Public Health Assessment for

ATLANTIC RESOURCES CORPORATION
SAYREVILLE, MIDDLESEX COUNTY, NEW JERSEY
EPA FACILITY ID: NJD981558430
FEBRUARY 5, 2003

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
PUBLIC HEALTH SERVICE
Agency for Toxic Substances and Disease Registry

PUBLIC HEALTH ASSESSMENT

ATLANTIC RESOURCES CORPORATION

SAYREVILLE, MIDDLESEX COUNTY, NEW JERSEY

EPA FACILITY ID: NJD981558430

Prepared by:

Hazardous Site Health Evaluation Program
Consumer and Environmental Health Services
Division of Epidemiology, Environmental and Occupational Health
New Jersey Department of Health and Senior Services
Under Cooperative Agreement with the
Agency for Toxic Substances and Disease Registry

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.

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FOREWORD

The Agency for Toxic Substances and Disease Registry, ATSDR, was established by Congress in 1980 under the Comprehensive Environmental Response, Compensation, and Liability Act, also known as the *Superfund* law. This law set up a fund to identify and clean up our country's hazardous waste sites. The Environmental Protection Agency, EPA, and the individual states regulate the investigation and clean up of the sites.

Since 1986, ATSDR has been required by law to conduct a public health assessment at each of the sites on the EPA National Priorities List. The aim of these evaluations is to find out if people are being exposed to hazardous substances and, if so, whether that exposure is harmful and should be stopped or reduced. If appropriate, ATSDR also conducts public health assessments when petitioned by concerned individuals. Public health assessments are carried out by environmental and health scientists from ATSDR and from the states with which ATSDR has cooperative agreements. The public health assessment program allows the scientists flexibility in the format or structure of their response to the public health issues at hazardous waste sites. For example, a public health assessment could be one document or it could be a compilation of several health consultations - the structure may vary from site to site. Nevertheless, the public health assessment process is not considered complete until the public health issues at the site are addressed.

Exposure: As the first step in the evaluation, ATSDR scientists review environmental data to see how much contamination is at a site, where it is, and how people might come into contact with it. Generally, ATSDR does not collect its own environmental sampling data but reviews information provided by EPA, other government agencies, businesses, and the public. When there is not enough environmental information available, the report will indicate what further sampling data is needed.

Health Effects: If the review of the environmental data shows that people have or could come into contact with hazardous substances, ATSDR scientists evaluate whether or not these contacts may result in harmful effects. ATSDR recognizes that children, because of their play activities and their growing bodies, may be more vulnerable to these effects. As a policy, unless data are available to suggest otherwise, ATSDR considers children to be more sensitive and vulnerable to hazardous substances. Thus, the health impact to the children is considered first when evaluating the health threat to a community. The health impacts to other high risk groups within the community (such as the elderly, chronically ill, and people engaging in high risk practices) also receive special attention during the evaluation.

ATSDR uses existing scientific information, which can include the results of medical, toxicologic and epidemiologic studies and the data collected in disease registries, to determine the health effects that may result from exposures. The science of environmental health is still developing, and sometimes scientific information on the health effects of certain substances is not available. When this is so, the report will suggest what further public health actions are needed.

Conclusions: The report presents conclusions about the public health threat, if any, posed by a site. When health threats have been determined for high risk groups (such as children, elderly, chronically ill, and people engaging in high risk practices), they will be summarized in the conclusion section of the report. Ways to stop or reduce exposure will then be recommended in the public health action plan.

ATSDR is primarily an advisory agency, so usually these reports identify what actions are appropriate to be undertaken by EPA, other responsible parties, or the research or education divisions of ATSDR. However, if there is an urgent health threat, ATSDR can issue a public health advisory warning people of the danger. ATSDR can also authorize health education or pilot studies of health effects, full-scale epidemiology studies, disease registries, surveillance studies or research on specific hazardous substances.

Community: ATSDR also needs to learn what people in the area know about the site and what concerns they may have about its impact on their health. Consequently, throughout the evaluation process, ATSDR actively gathers information and comments from the people who live or work near a site, including residents of the area, civic leaders, health professionals and community groups. To ensure that the report responds to the community's health concerns, an early version is also distributed to the public for their comments. All the comments received from the public are responded to in the final version of the report.

Comments: If, after reading this report, you have questions or comments, we encourage you to send them to us.

Letters should be addressed as follows:

Attention: Chief, Program Evaluation, Records, and Information Services Branch, Agency for Toxic Substances and Disease Registry, 1600 Clifton Road (E-60), Atlanta, GA 30333.

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Summary

The Atlantic Resources Corporation (ARC) site is located at the end of Horseshoe Road, about 200 feet from the Raritan River in northern Sayreville, Middlesex County, New Jersey. The site itself is remote; however, the area around the site is densely populated and includes residential, business, commercial and industrial areas. The ARC site is formally a part of the Horseshoe Road Complex (HRC) Superfund site.

