Site Exposure Potential, *cont.*

chemicals, feed, and water. Petroleum products were stored in underground tanks (Westinghouse 1989).

Other sources include an unlined sludge lagoon, land areas where sludge was applied, and sanitary landfills. Sources of radioactive contamination include burial grounds for radioactive wastes, buried debris from an exploded evaporator, and a sump for high-level radioactive sludge. Other areas include concrete-lined disassembly basins that contain water used to store irradiated parts from reactors, basins that received radioactive purge water from these disassembly basins, and a building where target rods from nuclear reactors are dissolved using nitric acid. Contaminants emitted into the atmosphere include tritium and 1,1,1-trichloroethane.

The site covers approximately 780 km^2 and is bordered on the south by the Savannah River. There are extensive wetlands along the Savannah River and its numerous tributaries. Manmade lakes on the site include Pond B, L-Lake, and the 1,060-hectare Par Pond. Surface geology is characterized by unconsolidated sand, clayey sand, and sandy clay, underlain by dense crystalline metamorphic rock or consolidated red mudstone. Groundwater on the site flows generally towards the Savannah River or its tributaries.

Site activities have potentially contaminated soil, groundwater, surface water, and sediment. Because of the geography and geology of the site, surface water runoff and groundwater transport represent the primary pathways for transport of contaminants to the Savannah River.

Site-Related Contamination

The only contaminant data for soils presented in the 1988 Savannah River Environmental Report were those from radiological monitoring. Groundwater was contaminated by metals throughout the site. Sediment samples were tested for PCBs and pesticides only (Westinghouse 1989).

Radionuclides and trichloroethylene were found in groundwater throughout the site. Other organic contaminants were also measured, including carbon tetrachloride, benzene, 1,2-dichloroethane and 1,1-dichloroethylene, but there are no

Site-Related Contamination, *cont.*

Table 1. Maximum concentrations of major contaminants in groundwater, surface water, and sediment collected at the Savannah River site.

	Water			Sediment	
	Ground-water µg/l	Surface Water µg/l	AWQC[1] µg/l	Sediment mg/kg	ER-L[2] mg/kg
INORGANIC SUBSTANCES					
cadmium	113	< 10	1.1+	NT	5
chromium	854	< 20	11	NT	80
copper	2,040	20	12+	NT	70
iron	803,000	1,500	1,000	NT	NA
lead	3,600	60	3.2+	NT	35
mercury	19.3	0.83	0.012	NT	0.15
nickel	1,420	< 5	160+	NT	30
silver	66	ND	0.12	NT	1
zinc	7,300	30	110+	NT	120
ORGANIC COMPOUNDS					
DDT	ND	< 0.05	0.001	< 2	0.003
endrin	12.6	< 0.05	NA	< 2	0.00002
PCB 1260	ND	< 0.50	0.014*	< 20	0.03

1: Ambient water quality criteria for the protection of aquatic organisms. Freshwater chronic criteria presented (EPA 1986)
2: Effective 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 Morgan (1990).
+ Hardness-dependent criteria; 100 mg/l $CaCO_3$ used.
NT Not tested
* Value shown is for total PCB
ND Not detected at method detection limit, detection limit not available
NA Screening level not available

screening levels available for these compounds (Westinghouse 1989). Maximum concentrations of metals found in waters and sediments at the site are shown in Table 1, along with appropriate screening levels (Westinghouse 1989).

Radioactivity is monitored in rainfall, soil, and sediment; and in tissues of fish, invertebrates, and hogs and deer. The maximum concentration of non-volatile beta radioactivity in fish was measured in bass at 162 pCi/g in Pond B. In comparison, the maximum concentration measured in bass at the mouth of the Savannah River was 1.8 pCi/g. The maximum concentration of cesium-137 in fish (145 pCi/g) was found in bass in Pond B, compared to concentrations of 0.10 pCi/g in bass

Table 2. Maximum groundwater concentrations for radionuclides and trichloroethylene at the site compared to EPA drinking water

Contaminant	Units	Maximum Concentration	Drinking Water Standard*
gross alpha	pCi/l	2,140	15
total radium	pCi/l	140	5
radium 226	pCi/ml	1.52	0.005
tritium	pCi/ml	3,480,000	20
trichloroethylene	mg/l	128	0.005

*U.S.Government Printing Office 1987

from the mouth of the Savannah River (Westinghouse 1989). Soil data were not presented, but cesium-137 concentrations were discussed as ranging from 0.14 to 1.1 pCi/g (Westinghouse 1989). Table 2 compares maximum concentrations of radionuclides and trichloroethylene to EPA drinking water standards (Westinghouse 1989).

NOAA Trust Habitats and Species

Table 3. Species and habitat use in the Savannah River near the site.

Table available in hardcopy

The habitat of concern to NOAA is the Savannah River, which borders the site for approximately 48 km, beginning at river km 233. The river bordering the site is fresh water, and provides habitat for several spawning runs of andromous species, including the federally and state endangered shortnose sturgeon (Table 3; Oakley personal communication 1990). The anadromous species listed in Table 3 all spawn within the portion of the river bordered by the site.

The Savannah River is heavily polluted, particularly from sewage from the city of Augusta, upstream of the site (Oakley personal communication 1990).

Amercian shad are commercially fished in the river during the summer months. Both Atlantic and shortnose sturgeon spawn near the site, and juveniles spend from one year to 18 months in the river before migrating downstream to the estuary at the river mouth. To augment the natural population of shortnose sturgeon, the South Carolina Marine Resources Division stocks the river with juveniles that were raised in hatcheries. Atlantic sturgeon were previously fished in the river, but

NOAA Habitats and Species, *cont.*

fishing has been restricted for about five years. Striped bass are fished recreationally in the river from the South Carolina side, but fishing is restricted by the state of Georgia (Oakley personal communication 1990).

The estuary at the mouth of the Savannah River is a major nursery area for marine species, including summer flounder, spot, Atlantic menhaden, croaker, tarpon, and blue crab.

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Camp Pendleton Marine Corps Base

Camp Pendleton, California
Region 9
CA2170023533

Site Exposure Potential

The Camp Pendleton Marine Corps Base is a 51,000-hectare site in San Diego County, with San Clemente to the north, Oceanside to the south, and Fallbrook to the east (Figure 1). The base is a training base and logistics support facility in operation since 1941.

Support activities and waste handling practices have generated hazardous wastes including pesticides, petroleum products, PCB-contaminated oils, and solvents. Over 140,000 liters of these wastes have been disposed of on the site (EPA 1988). Past practices have included direct discharge of excess pesticides to surface water and use of PCB-contaminated oils for dust control. Sites of concern include burn areas, disposal pits, salvage yards, drainage ditches, and two landfills. The majority of these sites are located within the Santa Margarita River basin.

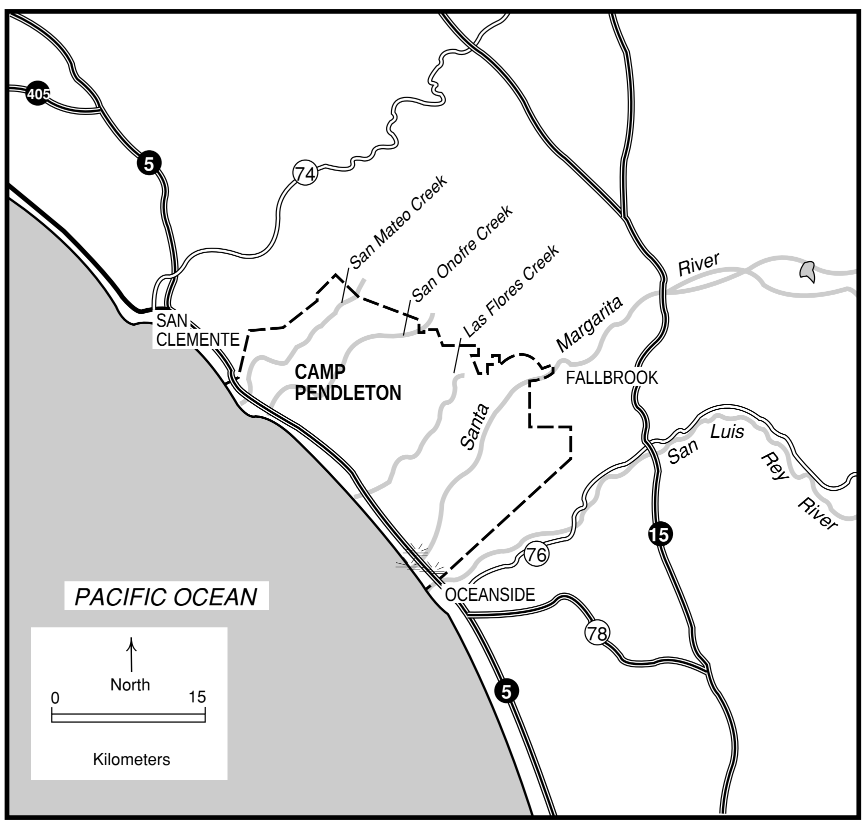

Figure 1.
The U.S. Marine Corps Base, Camp Pendleton, California.

Site Exposure Potential, *cont.*

The four main drainage basins at Camp Pendleton, formed by the Santa Margarita River, Las Flores Creek, San Onofre Creek, and San Mateo Creek, empty into coastal wetlands within Camp Pendleton boundaries. In addition, there are two wetland habitats that are protected by state and county agencies. These habitats (vernal pools and coastal marshes) support several threatened or endangered plant, bird, and mammal species.

Drainage basins within Camp Pendleton are characterized by water-bearing alluvial deposits. Soil is highly permeable and groundwater is shallow, averaging 2 to 4 m below the surface (Jacobs 1990). Groundwater movement has only been identified for the Santa Margarita basin and is generally to the southwest.

