PUBLIC HEALTH ASSESSMENT WITH TRANSMITTAL LETTER NSY PORTSMOUTH VA
2/25/1994
VIRGINIA DEPARTMENT OF HEALTH

DEPARTMENT OF HEALTH & HUMAN SERVICES

Public Health Service
Agency for Toxic Substances
and Disease Registry

Memorandum

Date February 25, 1994

From Senior Regional Representative
ATSDR, Region III

Subject Public Health Assessment
Atlantic Wood Industries Inc.

To Vance Evans, Remedial Project Manager
EPA, Region III

Attached is the Public Health Assessment on Atlantic Wood Industries Inc. Site, Portsmouth, Portsmouth County, Virginia. This Public Health Assessment prepared by the Virginia Department of Health under a cooperative agreement with the Agency for Toxic Substances and Disease Registry represents an evaluation of the relevant health and environmental data and community concerns that have been collected on this site.

If after review, you or your staff have questions or comments, please contact our office at (215)597-7291.

Jack Kelly for
Charles J. Walters, Jr.

Attachment

cc: Max Howie, ATSDR,DHAC/RIMB
P. McMurray, VA DWM
V. Newby-Owens, Portsmouth HD
L. Nurse, EPA CRC
V. O'Dell, VA DOH
P. Sherertz, VA DOH

Public Health Assessment for

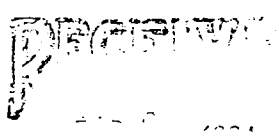
ATLANTIC WOOD INDUSTRIES INC.

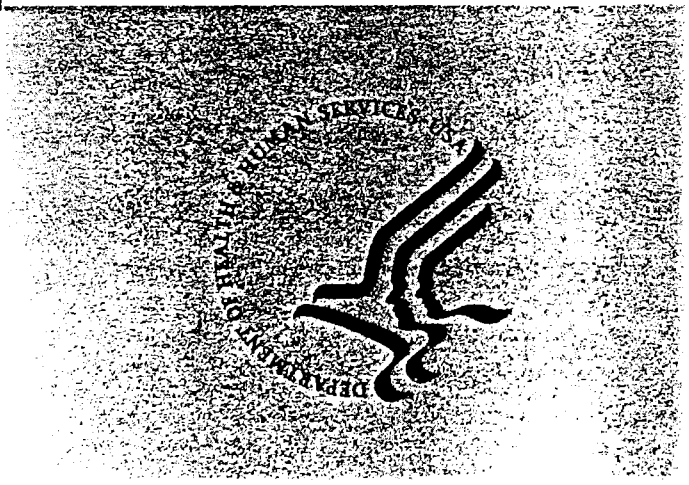
PORTSMOUTH, PORTSMOUTH COUNTY, VIRGINIA

CERCLIS NO. VAD990710410

FEBRUARY 15, 1994

[illegible] DEPARTMENT OF HEALTH & HUMAN SERVICES
[illegible] Health Service
[illegible] for Toxic Substances and Disease Registry





PUBLIC HEALTH ASSESSMENT

ATLANTIC WOOD INDUSTRIES INC.

PORTSMOUTH, PORTSMOUTH COUNTY, VIRGINIA

CERCLIS NO. VAD990710410

Prepared by:
Bureau of Toxic Substances
Virginia Department of Health (VDH)
for:
Division of Health Assessment and Consultation (DHAC)
Agency for Toxic Substances and Disease Registry (ATSDR)

THE ATSDR PUBLIC HEALTH ASSESSMENT: A NOTE OF EXPLANATION

This Public Health Assessment was prepared by ATSDR pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund) section 104 (i)(6) (42 U.S.C. 9604 (i)(6), and in accordance with our implementing regulations 42 C.F.R. Part 90). In preparing this document ATSDR has collected relevant health data, environmental data, and community health concerns from the Environmental Protection Agency (EPA), state and local health and environmental agencies, the community, and potentially responsible parties, where appropriate.

In addition, this document has previously been provided to EPA and the affected states in an initial release, as required by CERCLA section 104 (i)(6)(H) for their information and review. The revised document was released for a 30 day public comment period. Subsequent to the public comment period, ATSDR addressed all public comments and revised or appended the document as appropriate. The public health assessment has now been reissued. This concludes the public health assessment process for this site, unless additional information is obtained by ATSDR which, in the Agency's opinion, indicates a need to revise or append the conclusions previously issued.

Agency for Toxic Substances and Disease Registry.....*William L. Roper, M.D., M.P.H. Administrator*
Barry L. Johnson, Ph.D., Assistant Administrator

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Use of trade names is for identification only and does not constitute endorsement by the Public Health Service or the U.S. Department of Health and Human Services

Additional copies of this report are available from:
National Technical Information Service, Springfield, VA
(703) 487-4650

ATSDR and its Public Health Assessment

ATSDR is the Agency for Toxic Substances and Disease Registry, a federal public health agency. ATSDR is part of the Public Health Service in the U.S. Department of Health and Human Services. ATSDR is not a regulatory agency. Created by Superfund legislation in 1980, ATSDR's mission is to prevent or mitigate adverse human health effects and diminished quality of life resulting from exposure to hazardous substances in the environment.

The Superfund legislation directs ATSDR to undertake actions related to public health. One of these actions is to prepare public health assessments for all sites on or proposed for the Environmental Protection Agency's National Priorities List, including sites owned or operated by the federal government.

During ATSDR assessment process the author reviews available information on

- the levels (or concentrations) of the contaminants,
- how people are or might be exposed to the contaminants, and
- how exposure to the contaminants might affect people's health

to decide whether working or living nearby might affect peoples' health, and whether there are physical dangers to people, such as abandoned mine shafts, unsafe buildings, or other hazards.

Four types of information are used in an ATSDR assessment.

1) environmental data; information on the contaminants and how people could come in contact with them

2) demographic data; information on the ethnicity, socioeconomic status, age, and gender of people living around the site,

3) community health concerns; reports from the public about how the site affects their health or quality of life

4) health data; information on community-wide rates of illness, disease, and death compared with national and state rates

The sources of this information include the Environmental Protection Agency (EPA) and other federal agencies, state, and local environmental and health agencies, other institutions, organizations, or individuals, and people living around and working at the site and their representatives.

ATSDR health assessors visit the site to see what it is like, how it is used, whether people can walk onto the site, and who lives around the site. Throughout the assessment process, ATSDR health assessors meet with people working at and living around the site to discuss with them their health concerns or symptoms.

A team of ATSDR staff recommend actions based on the information available that will protect the health of the people living around the site. When actions are recommended, ATSDR works with other federal and state agencies to carry out those actions.

A public health action plan is part of the assessment. This plan describes the actions ATSDR and others will take at and around the site to prevent or stop exposure to site contaminants that could harm peoples' health. ATSDR may recommend public health actions that include these:

- restricting access to the site,
- monitoring,
- surveillance, registries, or health studies,
- environmental health education, and
- applied substance-specific research.

ATSDR shares its initial release of the assessment with EPA, other federal departments and agencies, and the state health department to ensure that it is clear, complete, and accurate. After addressing the comments on that release, ATSDR releases the assessment to the general public. ATSDR notifies the public through the media that the assessment is available at nearby libraries, the city hall, or another convenient place. Based on comments from the public, ATSDR may revise the assessment. ATSDR then releases the final assessment. That release includes in an appendix ATSDR's written response to the public's comments.

If conditions change at the site, or if new information or data become available after the assessment is completed, ATSDR will review the new information and determine what, if any, other public health action is needed.

For more information about ATSDR's assessment process and related programs please write to:

Director
Division of Health Assessment and Consultation
Agency for Toxic Substances and Disease Registry
1600 Clifton Road (E-32)
Atlanta, Georgia 30333

TABLE OF CONTENTS

SUMMARY

Atlantic Wood Industries, Inc. (AWI), an active wood processing facility prior to August 6, 1991, is located on the industrialized waterfront of Portsmouth, Virginia. Currently, only the storage and distribution of wood products treated at other AWI locations occur at this site. Arsenic, benzene, pentachlorophenol (PCP), and polycyclic aromatic hydrocarbons (PAHs) have been detected in surface and subsurface soils on the site, in groundwater, surface water, and sediments on the site, and in biota in the adjacent Elizabeth River. Approximately 13 people now work at the AWI site, and 77,000 persons live within a 4-mile radius of the site. The Norfolk Naval Shipyard, which is located within 1/2 mile of the site, employs 14,000 persons. Residents of the area have not demonstrated concern over the site *per se*; however, there is community concern over the possibility of incineration as a cleanup option. The general water quality of the Elizabeth River and the Chesapeake Bay has been a concern, also. Potential exposure pathways include ingestion and inhalation of contaminated soils through fugitive dusts, dermal contact with contaminated soils, and ingestion of contaminated biota.

The Virginia Department of Health concludes the AWI site to be an indeterminate public health hazard. Existing data do not indicate human exposures have occurred at levels that would be expected to cause adverse health effects; however, data are not available for all media to which humans may be exposed. Site-specific health outcome data are not available. No adverse health effects have been reported by people in the area. Additional air sampling (on-site and off-site), surface water sampling (on-site and off-site), and biota sampling are recommended.

To determine if public health actions are needed at the site, the Agency for Toxic Substances and Disease Registry's (ATSDR) Health Activities Recommendations Panel (HARP) evaluated the data and information developed in the Atlantic Wood Industries Public Health Assessment. No follow-up health actions are indicated at this time because there is no evidence that people have been exposed to contaminants associated with the site at levels that may cause adverse health effects. If information becomes available indicating exposure has occurred at levels of concern, ATSDR will evaluate that information to determine what actions, if any, are necessary.

ATSDR will coordinate with the Environmental Protection Agency (EPA) and state agencies to discuss the feasibility of implementing recommendations made in this public health assessment.

BACKGROUND

Atlantic Wood Industries, Inc. (AWI) is an active wood storage and distribution facility that has been in operation since 1926. AWI was initially proposed for listing on the **National Priorities List (NPL)**[1] in 1986, and was included on the list in February 1990. The AWI facility is located on the industrialized waterfront of Portsmouth, Virginia, and currently occupies 47.5 acres. The site has been used for various purposes during its history, including a possible coal tar refinery, a creosote treating plant, a PCP treating plant, and a treated lumber storage facility. The nearest residential area is approximately 1/2 mile southwest of the site. Commercial crabbing operations are active in the area as well. The Virginia Department of Health, Division of Shellfish Sanitation, prohibited collecting bivalve mollusks from the Elizabeth River in April 1982. Site specific health outcome data for this site have not been collected because no adverse health outcomes have been identified.

A. SITE DESCRIPTION AND HISTORY

Atlantic Wood Industries, Inc. is an active wood storage and distribution facility that has been in operation since 1926. Past on-site operations included wood treatment, which ceased in 1991. The Environmental Protection Agency (EPA) conducted preliminary assessments on the site in 1982 and 1983. In addition, EPA performed site investigations with limited sampling in 1984 and 1985. ATSDR conducted a Preliminary Health Assessment in December 1988. AWI was initially proposed for listing on the National Priorities List (NPL) in 1986, and was finalized in February 1990. In July 1987, AWI entered into a Consent Agreement with EPA to develop a removal action workplan and to perform a removal action (Phase I). AWI conducted the Phase I Removal Sampling Investigation during July and August 1988, and the results of that investigation were submitted to EPA on August 11, 1989.