As part of the 1999 Remedial Investigation (RI) at the Horseshoe Road Complex site, the USEPA conducted sampling at the ARC site. The results of this RI showed that there were elevated levels of contamination including volatile organic compounds (VOCs), pesticide, polychlorinated biphenyls (PCBs), PAHs and heavy metals remaining in the soil and subsoil, surface water and groundwater at the ARC site. The only two pathways previously identified at the ARC site were potential exposures to determined trespassers, and the potential for contribution to contamination of Raritan River biota.

The ATSDR/NJDHSS used data from the 1999 RI to complete two Health Consultations (HC) in 2000 and 2001, regarding the Horseshoe Road Complex (HRC) and ARC site. Environmental contamination (on and off-site) as well as biota contamination and physical hazards at the ARC site have been examined in detail in these reports. In the 2000 HC, the ATSDR/NJDHSS determined that although there are presently no completed human exposure pathways at the site, trespassers constitute a potential exposure pathway. The HC concluded that trespasser exposures to the known contaminants at the HRC site would not likely result in serious adverse health effects, since it is unlikely that trespassers would be present often or long enough to experience a significant exposure. Therefore, the the ARC site currently represents **no apparent public health hazard**. The ARC site presently contains numerous physical hazards that could cause harm to trespassers. Physical hazards at the ARC facility include lack of structural integrity of the buildings, and potential injury due to drums carcasses and other inactive processing equipment which are rusted and deteriorated. Because of the physical hazards present at the ARC facility, the ATSDR/NJDHSS had determined that these buildings represent a **public health hazard** to the trespassers who access the ARC facility. However, because of the actions taken by the U.S. EPA, the physical hazard posed by the ARC facility have been greatly reduced.

The ATSDR Health Consultation for the HRC site in 2001 was an evaluation of the potential public health threat posed by persons consuming edible biota (specifically "blue claw crabs") from commercial and subsistence fishing that occurs in the Raritan River adjacent to the Horseshoe Road Complex (HRC) site. The crabs caught near the HRC site were found to be not substantially different from the rest of the crabs in the river or bay. In conclusion, the ATSDR/NJDHSS determined that, in this context, the HRC site represents **no apparent public health hazard** to persons who eat crabs caught near the HRC site. Nonetheless, individuals should follow existing NJDHSS and the New Jersey Department of Environmental Protection fish and crab consumption advisories, and should not eat the hepatopancreas from blue crabs taken from the Raritan Bay Complex.

The ATSDR/NJDHSS recommends that the USEPA continue to restrict public access to contaminated areas of the ARC and proceed with plans for site remediation, including plans to remove the structures and other physical hazards at the site, utilizing optimal dust control measures during site remediation.

The NJDHSS has prepared a Citizen's Guide to this Public Health Assessment for the ARC site which will be made available to local health agencies and other interested parties.

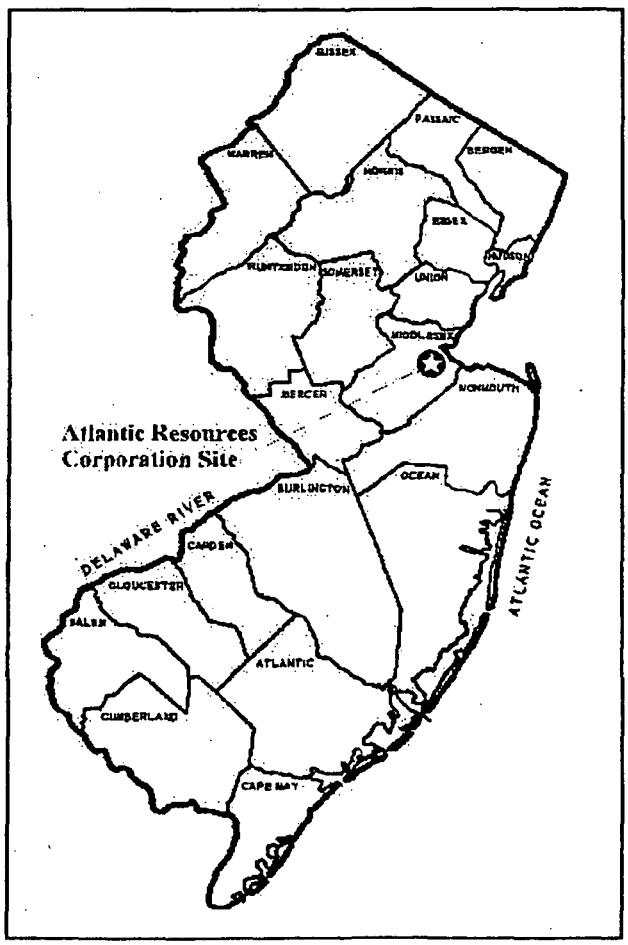
The ATSDR/NJDHSS will reevaluate and expand the Public Health Action Plan when needed. New environmental, toxicological, health outcome data, or the results of implementing the above proposed actions may determine the need for additional actions at this site.