Potential pathways of contaminant transport at the Camp Pendleton site are direct discharge of contaminated groundwater to surface drainages, surface runoff, or subsurface migration.

Site-Related Contamination

Limited information is available for evaluation of levels of contamination present at the Camp Pendleton site. Available data indicate that groundwater and surface water may be contaminated in the Santa Margarita River Basin (SCS Engineers 1984). The herbicide Silvex was measured in surface water at concentrations of 13 µg/l and in groundwater at concentrations of 73 µg/l near the pest control facility drainage ditch leading to the Santa Margarita River. Other pesticides have been detected in surface water from this river, including 2,4-D (98 µg/l), 2,4,5-TP (51 µg/l), and methoxychlor (6 µg/l). Methoxychlor, the only one of these pesticides with an ambient water quality criteria value, exceeds its freshwater chronic AWQC of 0.03 µg/l. Mercury has also been measured at 2.6 µg/l in surface water and 49 µg/l in groundwater, exceeding its freshwater chronic AWQC of 0.012 µg/l (EPA 1986).

NOAA Trust Habitats and Species

Camp Pendleton contains 27 km of undeveloped shoreline along the Pacific Ocean, including three saltwater marshes at the outlets of San Mateo and Las Flores creeks and the Santa Margarita River. A variety of marine species use the offshore

NOAA Trust Habitats and Species

habitats, including marine mammals that migrate through the area (Table 1; Buck personal communication 1990; Mitsos personal communication 1990; USFWS 1990).

The mouth of the Santa Margarita River forms a lagoon that is sometimes silted over and blocked from saltwater influence. The U.S. Fish and Wildlife Service, the Marine Corps, and the

Table 1.
Species and habitat use along the coast and offshore of the site, including the lagoon at the mouth of the Santa Margarita River.

Table available in hardcopy

California Department of Fish and Game plan to maintain artificially saltwater access to the lagoon, allowing it to function continuously as an estuarine habitat (Goodbread personal communication 1990). Fish sampling by the U.S. Fish and Wildlife Service in the lagoon from 1986 to 1989 found 24 different species of fish, including many juveniles (USFWS 1990). Among the species caught were the commercially important California halibut. Salmon and trout runs have not occurred in the Santa Margarita River since the 1920s.

The marine habitat offshore of Camp Pendleton is largely sandy, with rocky reefs and kelp forests in the northern portion that harbor fish communities, including garibaldi and bass. The California Department of Fish and Game constructed an artificial reef in 1980 south of San Onofre. Commercial fishing for white

NOAA Trust Habitats and Species, *cont.*

but, and lobster takes place in the area. California halibut, lobster, barred sand bass, kelp bass, halibut, and lobster are all fished recreationally in the area.

Several species of marine mammals occur intermittently in the area, including harbor seals and California sea lions that may haul out on the beaches (Buck personal communication 1990). Grey whales, especially females and calves, may come close inshore to feed during migrations up and down the coast (SCS Engineers 1984).

References

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Fort Ord Army Base

Marina, California
Region 9
CA7210020676

Site Exposure Potential

The 11-km^2 Fort Ord Army Base site is located on Monterey Bay near Marina, California (Figure 1). Established in 1917 as a maneuvers and field artillery range, the base is currently used for training. Waste-generating activities included fire drills, vehicle maintenance, battery repair, spray painting, photo processing, laundry, dry cleaning, and arms repair. Hazardous wastes from these activities were stored on the base prior to off-site disposal. More than 20 potentially contaminated areas have been identified on the base; one of the eight on-site landfills is still active. Four main areas have been investigated for type and extent of contamination in soils and groundwater: the 14th Engineers Motor Pool, the 707th Maintenance Facility, the Cannibalization Area, and the Fire Department Burn Pit (E.A. Engineering 1990).

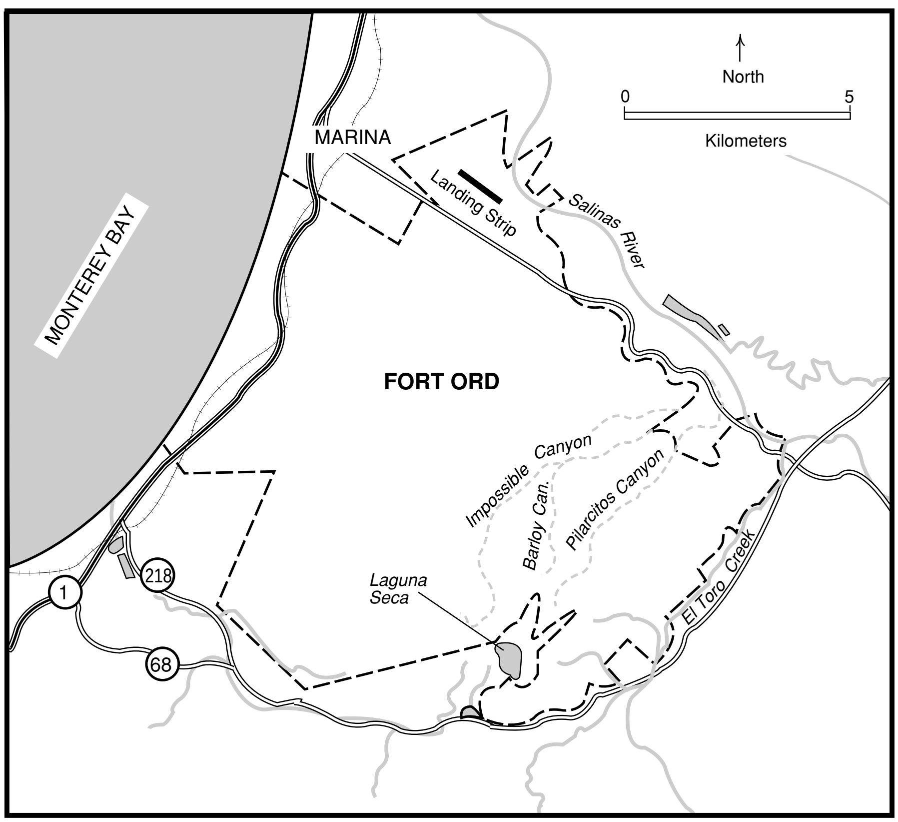

Figure 1.
Fort Ord Army Base, Marina, California.

Site Exposure Potential, *cont.*

The base is bordered by the Salinas River to the north, El Toro Creek to the east, and Monterey Bay to the west. Sand dunes, the primary landforms in this area, underlie most of the base. The area consists of confined and partially confined aquifers in sandy or finer substrates. Three aquifers underlie the Fort Ord site: a shallow, unconfined sand aquifer, and aquifers composed of finer materials at 55 m and 122 m. These aquifers are not consistently isolated from one another. Groundwater movement in the shallow aquifer is generally west or northwest. The deeper aquifers may be influenced by groundwater pumping in Marina and flow in a more northeasterly direction.

During the original evaluation of Fort Ord as a potential National Priorities List site, surface water transport was not considered an important pathway for off-site migration of contaminants (EPA 1988). However, surface water runoff occurs at all sites investigated on the base. Most runoff is currently collected in storm drains, some of which enter the sanitary sewers that ultimately discharge into Monterey Bay. In the past, runoff occurred from sites with no diversion, ditching, or other collection. There was no information in the Preliminary Assessment regarding the potential for runoff to reach major surface water bordering the site.

Groundwater movement and surface water runoff remain potential pathways for contaminants to reach NOAA resources.

Site-Related Contamination

Limited studies have indicated that both soil and groundwater are contaminated in areas on the site (E.A. Engineering 1990). In 1985, volatile organic compounds (VOCs) were detected in groundwater sampled from the northwest section of the base. Concentrations of these compounds exceeded California state action levels for drinking water but did not exceed AWQC (EPA 1986). In 1989, groundwater and soil samples from the four main areas were collected as part of a preliminary site investigation. VOCs were detected in groundwater at levels below ambient water quality values by a factor of 10 (EPA 1986; E.A. Engineering 1990).
Groundwater samples were contaminated with VOCs, but at

Site-Related Contamination, *cont.*

levels below ambient water quality values. Mercury, chromium, zinc, nickel, and copper exceeded ambient water quality levels in groundwater by a factor of 10.

Soil samples were contaminated with VOCs, phthalate esters, PAHs, and total petroleum hydrocarbons. In several areas, elevated concentrations of mercury were detected in soil. Mercury concentrations in groundwater sampled from the 707th Maintenance Division ranged from 17-98 µg/l, greatly exceeding the freshwater chronic AWQC of 0.012 µg/l.

NOAA Trust Habitats and Species

The Fort Ord site includes approximately 7 km of shoreline along Monterey Bay and part of the Salinas River. The mostly flat, sandy-bottomed nearshore area provides habitat for many commercially important marine species, several of which spawn nearby (Table 1; Benteen personal communication 1990; Hardwick personal communication 1990). The Salinas River Wildlife Refuge, operated by the U.S. Fish and Wildlife Service, encompasses the lagoon and dunes area at the mouth

Table 1. Species and habitat use in Monterey Bay and the Salinas River near the site.

Table available in hardcopy

NOAA Trust Habitats and Species, *cont.*

of the Salinas River, north of the town of Marina. A state park along the shoreline near Marina is heavily used for recreation (Hardwick personal communication 1990).

Chinook salmon and squid are caught commercially within one-quarter mile of shore, and California halibut is caught recreationally in Monterey Bay in the vicinity of Fort Ord. Halibut and squid spawn in the sandy nearshore area of the bay. Sanddabs and English sole, both the object of offshore commercial fisheries, use the area as a nursery ground and may also spawn nearby. Surf smelt are fished north of Fort Ord (Hardwick personal communication 1990).