AWI also performed soils analyses to determine the level of contamination present and the extent of excavation required to achieve satisfactory remediation of the areas addressed by Phase I activities. Clean "fill" replaced excavated soils, and temporary drainage was provided while the sewer replacement was in progress. AWI also agreed to conduct a **Remedial Investigation/Feasibility Study (RI/FS)**, and results of that study were submitted to EPA in May 1992. The RI/FS (Phase II) was initiated in January 1990. The **Record of Decision (ROD)**, which will describe the selected remedies for cleanup, has not been signed.

The AWI facility is located on the industrialized waterfront of Portsmouth, Virginia, and currently occupies 47.5 acres. It lies on the west bank of the Southern Branch of the Elizabeth River, approximately 7 miles upstream from the Chesapeake Bay. The eastern half of the site contains active wood processing facilities and wood storage areas, and the western half is used to store treated and untreated wood (Figure 1).

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[1] Words appearing in bold are defined in the Glossary of this public health assessment.

The site is bounded on the north by Elm Avenue and the United States Norfolk Naval Shipyard facilities and on the west by Virginia Power, Inc., right-of-way. To the south of the site is the south annex of the U.S. Naval Reserve Station and a maintenance building occupied by the Portsmouth City School Board. AWI is bounded on the east by the Southern Branch of the Elizabeth River. The site is split into eastern and western portions by the Norfolk and Portsmouth Beltline Railroad and Burtons Point Road. West of the site, just beyond the 60-foot power line right-of-way, are several closed landfills and chemical waste pits, including an underground waste oil tank. This property is owned and operated by the U.S. Norfolk Naval Shipyard. The Navy also operates a disposal landfill area south of the property owned by the Portsmouth City School Board. The Norfolk Veneer Mill (formerly the Wycoff Company) is located immediately north, across Elm Avenue from the eastern portion of the AWI facility.

The site has been used for various purposes during its history, including a possible coal tar refinery, a creosote treating plant, a PCP treating plant, and a treated lumber storage facility. Over the years, the company changed corporate names several times. Site ownership changed in 1986 when the employees of AWI purchased the operating assets of the corporation.

Creosote and PCP, both wood preservatives used by the facility, are the major raw materials from which on-site contaminants originated. PCP was used at the site from 1972-1985 and for five months during 1991. A special formulation of PCP and creosote (creo-penta) was used from the late 1950s to the early 1960s. Timber treated with chromated copper arsenate (CCA) was stored on-site, though this compound was not used at AWI.

The original plant was constructed in 1926 by the Savannah Creosoting Company and consisted of two of the existing four wood treatment retorts (closed cylinders), the existing office building, several existing maintenance and storage buildings, and the recently-removed, above-ground tank farm that was located adjacent to Elm Avenue. Originally, creosote was stored in four above-ground storage tanks constructed in about 1940. Tank 1 held 3.3 million liters and the remaining three each held 1.7 million liters. Prior to removal in 1985-1986, these tanks contained approximately 1.3 million liters of creosote and creosote-contaminated water, which was leaking into the storm sewer system. Since 1975, actively used creosote has been stored in smaller tanks located in the central part of the site.

From approximately 1966 until 1982, the waste from the wood treatment process was stored at the southwest corner of the property in an unlined waste lagoon. The lagoon was 17 meters wide, 45 meters long, 1.5 meters deep and held approximately 1,200 cubic meters of waste material. From 1972 to 1983, the lagoon was used to hold cuttings from the processed wood. A total of 560 cubic meters of contaminated wood chips were disposed in the waste pit. This area, termed the historical disposal area, may contain up to 20,000 cubic feet of general debris, steel bands, untreated and treated wood waste, and cylinder and tank clean-out material. The tank clean-out material may contain creosote and PCP. The lagoon was backfilled in 1983. In addition to the known on-site disposal areas and storage tanks, there is

an undetermined quantity of contaminated soils in the treated-wood storage and processing areas. Other contaminated media include sediments in the storm sewer, the intertidal drainage ditch, and the Southern Branch of the Elizabeth River (Figure 2).

The four tanks west of the retorts were previously associated with a tar distillation unit located east of the office building. A shallow concrete basin also was associated with the tar distillation unit. The tar distillation unit was disassembled in the 1940s, the basin was filled in, and the 4 tanks were moved to their present location.

From 1940 until about August 1985, the plant used a concrete, closed-loop recovery system located north of the retort building to recover preservative and to recycle process water. . This oil/water separator was used to recover creosote preservative and process conditioning water for reuse. Until 1972, some excess process water was discharged to an area immediately south of the railroad spur that juts out into the Southern Branch of the Elizabeth River. When the Clean Water Act was implemented in the early 1970s, the plant was required to stop discharging effluent from the oil/water separator. At that time, a liquid incineration unit known as a "Liquidator" was constructed, and excess process water that was previously discharged through the oil/water separator into the river was incinerated. AWI stopped using the Liquidator unit in 1984.

In 1974, a closed-loop recovery system was installed to recover PCP and process conditioning water for reuse. This operation ceased in 1985 when the use of PCP was discontinued. Until the early 1970s, operations included an open steaming process (the induction of steam into the retort to heat and condition the wood). This process generated excess amounts of process water. Closed steaming (generating steam in the retort by means of steam heating coils covered with water) was instituted in the early 1970s to reduce the amount of process water generated.

Over the years, several site investigations have been conducted by AWI, the Virginia State Water Control Board, and EPA. The plant was granted an interim status permit by EPA to operate as a small quantity generator or storer of hazardous wastes under the **Resource Conservation and Recovery Act (RCRA)** in November 1980. Subsequently, the permit was withdrawn at AWI's request in January 1985. Although the facility now removes its process waste to off-site, permitted waste-handling facilities, AWI has a **National Pollutant Discharge Elimination System (NPDES)** permit to discharge storm water runoff to the Southern Branch of the Elizabeth River.

Although all of the contaminants detected can be associated with wood treatment processes, AWI is not the only wood treatment facility in the Portsmouth area. Other wood-treating facilities located near AWI, which handled many of the same chemicals, include Wyckoff Company, Republic Creosoting Company, Eppinger and Russel Company, and Bernuth Lembcke Company. Between 1960-1963, a fire at Eppinger and Russel caused a release of creosote into the Elizabeth River. Eppinger and Russell stopped treating wood in 1980, and Republic Creosoting stopped in 1971. Bernuth Lembcke is still handling and storing

creosote. The Norfolk Veneer Mill (formerly Wyckoff Company) is located north of the AWI site across Elm Avenue. Although no wood treatment is currently performed at the mill, Wyckoff, a past owner, performed pressure treating of wood with creosote.

B. SITE VISIT

A site visit was conducted on September 26, 1990, by staff from the Virginia Department of Health (VDH), which included Dr. Peter Sherertz, Ms. Connie Webb, Mr. Stan Orchel, Jr. In addition, people from the Virginia Department of Waste Management, EPA, AWI, and Keystone Environmental Resources, Inc., consultants to AWI, toured the site. The following observations were noted:

* A strong creosote odor was apparent on-site.

* The site was not completely restricted; however, a guard is on duty after hours and on weekends.

* Three storm water runoff ditches discharge to the Elizabeth River or Paradise Creek. All have oil screens. An oil sheen was observed on the water draining from the northern ditch.

* The nearest residential area is approximately 1/2 mile southwest of the site.

C. DEMOGRAPHICS, LAND USE, AND NATURAL RESOURCE USE

According to the 1980 census, approximately 77,000 persons lived within a 4-mile radius of the AWI site. The Norfolk Naval Shipyard, which is located within 1/2 mile of the site, employs approximately 14,000 persons. Approximately 13 people work on the AWI site. The nearest residential area is 1/2 mile from the site.

The site is located on the waterfront in a highly industrialized area with the Norfolk Naval Shipyard and Elm Avenue on the north and the U.S. Naval Reserve Station on the south. Also to the south is a parcel of land owned by the Portsmouth City School Board. West of the site, on land owned and operated by the Norfolk Naval Shipyard and just beyond a 60-foot power line right-of-way, are several closed landfills and chemical waste pits, including an underground waste oil tank. The Navy also operates a disposal landfill area south of the property owned by the Portsmouth City School Board. The Norfolk Veneer Mill is located immediately north, across Elm Avenue from the eastern portion of the AWI facility.

Two separate, water-bearing zones underlie the AWI site but are not used for drinking water (salinity of the water in the area of AWI ranges from 10-22 parts per thousand). The public water supply is provided by the Portsmouth Water Company from four lakes and three deep groundwater wells located about 17 miles southwest of the site. The water company services

Portsmouth, Chesapeake, and Suffolk, Virginia. Chesapeake maintains an emergency water supply 7 miles from the site. The City of Norfolk uses a combination of surface water and groundwater from areas in Suffolk County located more than 3 miles from the site. A few deep (600 feet) industrial wells used for process water supplies are located within a 3-mile radius of the site.

Commercial crabbing operations are active in the area. The Virginia Department of Health, Division of Shellfish Sanitation, prohibited collecting bivalve mollusks from the Elizabeth River in April 1982. That action was based on contamination by heavy metals, including arsenic, cadmium, chromium, copper, lead, and zinc. The ban covers the river and its tributaries from Craney Island at the river mouth, and includes all areas upstream.

Jones Creek is 2,500 feet from the site and Paradise Creek is approximately 3,000 feet from the site. Paradise Creek is a small tributary that flows into the Elizabeth River approximately 2,656 feet south of the treatment building.

D. HEALTH OUTCOME DATA

Following consultations with state and local health officials, VDH determined that site-specific health outcome data were unavailable for AWI.

COMMUNITY HEALTH CONCERNS

Although there has been no significant community involvement with the AWI site to date, there has been some concern voiced by an area environmental group over the possibility of using incineration as a cleanup option at the site. The St. Julians Citizens Committee has been very active, and somewhat successful, in opposition of local incineration projects. In addition, the general water quality of the Southern Branch of the Elizabeth River and the Chesapeake Bay has been a concern. Many environmental groups are active in the area; however, these groups focus on larger, more regional issues such as the Chesapeake Bay quality and the Back Bay Restoration Project.

The initial draft of this document was released for public comment from October 15, 1992, through November 16, 1992. Copies of the initial draft were available to the public at the Portsmouth Public Library, 601 Court Street; the Portsmouth Health Department, 800 Crawford Parkway; and at the Portsmouth City Hall, 801 Crawford Street. Comments from Atlantic Wood Industries and the Virginia Department of Waste Management were the only ones received. Those comments and a response to the comments are in *Appendix C.*

ENVIRONMENTAL CONTAMINATION AND OTHER HAZARDS

The tables in this section list the contaminants of concern. VDH and ATSDR evaluate the contaminants of concern in subsequent sections of the public health assessment and determine whether exposure to them has public health significance. VDH and ATSDR select and discuss the contaminants based upon several factors, including (a) concentration of chemicals on site and off site, (b) comparison of on-site and off-site concentrations with comparison values for carcinogenic and non-carcinogenic endpoints, and (c) community health concerns.

In the data tables under *On-Site Contamination* and *Off-Site Contamination*, the fact that a contaminant is listed does not mean that it will cause adverse health effects from exposure. Instead, the list indicates which contaminants will be evaluated further in the public health assessment. When selected as a contaminant of concern in one medium, the contaminant will be reported in all media sampled.