Purpose and Health Issues

This Public Health Assessment (PHA) evaluates the public health issues associated with the Atlantic Resources Corporation (ARC) site, which was proposed for inclusion on the National Priorities List (NPL) on September 13, 2001. NPL or "Superfund" sites represent those sites which are associated with significant public health concern in terms of the nature and magnitude of contamination present, and the potential to adversely impact the health of populations in their vicinity.

This document will evaluate human exposure pathways associated with known contaminated environmental media within or associated with the ARC site, evaluate the public health implications of these exposures and recommend actions consistent with protection of public health. At the ARC site, the known contaminated media include soils, groundwater, sediments, and surface water. Trespassers on the restricted ARC site may be exposed to on-site contaminants and potential physical hazards from abandoned buildings. Off-site contamination through the drainage system and flood migration to the nearby sediment and surface water may lead to potential human exposure due to consumption of fish and crabs from the nearby Raritan River.

In recent work conducted by the Agency for Toxic Substances and Disease Registry (ATSDR) and the New Jersey Department of Health and Senior Services (NJDHSS), environmental contamination (on and off-site) as well as biota contamination and physical hazards at the ARC site have been examined in detail. This PHA, therefore, will evaluate health concerns associated with new environmental data or community concerns that were not available for those reports, and summarize these previously reported conclusions and recommendations.



Background

A. Site Description and History

The Atlantic Resources Corporation (ARC) site is located at the end of Horseshoe Road, about 200 feet from the Raritan River in northern Sayreville, Middlesex County, New Jersey (Inset and Figure 1, Appendix A). The site itself is remote; however, the area around the site is densely populated and includes residential, business, commercial and industrial areas.

The ARC site is formerly a part of the Horseshoe Road Complex (HRC) Superfund site. The HRC site was composed of four distinct areas that were grouped together in September 1995 and were once considered as one site on the NPL. They were initially considered one site because: (1) while the areas were not necessarily part of the same operation, the potentially responsible parties (PRPs) likely shared the use of the same dump areas; (2) contamination is threatening the same groundwater, surface water, and air, and; (3) they are no more than about 1,000 feet apart.

For the purpose of conducting a Pre-Remedial Investigation, the New Jersey Department of Environmental Protection (NJDEP) has broken the HRC site into three sub-areas due to past practices and based on geographic location. These areas included the following: (1) Atlantic Resources Corporation (ARC), which also includes the Horseshoe Road Drum Dump (HRDD) area; (2) Atlantic Development Corporation (ADC); and (3) The Sayreville Pesticide Dump (SPD) (Figure 2, Appendix A).

In April 1997, as a result of legal actions taken by the PRPs of ARC, the ARC portion of the HRC Superfund site was removed from the NPL by the U.S. Environmental Protection Agency (USEPA). At the time of the ARC's removal from the NPL, the USEPA made it clear in their decision that this did not preclude them from taking further action against the PRPs of ARC regarding possible site contamination and remediation.

As part of the Remedial Investigation (RI) at the Horseshoe Road Complex site, the USEPA conducted sampling at the ARC site between October 1997 and August 1998. The results of this RI showed that there were significant levels of contamination including volatile organic compounds (VOCs), pesticides, polychlorinated biphenyls (PCBs), PAHs and heavy metals remaining in the soil, and subsoil, surface water and groundwater at the ARC site. Much of this contamination was determined to be above the USEPA clean-up criteria. Due to this contamination, the USEPA has decided to add the ARC to the NPL list.

As part of its early history, the ARC conducted various industrial operations from 1972 to August, 1985, including: solvent reclamation; hazardous waste incineration; and precious metal recovery. Between 1968 and 1972, the International Recycling Company conducted similar operations at the site. Operations at the ARC site ended in 1985 soon after 2,3,7,8-TCDD (dioxin) was found on the property by the NJDEP.

In addition to precious metal recovery by means of incineration, the ARC received scrap printed circuit boards, casting sweeps and fines for metal reclamation and refining. Fourteen "reverse platers" were used to dip circuit boards in a sodium cyanide acid baths to release metals into solution. Metals were then smelted into ingots.

Employee documentation, collected by the NJDEP, revealed that the ARC workers were directed by the company to: (1) dump drums of unknown materials into the Raritan River; (2) dump drums of potassium cyanide, nitric, muriatic, and hydrochloric acid, and 30% hydrogen peroxide into the wooded area behind the Horseshoe Road; and (3) strip gold and silver with nitric acid at night so that

area residents and enforcement agencies would not be alerted by the toxic "ruby red fumes" that are emitted by the process.