The sea otter is the only resident of the several species of marine mammals in this part of Monterey Bay. Elephant seal, northern fur seal, and California sea lion are seen intermittently on the beaches adjacent to Fort Ord.

The Salinas River and lagoon are tidally influenced for approximately 1.6 km upstream from Monterey Bay. Riverflow is intermittent part of the year since upstream dams retain most of the water during dry months. There is a native run of steelhead trout in the Salinas River, but migrations up- and downriver are restricted to periods when the river is flowing. This steelhead run is fished recreationally (Benteen personal communication 1990).

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Travis Air Force Base

Fairfield, California
Region 9
CA5570024575

Site Exposure Potential

Travis Air Force Base (AFB) occupies approximately 2,000 hectares in Solano County, 5 km east of Fairfield, California (Figure 1). The base was established in 1943 for the transport and servicing of tactical aircraft, becoming the largest West Coast port facility during the Korean and Viet Nam conflicts. Currently, it provides global strategic airlift support and is one of the largest operating bases for the Military Airlift Command (Weston 1990).

Waste materials have been generated on the base as part of aircraft and vehicle maintenance and repair, fuel handling, fire protection training, and through use of pesticides and herbicides. Wastes included oil, contaminated fuels, hydraulic

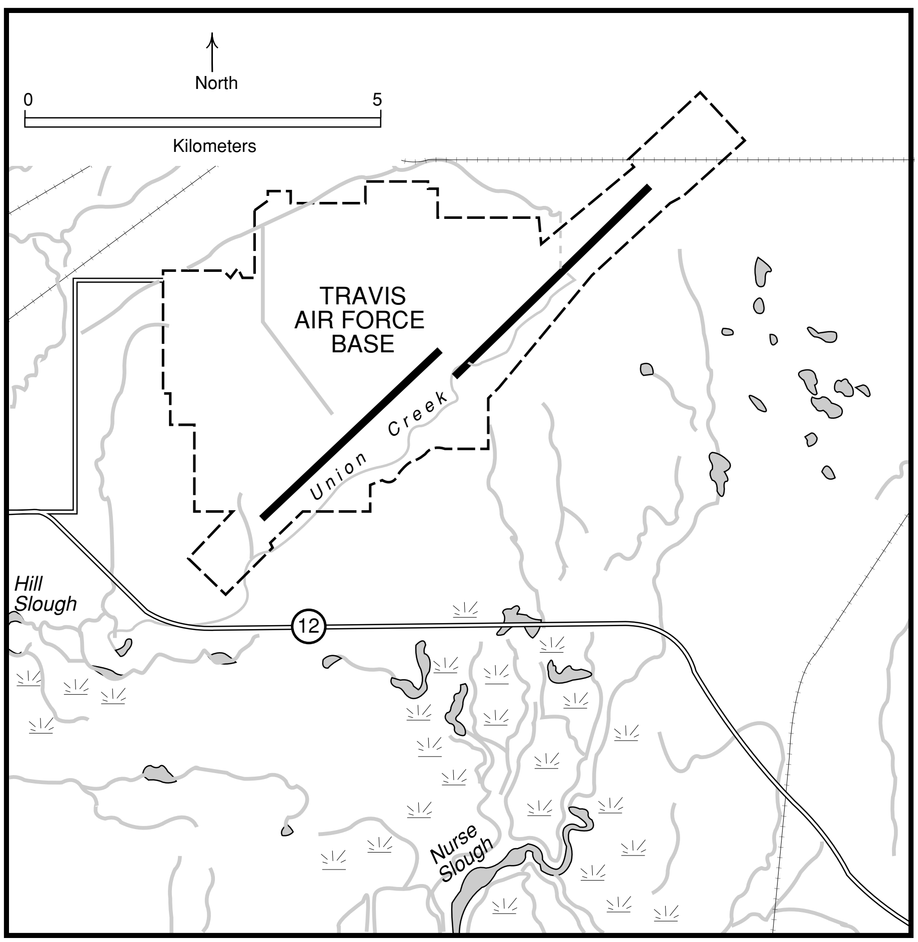

Figure 1.
Travis Air Force Base, Fairfield, California.

Site Exposure Potential, *cont.*

fluids, solvents, paint thinners, cyanide, pesticides, and sewage sludge. Wastes were burned, disposed in landfills or pits located on-site, or discharged to the sewage or storm drain system (Weston 1990).

The base is located in the Suisun-Fairfield Basin on the western edge of the Sacramento Valley. Natural surface drainages on the site are highly modified due to extensive channelization. Union Creek flows across the base as part of the storm sewer system and enters Hill Slough 1.8 km beyond the base boundary (Figure 1). This slough is part of the Suisun Marsh, a major wetland adjoining the San Francisco Bay estuary. Local groundwater exists in semi-confined conditions and aquifers are characterized by alluvial sediment with low permeability and pockets of sand and gravel. Groundwater in the local aquifer flows southward towards the Suisun Marsh.

Based on site characteristics and historical practices, surface water transport and groundwater discharge are the primary pathways of contamination to the aquatic environment.

Site-Related Contamination

Surface and subsurface soil, groundwater, surface water, and sediment samples were collected from more than 17 areas at Travis AFB as part of the Installation Restoration Program (Weston 1990). The samples were analyzed for a broad range of hazardous substances and all matrices were found to be contaminated with trace elements and other inorganic compounds, volatile organic compounds, and total petroleum hydrocarbons (Table 1; Weston 1990).

Concentrations of cadmium, chromium, lead, mercury, silver, and zinc, were highly elevated in groundwater and surface water and greatly exceeded applicable ambient water quality criteria (EPA 1986). Most of these samples were collected from the storm sewer zone representing a large area in the central portion of the base.

Silver, cadmium, lead, and zinc were greatly elevated above background levels in soils (Lindsay 1979). Most trace elements were found in high concentrations in storm sewer

Site-Related Contamination, *cont.*

sediment on the base. In addition, barium occurred in extremely high concentrations in sediment.

Trichloroethylene and associated volatile organic compounds were measured in high concentrations in groundwater, surface water, and soils. Total petroleum hydrocarbon (TPH) concentrations were extremely high in samples from surface water, groundwater, soil, and sediment.

Table 1. Maximum concentrations of contaminants in surface water, groundwater, soil, and sediment at the site, with applicable screening levels.

	Water			Soil		Sediment	
	Surface Water µg/l	Ground-water µg/l	Chronic AWQC[1] µg/l	Soil mg/kg	Average U.S. Soil[2] mg/kg	Sediment mg/kg	ERL[3] mg/kg
INORGANIC SUBSTANCES							
arsenic	20	10	190	32	5	26.4	33
barium	680	2,500	NA	820	430	151,000	NA
cadmium	230	110	1.1+	13	0.06	124	5
chromium	530	260	11	60	100	1130	80
copper	260	60	12+	160	30	1240	70
lead	4,600	360	3.2+	850	10	6360	35
mercury	10	940	0.012	25	0.03	5.5	0.15
nickel	130	4,100	160+	46	40	5710	30
silver	80	70	0.12	120	0.05	24.0	1.0
thallium	780	170	40*	ND	0.1	216	NA
zinc	14,000	310	110+	4400	50	23,500	120
ORGANIC COMPOUNDS							
TPH[4]	39600000	10500000	NA	15,300	NA	74,300	NA
TCE	18	19,000	NA	290	NA	0.12	NA
t-1,2-dichloro-ethene	442	1,300	NA	ND	NA	ND	NA

1: Ambient water quality criteria for the protection of aquatic life, freshwater chronic criteria presented (EPA 1986).
2: Lindsay (1979).
3: Effective 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 Morgan (1990).
4: Total Petroleum Hydrocarbons.
+ Hardness-dependent criteria: 100 mg/l $CaCO_3$ used.
* Insufficient data to develop criteria. Value presented is the Lowest Observed Effects Level (LOEL).
ND: Not detected at method detection limit; detection limit not reported.
NA: Screening level not available.

NOAA Trust Habitats and Species

NOAA trust habitats in the vicinity of Travis AFB are Suisun Marsh, its associated waterways, and Suisun Bay. Several creeks intersect the base, including Union Creek, Suisun Valley Creek, Green Valley Creek, and Ledgewood Creek. Union Creek is a major drainage pathway to Suisun Marsh, an important wetlands system in San Francisco Bay that provides

NOAA Trust Habitats and Species, *cont.*

essential nursery habitat for several anadromous and marine species (Table 2; Rugg personal communication 1990). The Hill Slough Wildlife Area, adjacent to the base, is managed by the State of California as a wetland and provides public access for fishing and recreation.

Table 2. Anadromous and marine species and habitat use in Suisun Marsh and associated waterways, and Suisun Bay in the vicinity of the site.

Table available in hardcopy

Suisun Bay, a transition zone between the saltwater ecosystem of San Francisco Bay and the freshwater ecosystems of the Sacramento and San Joaquin rivers, forms a migration corridor and nursery area for anadromous fish which spawn in the rivers. Striped bass migrate through Suisun Bay and spawn in the Sacramento River delta region. Chinook salmon, steelhead trout, white and green sturgeon, and American shad spawn in the upper reaches and tributaries of the Sacramento and San Joaquin rivers, with the largest populations found in the mainstem of the Sacramento River. Steelhead trout also spawn in Suisun Valley Creek and in Green Valley Creek. Extensive recreational fishing for striped bass, steelhead, salmon, and shad occurs in Suisun Bay and Suisun Marsh. Although no commercial fishery exists in Suisun Bay, commercial fishing of bay shrimp for bait may move into the lower reaches of Suisun Bay during periods of abnormally high salinity (Hergeshell personal communication 1990; Rugg personal communication 1990).