Comparison values for public health assessments are contaminant concentrations in specific media that are used to select contaminants for further evaluation. These values include **Environmental Media Evaluation Guides (EMEGs)**, **Cancer Risk Evaluation Guides (CREGs)**, and other relevant guidelines. CREGs are estimated contaminant concentrations based on a one excess cancer in a million persons exposed over a lifetime (70 years). **Maximum Contaminant Levels (MCLs)** represent contaminant concentrations that EPA deems protective of public health over a lifetime at an exposure rate of 2 liters of water per day. **Proposed Maximum Contaminant Levels (PMCLs)** are MCLs that are being proposed by EPA. MCLs and PMCLs consider factors such as the technology available to achieve that concentration as well as health issues.

A. ON-SITE CONTAMINATION

The activities at AWI have resulted in on-site contamination of air, the surface and subsurface soils, groundwater, and surface (storm) water. Elevated concentrations of pentachlorophenol (PCP) and creosote constituents (polycyclic aromatic hydrocarbons or PAHs) have been detected in surface and subsurface soils at the site. Arsenic was also detected above background levels in soils in the area. PCP, creosote constituents, benzene, and arsenic were detected in concentrations above comparison values in groundwater. According to the September 1991 RI report, primary sources of the on-site contamination are the filled waste lagoon areas, the treated wood storage area, and the wood treatment and processing area (Figure 2). The RI indicated that contamination of soil, groundwater, and sediment has been observed in all areas of the site. Each table (1 - 4) presents a list of the contaminants of concern detected in a different medium: surface and subsurface soil, groundwater, sediments, and surface water.

Air

EPA conducted air sampling investigations on the AWI site on July 18 and 19, 1985. Fifty-eight air samples from 11 stations were collected during that period. The data showed naphthalene levels at 6 parts per billion (ppb) along the northern property boundary and at 62 ppb along the southern property boundary. (Those concentrations are below 800 micrograms per cubic meter ($\mu g/m^3$), Virginia's criteria for acceptable ambient air concentration.) According to EPA, off-site migration of naphthalene occurred on July 19, 1985. The northeast storm water discharge trench, storage pit, working pressure tanks, and wood storage pile located on site were considered sources for on-site air pollution. Only one sample set was taken; no confirmation samples were collected to determine if the higher naphthalene level at the southern boundary was accurate. No recent air monitoring data are available. No data are available on other contaminants in air.

Air was not investigated as a part of the 1991 RI. The **Toxic Chemical Release Inventory (TRI)** for 1987, 1988, and 1989 lists total air releases by AWI for three chemicals: anthracene 62 lbs/year (1987), 71 lbs/year (1988), and 3 lbs/year (1989); dibenzofuran 165 lbs/year (1987), 143 lbs/year (1988), and 66 lbs/year (1989); and naphthalene 1,385 lbs/year (1987), 438 lbs/year (1988), and 558 lbs/year (1989).

Soil

The site was divided into nine sections in the RI work plan for the purpose of collecting surface and subsurface soil samples during the RI. The samples were not randomly distributed, but were focused on areas where constituent concentrations were suspected to be elevated. Surface and subsurface soil samples taken on-site in 1989 contained arsenic, benzene, PCP, and PAHs, such as benz(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene. Results are presented in Table 1.

PAHs and PCP were detected in surface and subsurface soils in all nine areas of the site. High concentrations of PAHs were reported in subsurface soil in the wood-treatment area [2,400 mg/kg benzo(a)anthracene] and Area 9. The maximum concentration of total PAHs (range of 7,253 micrograms per kilograms [$\mu g/kg$] to 13,254,000 $\mu g/kg$) was observed in the wood-treatment area subsurface soil. The maximum concentrations of PAHs in surface soil were 1,600 mg/kg for both benzo(b)fluoranthene and benzo(k)fluoranthene. The highest levels of PCP were detected in Area 9. The concentrations of PCP were higher in surface soil than in the subsurface soil on-site. The maximum soil concentration for PCP (970 mg/kg) is much higher than the comparison value. Benzene levels were higher in the subsurface soil than in the surface soil.

Concentrations of arsenic were higher in the surface soil compared to the subsurface soil. Arsenic concentrations were highest in the wood-storage area. The maximum concentration

of arsenic (495 mg/kg) exceeded comparison values and background arsenic concentrations for soils (< 73 mg/kg) in the eastern portion of the U.S. (9).

Groundwater

On-site groundwater was sampled from April 1989 through February 1990. There are 42 monitoring wells on-site. Thirty-nine shallow wells were installed to monitor the uppermost **aquifer** (Columbia), and three wells were installed to monitor the underlying, deeper Yorktown-Eastover Aquifer. Some of these wells were installed and sampled prior to conducting the RI. The 1991 RI indicated the absence of an upgradient well for the site. This was because groundwater flow direction varies in different areas of the site. The most recent RI data indicate that groundwater contamination occurs at the site. Results are presented in Table 2.

Data show that PCP and PAH contamination is confined to the Columbia Aquifer. None of those contaminants were detected in any of the wells monitoring the Yorktown-Eastover Aquifer. Elevated levels of PCP and PAHs were found in monitoring wells around the wood treatment area. Benzene was detected in both the Columbia Aquifer (maximum 58 micrograms per liter [μg/L]) and the Yorktown-Eastover Aquifer (maximum 5 μg/L). Arsenic contamination was detected in both the Columbia Aquifer (876 μg/L) and Yorktown-Eastover Aquifer (12.8 μg/L). One of the four wells (107 μg/L) is adjacent to Navy property; the others are all located in the western portion of the site. In general, arsenic concentrations were found to be more elevated in those wells within the western portion of the site and may reflect the presence of CCA-treated wood storage within this area of the property. Arsenic concentrations in the three wells in the western portion of the site were 84.8 μg/L, 119 μg/L, and 876 μg/L.

Surface Water and Sediment

The AWI site lies on the Southern Branch of the Elizabeth River. The Elizabeth River system has three main branches which empty into the southern end of the Chesapeake Bay. This river is known to be a very polluted waterway. Numerous studies have been conducted during the last decade that have shown significant water and sediment pollution, including PAH contamination associated with wood treatment, increasing abnormalities in fish, and **bioaccumulation** in some shellfish. According to a 1983 report, the river receives permitted discharges from at least 48 industrial outfalls and 15 domestic outfalls, in addition to significant uncontrolled runoff from the heavily urbanized and industrialized drainage basin.

The primary surface water bodies on-site are three storm water collection ditches, an inlet receiving storm water discharge from NPDES Outfall-002, and storm water runoff from Outfalls 001 and 003 (Figure 2).

Table 1 (11)

Contaminants of Concern Detected in Soil at the Atlantic Wood Industries Site[1]

	Maximum Concentrations (ppm)[2]		Comparison Values (ppm)	
Chemical	Surface	Subsurface	Comparison Value	Source[3]
Benzene	0.03	0.14	20	CREG
Benz(a)anthracene[5]	890.0	2,400.0	NA	
Benzo(a)pyrene[5]	840.0	5,200.0	0.1	CREG
Benzo(b)fluoranthene[5]	1,600.0	3,600.0	NA	
Benzo(k)fluoranthene[5]	1,600.0	3,600.0	NA	
Chrysene[5]	1,100.0	5,800.0	NA	
Dibenz(a,h)anthracene[5]	130.0	800.0	NA	
Indeno(1,2,3-cd)pyrene[5]	380.0	2,600.0	NA	
Pentachlorophenol	970.0	290.0	6	CREG
Arsenic	495.0	445.0	0.4	CREG

1 Data obtained from 1991 RI report
2 ppm = parts per million
3 Source = Source of Comparison Values; See Glossary
4 NA = not available
5 Polycyclic aromatic hydrocarbons (PAHs); probable human carcinogens

Table 2 (11)

Contaminants of Concern Detected in Groundwater
at the Atlantic Wood Industries Site[1]

	Maximum Concentrations (ppb)[2]	Comparison Values (ppb)	
Chemical	**Concentration**	**Comparison Value**	**Source[3]**
Benzene	58.0	1.0	CREG
Benz(a)anthracene[4]	260.0	0.1	MCL
Benzo(a)pyrene[4]	130.0	0.005	CREG
Benzo(b)fluoranthene[4]	200.0	0.2	PMCL
Benzo(k)fluoranthene[4]	95.0	0.2	PMCL
Chrysene[4]	220.0	0.2	PMCL
Dibenz(a,h)anthracene[4]	ND[5]	0.3	PMCL
Indeno(1,2,3-cd)pyrene[4]	40.0	0.4	PMCL
Pentachlorophenol	1,300.0	0.3	CREG
Arsenic	876.0	0.02	CREG

1 Data obtained from 1991 RI report
2 ppb = parts per billion
3 Source = Source of Comparison Values; See Glossary
4 Polycyclic aromatic hydrocarbons (PAHs); probable human carcinogens
5 ND = not detected

Table 3 (11)

Contaminants of Concern Detected in Sediments at the Atlantic Wood Industries Site[1]

	Maximum Concentrations (ppm)[2]		Comparison Values (ppm)	
Chemical	On-site	Off-site	Comparison Value	Source[3]
Benzene	ND[4]	ND	20	CREG
Benz(a)anthracene[6]	290	1,500	NA	
Benzo(a)pyrene[6]	210	630	0.1	CREG
Benzo(b)fluoranthene[6]	220	1,600	NA	
Benzo(k)fluoranthene[6]	310	1,600	NA	
Chrysene[6]	320	2,000	NA	
Dibenz(a,h)anthracene[6]	35	110	NA	
Indeno(1,2,3-cd)pyrene[6]	84	210	NA	
Pentachlorophenol	12	ND	6	CREG
Arsenic	364	ND	0.4	CREG

1 Data obtained from the 1991 RI report
2 ppm = parts per million
3 Source = Source of Comparison Value; See Glossary
4 ND = not detected
5 NA = not available
6 Polycyclic aromatic hydrocarbons (PAHs); probable human carcinogens

Table 4 (11)

Contaminants of Concern Detected in Surface Water at the Atlantic Wood Industries Site[1]

	Maximum Concentrations (ppb)[2]	Comparison Values (ppb)	
Chemical	Concentration	Comparison Value	Source[3]
Benzene	NT[4]	1.0	CREG
Benz(a)anthracene[5]	30	0.1	MCL
Benzo(a)pyrene[5]	NT	0.005	CREG
Benzo(b)fluoranthene[5]	NT	0.2	PMCL
Benzo(k)fluoranthene[5]	NT	0.2	PMCL
Chrysene[5]	100	0.2	PMCL
Dibenz(a,h)anthracene[5]	NT	0.3	PMCL
Indeno(1,2,3-cd)pyrene[5]	NT	0.4	PMCL
Pentachlorophenol	410	0.3	CREG
Arsenic	90	0.02	CREG

1 Data obtained from 1991 RI report; samples taken from outfalls between March 1986 and October 1989
2 ppb = parts per billion
3 Source = Source of Comparison Value; See Glossary
4 NT = samples not tested for the chemical
5 Polycyclic aromatic hydrocarbons (PAHs); probable human carcinogens

As a part of the NPDES permit, surface water samples from outfalls were collected between March 1986 and October 1989. Results are presented in Table 4. No on-site surface water samples were collected as a part of the RI. The on-site, NPDES surface water sampling data indicated the presence of benz(a)anthracene, chrysene, PCP, and arsenic.

As a part of the RI, on-site and off-site sediment sampling was conducted in August and September 1989. Sediment samples taken at on-site locations showed higher levels of PCP and arsenic contamination than off-site locations. Benzene was not detected in any of the sediment samples. All other contaminants of concern (Table 3) were detected in sediment samples taken at on-site or off-site locations.