Past and Current USEPA Activities

The USEPA began limited remediation at the site in early 1987. Remedial activities at the site have included: drum and storage tank removal; laboratory chemical removal; and the covering of dioxin-contaminated soil. This section of the site was also stabilized by repairing and adding barbed wire to the fence.

More USEPA actions were carried out at or near the ARC site in the 1990s. The following USEPA removal actions were completed by June 7, 1999 (USEPA, 1999):

1. Removal of potentially contaminated surface debris from several areas (fragments of tar-like solids, resinous/gelatinous, glue-like material, glass containers, corroded/rusted drum carcasses, and other miscellaneous debris) found outside the fence, including areas adjacent to the HRDD and SPD;
2. Removal of ash (primarily contaminated with dioxin and metal compounds) on concrete pads, in open kilns, and other contaminated materials in the building at the ARC facility;
3. Posting of signs along the river adjacent to the site summarizing the State health advisory regarding fish and crab consumption;
4. Repair/re-installation of damaged sections of fencing around the site, and drainage control to minimize off-site migration of contaminated sediments.

Currently, the USEPA has planned an additional remedial action at the ARC facility (Brown and Caldwell, 2002). They began asbestos removal and mobilization in early July 2002. As of September 2002, the buildings at ARC have been demolished and removed. All of the above ground equipment at the site (tanks, kilns, and pipes etc.) has also been removed. While doing the removal, three very large underground storage tanks or UST's (30' long). One UST has been removed, and the others are in the process of being emptied and removed from the ground. The surface soil has been covered with crushed concrete and sand.

After building demolition, the USEPA will start a groundwater and soil remediation action on-site. Following these actions, future possible remedial actions for nearby marsh and sediment areas will be evaluated.

Past ATSDR/NJDHSS Activities

The NJDHSS, under a cooperative agreement with the ATSDR, prepared a Preliminary Public Health Assessment for the Horseshoe Road Complex (HRC) site including the ARC site (ATSDR, 1995). Prior to this health assessment, the ATSDR prepared a Health Consultation for the HRC site in 1991 (ATSDR, 1991). The U.S. Environmental Protection Agency (USEPA) completed a Remedial Investigation (RI) for the HRC site including ARC in 1999. Following completion of the RI, the ATSDR used its data to conduct a Health Consultation (HC) at the site dated June 28, 2000.

This HC served to evaluate the public health significance of persons trespassing on the site (ATSDR, 2000, see Appendix C). The ATSDR/NJDHSS determined that trespasser exposures to the ***known*** contaminants at the HRC site, would not likely result in serious adverse health effects. Therefore, this exposure was found to be ***no apparent public health hazard***. However, the chemical-specific nature of one small area of the water called "the purple puddle" is not known; therefore, the public health significance of exposure to this surface water (soil, if dry) could not be evaluated. This exposure would be considered by ATSDR/NJDHSS to present an ***indeterminate public health hazard***. Finally, because of the physical hazards present at the ARC and ARD facilities, ATSDR/NJDHSS has determined that these buildings represent a ***public health hazard*** to the most determined trespasser who may gain access to these areas.

The ATSDR prepared an additional HC for the HRC site in 2001 (ATSDR, 2001, see Appendix D). This HC was an evaluation of the potential public health threat posed to persons consuming edible biota (specifically "blue claw crabs": *Callinectes sapidus*) from commercial and subsistence fishing that occurs in the Raritan River adjacent to the Horseshoe Road Complex (HRC) site. Although biota sampling near the HRC site showed that the blue claw crab muscle tissue was contaminated, and several contaminants were present at levels above the USEPA Region 3 Risk-Based Concentrations, a toxicological evaluation, using known site data and standard assumptions, showed that human exposure levels were not at levels likely to result in adverse health effects. Compared to the blue claw crab muscle tissue samples, relatively higher levels of contaminants were detected in blue claw crab hepatopancreas tissue. The NJDEP has a blue claw crab consumption advisory for the Raritan Bay Complex that recommends against the consumption of the hepatopancreas. Based on information reviewed, the ATSDR/NJDHSS concur that the advisory is appropriate and protective of the public health. Although the HRC site is likely contributing to the contamination burden of the Raritan River, the blue claw crab muscle tissue samples collected during the recent RI were not unlike crab muscle tissue collected in previous studies of the Raritan Bay Complex and at the reference locations. Therefore, it does not appear that the crabs caught near the HRC site are substantially different from the rest of the crabs in the river or bay. In conclusion, the ATSDR/NJDHSS determined that, in this context, the HRC site represents no apparent public health hazard to persons who eat crabs caught near the HRC site.