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U.S. Naval Submarine Base, Bangor

Bangor, Washington
Region 10
WA5170027291

Site Exposure Potential

The U.S. Naval Submarine Base (Subase) Bangor is located approximately 16 km north of Bremerton near Bangor, Washington in Kitsap County (Figure 1). The 2,830-hectare subase is adjacent to Hood Canal, a major Puget Sound estuary. Established in 1944, the base originally served as an ammunition depot. In 1963, the Polaris Missile Facility Pacific was added, and in 1974 the base was designated a homeport for Trident submarines.

A wide variety of solid and liquid wastes were disposed of at Subase Bangor from the 1940s to the 1980s. General refuse, ordnance materials, demilitarization wastes, and Otto fuel were either burned or disposed of in landfills at various locations on the base. Ten areas on the subase were identified in the RI/FS process as potential uncontrolled hazardous waste sites (Hart CrowserInc. 1989).

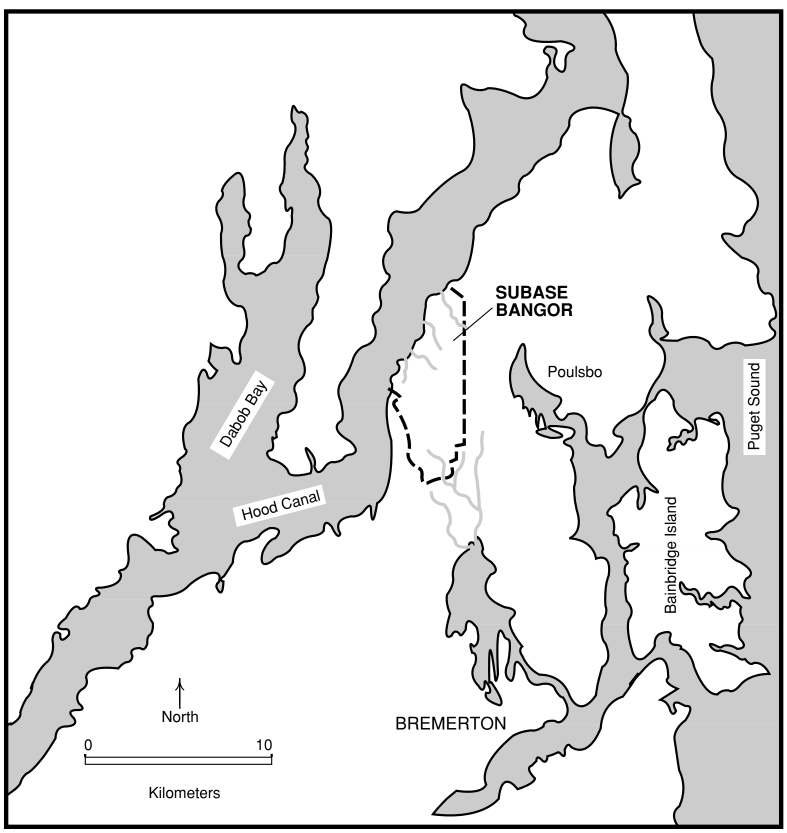

Figure 1.
The U.S. Naval Submarine Base, Bangor, Washington.

U.S. Naval Submarine Base, Bangor

Site Exposure Potential, *cont.*

The Bangor facility can be divided into two main watersheds. The largest, Hood Canal watershed, includes Cattail Lake, Hunters Marsh, and DevilÕs Hole. Eight of the ten contaminated sites identified in the RI/FS process are located in this watershed. Contaminants within Hood Canal watershed could migrate via surface water runoff and groundwater transport into Hood Canal.

The second watershed is the Clear Creek watershed, which drains a comparatively small area in the southeastern portion of the Bangor facility. All surface and groundwater discharge from this small watershed flow into Clear Creek, which discharges into Dyes Inlet, another Puget Sound estuary, approximately 5.1 km downstream of the Subase.

Groundwater flow and surface water runoff are the primary pathways for off-site migration of contaminants from this watershed.

Site-Related Contamination

Trace elements are the primary contaminants of concern to NOAA. Maximum concentrations of contaminants over the entire subase are reported in Table 1 (Hart Crowser 1989; Ribic and Swartzman 1989). Concentrations of contaminants were generally elevated in surface waters collected within the Hood Canal Watershed, particularly in the Hunters Marsh area. Clear Creek watershed samples had elevated levels of chromium, copper, and lead. Mercury concentrations in groundwater samples collected from the Hunters Marsh area were high and concentrations of other inorganic substances were elevated.

Ordnance compounds were also reported at high levels in samples from Hunters Marsh and DevilÕs Hole. RDX and trinitrotoluene (TNT) concentrations were measured at 8,600 µg/l and 7,600 µg/l, respectively, in groundwater from the DevilÕs Hole area. The propellants picranic acid, picric acid, and Otto fuel were measured at 2,800 µg/l, 290,000 µg/l, and 5,000 µg/l in groundwater from the Hunters Marsh area.

Soil was contaminated with trace elements in the DevilÕs Hole area of the Hood Canal watershed and the Clear Creek watershed. Cadmium, copper, and zinc soil concentrations were

Site-Related Contamination, *cont.*

above background levels in both areas (Lindsay 1979). Nickel concentrations were slightly above average background levels in the DevilÕs Hole area. Chromium, mercury, and silver were above background levels in soil samples from the Clear Creek watershed. However, mercury was not measured in soil from other areas. Ordnance compounds were also detected in soil

Table 1. Maximum concentrations of major inorganic contaminants at the site compared with applicable screening levels.

	Water			Soil		Sediment	
	Surface Water µg/l	Ground-water µg/l	Chronic AWQC[1] µg/l	Soil mg/kg	Average U.S. Soil[2] mg/kg	Hood Canal Sediment mg/kg	ER-L[3] mg/kg
INORGANIC SUBSTANCES							
cadmium	4.6	1.2	9.3	16	0.06	2.2	5
chromium	6	17	50	150	100	28	80
copper	6	16	2.9	59	30	100	70
lead	10	<5	5.6	400	10	72	35
mercury	1.0	1.0	0.025	0.16	0.03	0.24	0.15
nickel	7	14	8.3	34	40	NT	30
silver	3	2.7	2.3[a]	1	0.05	NT	1
zinc	230	250	86	540	50	480	120

1: Ambient water quality criteria for the protection of aquatic life, marine chronic criteria presented (EPA 1986).
2: Lindsay (1979).
3: Effective range-low; the concentration representing the lowest10 percentile value for the data in which effects were observed or predicted in studies compiled by Long and Morgan (1990).
a Marine acute criteria presented; no chronic criteria available
NT: Not analyzed

from the DevilÕs Hole area; RDX and TNT were measured at 760 mg/kg and 6,000 mg/kg, respectively.

Sediment and clam tissues were collected from areas adjacent to the pier facilities in Hood Canal. Copper, lead, zinc, and mercury in Hood Canal sediment exceeded levels reported to be associated with toxic effects to aquatic organisms in other studies (Long and Morgan 1990). Trace elements were found

Table 2. Maximum concentrations of metals in tissues from shellfish collected in Hood Canal in the vicinity of the site compared to levels reported for Puget Sound.

	Mytilus edulis		*Macoma* spp.		*Saxidomus giganteus*	
	Bangor	Puget Sound[1]	Bangor	Puget Sound[2]	Bangor	Puget Sound[3]
		Max		Max		Max
cadmium	5.5	5.5	1.0	0.2	0.6	0.4
chromium	3.9	12.0	21.0	1.8	5.1	NT
copper	19.0	13.0	98.0	89.0	14.0	4.2
mercury	0.2	0.13	0.2	NT	0.08	0.04
lead	7.2	15.0	2.7	9.7	0.3	0.42
zinc	260.0	320	300	260	64.0	16.4

1: Olsen and Schell (1977).
2: Stober and Chew (1984); values are from a single sample only.
3: Faigenblum et al. (1988).
NT Not tested

Site-Related Contamination, *cont.*

in Hood Canal clam tissues (Table2; Olsen and Schell 1977; Stober and Chew 1984; Faigenblum et al. 1988; Ribic and Swartzman 1989). Concentrations of cadmium, chromium, copper, mercury, lead, and zinc exceeded maximum levels reported for Puget Sound in some species.

NOAA Trust Habitats and Species

The primary habitats of concern to NOAA are Hood Canal and Dyes Inlet. Habits of secondary concern include Clear Creek, DevilÕs Hole Lake, and Cattail Lake. Hood Canal is within the Puget Sound estuary and consists of a narrow inlet that extends 75 km southwest from Admiralty Inlet in northern Puget Sound.

The nearshore areas adjacent to the subase support numerous species of interest to NOAA and are of the most concern (Table 3; Peeling and Goforth 1975; Bax et al. 1978; USFWS 1981; Naval Energy and Environmental Support Activity 1983; Research Planning Institute Inc. 1985). Clams and mussels abound in the coves along Hood Canal in the area of the subase and oysters are found in protected areas. Subtidal geoduck beds occur intermittently along the shoreline, with the greatest abundances in the river delta areas. All species listed in Table 3 support commercial or recreational fisheries. Many of these are harvested recreationally along the shoreline of Subase Bangor and some are commercially harvested from offshore areas (National FisheryResearchCenter 1988).

Abundant eelgrass beds along the shoreline adjacent to the subase provide habitat for several marine species of interest to NOAA, including juvenile rockfish, lingcod, and English sole. Herring use nearshore areas for spawning and nursery grounds, especially where eelgrass is prevalent (Jongejan / Gerrard Associates 1974 ; Peeling and Goforth 1975; Naval Energy and Environmental Support Activity 1983).