Non-Soil Materials

As stated in the RI, the non-soil materials present on the site were dense non-aqueous phase liquid (DNAPL) present in groundwater monitoring wells, acetylene sludge (predominantly calcium hydroxide), Black Beauty sand blasting grit, and red ballast stone. Except for the DNAPL, all other non-soil materials present on the site have been considered unrelated to site activities.

Acetylene sludge and Black Beauty sand blasting grit have been reported to be associated with activities at the adjacent Norfolk Naval Shipyard (8). The DNAPL was composed of wood preserving constituents. A sample taken from groundwater monitoring well-117 in July 1989 contained indeno(1,2,3-cd)pyrene at 3,600 mg/L. All other contaminants of concern, except benzene and PCP, were present in the DNAPL, but their concentrations were estimated.

B. OFF-SITE CONTAMINATION

Surface Water and Sediment

The off-site sediment sampling, as a part of the RI, included the collection of sediment samples in the Elizabeth River. Sediment samples were taken in 1989 from locations upriver, adjacent to, and downriver from the AWI site (Table 3). The concentrations of all PAHs reported at upriver sampling locations were found to be higher than those at the downriver sampling locations. This may be influenced by the tidal action of the river. Also, four additional wood treatment facilities are located upstream of the AWI site: Eppinger and Russel Company (1905 - 1980), Republic Creosoting Company (1933 - 1972), Wyckoff Company (closed, no dates available), and Bernuth Lembcke Company (active). During the above sampling episode, sediment samples were not tested for benzene or arsenic.

Biota

In 1984, the Virginia Institute of Marine Science sampled oysters from the Elizabeth River.

The major contaminants detected were PAHs. Oysters sampled close to the AWI site showed high concentrations of total PAHs (60.2 mg/kg dry weight maximum). The harvesting of bivalve mollusks for human consumption has been banned in the Elizabeth River by the VDH Division of Shellfish Sanitation since 1982.

To measure bioavailability of PAHs in the Elizabeth River, bioaccumulation of total PAH was measured in oysters transplanted to five stations along the Elizabeth River, including one station near AWI (station 17), one station 2 km upstream (station 19), and one station 5 km downstream (station 12) (6). The highest concentrations of total PAH were found in oysters near AWI (Table 5). Huggett and coworkers found that the highest levels of PAH in sediments were located 2 km upstream from AWI suggesting that current releases may be the source of the highest residue levels in oysters. In the same study, fish collected from the Elizabeth River show reduced abundance (reduced total biomass, total number of individuals, and abundance of selected species) and increased prevalence of several gross abnormalities that correlate with both PAH contamination in the sediments and proximity to the wood treatment facilities. Abnormalities observed include fin erosion in hogchoker and toadfish, and cataracts in spot, gray trout and croakers (6).

Table 5 (6)

Total PAH Concentrations (mg/kg dry weight)[1]
Measured in Oysters Transplanted to the South Branch of the Elizabeth River
(Huggett et al., 1987)

Station	Exposure in Weeks				
	1	2	4	6	9
7	1.9	6.1	-	6.8	13.9
12	5.5	7.4	16.2	8.8	20.5
17	27.0	31.0	57.3	31.8	60.2
19	19.3	25.7	25.8	22.5	36.3
24	3.2	7.8	11.7	7.0	16.5

1 mg/kg dry weight = milligrams per kilogram in dry weight samples = parts per million (ppm) in dry weight samples

C. QUALITY ASSURANCE AND QUALITY CONTROL (QA/QC)

Contaminant concentrations considered for this public health assessment were derived from information supplied by EPA. A majority of the samples were analyzed as per the EPA contract laboratory program, which uses mandated **Quality Assurance/Quality Control (QA/QC)** programs for review and reporting of data prior to publication. The quality of the data available for on-site contamination of soil and groundwater media is considered adequate for this public health assessment. VDH and ATSDR further assume QA/QC measures were taken with regard to collection of samples, chain-of-custody, and laboratory procedures. The selection of analytical procedures required for the analyses of the wide range of contaminants present at the AWI site is a practical problem. Since the conclusions made in this assessment are based on the information provided, their accuracy is directly related to the reliability of the referenced information.

D. PHYSICAL AND OTHER HAZARDS

Because AWI is an active wood storage and distribution facility, there are a number of associated physical hazards. These include large piles of wood products in various stages of treatment, open ditches and open pipes, and several sheds on the back of the site that are in disrepair. There are small piles of building debris near the ditches. The site is not fenced, although a guard is on duty after working hours and on weekends.

PATHWAYS ANALYSES

This section addresses the pathways by which human populations in the area surrounding the site could be exposed to contaminants at, or migrating from, the site. If it is determined that exposure to chemicals not related to the site is also a concern, these pathways will be evaluated as well. When a chemical is released into the environment, the release does not always lead to an exposure. Exposure only occurs when a chemical comes into contact with and enters the body. In order for a chemical to pose a health risk, a complete exposure pathway must exist. A complete exposure pathway consists of five elements: 1) a source and a mechanism of chemical release to the environment; 2) transport through an environmental medium (*e.g.*, air, soil, water); 3) a point of human contact with the contaminated medium (known as the exposure point); 4) an exposure route (*e.g.*, inhalation, dermal absorption, ingestion) at the exposure point; and 5) a human population at the exposure point.

Exposure pathways are classified as either completed, potential, or eliminated. Completed exposure pathways exist when all five elements are present. Potential exposure pathways are either: 1) not currently complete, but could become complete in the future, or 2) are possible, but information needed to confirm the pathway is missing. Pathways are eliminated

from further assessment if they are determined to be unlikely to occur because a pathway element is missing and will never be present.

A time frame given for each pathway indicates whether the exposure occurred in the past, is occurring, or will occur in the future. For example, a completed pathway with only a past time frame indicates that exposure did occur in the past, but does not currently exist and will not exist in the future. Human exposure pathways are evaluated for each environmental medium possibly impacted by site-related chemicals. The toxicological implications of the various exposure pathways identified as being of concern will be evaluated in the *Public Health Implications* section.

Completed Pathways

Soils

Past processes and waste handling practices at the site resulted in surface soil contamination with benzene, PAHs, PCP, and arsenic. On-site workers, visitors, and trespassers are exposed to contaminants in surface soils through dermal contact, incidental ingestion of particulates, and inhalation of airborne particulates and volatile compounds. Surface contaminants can be transported off the site to nearby areas where workers at facilities close to the site can be exposed, primarily, through inhalation of airborne particulates and volatiles and through incidental ingestion of particulates in the air or that are deposited on the ground. The levels of contaminants in soils available to people off site are much less than those on site because of dispersion by the wind and vegetation that captures the soil particles.

Currently, the facility employs 13 people, four of whom are truck drivers that go on and off the site. The area around the site is highly industrialized with no private residences closer than 1/2 mile. No information was gathered on the number of nearby workers who are outside most of the work day and would more likely be exposed to migrating contaminants than residents who live 1/2 mile or more from the site.

Potential Exposure Pathways

Soils

Past processes and waste disposal practices at the site have resulted in contamination of subsurface soils. Remedial workers or workers who dig through the surface soil to subsurface soils may come into contact with contaminants if they are not adequately protected during those types of operations. Any remediation plans require descriptions of measures to be taken to protect workers; therefore, contact with subsurface soil contaminants is not likely to result in a completed exposure pathway. However, workers who have worked at the site in the past may have been exposed to subsurface soil contaminants through dermal contact,

incidental ingestion, and inhalation of airborne particulates and volatile compounds.

Groundwater

Past processes and waste disposal practices at the site have resulted in contamination of groundwater on the site and migration of contaminants in groundwater off the site. On-site and downgradient groundwater is not used for drinking water in the vicinity of the site. However, some deep, industrial wells are used for processing water within 3 miles of the site. No water samples from those wells have been analyzed for possible site-related contaminants, and no information is available on whether the water is used only for non-contact processes or if workers actually come into contact with the water. Monitoring wells in the deep aquifer, which is tapped for those wells, have been tested and found to contain up to 5 µg/L benzene and up to 12.8 µg/L arsenic. Both values are above comparison values for drinking water. Workers who use the industrial well water may come into contact with contaminants through dermal contact, ingestion (if the well water is used for drinking water), and inhalation of volatile compounds. The total number of people who come into contact with industrial well water is not known.

The availability of public water supplies in the area makes it unlikely that residential wells may be drilled for future use in the area. Industrial wells are more likely to be drilled for future use as process water supplies. If wells are drilled into contaminated groundwater, workers could be exposed to contaminants as previously described.

Surface Water and Sediment

The Elizabeth River, and its tributaries in the areas at and near the site, have become contaminated by the site as a result of surface runoff and groundwater discharge. Contaminants either settle in the sediment or remain suspended in the water column. The site is only one contributor to the contamination that is in the river. The area is highly industrialized, and most of those industries have contributed to the contamination, either now or in the past. The surface waters at and near the site are not used recreationally. However, some occasional use of the water by fishermen may occur. Although contact with the water and sediments is likely to be minimal, people who are unaware of the shellfish collection ban or who do fish in contaminated areas may contact contaminated water and sediments. Exposures would primarily occur through dermal contact with some inhalation of volatile compounds. Incidental ingestion of contaminants in the surface water and sediments would be unlikely or very minimal.

Biota

Shellfish and fin fish in the industrialized area of the Elizabeth River contain contaminants associated with wood treating processes such as those that once were conducted at the site

and other nearby facilities. Shellfish have been collected and analyzed for PAHs. Some types of fin fish collected in the industrialized area of the river where PAHs were high in sediments had physical abnormalities that indicate the fish are affected by the pollution. If people consume contaminated shellfish and fin fish, those people may also consume the contaminants in the animals. The ban on shellfish collection in the area should reduce the number of people who may be exposed to contaminants through consumption of shellfish. However, some people may be unaware of the ban or may collect and consume fin fish. No estimate can be made of people who may fish the area.

Air

Airborne particulates and volatile compounds in soils and volatile compounds in groundwater that may result in exposures were discussed in previous subsections of the *Pathways Analysis* section. Sources of potential contaminant release to the air at the site have been identified, but limited sampling has not identified any contaminants present at levels of concern. The limited sampling did not test for all contaminants released as reported in TRI data.

PUBLIC HEALTH IMPLICATIONS

A. TOXICOLOGICAL EVALUATION

In this section, VDH and ATSDR discuss health effects that could result from exposures to site contaminants. People can only be exposed to a site contaminant if they come in contact with it. People can be exposed by breathing the contaminants, eating or drinking the contaminants, or by contacting (skin) contaminants present in air, water, soil, or biota (fish and shellfish, in this instance).

In order to understand health effects that may be caused by a specific contaminant, a review of factors related to how the human body processes the chemical after exposure is helpful. Those factors include the exposure concentration (level), the duration of exposure (how long), the route of exposure (breathing, eating, drinking, or skin contact), the chemical availability, and the multiplicity of exposure (combination of contaminants). Once exposure occurs, individual characteristics such as age, sex, nutritional status, health status, lifestyle, and genetics influence how the chemical is absorbed, distributed, metabolized (processed), and excreted (eliminated). Together, those factors determine health effects that exposed people may have.