B. Site Visit

On November 15, 2001, Mary Baird, Steve Miller, Julie Petix and Stella Manchun Tsai of the NJDHSS visited the ARC site (Figure 3a&b). The NJDHSS was accompanied by representatives of the USEPA and the Edison Wetland Association (EWA). The following observations were made during the site visit:

- The ARC facility is located at the end of Horseshoe Road. ARC is located in a remote area approximately 200 feet from the Raritan River. The facility is on the northeastern corner of the former Horseshoe Road industrial complex. The nearby area surrounding the site includes residential properties, commercial and industrial areas.

- The former Atlantic Development Corporation (ADC) facility, part of the former industrial complex listed under the National Priority List (NPL) since 1995, was torn down. The soil surface was covered by a concrete pad which was completed in 2001.

- The ARC facility is currently inactive and is surrounded by a chain link fence installed by the USEPA (Figure 4, see Appendix A). It consists of a large brick building, incinerators, bag houses, a ball mill, and debris from previous operation (Figure 5 and 6, see Appendix A).

- Physical hazards at the ARC facility include lack of structural integrity of the buildings, drum carcasses and other inactive processing equipment which are rusted and deteriorated.

- The facility was used to recover precious metals (i.e., gold and silver) from fly ash, X-ray and photographic film, circuit boards, and building materials. Mercury has been observed inside the building on the ground.

- Although a fence borders the ARC site, the site is not completely protected from access by trespassers; therefore, trespassers may be exposed to chemicals at the ARC and be injured by the physical hazards posed by the ARC site.

- Two drainage ways around the facility may carry contaminants through surface runoff water into the marsh or the Raritan River area. More biota sample evaluation will be conducted after analysis is completed by the NJDEP (NJDEP, personnel communication, July 2002).

- The groundwater contamination on-site has been investigated. There is no connection between this site and the Farrington Sand Aquifer which serves at least two municipal public water supply wells.

- The USEPA has planned a remediation action for the ARC facility. The buildings and all equipment above ground will be demolished and removed. After building demolition, groundwater and soil remediation action will start on-site. After these remediation actions, possible future action for the marsh and sediment areas will be evaluated.

C. Demographics, Land Use, and Natural Resources Use

In order to evaluate potential health effects associated with exposure to hazardous substances in the environment, the NJDHSS obtains information on the population in the vicinity of the site ("demographics"), the types of land near the site, and natural resources use in the area. Population information is needed because some types of illness and diseases are more common in certain age groups such as the elderly or children, or in certain ethnic groups. In addition, some groups may be more sensitive to the presence of hazardous substances in the environment. Land use information is important because sensitive groups of people such as school children or residents of health care facilities may be located near the site. Use of some of the natural resources, such as groundwater, may have an effect on the potential for human exposure to hazardous substances.

Demographics

Population demographics based upon the 2000 United States Census data have been prepared by the ATSDR using area-proportion spatial analysis, and are presented in Table 1. Within a one mile radius, there are approximately 1,319 homes with as many as 3,599 people. There are no residences within 1000 feet of the ARC site. A total of 323 children age 6 or younger, and a total of 372 senior citizens are within one mile of the ARC site.

Land Use

The ARC site is a relatively remote area where the land is primarily used for commercial and industrial purposes, although several residences and undeveloped lots are found near the site. The Middlesex County Utilities Authority sewage treatment plant is located northeast of the site. New Jersey Steel, an active manufacturing facility recycling scrap steel, is approximately one-half mile to the southwest.

Except for private gardens, land near the site is not used for agriculture. No known school, daycare or health care facility are within 1,000 feet of the site.

There is another USEPA Superfund site, the Sayreville Landfill, located approximately 3 miles south and west of the site. The Raritan Arsenal, a federal hazardous waste site, is located just across the Raritan River and within one-half mile northwest of the ARC site.

Natural Resources Use

The Sayreville Water Company provides potable water to the Borough of Sayreville, which maintains wells several miles south of the site. The water company wells range from 300 to 700 feet in depth and draw water from the Old Bridge formation serving approximately 8,500 people. It has been reported in previous site documents that there are two private wells in the area. It was believed that one of these wells was not in current use due to high salinity. The other well was drawing water from the same Old Bridge formation as the Sayreville municipal well system.

A telephone conversation with the Borough of Sayreville Water Company, (12/6/93), did not confirm the presence of any private wells in the vicinity of the site. The Sayreville Water Company indicated that residences had been connected to the Borough of Sayreville's municipal well system for "many years", possibly since the 1960's. It is not known if some residents are still using residential well water for non-drinking purposes.