Subtidal areas provide highly productive habitat for various crustacean species. The Puget Sound recreational shrimp fishery is dominated by the Hood Canal spot shrimp, which accounts for nearly 70 percent of all Puget Sound shrimp landings (Washington Department of Fisheries 1988). It is estimated that Hood Canal provides 30 percent of the total

NOAA Habitats and Species, *cont.*

annual catch of chum salmon for Puget Sound and 20 percent of the pink salmon catch (Jongejan / Gerrard Associates 1974). Salmonids enter Hood Canal from surrounding streams as juveniles during the late winter and spring and migrate north

Table 3. Major invertebrate and fish species use of Hood Canal, and major commercial and recreational fisheries in Hood Canal.

Table available in hardcopy

along the shoreline toward the Strait of Juan de Fuca (Jongejan / Gerrard Associates 1974). The out-migrating salmon use the shallow portions of the canal adjacent to the site for foraging.

Steelhead trout, and coho and chum salmon use the lower reaches of Clear Creek (National Fishery Research Center

NOAA Trust Habitats and Species, *cont.*

1988). DevilsÕ Hole Lake is a six-hectare lake connected to Hood Canal by a small stream with a fish ladder. The Navy uses the lake for rearing sea-run cutthroat trout and coho salmon (Munn personal communication 1990).
Cattail Lake supports a native, naturally reproducing stock of cutthroat trout, which spawn in the small streams entering the lake (National Fishery ResearchCenter 1988). There are currently no anadromous fish runs in Cattail Lake, as fish migration is prevented by a screened spillway. Historical records indicate that the stream may have supported anadromous fish runs in the past (Jongejan/Gerrard Associates 1974).

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Bonneville Power Administration, Ross Complex

Vancouver, Washington
Region 10
WA1891406349

Site Exposure Potential

The Bonneville Power Administration's (BPA) Ross Complex in Vancouver, Washington is an active control center for the generation and transmission of electricity throughout the Pacific Northwest (Figure 1). Since its construction in 1939, the Ross Complex has provided research and testing facilities, as well as maintenance and operation capabilities for the BPA (U.S. DOE 1986).

A variety of waste materials have been generated at the site, including transformer and capacitor oils containing PCBs, organic and inorganic compounds used for preserving wood poles, paints, solvents, waste oils, and other materials contaminated with organic and inorganic chemicals. These wastes have been discharged or disposed of throughout the BPA site, including the capacitor test site, the Fog Chamber dump, the Cold Creek fill area, the laboratory drain field, the top coat test area, and the wood pole storage areas.

BPA is located on a terraced ridge between two small stream valleys: Cold Creek on the north and Burnt Bridge Creek on the west. These creeks merge 400 m west of the site before emptying into Vancouver Lake 3 km downstream of the site. Water from Vancouver Lake enters the Columbia River

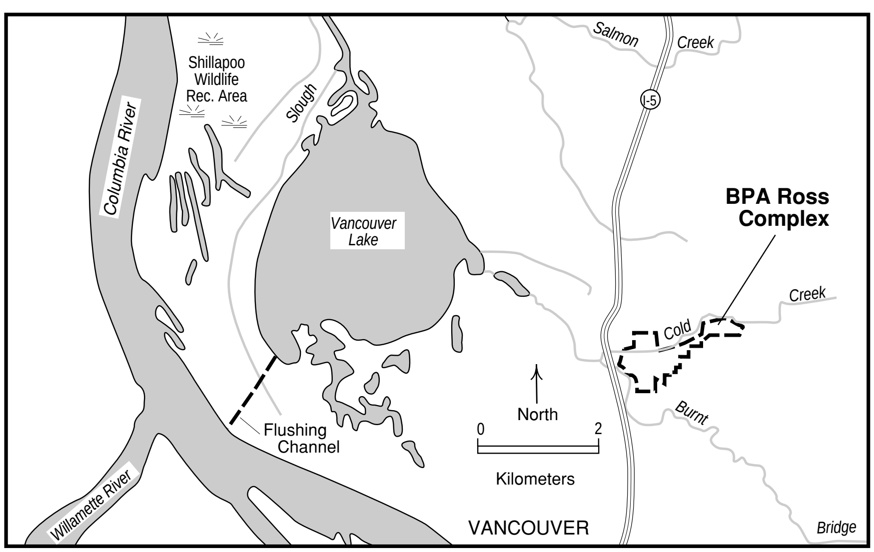

Figure 1. Bonneville Power Administration, Ross Complex, Vancouver, Washington.

Site Exposure Potential, *cont.*

through Lake River and a flushing channel between the lake and the Columbia River.
Surface runoff from the site is directed through oil-water separators that remove oily contaminants before the water discharges to Cold Creek and Burnt Bridge Creek. Storm runoff not intercepted by the oil-water separators is discharged to open fields, Cold Creek, and Burnt Bridge Creek.

Groundwater at the BPA site occurs primarily in the Troutdale aquifer 30 to 45 m below ground. Although no shallow groundwater has been found on the site, some perched groundwater has been found in the clay, silt, and sand overlaying this deeper aquifer in nearby areas. The groundwater flow in the main aquifer beneath the site is generally to the southwest. Flow that would occur in a shallow system would probably discharge to Cold Creek (U.S. DOE 1986). Cold Creek originates as a groundwater discharge to the surface approximately 0.2 km north of the site (Battelle 1988).

The primary pathways of contaminant transport to NOAA resources or habitats are surface runoff to on-site creeks and the leaching of contaminants from fill areas adjacent to surface water. Groundwater may also represent a potential migration pathway, but insufficient information is available to evaluate its significance.

Site-Related Contamination

Groundwater, surface water, soil, and sediment samples were collected during the preliminary assessment (U.S. DOE 1986) and subsequent site investigations (Battelle 1988). Based on the limited data collected during these investigations, the contaminants of most concern to NOAA are lead, mercury, silver, zinc, and PCBs. Copper may also be of concern because high concentrations have been detected in on-site soil. Maximum concentrations of contaminants in various matrices sampled are presented together with available screening levels in Table 1 (U.S. DOE 1986; Battelle 1988).

The maximum concentration of lead was measured in surface water samples collected from Cold Creek, downstream from the fill area during the 1988 site investigation (Battelle 1988). Silver was measured at high levels from Cold Creek down-

Site-Related Contamination, *cont.*

Table 1. Maximum concentrations of major contaminants near the site compared with applicable screening levels.

	Water			Soil		Sediment	
	Ground-water µg/l	Surface Water µg/l	AWQC[1] µg/l	Soil mg/kg	Average U.S. Soil [2] mg/kg	Sediment mg/kg	ER-L[3] mg/kg
INORGANIC SUBSTANCES							
arsenic	<10	<5	190	50	5	16	33
chromium	NT	0.5	11	460	100	20	80
copper	NT	1	12+	37,000	30	19	70
lead	13	10	3.2+	1,300	10	32	35
mercury	<0.5	<0.5	0.012	0.76	0.03	0.05	0.15
silver	NT	2.5	0.12	0.13	0.05	0.12	1.0
zinc	NT	76	110+	1,100	50	116	120

1: Ambient water quality criteria for the protection of aquatic life, freshwater chronic criteria presented (EPA 1986).
2: Lindsay (1979)
3: Effective 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 Morgan (1990)
+ Hardness-dependent criteria; 100 mg/l $CaCO_3$ used.
NT: Not analyzed

stream from the Construction and Services Building during the preliminary assessment (U.S. DOE 1986). High concentrations of arsenic, chromium, copper, and lead were detected in soil taken from the fog chamber dump. Concentrations of mercury, silver, and zinc were measured in a soil sample collected from a surface drain in the Cold Creek fill area.

No PCB analyses were performed on groundwater samples. Trace amounts of PCBs were detected in surface water from Cold Creek downstream of the fill area. The highest concentrations of PCBs in soil were found in samples from the capacitor testing yard. Elevated levels were also found in the soil collected from the landfill surface drain. PCB concentrations were below the detection limit in Cold Creek sediment collected downstream of the surface drain discharge.

Measurements of organic compounds in groundwater indicated the presence of some organic contamination but at low levels with respect to NOAA concerns. Benzene was the only organic compound detected in surface water samples and occurred at very low levels. PCP and numerous PAHs associated with creosote were present at low concentrations in soil from wood pole storage areas. No volatile or semi-volatile organic compounds were detected in sediment from Cold Creek; however, the number of samples taken was very small.

PCP was not detected in groundwater or surface water samples. No PCP analyses were performed on Cold Creek sediment.

NOAA Trust Habitats and Species

The habitats of most concern to NOAA are all freshwater, including Cold Creek, Burnt Bridge Creek, and Vancouver Lake. Cold Creek and Burnt Bridge Creek are small streams 2-5 m wide, less than one meter deep, and with gravel and sandy substrates, respectively. Cold Creek has been channelized as it crosses the BPA site. Burnt Bridge Creek drains a larger, more developed area but is usually dry during periods of low precipitation (Battelle 1988; Starkes personal communication 1990).

Vancouver Lake is a shallow, weedy lake serving as waterfowl habitat. In the early 1980s, the lake was dredged to a depth of approximately three meters and a channel was constructed between the Columbia River and the east end of Vancouver Lake to increase flushing (Roller personal communication 1990).

Species in Vancouver Lake of special interest to NOAA include chinook salmon, coho salmon, steelhead trout, cutthroat trout, and white sturgeon. Chum salmon are no longer found in Burnt Bridge and Cold creeks because of habitat degradation caused by residential and commercial development in the lower watershed, and agricultural runoff in the upper watershed. Coho salmon, steelhead trout, and cutthroat use Burnt Bridge and Cold creeks for spawning and nursery habitat. However, populations of these fish are very small due to habitat degradation. Although some chinook salmon may enter these streams, no spawning occurs there. Juvenile sturgeon are found in Vancouver Lake and the lower reaches of Burnt Bridge Creek, where the water flow is slowed by “backup” from the lake (Roller personal communication 1990; Van Tussenberg personal communication 1990).