To determine the possible health effects of specific chemicals, VDH and ATSDR search scientific literature. That information is compiled and published in a series of chemical-specific ATSDR documents called *Toxicological Profiles*. *Toxicological Profiles* are

references that describe adverse health effects that could be associated with exposure to a specific chemical in the environment. In addition, they include health guidelines such as ATSDR's **minimal risk levels (MRLs)** and EPA's **reference doses (RfDs)**, **reference concentrations (RfCs)**, and **cancer slope factors (CSFs)**. VDH and ATSDR compare contaminant concentrations in different environmental media (soil, air, water, and food) that populations may be exposed to daily to a variety of those health guidelines. That comparison will help assess whether exposure to given levels of contaminants is likely to cause an increased risk of developing cancer and/or non-cancerous adverse health effects.

ATSDR's estimation of human exposure to contaminated media uses media-specific rates for adults and children. The rates are calculated by multiplying contaminant concentration by the ingestion rate for an adult or a child, then dividing that number by the appropriate standard body weight (70 kg for adults, 16 kg for a child). The water ingestion rates used for adults and children are 2.0 L/day for adults and 1.0 L/day for children. ATSDR uses an inhalation rate of 23 cubic meters per day (m^3/day) for adults and 15 m^3/day for children. Some exposures occur on an intermittent or irregular basis; in those cases, an exposure factor (EF) is calculated that averages the dose over the exposure period.

The maximum contaminant concentration detected in a particular medium is used to determine estimated exposure. Using the maximum concentration results in an evaluation that, although may be an overestimate, is protective of public health under worse-case conditions.

The following toxicological summaries provide a broad, qualitative assessment of public health risks associated with exposures to the contaminants identified in the one completed exposure pathway, exposures to contaminants in surface soil.

Past and present on-site workers are or have been exposed to contaminants in surface soils. Off-site workers may have been exposed to lower levels of the surface soil contaminants as wind has blown particulates off site. Surface soils contain benzene, PAHs, PCP, and arsenic. Benzene does not exceed the comparison value for soil; exposure to benzene in soil is not expected to result in any cancerous or non-cancerous adverse health effects and will not be discussed further. Should exposure to benzene and other contaminants in groundwater be confirmed, ATSDR will reevaluate those exposures. PAHs, PCP, and arsenic are present in surface soils above comparison values, and exposures to those will be evaluated in the following discussions.

Arsenic

Arsenic is a naturally occurring element and is also used in processes used to treat lumber. Arsenic compounds were not used for treating lumber at the site, but arsenic-compound treated lumber is stored at the site. On-site workers have been and are exposed to arsenic in surface soil through dermal contact, incidental ingestion, and inhalation of airborne particulates. Arsenic has been detected in surface soils at a maximum of 495 ppm. In

determining whether or not adverse health effects may be expected from incidental ingestion of arsenic, VDH and ATSDR assumes that workers are exposed 5 days a week, 50 weeks per year, for 30 years.

Arsenic may enter the body by ingestion of contaminated food or water. Most ingested arsenic is quickly absorbed through the stomach and intestine and enters the bloodstream; however, this varies somewhat for different chemical forms of arsenic. The amount of arsenic intake required to cause harmful effects in humans depends on the chemical and physical form of the arsenic. In general, inorganic forms of arsenic are more toxic than organic forms, and forms that dissolve easily in water (soluble forms of arsenic) tend to be more toxic than those that dissolve poorly in water. Also, toxicity depends somewhat on the electric charge (the oxidation state or valence) of the arsenic (1). For this site, the form in which arsenic exists is inorganic (11). Most arsenic that is absorbed into the body is converted by the liver to a less toxic form that is efficiently excreted in the urine. Consequently, arsenic does not have a strong tendency to accumulate in the body except at continued high exposure levels (1).

Studies in humans indicate that there is considerable variation in effects from arsenic among individuals, and it is difficult to identify, with certainty, the exposure ranges of concern. For example, some humans can ingest over 150 micrograms of arsenic per kilogram body weight per day (μg/kg/day) of soluble forms of inorganic arsenic without apparent ill effects. However, more sensitive individuals in exposed populations often begin to display one or more of the characteristic signs of arsenic toxicity (stomach and digestive irritation, low red blood cell count, disturbances of the nervous system, skin lesions, blood vessel lesions, and liver or kidney injury) at oral doses of 20 μg/kg/day. Effects are usually mild at this exposure level, becoming more severe as doses increase. Doses of 600 to 700 μg/kg/day (around 50,000 μg/day in an adult) have caused death in some cases (1). When exposure is from ingestion of contaminated water, concentrations of 100 to 200 micrograms per liter (μg/L) do not seem to produce significant non-cancer health risks, while typical signs of arsenic toxicity have been reported in several populations with drinking water containing 400 μg/L or more of arsenic (1). The levels of arsenic that most people ingest in food or water (around 50 μg/day) usually are not considered to be a health concern. Incidental ingestion or inhalation of the maximum amount of arsenic detected on site under the conditions described are not likely to result in non-cancerous adverse health effects (1).

Small amounts of arsenic may enter the body through the skin. Direct skin contact with arsenic compounds can cause mild-to-severe skin irritation, but no reliable dose estimates are available on the exposure levels at which these effects appear (1). Because the levels of arsenic that can cause skin irritations are not known, constant contact with the maximum detected level of arsenic at the site may result in some skin irritation in sensitive individuals. However, workers are not likely to be in constant contact with maximum levels.

EPA has determined arsenic is a **Class A human carcinogen** because enough human data are available to indicate oral and inhalation exposures do cause cancer (1). Dermal exposure to

arsenic has not been shown to cause cancer. Also, the National Toxicology Program has classified arsenic as a known carcinogen through the oral and inhalation routes. Workers exposed to the highest amount of arsenic detected on site through incidental ingestion and inhalation are at a moderate increased risk of developing cancer under the assumed conditions and if protective equipment is not used. The risk may be somewhat greater for workers who have additional sources of arsenic exposure such as through smoking (1).

Seafood is a natural dietary source of arsenic for people. However, arsenic levels have not been tested in fish and shellfish near the site to determine if levels are higher than normal levels. People who ignore the shellfish ban and eat fish and shellfish caught in the river near the industrialized area may be exposed to higher levels of arsenic from the food than under normal conditions. More information would be needed to adequately assess whether or not those exposures could cause adverse health effects.

Pentachlorophenol (PCP)

Surface soil at the site is contaminated with PCP because of past processes and waste handling at the site. On-site workers are exposed to PCP in surface soils through dermal contact, incidental ingestion, and inhalation of airborne particles. The maximum amount of PCP detected in surface soil on site is 970 ppm (11). Nearby off-site workers may be exposed to much lower amounts because of migration of contaminated dusts to nearby areas.

The major target organs for both humans and animals are the liver and the kidney. The central nervous system (CNS) and the immune system also appear to be affected by PCP exposure. Absorption is predominantly through the skin and/or respiratory system, although ingestion is also possible. People are generally exposed to technical grade PCP, which usually contains such toxic impurities as polychlorinated dibenzo-p-dioxins and dibenzofurans. Animal studies with both technical and purified PCP have demonstrated that many, but not all, of the toxic effects attributed to PCP are actually due to the impurities (4). Under the assumptions previously made for arsenic exposure and on the assumption that exposure is to PCP and not impurities found in PCP, on-site workers are not expected to receive a daily dose of PCP that would likely result in non-cancerous adverse health effects (4).

EPA classifies PCP as a **Class B2 (probable) carcinogen** (4). An increased incidence of liver and spleen cancer has been shown in laboratory animals exposed to large concentrations of PCP (4). Workers who are exposed daily to PCP at the maximum levels detected on the site may have a slight increased risk of developing cancer under the assumed conditions and if protective equipment is not used.

Polycyclic Aromatic Hydrocarbons (PAHs)

Surface soils are contaminated with PAHs at the site because of past processes and past waste

disposal activities. Also, PAHs are a group of chemicals that are formed by the incomplete burning of coal, oil, gas, garbage, tobacco, or almost any other organic substance. Natural sources include forest fires and volcanoes. Consequently, PAHs occur naturally throughout the environment in the soil and other environmental media (3). On-site workers are exposed to PAHs in surface soils through dermal contact, incidental ingestion, and inhalation of airborne particles. PAHs found at the site include benz(a)anthracene (890 mg/kg), benzo(a)pyrene (840 mg/kg), benzo(b)fluoranthene (1,600 mg/kg), benzo(k)fluoranthene (1,600 mg/kg), chrysene (1,100 mg/kg), dibenz(a,h)anthracene (130 mg/kg), and indeno(1,2,3-cd)pyrene (380 mg/kg). Nearby off-site workers may be exposed to much lower site-related amounts because of migration of contaminated dusts to nearby areas.

Reproductive effects have occurred in animals that were fed certain PAHs. Long-term ingestion of PAHs in food has resulted in adverse effects on the liver and blood in mice. Those effects may also occur in humans, but there is no experimental evidence to substantiate that (3). No information is available from human studies to determine what non-cancerous adverse health effects, if any, may result from exposure to specific levels of the individual PAHs, although inhalation and skin exposures to mixtures containing PAHs have been associated with cancer in humans. The levels and lengths of exposure to the individual PAHs that affect human health cannot be determined from the human studies available (3). Therefore, evaluation of non-cancer adverse health effects that may result from exposure cannot be done.

EPA classifies a small group of PAHs as B2 (probable) carcinogens (3). Several PAHs, those listed as present in surface soils at the site, have caused cancer in laboratory animals through ingestion, skin contact, and inhalation. Reports from human studies show that individuals exposed to mixtures of other compounds and PAHs by breathing or through skin contact for a long period of time can also develop cancer (3). Exposure to the PAHs found in surface soils at the site may result in a moderate increased risk of developing cancer under the assumed conditions and if protective equipment is not used. People who are exposed to PAHs at the site and are also exposed through other sources such as smoking may be at higher risk of developing cancer than those who do not smoke or come into contact with high levels of PAHs through other sources (3).

B. HEALTH OUTCOME DATA EVALUATION

No adverse health outcomes have been reported as a result of exposure to site contaminants. Therefore, no health outcome databases have been evaluated.

C. Community Concerns Evaluation

Community members are concerned about the possibility of use of incineration as a remedial alternative.

No Record of Decision has been signed; therefore, the remedial alternative(s) have not been selected. If incineration is a selected remedy, the community will have an opportunity to present its concerns to EPA and to ATSDR before the decision becomes final. At that time, ATSDR can review the proposal to determine if the selected remedy, whether it is incineration or another remedy, is protective of public health. EPA considers community concerns when selecting the final remedy.

Community members are concerned about the water quality of the Southern Branch of the Elizabeth River and the Chesapeake Bay.

The highly industrialized areas have caused depletion of water quality of the those bodies of water because of discharges of treated and untreated wastes through the years. Today, science and industry know more about what does impact water quality, and efforts are being made to improve the water quality in Virginia and all over the country. Cleanup takes a long time, and sometimes progress is slow. Problems are being identified and solutions are being implemented. In the mean time, people should heed warnings about consuming shellfish and fish as they are issued, people should not use undesignated areas for recreation, and people should report to state authorities or EPA any activities that appear to be contributing to the pollution.

Other comments were received during the public comment period for this public health assessment. Those comments, and a response to those comments, appear in *Appendix C.*

CONCLUSIONS

From the information reviewed, VDH concludes the Atlantic Wood Industries site to be an indeterminate public health hazard. The limited data available indicate that people working at the site may be or have been exposed to levels of contamination that could cause adverse health effects if exposure occurs over a long period of time to maximum levels of contaminants detected in surface soil. However, those conclusions are based on worse-case conditions, and no information is available to indicate that anyone has been exposed to contaminants under those conditions. Also, information is not available for all environmental media to which humans may be exposed.