Discussion

Assessment Methodology

In order to determine whether trespassers and people near the ARC site are exposed to contaminants on- and off-site, the NJDHSS and ATSDR evaluate the environmental and human components that lead to human exposures. An exposure pathway is the process by which an individual is exposed to contaminants that originate from some source of contamination. Five elements are included in this pathway analysis for human exposure: (1) a **source** of contamination; (2) transport through an **environmental medium**; (3) a **point** of human exposure; (4) **route** of human exposures; and, (5) a **receptor population**. The ATSDR and NJDHSS classify exposure pathways into three groups: (1) "**completed pathways**," that is, those in which exposure has occurred, is occurring, or will occur; (2) "**potential pathways**," that is, those in which exposure might have occurred, may be occurring, or may yet occur; and (3) "**eliminated pathways**," that is, those that can be eliminated from further analysis because one of the five elements is missing and will never be present, or in which no contaminants of concern can be identified. A completed exposure pathway must include each of five elements that link a contaminant source to a receptor population.

After the pathways are designated as completed, potential, or eliminated, the NJDHSS and ATSDR conduct a two-step assessment methodology to comment on public health issues related to exposure pathways at the hazardous waste site. First, the NJDHSS and ATSDR evaluate representative environmental sampling data for the hazardous site of concern and surrounding area, and compiles a list of site-related contaminants. Then, the NJDHSS and ATSDR compare levels of site-related contaminants in environmental media to medium-specific health comparison values (HCVs). Health assessment comparison values used include the ATSDR Environmental Media Evaluation Guides (EMEGs), the ATSDR Reference Dose Media Evaluation Guides (RMEGs), the ATSDR Cancer Risk Evaluation Guides (CREGs), the USEPA Region III Risk-Based Concentration (RBC), and other guidelines. However, a contaminant found at a level above a health comparison value is not a direct predictor of adverse health effect. Instead, these constitute contaminants of concerns (COCs) that will be further evaluated in the public health assessment. The NJDHSS and ATSDR will evaluate site-specific conditions to determine what exposure scenario is realistic for a given pathway. Based on each exposure scenario, a dose will be calculated and compared to scientific studies to determine whether the extent of exposure indicates a public health hazard.

Health effects evaluations are accomplished by estimating the amount (or dose) of those contaminants that a person might come in contact with on a daily basis. This estimated exposure dose is then compared to established health guidelines. People who are exposed for some crucial length of time to contaminants of concern at levels above established guidelines are more likely to have associated illnesses or disease. Health guidelines are developed for contaminants commonly found at hazardous waste sites. Examples of health guidelines are the ATSDR's Minimum Risk Level (**MRL**) and the USEPA's Reference Dose (**RfD**). When exposure (or dose) is below the MRL or RfD then non-cancer, adverse health effects are unlikely to occur. MRLs are developed for each route of exposure, and, length of time exposed such as acute (less than 14 days), intermediate (15

to 364 days), and chronic (365 days and greater). ATSDR presents these MRLs in Toxicological Profiles. These chemical-specific profiles provide information on health effects, environmental transport, human exposure, and regulatory status.

Site Contaminants of Concerns

The environmental contamination section will summarize sampling data from a variety of media sources including: surface soil, groundwater, surface water, sediment, and biota samples associated with the ARC site. The NJDHSS/ATSDR has evaluated these media in two previous health consultations to determine whether exposure to them has public health significance (ATSDR, 2000; ATSDR, 2001).

A. On-Site Contamination

Since the ARC site is a part of the HRC site, contamination may not be separated from the HRC site. The USEPA documented site-specific contamination in the Hazard Ranking System Documentation for the ARC site specifically (USEPA, 2001). Environmental data documented in the RI (CDM, 1999) from surface soil samples, groundwater samples, sediment samples, and surface water samples on-site are discussed in this section.

In the ARC area, surface soil samples (SS07 through SS10) were collected between October 1997 and December 1997 as part of the EPA RI (Figure 3b). In a previous health consultation, the contaminants of concern for completed and potential exposure pathways to on-site trespassers were evaluated for the HRC site (ATSDR, 2000). The compounds of concern are lead, cadmium and PCBs at the ARC site.

A USEPA study indicated that there is no connection between the contaminated groundwater and the Farrington Sand aquifer which serves at least two municipal public water supply wells (CDM, 1999). In the USEPA RI, it verified that the groundwater below the ARC site is significantly contaminated and is commingled with the groundwater plumes under at least the ADC area. One area of plume exists in the northern half of the ARC area which overlaps a plume under the ADC. Contaminants including chlorinated solvents and elevated heavy metals were detected in these plumes (USEPA, 2001).

During the EPA RI, sediment and surface water samples were collected from the drainage of the ARC site, and from the marsh into which the drainage channel flows. Sediment and water samples taken from the drainage area contained many of the same contaminants as the soils on the ARC site (USEPA, 2001). Elevated levels of VOCs and heavy metals were detected in the sediment samples (SD23, SD36 and SD37), and surface water samples (SW15, SW19, SW20, SW22 and SW23) (Figure 3a).

The site contains several physical hazards. The perimeter of the ARC site is fenced to prevent unauthorized access, however, signs of trespassing have been observed. Trespassers entering the

ARC facility area could be severely injured due to the dilapidated condition of the structures. The rusted and deteriorated condition of some of drum carcasses and other debris could cause physical harm or injury to trespassers.