There are no commercial fisheries of NOAA trust resources near the site. The only commercial fishery in the area is for carp in Vancouver Lake. Recreational fishing occurs in Cold Creek, Burnt Bridge Creek, and Vancouver Lake, mainly for freshwater species (blue gill, black and white crappie, and

NOAA Habitats and Species, *cont.*

catfish). Salmon and trout populations are too limited to support a recreational fishery (Van Tussenberg personal communication 1990).

No federally protected species are known to frequent nearby habitats of concern, although recreational fishermen are attempting to have endangered-species status conferred upon the Lower River wild chinook, Snake River fall-run chinook, and Upper Columbia summer-run chinook (Roller personal communication 1990).

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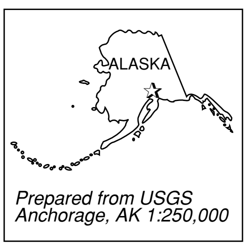
Elmendorf Air Force Base

Anchorage, Alaska
Region 10
AK8570028649

Site Exposure Potential

Elmendorf Air Force Base (AFB) occupies a 5,300-hectare site just north of Anchorage, Alaska (Figure 1). The base began operations in 1940 as Fort Richardson and Elmendorf Field, and has been known as Elmendorf AFB since 1948. Since the mid-1940s, industrial operations have resulted in the discharge and disposal of potentially hazardous substances, including waste oils, fuels, solvents, and other chemicals. The major sources of hazardous wastes on the base include industrial shops, fire training facilities, fuel storage facilities, and landfills (Black and Veatch 1989).

Spent solvents and waste oils were disposed of in storm and sanitary sewers or floor drains that discharged directly to dry wells or surface drainage ditches. Combustible chemicals,



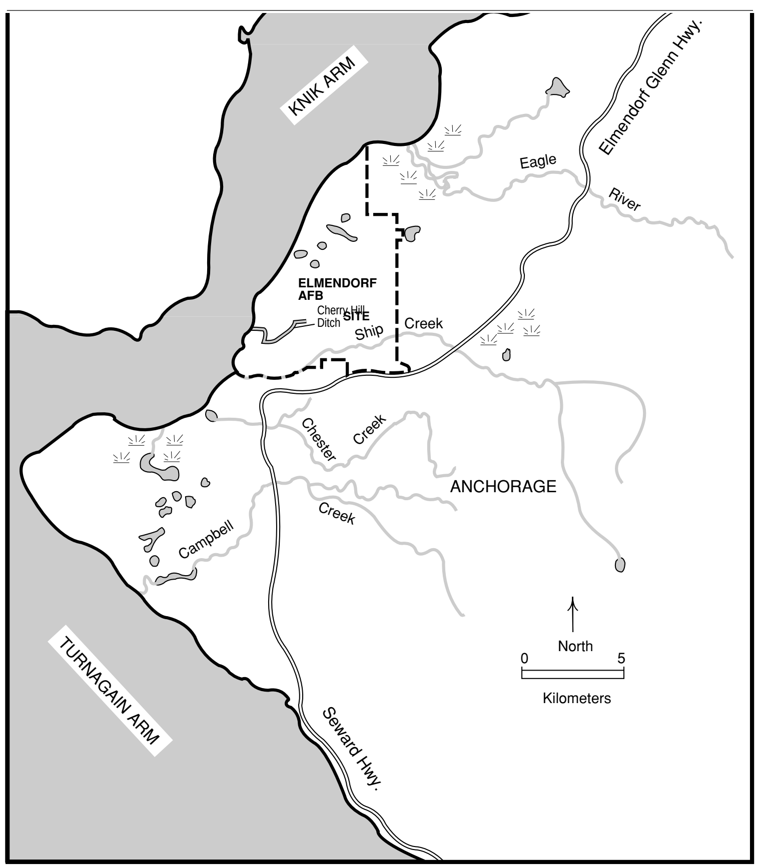


Figure 1. Elmendorf AFB site, Anchorage, Alaska.

Site Exposure Potential, *cont.*

such as oils, fuels, and solvents were used as fuel for fire training drills. Since the mid-1970s, waste liquids have been stored on the site for periodic removal and off-site disposal.

Ship Creek and Cherry Hill Ditch form the major surface drainages for the Elmendorf AFB. Ship Creek flows along the southern boundary of the base for 7 km before discharging to Knik Arm. Several on-site waste disposal operations are located near Ship Creek. Another proposed NPL site, Standard Steel, is located on Ship Creek immediately south of the base boundary. Cherry Hill Ditch flows southwest from the runway area of the base and discharges to Knik Arm. This ditch is composed primarily of surface runoff and storm drain discharge from much of the base. Occasional oily sheens and foam have been observed on water flowing from the ditch (Black and Veatch 1989).

Groundwater is extremely shallow at Elmendorf AFB, often occurring at the ground surface. Flow is generally south to southwest toward Ship Creek. The shallow aquifer and Ship Creek share a complex relationship. Ship Creek provides much of the groundwater recharge to the shallow aquifer in the mid- and upper reaches of the creek. However, in the lower reaches of Ship Creek, groundwater discharges to the creek.

The primary pathways for contaminant migration are groundwater and surface runoff. Contaminated groundwater eventually discharges to Ship Creek. Surface runoff and storm drainage patterns have not been investigated. Observations made during the Remedial Investigation suggest that the majority of the surface runoff discharges to Cherry Hill Ditch and Knik Arm. Sites near Ship Creek may discharge directly to the creek.

Site-Related Contamination

The contaminants of concern at Elmendorf AFB include arsenic, cadmium, chromium, copper, lead, mercury, nickel, zinc, and several PAHs. These substances were found at elevated concentrations in the groundwater and sediment of Cherry Hill Ditch. PAHs were not widespread but moderate concentrations of several of these compounds were observed in the

Site-Related Contamination, *cont.*

sediment collected at one site in Cherry Hill Ditch. Groundwater contaminated with trace elements may eventually discharge to Ship Creek at concentrations toxic to aquatic resources present in the stream. Sediments contaminated with these same elements and PAHs observed in Cherry Hill Ditch may be transported to Knik Arm during periods of erosion (e.g., during heavy precipitation events).

Elevated concentrations of arsenic, cadmium, chromium, copper, lead, mercury, nickel, or zinc were measured in most of the groundwater samples collected (Table 1; Black and Veatch 1989). Lead and mercury concentrations exceeded screening levels established for surface waters in samples from Cherry Hill Ditch. Concentrations of most trace elements in the soil were similar to background levels established

Table 1. Maximum concentrations of major contaminants at Elmendorf AFB site compared with applicable screening levels.

	Water			Soil		Sediment	
	Ground-water µg/l	Surface Water µg/l	AWQC[1] µg/l	Soil mg/kg	Average U.S. Soil[2] mg/kg	Sediment mg/kg	ER-L[3] mg/kg
INORGANIC SUBSTANCES							
arsenic	715	17	190	31	5	70	33
cadmium	13	ND	1.1+	ND	0.06	8	5
chromium	1300	ND	11	57	100	117	80
copper	5500	10	12+	35	30	190	70
lead	222	10	3.2+	39	10	852	35
mercury	17	0.2	0.012	0.2	0.03	1.35	0.15
nickel	3300	ND	160+	39	40	75	30
zinc	3100	ND	110+	70	50	455	120
ORGANIC COMPOUNDS							
Total PAHs	ND	ND	NA	37	NA	170	NA

1: Ambient water quality criteria for the protection of aquatic life, freshwater chronic criteria presented (EPA 1986).
2: Lindsay (1979).
3: Effective 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 Morgan (1990).
+: Hardness-dependent criteria; 100 mg/l $CaCO_3$ used.
ND: Not detected at method detection limit; detection limit not reported
NA: Screening level not available

for U.S. soil (Lindsay 1979). Concentrations of trace elements in the sediment of Cherry Hill Ditch were measured at levels above the low end of the range in which effects had been observed in studies reviewed by Long and Morgan (1990). PAHs were the primary organic compounds of concern observed at Elmendorf AFB. PAHs were generally not found in

Site-Related Contamination, *cont.*

groundwater at the base, but naphthalene (280 µg/l) and 2-methylnaphthalene (500 µg/l) were observed in low concentrations in one monitoring well. Low concentrations (<10 mg/kg) of phenanthrene, benzo(a)anthracene, benzo(a)pyrene, and benzo(k)fluoranthene were measured in the soil taken at several sites. PAHs were observed in one sediment sample from Cherry Hill Ditch at high concentrations.

NOAA Trust Habitats and Species

Ship Creek and Knik Arm in upper Cook Inlet form the primary habitats of concern to NOAA. Intermittent pockets of riparian wetlands are found along Ship Creek from the mouth of the creek to the site (Brna personal communication 1990).

Ship Creek is a spawning ground and migratory corridor for anadromous Dolly Varden and adult chinook, coho, pink, sockeye, and chum salmon. Chinook and coho salmon use the creek for spawning and early juvenile rearing. Knik Arm is a juvenile rearing area. Anadromous Dolly Varden may spawn in the vicinity of the site (Wiedmer personal communication 1990).

Prior to 1989, the Alaska Department of Health and Human Services posted signs along Ship Creek stating, “The municipality of Anchorage recommends against the eating of fish taken from these waters because of chemical contamination of stream sediment.” The signs were removed in 1989 for administrative reasons.

Cook Inlet is one of eight recognized wintering areas worldwide for beluga whales. The Cook Inlet population is resident year-round, and may contain 300 to 500 whales. No comprehensive surveys have been done, so these numbers may be conservative (Morris 1988). Belugas are known to concentrate at the mouth of Ship Creek and feed on anadromous fish there from mid-May through September (Smith personal communication 1990).