Sources of releases of contaminants in the air have been identified. One air monitoring sampling round did not identify the presence of any contaminants of concern, although one sample showed slightly elevated naphthalene levels. No information is available on particulates that may be migrating to nearby facilities.

Contaminants identified in shellfish, as well as the poor water quality of the area, has resulted in a ban on shellfish collection. No information is available on fin fish collection, consumption, or quality. Physical evidence indicates fin fish may also contain contaminants.

Groundwater in the area is used as industrial process water. No information is available on the quality of that water and whether or not workers come into contact with the water.

No adverse health outcomes have been reported by the community, and no data are available to indicate that the site has had an adverse impact on human health.

Community health concerns do not address the AWI site specifically, but citizens are generally opposed to the use of incineration of wastes as a clean up method. The community is interested in improving the water quality of the Elizabeth River and the Chesapeake Bay.

RECOMMENDATIONS

VDH and ATSDR recommend the following actions:

1. Determine the extent of surface soil migration from the site, especially to adjacent areas where people are working.

2. Confirm if contaminants are migrating from the site through the air.

3. Determine if the ban on collecting shellfish is effective. Determine if the ban should include fin fish.

4. Further characterize surface water and sediment quality as it relates to site contaminants.

5. Determine if workers come into contact with groundwater at facilities in the area where well water is used for process water. If workers do come into contact with the water, determine if the facilities monitor the quality of the water.

6. Continue the use of proper protective equipment for on-site workers during operations and for remediation.

7. Continue to guard against trespassers.

The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended, requires ATSDR to perform public health actions needed at hazardous waste sites. To determine if public health actions are needed, ATSDR's Health Activities Recommendation Panel (HARP) evaluated the data and information developed in the Atlantic Wood Industries Public Health Assessment. No follow-up health actions are indicated at this time, because, although there is a possibility, no evidence indicates that people have been exposed to contaminants at levels that will cause adverse health effects. If information becomes available indicating exposure at levels of concern are occurring or have occurred, ATSDR will evaluate that information to determine what actions, if any, are necessary.

PUBLIC HEALTH ACTIONS

After review of the HARP determinations, VDH has developed the following public health actions to ensure that public health is protected:

As new information becomes available, ATSDR will evaluate that information to determine what actions, if any, are necessary.

ATSDR will coordinate with EPA and state agencies to discuss the feasibility of implementing recommendations made in this public health assessment.

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CERTIFICATION

The Atlantic Wood Industries, Inc., Site Public Health Assessment has been prepared by the Virginia Department of Health under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with approved methodology and procedures existing at the time the public health assessment was initiated.

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The Division of Health Assessment and Consultation, ATSDR, has reviewed this public health assessment and concurs with its findings.

Director, DHAC, ATSDR

REFERENCES

1. Agency for Toxic Substances and Disease Registry. *Toxicological Profile for Arsenic.* March 1989. 125 pp.

2. Agency for Toxic Substances and Disease Registry. *Toxicological Profile for Benzene.* May 1989. 173 pp.

3. Agency for Toxic Substances and Disease Registry. *Toxicological Profile for Polycyclic Aromatic Hydrocarbons.* October 1990. 231 pp.

4. Agency for Toxic Substances and Disease Registry. *Toxicological Profile for Pentachlorophenol.* December 1989. 135 pp.

5. Callahan, M.A., Slimak, M.W., Gable, N.W., et al. *Water-related Environmental Fate of 129 Priority Pollutants.* 1979. EPA 440/4-70-029. 1160 pp.

6. Huggett, R.J., Bender, M.E., and Unger, M.A. "Polynuclear Aromatic Hydrocarbons in the Elizabeth River, Virginia." In: Dickson, K.L., Maki, A.W., and Brungs, W.A. (eds.). *Fate and Effects of Sediment-Bound Chemicals in Aquatic Systems.* Soc. Environ. Toxicol. Chem., Spe. Pub. Ser. pp. 327-341.

7. National Oceanic and Atmospheric Administration. *Preliminary Natural Reserve Survey.* January 1990. VAD990710410.

8. Norfolk Naval Shipyard. *Remedial Investigation Interim Report.* August 1989. Project No. 303047.

9. Shacklette, H.T. and Boerngen, J.G. *Elemental Concentrations in Soils and Other Surficial Materials of the Conterminous United States.* U.S. Geological Survey, Professional Paper 1270. U.S. Department of the Interior. 1984.

10. Goodman, L.S. and Gilman, A.G. *The Pharmacological Basis of Therapeutics.* Seventh Edition. 1985. McMillan, New York.

11. Keystone Environmental Resources. *Atlantic Wood Industries, Inc., Remedial Investigation.* Sept. 1991.

APPENDIX A

GLOSSARY

GLOSSARY

Aquifer: A permeable body of rock capable of yielding quantities of ground water to wells and springs.

Bioaccumulation: The accumulation of a chemical by organisms of a single species from water directly or through consumption of food containing the chemical.

Biomagnification: Efficient transfer of chemical from food to consumer, through two or more trophic levels, results in a systematic increase in tissue residue concentrations from one trophic level to another.

Biotransformation: the transformation of chemical compounds within a living system.

Cancer Risk Evaluation Guide (CREG): Guides used to select contaminants of concern that are calculated from EPA's cancer slope factors for 1×10^{-6} excess cancer risk.

Cancer Slope Factors (CSF): factors (for inhalation and ingestion) that define the relationship between exposure doses and the likelihood of an increased risk of developing cancer compared with non-exposed controls. Usually derived from animal or occupational studies, cancer slope factors are used to calculate the exposure dose likely to result in one excess cancer case per one million persons exposed over a lifetime (70 years).

Class A human carcinogen: EPA classification based on sufficient evidence of carcinogenicity in humans and in animals.

Class B2 carcinogen: EPA classification based on sufficient evidence in animals and inadequate data in humans.

Environmental Media Evaluation Guides (EMEGs): Media specific comparison values, calculated from ATSDR's Minimal Risk Levels, used to select chemical contaminants of potential health concern at hazardous waste sites. The values consider non-carcinogenic health effects only.

Hydrolysis: Decomposition or alteration of chemical substances by water.

Maximum Contaminant Level (MCL): Enforceable standards for public drinking water supplies under the Safe Drinking Water Act. Also referred to as drinking water standards.

Minimal Risk Level (MRL): An estimate of daily human exposure to a chemical likely to be without appreciable risk of harmful effects (non cancerous) over a specified duration of exposure. MRLs are based on human and animal studies and are reported for acute (less than or equal to 14 days), intermediate (15-364 days), and chronic (greater than or equal to 365 days) exposures. If an individual's daily exposure is below the MRL, adverse health

effects are not expected.

National Priorities List (NPL): EPA's list of top-priority hazardous waste sites that are eligible to receive Federal funds for investigation and cleanup under the Superfund program.

National Pollutant Discharge Elimination System (NPDES): A nationwide program requiring industrial, municipal, and other point source dischargers to obtain permits setting forth specific limitations on the discharge of pollutants into navigable U.S. waters.

Photolysis: Chemical changes produced by use of radiant energy.

Quality Assurance/Quality Control (QA/QC): A system of procedures, checks, audits, and corrective actions used to ensure that field work and laboratory analysis during the investigation and cleanup of Superfund sites meet established standards.

Record of Decision (ROD): A public document that explains which cleanup alternative(s) will be used at National Priorities List Superfund sites. The record of decision is based on information and technical analysis generated during the Remedial Investigation/Feasibility Study and involves the consideration of public comments and community concerns.

Reference Concentration (RfC): EPA's estimate for the human population, including sensitive subpopulations, of the daily exposure by the inhalation route likely to be without appreciable risk of harmful noncancerous effects during a lifetime.

Reference Dose (RfD): An estimate of the daily exposure of the human population to a potential hazard that is likely to be without risk of deleterious effects during a lifetime. RfDs are not applicable to nonthreshold effects such as cancer.

Reference Dose Medium Evaluation Guide (RMEG): Media specific comparison values, calculated from EPA's RfD, used to select chemical contaminants of potential health concern at hazardous waste sites. The values consider non-carcinogenic health effects only.

Remedial Investigation/Feasibility Study (RI/FS): Investigative and analytical studies usually performed at the same time in an interactive, iterative process, and together referred to as the "RI/FS." They are intended to gather the data necessary to determine the type and extent of contamination at a Superfund site; establish criteria for cleaning up the site; identify and screen cleanup alternatives for remedial action; and analyze, in detail, the technology and costs of the remedial alternatives.

Resource Conservation and Recovery Act (RCRA): EPA's comprehensive regulations for the management of hazardous waste.

Toxic Chemical Release Inventory (TRI): EPA database containing information on the

annual industry-estimated releases of toxic chemicals to the environment.

APPENDIX B

FIGURES

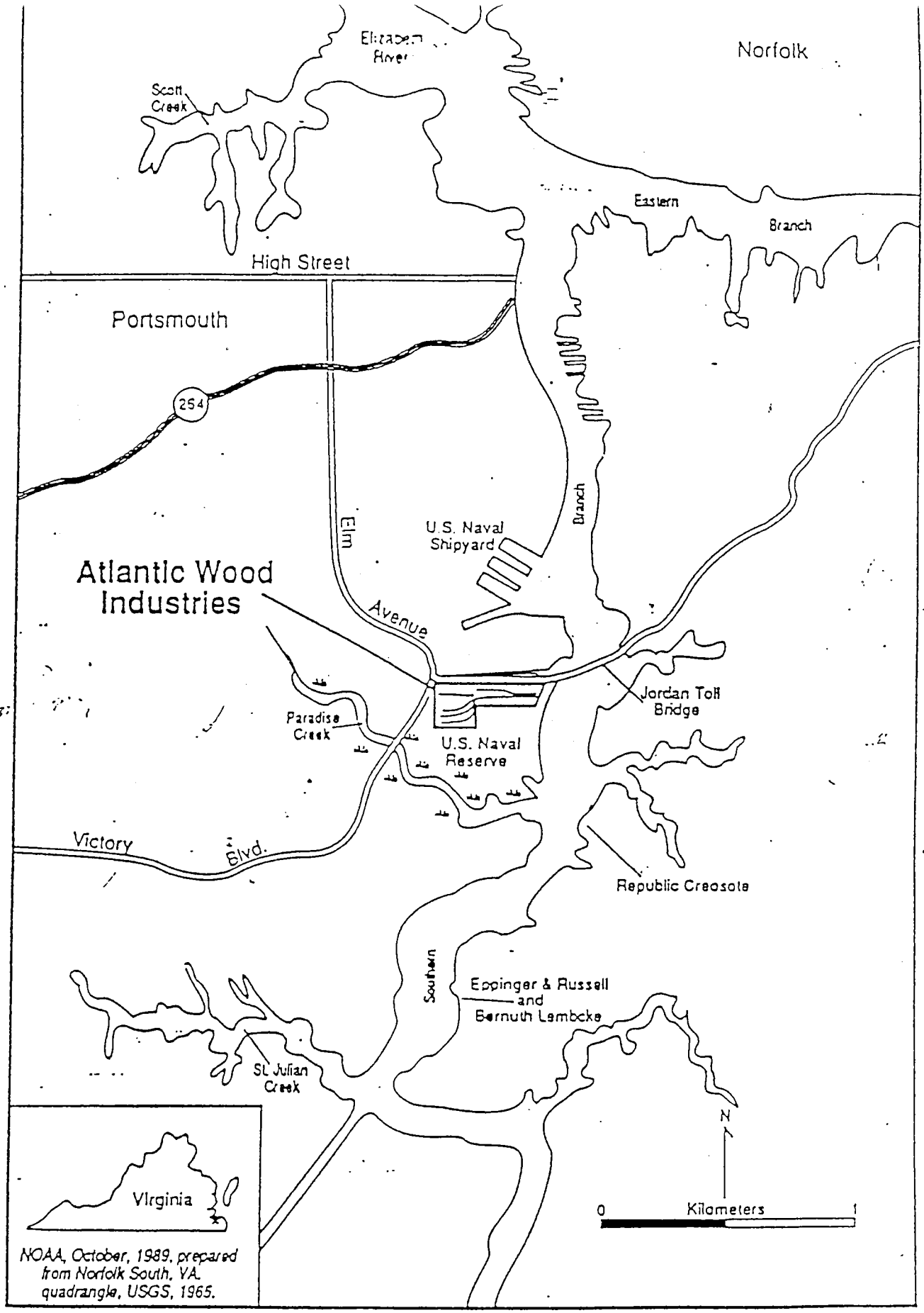

Figure 1. Atlantic Wood Industries Site in Portsmouth, Virginia,.