There are no known or suspected radiological or biological hazards associated with the site.

B. Off-Site Contamination

Since ARC is part of the original HRC, the off-site area defined in this public health assessment include the whole HRC site and the Raritan River area adjacent to the HRC site.

The contaminants of concerns at the HRC site have been evaluated in the previous Public Health Assessment (ATSDR, 1995) and in a Health Consultation for trespassers (ATSDR, 2000). In the Health Consultation for trespassers, exposure to lead and PCBs from surface soils have been evaluated for the entire HRC site.

For the Raritan River contamination associated with the site, the EPA collected surface water, sediment , and biota samples adjacent to the HRC and the ARC site between October and December 1999. The ATSDR/NJDHSS summarized the contaminants of concerns detected from these media in the Health Consultation (ATSDR, 2001). Bis(2-ethylhexyl)phthalate, heptachlor epoxide, dieldrin, 4,4'-DDE, 4.4'-DDD and lead were of concern in biota samples. Evaluation of these compounds has been conducted in the previous health consultation.

C. Quality Assurance and Quality Control

In preparing this Public Health Assessment, the ATSDR/ NJDHSS rely on the information provided in the referenced documents and assumes that adequate quality control measures were followed with regard to chain-of-custody, laboratory procedures, and data reporting. The validity of analysis and conclusions drawn for this health assessment is determined by the availability and reliability of the referenced information.

Exposure Pathway Analysis

Based upon current site conditions and information available to the ATSDR/NJDHSS, there are no documented completed human exposures to ARC site-related contamination in the following media: on-site groundwater, sediments, surface water, and air. Determined trespassers may constitute a potential exposure pathway to on-site surface soil; however, trespassing is not likely to occur at a frequency of a public health concern. The ATSDR/NJDHSS have determined that contaminated media of the ARC site represent a potential exposure pathway for short term exposures only. The health implications for trespassing have been evaluated in a previous Health Consultation for the HRC site which also includes evaluation for the ARC site (ATSDR, 2000). It is very unlikely that very young children would trespass on the site, mostly due to the remoteness of the site. The ARC

site is presently fenced to prevent trespassing so human access to the site would likely involve "determined" trespassers who circumvent the site fencing. The ARC site presently contains numerous physical hazards that could cause harm to trespassers. Physical hazards at the ARC facility include lack of structural integrity of the buildings, drum carcasses and other inactive processing equipment which are rusted and deteriorated.

Another potential pathway, consuming biota from the Raritan River, has also been evaluated in a previous Health Consultation (ATSDR, 2001). The evaluation is applicable to the ARC facility off-site contamination based on current available data; therefore, no further discussion of biota samples will be included in this Public Health Assessment.

Public Health Implications

A. Toxicologic Evaluation

The public health implications of ingestion of contaminated surface soils and the hazards posed by persons who use the ARC building have been discussed in the previous Health Consultation for trespassers (ATSDR, 2000). Lead and PCBs found in the surface soils at the ARC site were evaluated.

The toxicological effects of the contaminants detected in environmental media have been considered individually. The cumulative or synergistic effects of mixtures of contaminants may enhance their public health significance. Additionally, individual contaminants or mixtures may have the ability to produce greater adverse health effects in children as compared to adults. This situation depends upon the specific chemical being ingested or inhaled, its pharmacokinetics in children and adults, and its toxicity in children and adults.

B. Health Outcome Data

There are multiple sources of health outcome data in New Jersey. State and local data for heath outcome information include the New Jersey State Cancer Registry, Birth Defects Registry, Vital Statistics Records, and Hospital Discharge Reports. Federal databases such as those maintained by the agencies within the US Department of Health and Human Services (i.e. National Cancer Institute, National Institute for Occupational Safety and Health, and ATSDR) are not site-specific, but may be used for comparison or evaluation purposes.

Health outcome data at the ARC site were not evaluated because there are no new community concerns of illness or diseases that could be addressed and there is no evidence of any completed exposure pathways.

C. Community Health Concerns

In order to gather information on community health concerns, the NJDHSS spoke with the Middlesex County Health Department (MCHD), Environmental Health Division (1/30/02), to ascertain whether the County had received any comments or concerns from community members regarding the ARC Site. The MCHD stated that they had not received any queries or comments at all in the last two to two and one half years. The last issue that was raised was posting consumption advisories at fishing areas and the blue claw crab consumption issue. There are, therefore, no new community concerns associated with the site.

The ATSDR/NJDHSS addressed two major past community concerns. Trespassing issues were addressed by the preparation of a Health Consultation (HC) in 2000 (ATSDR, 2000, see Appendix C). The blue claw crab consumption issue was addressed through a second HC in 2001 (ATSDR, 2001, see Appendix D). The findings of these two HCs were discussed above in the section labeled past ATSDR/NJDHSS activities.