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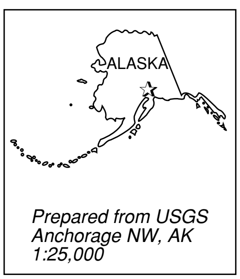
Standard Steel

Anchorage, Alaska
Region 10
AK980978787

Site Exposure Potential

Standard Steel occupies 2.5 hectares along Ship Creek in a heavily industrialized area of Anchorage, Alaska (Figure 1). Since 1972, recycling and salvage operations have been conducted on the site, including reclaiming of transformers contaminated with PCBs, salvaging batteries, and processing equipment and drums from nearby military bases. From 1972 to 1981, an on-site incinerator burned excess oil on copper wires salvaged from the inside of electrical transformers, generating dioxin-contaminated ash. Transformer oil was also reportedly used to ignite large piles of debris on-site, which may have included transformer carcasses or cores. The majority of the site is covered haphazardly with heavy salvage debris extending into Ship Creek. In 1986, a rip-rap erosion wall was built along the creek adjacent to the site to prevent roadbed erosion and the transport of potentially contaminated soils and materials into the creek. Groundwater at the site is very shallow, from 0.9 to 2.9 m below ground surface, and generally flows south-southwest towards Ship Creek. On-site soils are highly permeable, making transport of contaminants



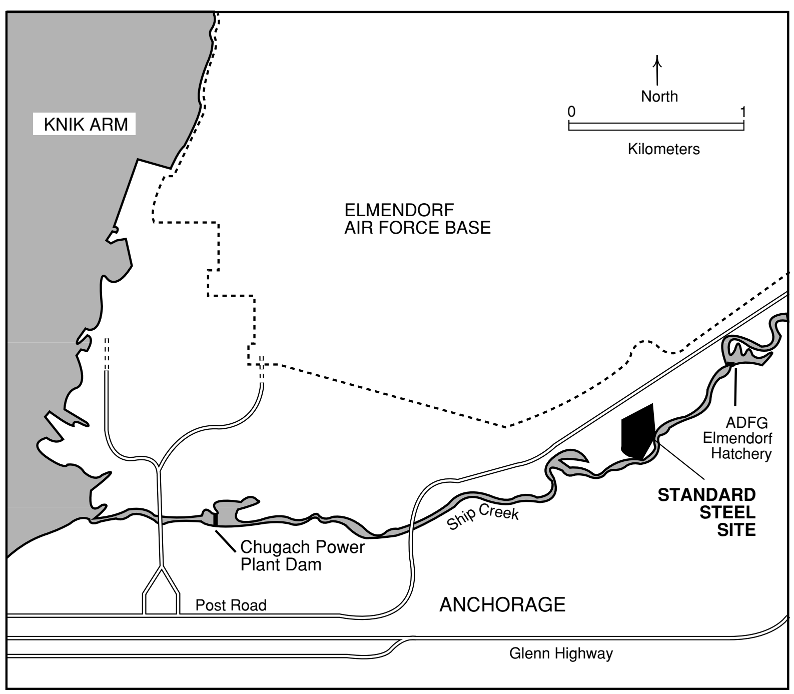


Figure 1. Standard Steel, Anchorage, Alaska.

Site Exposure Potential, *cont.*

in surface soils very probable (Ecology and Environment 1986). The primary pathways of contaminant transport that may affect NOAA resources or habitats are groundwater discharge and, for the western portion of the site, surface water runoff. Contaminated soils and sediments may represent a secondary source of contamination.

Site-Related Contamination

Surface and subsurface soils, groundwater, surface water, and sediment samples were collected during a series of preliminary studies (Table 1; Ecology and Environment 1986, 1987, 1988; Roy F. Weston 1986; EPA 1987; Robinson-Wilson personal communication 1990). Samples were analyzed for priority pollutant metals, organic compounds, and PCBs. Ash samples collected from the on-site incinerator were analyzed for dioxins and furans. Results indicated that trace metals, PCBs, dioxins, and related furans are the contaminants of concern to NOAA at the Standard Steel site. Maximum concentrations of contaminants in the various matrices analyzed are presented in Table 1 along with applicable screening levels.

Copper, lead, nickel, and zinc were detected at high levels in groundwater. The maximum concentrations of copper, lead, and zinc were observed in a monitoring well located on the

Table 1. Maximum concentrations of major contaminants in the vicinity of the site compared with applicable screening levels.

	Water			Soil	
	Ground-water µg/l	Surface Water µg/l	AWQC[1] µg/l	Soil mg/kg	Average U.S. Soil[2] mg/kg
INORGANIC SUBSTANCES					
arsenic	ND	NT	190	53	5
cadmium	ND	NT	1.1+	750	0.06
chromium	ND	NT	11	1,600	100
copper	650	NT	12+	7,700	30
lead	760	NT	3.2+	11,000	10
mercury	ND	NT	0.012	180	0.03
nickel	100	NT	160+	650	40
silver	ND	NT	0.12	32	0.05
zinc	1,900	NT	110+	10,000	50
ORGANIC COMPOUNDS					
Total PCBs	2,025	<0.10	0.014	165,000	NA

1: Ambient water quality criteria for the protection of aquatic life, freshwater chronic criteria presented (EPA 1986).
2: Lindsay (1979).
+ Hardness-dependent criteria; 100 mg/l $CaCO_3$ used.
ND: Not detected at method detection limit; detection limit not reported
NT: Not analyzed
NA: Screening level not available.

Site-Related Contamination, *cont.*

southwest boundary of the site. The maximum concentration of nickel was observed in a monitoring well near the main transformer storage area. Elevated levels of nine trace metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, silver, and zinc) were observed in soil samples on site. Surface water and sediment samples were not analyzed for trace metals.

Groundwater and three soil samples were analyzed for volatile and semi-volatile organic compounds, but only very low levels of contamination were detected in any of the samples. Surface water and sediment samples were not analyzed for volatile or semi-volatile organic compounds.

Elevated levels of PCBs (primarily Aroclor 1260) were observed in groundwater, on-site soil, and sediment. PCBs in groundwater were measured at very high levels in a monitoring well near the main transformer storage area. Floating oil containing extremely high levels of PCBs (9,040,000 µg/l) was detected in another nearby groundwater monitoring well. The maximum concentration of PCBs in soil was measured in a sample collected from the main transformer storage area. PCBs in sediment had a maximum value of 2.5 mg/kg and were detected in a sample collected 45 m downstream of the Standard Steel site. PCBs were not detected in any surface water samples, but detection limits (0.10 µg/l) were higher than the screening levels for this contaminant. Groundwater, soil, and sediment were not analyzed for pesticides, so no evaluation of Standard Steel as a potential source can be made at present (Tetra Tech 1988).

Ash samples collected from the on-site incinerator were found to contain up to 4.2 µg/kg tetrachlorinated dioxins (TCDD); however, the samples did not contain the most toxic isomer, 2,3,7,8-TCDD. Because this isomer was not present, and dioxin isomers have different toxicities, all dioxin concentrations reported for the Standard Steel site are expressed as concentrations equivalent to the 2,3,7,8-TCDD isomer. A concentration equivalent to 5.71 µg/kg 2,3,7,8-TCDD was found in an ash sample collected from inside the incinerator. Significant levels of chlorinated dioxins and furans were present in all

Site Related Contamination, *cont.*

samples collected in and around the incinerator. Groundwater, surface water, and soil outside of the incinerator area were not analyzed for dioxins (Ecology and Environment 1986). Tissue samples of Dolly Varden trout from Ship Creek immediately downstream of the Standard Steel site were tested for PCBs, DDE, and the dioxin concentration equivalents to

Table 2. Maximum concentrations of contaminants in Dolly Varden trout from Ship Creek compared with fish from nearby surface water.

	Collection Site	
Contaminant	Ship Creek µg/kg	Anchorage Area µg/kg
PCBs	143.0	218.0
DDE	50.5	17.2
2,3,7,8-TCDD	0.87	0.000685

2,3,7,8-TCDD (Table 2; Tetra Tech 1988). Maximum levels of DDE and TCDD were higher than those from tissue samples of trout collected from other surface waters in the vicinity of Anchorage.

NOAA Trust Habitats and Species

Ship Creek and Knik Arm in upper Cook Inlet form the primary habitats of concern to NOAA. Intermittent pockets of riparian wetlands are found along Ship Creek from the mouth of the creek to the site (Brna personal communication 1990). Ship Creek is a spawning and migratory corridor for adult chinook, coho, pink, and chum salmon, and Dolly Varden. Chinook and coho salmon also use the creek for spawning and early juvenile rearing. Knik Arm is a juvenile rearing area. Anadromous Dolly Varden use Ship Creek as a migratory corridor and may spawn near the Standard Steel site (Wiedmer personal communication 1990).

Prior to 1989, the Alaska Department of Health and Human Services posted signs on Ship Creek stating, ÒThe municipality of Anchorage recommends against the eating of fish taken from these waters because of chemical contamination of stream sediments.Ó The signs were removed in 1989 for administrative reasons.

Standard Steel

Cook Inlet is one of eight recognized wintering areas world-wide for beluga whales. The Cook Inlet population is resident year-round, and may contain 300 to 500 whales. No comprehensive surveys have been done, so these numbers may be conservative (Morris 1988). Belugas are known to concentrate at the mouth of Ship Creek and feed on anadromous fish there from mid-May through September (Smith personal communication 1990).