VDH

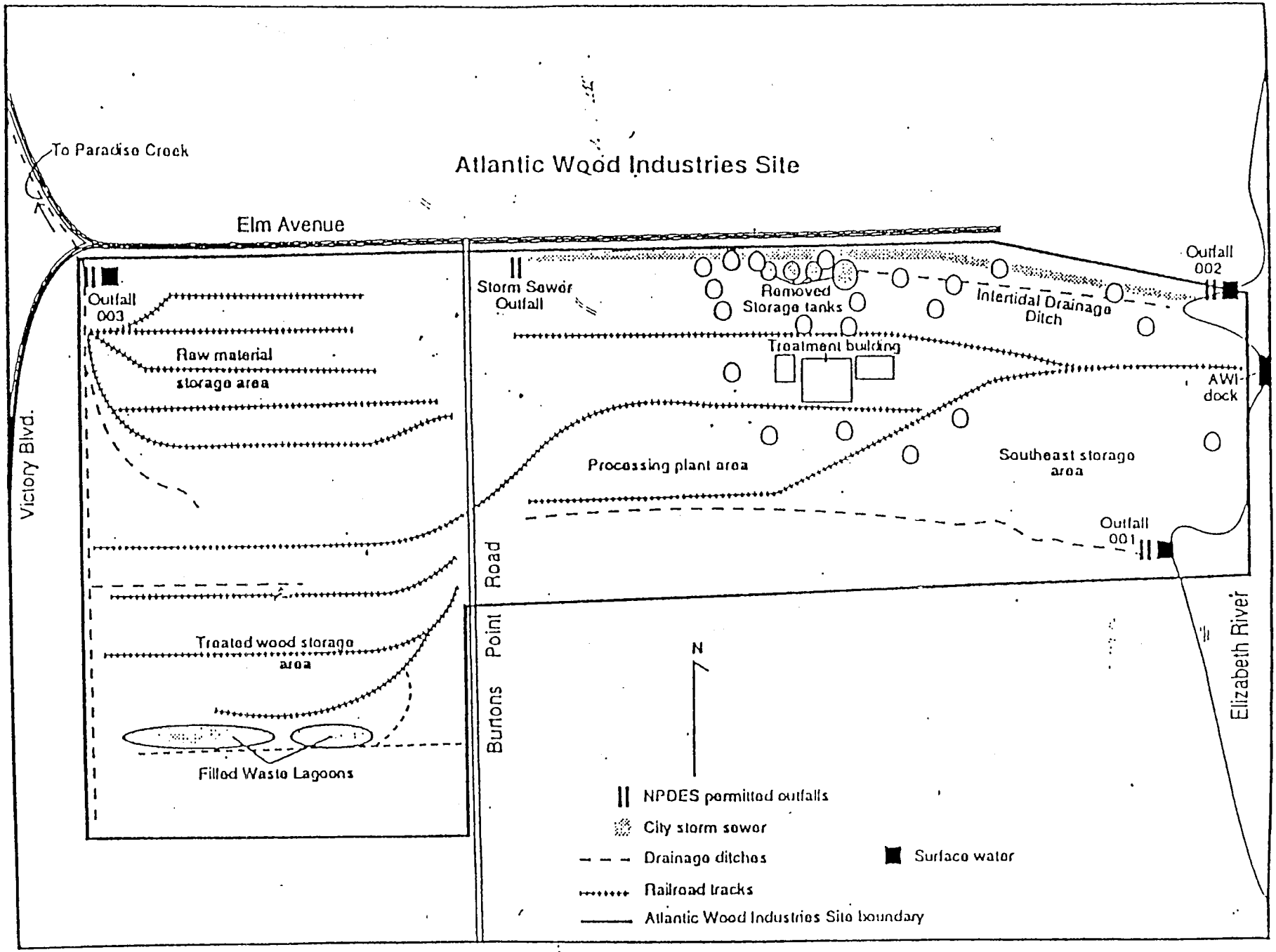

Figure 2. Site features and surface water sampling locations at Atlantic Wood Industries

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APPENDIX C

PUBLIC COMMENTS

PUBLIC COMMENT PERIOD

The initial draft of this document was released for public comment from October 15, 1992, through November 16, 1992. Copies of the initial draft were available to the public at the Portsmouth Public Library, 601 Court Street; the Portsmouth Health Department, 800 Crawford Parkway; and at the Portsmouth City Hall, 801 Crawford Street. No comments were received from any member of the public except the potentially responsible party, Atlantic Wood Industries, Inc. One comment was received from the Virginia Department of Waste Management. Those comments that reflect data we did not have access to during initial preparation were used to revise this document.

All comments received, and the response to those comments, follow.

COMMENT: Page 1 indicates that the ROD was expected to be signed in the Spring of 1992. It should be noted that the ROD has not yet been signed.

RESPONSE: The change has been made to reflect that fact.

COMMENT: On page 7 the first paragraph [note that page numbers have likely changed because of revisions made in this document] is a little confusing. It seems to be saying that the air samples were questionable because standard quality control procedures were not followed. If this is the meaning, I don't think it would be clear to a member of the general public reviewing this document.

RESPONSE: Changes have been made to reflect that only one sampling was done and that analyses for all contaminants that could be a problem were not performed. Hopefully, the document is clearer now.

COMMENT: The meaning of the column "Concentrations from RfD" used in Tables 1-4 is not clear and has not been explained adequately in the text. It appears that the concentrations needed to cause adverse health effects were calculated from the RfDs. Since most of the chemicals of concern were carcinogens these values were not applicable. Why were similar concentrations not calculated for the carcinogens based on their slope factors?

RESPONSE: We agree that the document did not adequately clarify the different kinds of comparison values used. Changes have been made to the document to reflect that a wide variety of comparison values are considered. However, if one comparison value is exceeded, we do not list all others that may be exceeded, too. If one value is exceeded, the contaminant is further evaluated for possible cancer and non-cancer health effects if exposure to that contaminant has occurred.

EPA on August 11, 1989. The Remedial Investigation (RI) for the site was conducted during 1992. On May 28, 1992, AWII received permission from EPA to incorporate the Focused Feasibility Study (FFS). AWII has not removed any portion of the storm sewer as is stated in this paragraph. AWII submitted the draft FFS report to EPA on May 29, 1992.

RESPONSE: That information has been incorporated into the document.

COMMENT: It should be noted that the Norfolk Veneer Mill was formerly the Wycoff Company as described on page 4, third paragraph of the draft Public Health Assessment.

RESPONSE: The addition was made.

COMMENT: Over the years, AWII has changed corporate names several times, not ownership. AWII changed ownership once on January 1, 1986, when the employees of AWII purchased the operating assets of the corporation under an Employee Stock Ownership Plan (ESOP).

RESPONSE: The correction has been made.

COMMENT: Pentachlorophenol was used at the site from 1972-1985 and for a short period (approximately 5 months) in 1991. Again, all wood treatment activities at the site were discontinued on August 6, 1991.

RESPONSE: Corrections have been made.

COMMENT: The wood treatment retorts are "closed cylinders" not "tanks." These cylinders are large horizontal pressure vessels in which wood products are placed prior to the pressure treatment process. They are not used as a storage vessel for liquids.

RESPONSE: Corrections have been made.

COMMENT: It is inaccurate to say that waste preservative was stored in the southwest corner of the facility. The term "waste preservative" in the first sentence should be changed to "waste" since many different materials were deposited in the southwest corner of the site. The type of waste materials are described in detail later on in the paragraph.

RESPONSE: Changes have been made to clarify those issues.

COMMENT: Clarify what is meant by "other wastes include contaminated sediments in the Southern Branch of the Elizabeth River." This implies that contamination

from the site has migrated an extremely long distance from the site. Also, there is no specific evidence indicating that the sediments in the "Southern Branch of the Elizabeth River" were impacted solely by AWI, rather than other upstream facilities and sources.

RESPONSE: Changes have been made in several sections of this document to clarify those issues.

COMMENT: The RCRA interim status permit for the site was not revoked but withdrawn at AWII's request. The notice of termination of interim status was signed by the Commonwealth of Virginia on January 16, 1985, and is included as Attachment 2.

RESPONSE: The correction has been made.

COMMENT: AWII has a NPDES permit to discharge storm water run off only. It is more accurate to refer to the discharge as storm water runoff instead of surface water.

RESPONSE: Clarifications have been made. However, the monitoring of the storm water runoff is considered as "surface water" monitoring for public health assessment purposes.

COMMENT: The presence of zinc at the AWII site cannot be attributed to the treatment process. Neither AWII nor EPA have been able to determine the source of the zinc contamination at the site.

RESPONSE: Zinc is not identified as a contaminant of concern in any environmental media sampled on the site. Shellfish contain heavy metals, including zinc. No insinuation is made that the zinc is a result of site contaminants. Some changes made in this document may make that point clearer.

COMMENT: The use of the work "strong" to describe the creosote odor is very subjective. Creosote is a complex mixture of aromatic hydrocarbons. Many of these compounds can be detected by the human olfactory organs at parts per billion concentrations thus making it very difficult to quantify creosote odor.

RESPONSE: Description of the odor is subjective; however, to the people conducting the site visit, the odor was "strong." The word is used as a qualitative assessment of conditions for the average person who does not work with the material everyday. Use of the word is not intended to represent a quantitative value.

COMMENT: The three run off ditches are for storm water from the site. These ditches are dry except during precipitation events and should not be considered surface

water ditches.

RESPONSE: Clarification has been made to indicate the ditches are for storm water runoff; however, the water, when present in the ditches, constitutes surface water as opposed to groundwater.

COMMENT: ATSDR should update this paragraph using the most recent 1990 census data. Currently nine people work at the AWI site and four over the road truck drivers operate out of the site.

RESPONSE: The updated information has been added.

COMMENT: AWII believes the use of the word "high" to describe concentration levels of contaminants is subjective. As an alternative, the word "elevated" could be used or present a range of concentrations found at the site to quantify contaminate levels. Using a range of contamination concentrations would accurately reflect site conditions.

RESPONSE: The word "high" is appropriate in that it conveys the qualitative interpretation that levels are much greater than comparison values. Note that health implications are based entirely on actual concentrations and whether or not exposure has actually occurred. By using the "worst case" conditions (maximum levels) to evaluate possible health impact, no sensitive population is overlooked.

COMMENT: Since the off-site migration of naphthalene that occurred on July 19, 1985, was as stated in the draft Public Health Assessment "an anomaly and of dubious merit," this discussion should be removed from the report. Including this text only confuses the reader and provides no valuable information.

RESPONSE: Contaminated air is a potential, and probably, a completed exposure pathway. The data collected were not sufficient to conclude what kinds and how much contamination people may be exposed to at the site and off site. The responsibility of the health assessor is to discuss what data are available and the value of that data. The discussion is appropriate.

COMMENT: PAHs and PCP were detected in surface and subsurface soils in the nine areas of the site that were investigated, not in "all" areas of the site.

RESPONSE: Clarifications have been made in the document.

COMMENT: More explanation is required for the "concentrations calculated from RfDs." The text should state that these are not promulgated standards. The methodology and assumptions used to calculate the RfD concentrations should

be given either in the main text or an appendix to the report. Furthermore, why are carcinogenic PAHs for which there are no RfDs included in the tables and noncarcinogenic PAHs which have RfDs are excluded.

Response: A definition of an RMEG, a medium-specific comparison value calculated from EPA's RfD, has been added to the *Glossary*. RMEGs, as with EMEGs, are used to determine if a contaminant is present in the environment at levels, that upon human exposure, could possibly result in adverse health effects under certain conditions (which are discussed in the *Public Health Implications* section). Those values do not consider carcinogenic properties. CREGs, which are defined in the *Glossary*, are comparison values used to select possible carcinogenic contaminants of concern. If a CREG cannot be calculated (if there is no Cancer Slope Factor), the contaminant is automatically listed because no one knows how much exposure to a possible carcinogen may result in a person's increased risk of developing cancer. If contaminants were not listed, the levels present in the environment did not exceed any of the comparison values used to select contaminants of concern. Those contaminants are not believed to be present at levels that may cause adverse health effects, cancer or non-cancer, upon exposure.

COMMENT: Also, because the site and surrounding areas are industrial and it is extremely unlikely for a child to visit the site, the child and pica child scenarios are not relevant. It is inappropriate to be comparing site soils to health based levels developed for children and pica children when these exposures are extremely unlikely to occur. If discussions regarding pica are retained in this document, pica should be clearly defined.

RESPONSE: We reevaluated accessibility of the site to children and agree that children are not likely to play on the site. Changes have been made to the document to consider that.

COMMENT: A range of constituent concentrations should be presented in this section instead of only maximum constituent concentrations. The sole use of maximum concentrations in most of the discussion presents an inaccurate description of site conditions.

RESPONSE: We agree that using a range of concentrations gives a better over-all perspective of conditions of the site. However, by using the maximum contaminant values detected, the worst-case conditions are evaluated and measures can be taken to prevent exposure to contaminants where high levels may be present. The purpose of the public health assessment is to identify what exposures may cause health effects and to make recommendations to protect people who may come into contact with those contaminants.

COMMENT: [Under *Groundwater*, in the first paragraph, last sentence], the statement is incorrect. A number of monitoring wells at the site showed contaminant levels to be at background or below detection levels. Figures depicting groundwater quality at the site for contaminants of concern are included as Attachment 3. These figures are from the EPA approved RI Report dated March 1992.

RESPONSE: Some modification was made to the statement to better define contamination that is present.

COMMENT: The inlet associated with outfall 002 does <u>not</u> receive any "industrial discharge." Outfall 002 is for stormwater runoff only.

RESPONSE: The correction has been made.

COMMENT: The draft Public Health Assessment states that surface water samples were not analyzed for all site-related constituents of concern. This is incorrect. Since 1986....

RESPONSE: The correction has been made.

COMMENT: A statement is made that sediment samples collected at on-site locations showed higher levels of contamination than off site sampling locations. Analytical data presented in Table 3 indicate that only pentachlorophenol and arsenic in on-site sediments exceeded off site sediment concentrations. All.... We also suggest that on-site and off site sampling locations be identified on a map. This would provide the reader a visual awareness of where each sampling station is in relation to the AWII site.

RESPONSE: The text has been clarified. A good map that copied well and was easy to read of sampling locations was not available.

COMMENT: [Table 4] should be updated with the most recent data provided in Attachment 4.

RESPONSE: The Attachment was not provided to ATSDR. Therefore, we will have to evaluate the information when the site is reevaluated, which usually occurs as remedial activities are underway or concluded. The data that were available provides enough information to indicate what types of contaminants and their levels were present when more activity was occurring at the site.

COMMENT: The statement, "All other contaminants of concern, except benzene and PCP, were estimated to be present in the DNAPL" requires clarification. Benzo(a)pyrene was detected in the DNAPL at 1900 mg/L. Please explain that the remaining contaminants in questions were flagged with a J data

qualifier, and provide some explanation of the qualifier as shown in Table 4-249 of the EPA approved RI Report (March 1992).

RESPONSE: The statement has been modified.

COMMENT: Change "also, four additional wood treatment facilities" to also, this may be due to four additional wood treatment facilities."

RESPONSE: The sentence is clear as stated. No changes are felt to be necessary.

COMMENT: Due to high concentration of PAHs in sediments throughout the Southern Branch of the Elizabeth River, the multiple sources of PAHs, and the tidal action of the river, it is difficult to form any definite conclusions from the Huggett report which would link any discharge from the AWI site directly to PAH levels in oysters.

The correlation between PAH contamination in sediments and the increased prevalence of gross abnormalities in fish as reported by Huggett is also questionable. ... given that most fish exhibit movement over a large range, the text should include a discussion of non site related sources of contamination which could elicit the observed abnormalities.

RESPONSE: The document discusses the other sources of contamination of the Elizabeth River. The discussion in the section of the document related to this comment is to convey to the reader only what was found in the study. There is no need to repeat the discussions about other sources in that section.

COMMENT: The text on the fate and transport of constituents in air, soil, groundwater, and surface water should state that the discussion is theoretical...it gives the impression the physical and chemical processes described are currently occurring at the site.

RESPONSE: The section has been modified to convey what exposure pathways are complete and which are considered potential. The discussions now reflect what is or is potentially occurring.

COMMENT: The groundwater discharge rate of 0.48 liters per second converts to 1465 cubic feet per day not 720 cubic feet per day.

RESPONSE: This statement is part of the section that has been rewritten to more clearly define completed and potential exposure pathways.

COMMENT: Remove the words "a significant amount of" from this sentence or replace them with the groundwater discharge number from page 17 of the draft Public

Health Assessment.

RESPONSE: Again, this comment involves the section of the document that has been rewritten to reflect how people have been or may be exposed to contaminants.

COMMENT: Change the second sentence [*Toxicological Evaluation* section] to "As discussed in the Pathways Analyses section, the potential human exposure pathways for this site are ingestion, dermal contact, and inhalation of contaminated soils for on-site workers, and ingestion of contaminated fish and shellfish by off-site residents."

RESPONSE: Revisions have been made in the wording of the section to clarify the information. However, your suggestion was not used because ingestion, dermal contact, and inhalation are routes of human exposure that are only one element of an exposure pathway.

COMMENT: The draft Public Health Assessment indicates that "arsenic may enter the body by ingestion of contaminated food or water." This statement addresses the concept of exposure in terms too general for a Public Health Assessment. The EPA approved Remedial Investigation Report, containing a Public Health and Environmental Assessment (risk assessment), specifically identifies potential exposure scenarios and receptors for the Atlantic Wood site...subjective statement[s] should be replaced with facts from the EPA approved RI Report [risk assessment].

RESPONSE: Use of risk assessments as interchangeable documents for public health assessments is inappropriate. The goal of the risk assessment is, among other things, to establish acceptable clean-up levels for the site. Those levels should be at or below levels that may cause adverse effects on people or the environment. To do this, scenarios are developed about possible exposures. One goal of the public health assessment, on the other hand, is to identify actual completed exposure pathways and potential exposure pathways and to provide the exposed people with information about their specific exposure. People who have been exposed to contaminants are not usually interested in what chance in 10,000 or in 1,000,000 they have of developing cancer or other health effects. They usually want to know in simple terms how they are exposed to the contaminants and if that exposure is going to make them sick. The use of qualitative terms (moderate, high, slight) relates on a more personal basis what chances the exposure to a contaminant will make the person sick. We feel the document accurately imparts that information to the exposed people.

COMMENT: As explained in the EPA approved RI report, potential risks associated with exposure to benzene at the AWI site are negligible relative to the potential

risks associated with exposure to other constituents. Although benzene is present, it poses little significance with regard to impact to human health...Arsenic, pentachlorophenol, and polycyclic aromatic hydrocarbons are more important constituents with regard to public health impact at the site.

RESPONSE: In the revised public health assessment, discussions are limited only to contaminants of concern in completed exposure pathways. When new information becomes available about potential exposure pathways, further evaluations may be necessary.

COMMENT: [In the toxicological evaluation of pentachlorophenol], the formal definition of "Class B2 carcinogen" should be provided...Instead of presenting the maximum concentration, a discussion of the range of concentrations would provide a more representative description of the site...specific risks associated with exposure to pentachlorophenol are available in the risk assessment...The MCLG and MCL for PCP are 0 and 1.0 μg/L, respectively....

RESPONSE: Further information has been provided about B2 carcinogens. The questions about use of maximum levels of contaminants and the inappropriateness of using risk assessment information in public health assessments have already been addressed. References to MCLGs and MCLs have been removed from the discussion because those are not appropriate health comparison values for toxicological evaluations.

COMMENT: PAHs are ubiquitous in the environment and their presence due to anthropogenic and naturally occurring sources should be discussed.

RESPONSE: A discussion of that nature has been added to the toxicological evaluation of PAHs.

COMMENT: The Elizabeth River receives permitted discharges from numerous industrial and municipal outfalls...Therefore, the use of biota sampling to determine potential impacts from the AWI site does not appear to be an appropriate means for quantifying site related effects.

RESPONSE: ATSDR's obligation is to identify how people are or may be exposed to contaminants in the environment that may cause adverse health effects upon exposure. Sometimes information is found during the public health assessment process that indicates a mechanism for exposure that may not be site related, or entirely attributable to the site. ATSDR still has an obligation to the people who may be exposed to inform them of the contamination and to make recommendations to gather information that may help further evaluate the exposure pathway. EPA must decide whether or not to implement the recommendations and how the information will be gathered.

COMMENT: [In recommendation 5], the statement is incorrect. Please refer to the comments regarding NPDES sampling requirements...The statement that site related contaminants are found in the Elizabeth River should be changed to "contaminants similar to those found at the AWI site are also found in the Elizabeth River"...The draft Public Health Assessment also recommends that surface water samples should be collected from off-site locations. This does not appear to be necessary....

RESPONSE: The recommendation for additional on-site surface water sampling at NPDES stations has been deleted. Some changes in wording for other recommendations have been changed to clarify what specific information is needed. However, the recommendation for further surface water (Elizabeth River) and sediment characterization is appropriate.

COMMENT: A marked up copy of Figures 1 and 2 are included as Attachment 5 to correct inaccuracies and to provide additional information regarding site features.

RESPONSE: ATSDR was not provided the Attachment. VDH is believed to have verified the figures and made changes they felt appropriate.

COMMENT: The EPA approved Remedial Investigation Report (March 1992) prepared by Keystone Environmental Resources, Inc. on AWII's behalf should be added to the References section.

RESPONSE: Only the draft document dated September 1991 was provided for this public health assessment and that reference has been added.