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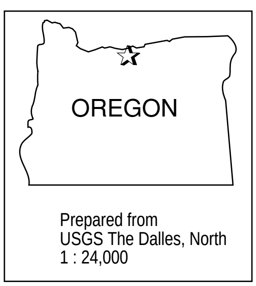
Union Pacific Tie Treating Facility

The Dalles, Oregon
Region 10
ORD009049412

Site Exposure Potential

The 33-hectare Union Pacific Tie Treating site is located along the Columbia River in an industrialized area of The Dalles, Oregon (Figure 1). Since the early 1920s, the facility was operated as a railroad tie-treating facility. Prior to 1950, creosote and fuel oil were used predominantly to preserve wood ties. Zinc chloride may also have been used during this time. Other substances used since 1950 include preservatives, including ammoniacal copper arsenate, PCP, and a proprietary flame retardant (Arban) (CH_2M Hill 1989).

Wastes generated by the plant include steam condensate, boiler blowdown, water and oil containing wood-preserving chemicals, and residues from treatment facilities cleaning. Process wastes were treated over the years and discharged to ponds on-site where the residues either percolated into the soil or evaporated. Until 1970, wastewater from an oil/water separator was discharged directly into process ponds. This wastewater contained residual wood-preserving contaminants not removed by the separator. In 1970, a wastewater treatment facility was installed for better oil/water separation, along with an evaporator for wastewater disposal. However,



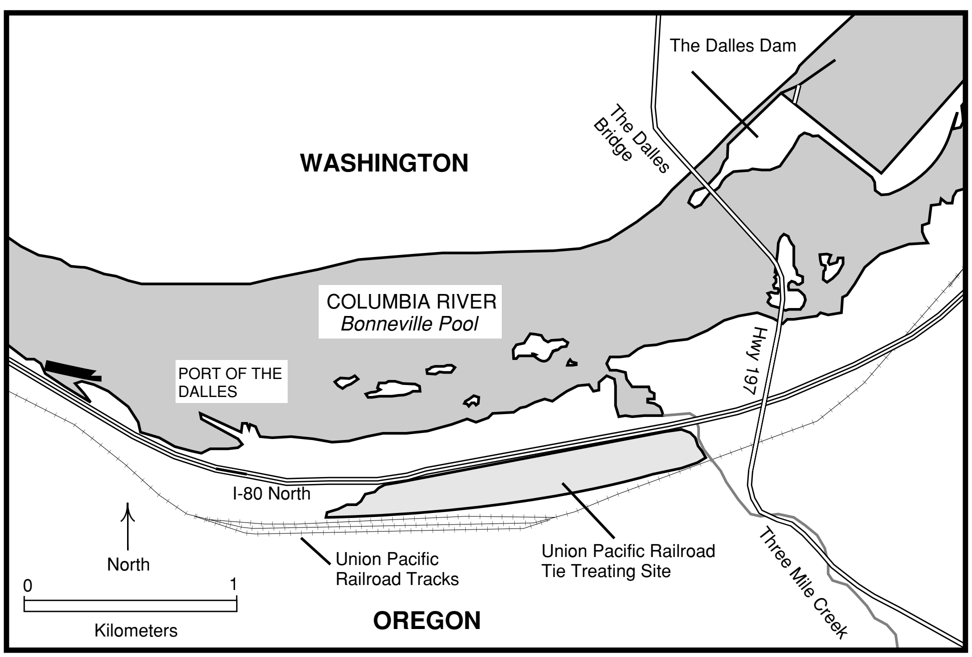


Figure 1.
The Union Pacific Tie Treating facility, The

Site Exposure Potential, *cont.*

excess wastewater may have been released onto the ground north and south of the treatment system. In 1980, approximately 8 million liters of liquids and 450,000 liters of sludge were removed from the process ponds and disposed of off-site. Clean fill material was placed over the former ponds. In 1983, the wastewater treatment system was improved and expanded to result in zero discharge.

Three Mile Creek flows along the eastern border of the site before discharging to the Columbia River. The site lies approximately 200 meters south of the Columbia River and is separated from the river by a levee constructed in 1937 for flood control. Prior to construction, the site was open to the river. In 1948, flooding along the Columbia River breached a levee, inundating operational portions of the plant. In 1958, construction of The Dalles Dam was completed and provided flood control for the site and the city of The Dalles.

Groundwater occurs in both an unconfined shallow aquifer and deeper confined aquifers. The unconfined unit is 1.5 to 3.5 meters below the ground surface and flows north towards the Columbia River. Deeper, confined aquifers are located about 12 to 15 meters below the level of the river. The confined aquifers lack good hydraulic connection with the Columbia River and discharge is believed to occur primarily by well pumping.

The primary migratory pathways for contamination from the site to the Columbia River and Three Mile Creek are via groundwater movement and surface runoff. Direct discharge to the Columbia River may also occur through the old pipeline beneath the levee.

Site-Related Contamination

The RI/FS sampling program has been completed and the RI report is in preparation. Data characterizing contamination at the site are very limited and are based on results from preliminary hydrogeologic surveys (CH_2M Hill 1986, 1987).

Concentrations of PAHs, the major contaminants found at the facility, were elevated in groundwater and soil (Table 1; CH_2M Hill 1986, 1987). Concentrations of PCP were also elevated in

Site-Related Contamination, *cont.*

Table 1. Maximum concentrations of contaminants of concern in groundwater and soil at the site.

	Water		Soil	
	Ground-water µg/l	AWQC[1] µg/l	Soil mg/kg	Average U.S. Soil[2] mg/kg
INORGANIC SUBSTANCES				
arsenic	190	190	59	5
zinc	26	110+	NR	50
ORGANIC COMPOUNDS				
total PAHs	>20,000	300*	>6300	NA
PCP	780	13++	0.4	NA
dibenzofuran	790	NA	990	NA
PCBs	6.3	0.014	ND	NA

1: Ambient water quality criteria for the protection of aquatic life, freshwater chronic criteria presented (EPA 1986).
2: Lindsay (1979).
+ Hardness -dependent criteria; 100 mg/l $CaCO_3$ used.
++ pH-dependent criteria; 7.8 pH used
* Insufficient data to develop criteria; lowest observed effect level for freshwater acute effects given
NA: Screening level not available
ND: Not detected at method detection limit; detection limit not reported

these matrices. PCBs were detected in groundwater but not found in soil samples. However, only a limited number of samples was taken.

NOAA Trust Habitats and Species

Bonneville Pool in the Columbia River and Three Mile Creek are the habitats of primary concern to NOAA. The Columbia River, the largest river basin in western North America, drains approximately 668,220 km^2 and supports diverse biota, particularly prolific salmonid runs that sustain intensive commercial and recreational fisheries (Beccasio et al. 1981).

Below The Dalles Dam, the Columbia River is approximately 850 meters wide and free-flowing until reaching the Bonneville Dam 67 kilometers downriver. Wetlands are sparse along this reach, known as the Bonneville Pool, due to levee and rip-raps.

Three Mile Creek, a narrow, shallow intermittent stream on the site's eastern boundary, flows unimpeded into the Columbia River below the Interstate 84 overpass. The substrate is sandy and stream flow varies with seasonal precipitation. Due to its shallowness, temperature variations are substantial. Extensive upstream agriculture results in periodic sediment

NOAA Trust Habitats and Species, *cont.*

loading in the creek (Newton personal communication 1990). Near the site, Three Mile Creek nurtures a corridor of wetlands consisting of narrow and broad-leaved emergents and short shrubs. The creek is undergoing a long-term restoration, coordinated by the Oregon Department of Fish and Wildlife (ODFW), to improve water quality and habitat (Newton personal communication 1990).

Table 2. Major anadromous fish species in Bonneville Pool.

Species		Habitat		
Common Name	Scientific Name	Spawning	Nursery	Adult Forage
white sturgeon [1]	*Acipenser transmontanus*		♦	♦
American shad	*Alosa sapidissima*	♦	♦	♦
chum salmon[2]	*Oncorynchus keta*			♦
coho salmon	*Oncorynchus kitsutch*	♦	♦	♦
steelhead trout	*Oncorynchus mykiss*	♦	♦	♦
sockeye salmon	*Oncorynchus nerka*	♦	♦	♦
chinook salmon	*Oncorynchus tshawytscha*	♦	♦	♦
cutthroat trout	*Salmo clarki*	♦	♦	♦

1. Before dam construction, white sturgeon migrated freely throughout the Columbia River basin. Migration is now limited to the lower reach south of Bonneville Dam. Except in cases of incidental release, separate pool populations have emerged (ODFW and WDF 1989; Newton personal communication 1990).
2. Chum salmon are regarded as a lower Columbia River species. They can occur above Bonneville Dam but would be considered rare there. There is no fishing effort for chum salmon in the Bonneville Pool (ODFW and WDF 1989; Newton personal communication 1990).

Bonneville Pool and Three Mile Creek provide habitat for several anadromous fish species (Table 2; Beccasio et al. 1981; ODFW and Washington Department of Fisheries (WDF) 1989) in addition to resident freshwater species of recreational significance.

Bonneville Pool is a migratory corridor and spawning, nursery, and adult forage ares for coho and chinook salmon, and steelhead and cutthroat trout. These species also use Three Mile Creek for spawning (Newton personal communication 1990). In the last decade, salmonid populations have declined due to increased fishing, restricted upstream passage, and loss of upstream spawning habitats. Summer chinook, coho, sockeye,

NOAA Trust Habitats and Species, *cont.*

and chum salmon, and summer steelhead have been particularly impacted (ODFW and WDF 1989). Within Bonneville Pool, coho and chinook populations are bolstered by hatchery releases. White sturgeon populations have rebounded slowly from nearly complete depletion in the late 1800s. Primarily deep channel spawners, it is doubtful that they spawn in the vicinity of the site, but they may use adjacent areas as nursery and forage areas. American shad, introduced in 1885, have flourished throughout the lower Columbia River, producing a record run of 2.2 million fish in 1988 (ODFW and WDF 1989).

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