ATSDR Child Health Initiative

ATSDR's Child Health Initiative recognizes that the unique vulnerabilities of infants and children demand special emphasis in communities faced with contamination in their environment. Children are at greater risk than adults from certain kinds of exposures to hazardous substances emitted from a waste site. They are more likely to be exposed because they play outdoors and they often bring food into contaminated areas. They are shorter than adults, which means they breathe dust, soil, and heavy vapors closer to the ground. Children are also smaller, resulting in higher doses of chemical exposure per body weight. The developing body systems of children can sustain permanent damage if toxic exposures occur during critical growth stages. Most important, children depend completely on adults for risk identification and management decisions, housing decisions, and access to medical care. The NJDHSS/ATSDR evaluated the potential for children to be exposed to surface soil at the ARC with contamination detected. It is unlikely that young children would trespass on the ARC site, mostly due to the remoteness of the site. It is possible that older children could trespass on the site.

Public Comment

A draft of this Atlantic Resources Corporation Public Health Assessment was released for public comment during the period from November 6 to December 6, 2002. No comments were received.

Conclusions

The ARC site is presently fenced to prevent trespassing. Human exposure to site related contaminants would likely involve "determined" trespassers who circumvent the fencing around the site. On the basis of the information reviewed from the USEPA RI, the ATSDR/NJDHSS has concluded that exposures to the known contaminants detected from the surface soil at the Atlantic

Resources Corporation (ARC) site would not likely result in serious adverse health effects. It is unlikely that trespassers would be present often or long enough to experience a significant exposure dose. Therefore, the ATSDR/NJDHSS has determined that, in this context, the ARC site represents **no apparent public health hazard** from contaminants of concern. Because of the physical hazards present at the ARC facility, the ATSDR/NJDHSS has determined that these buildings at the ARC site represent a **public health hazard** to the trespassers who access to the ARC facility. However, because of the actions by the U.S. EPA, the physical hazard posed by the ARC facility have been greatly reduced.

Recommendations

Cease/Reduce Exposure

1. Continue to restrict public access to contaminated areas of the ARC.

2. Continue with plans for site remediation, including plans to remove the structures and other physical hazards at the site.

3. Utilize optimal dust control measures during site remediation due to the nature and extent of soil contamination.

4. Individuals should follow existing NJDHSS and the New Jersey Department of Environmental Protection fish and crab consumption advisories, and should not eat the hepatopancreas from blue crabs taken from the Raritan Bay Complex.

Site Characterization

1. The ATSDR/NJDHSS has no recommendations for site characterization, at this time.

Public Health Actions

The Public Health Action Plan (PHAP) for the Atlantic Resources Corporation (ARC) site contains a description of the actions to be taken by ATSDR/NJDHSS at or in the vicinity of the site subsequent to the completion of this Public Health Assessment. The purpose of the PHAP is to ensure that this health assessment not only identifies public health hazards, but provides a plan of action designed to mitigate and prevent adverse human health effects resulting from exposure to hazardous substances in the environment. Included is a commitment on the part of ATSDR/NJDHSS to follow up on this plan to ensure that it is implemented. The public health actions to be implemented by ATSDR/NJDHSS are as follows:

A. Public Health Actions Taken

1. Available environmental data and other relevant information for the ARC site have been evaluated to determine human exposure pathways and public health issues.

2. The NJDHSS has prepared a Citizen's Guide to this Public Health Assessment for the ARC site which will be made available to local health agencies and other interested parties.

B. Public Health Actions Planned

1. The ATSDR/NJDHSS will coordinate with the appropriate environmental agencies to develop plans to implement the cease/reduce exposure recommendations.

2. Additional biota data from the Raritan River will be reviewed (when available) by the ATSDR/NJDHSS for potential public health implications. Should these data indicate a need, the public health implications of contaminated biota will be re-evaluated.

3. This Public Health Assessment will be placed in a local repository, and will be provided to persons who request it.

4. The ATSDR/NJDHSS will reevaluate and expand the Public Health Action Plan (PHAP) when needed. New environmental, toxicological, and health outcome data, or the results of implementing the above proposed actions may determine the need for additional actions at this site.

Certification

This Public Health Assessment was prepared by the New Jersey Department of Health and Senior Services (NJDHSS) under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It has been produced in accordance with approved methodology and procedures existing at the time the Public Health Assessment was begun.

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Superfund Site Assessment Branch (SSAB)
Division of Health Assessment and Consultation (DHAC)
ATSDR

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

Roberta Erlwein
Chief, SPS, SSAB, DHAC
ATSDR

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Appendices

Appendix A - Figures

Atlantic Resources

Sayreville, New Jersey

CERCLIS No. NJD981558430

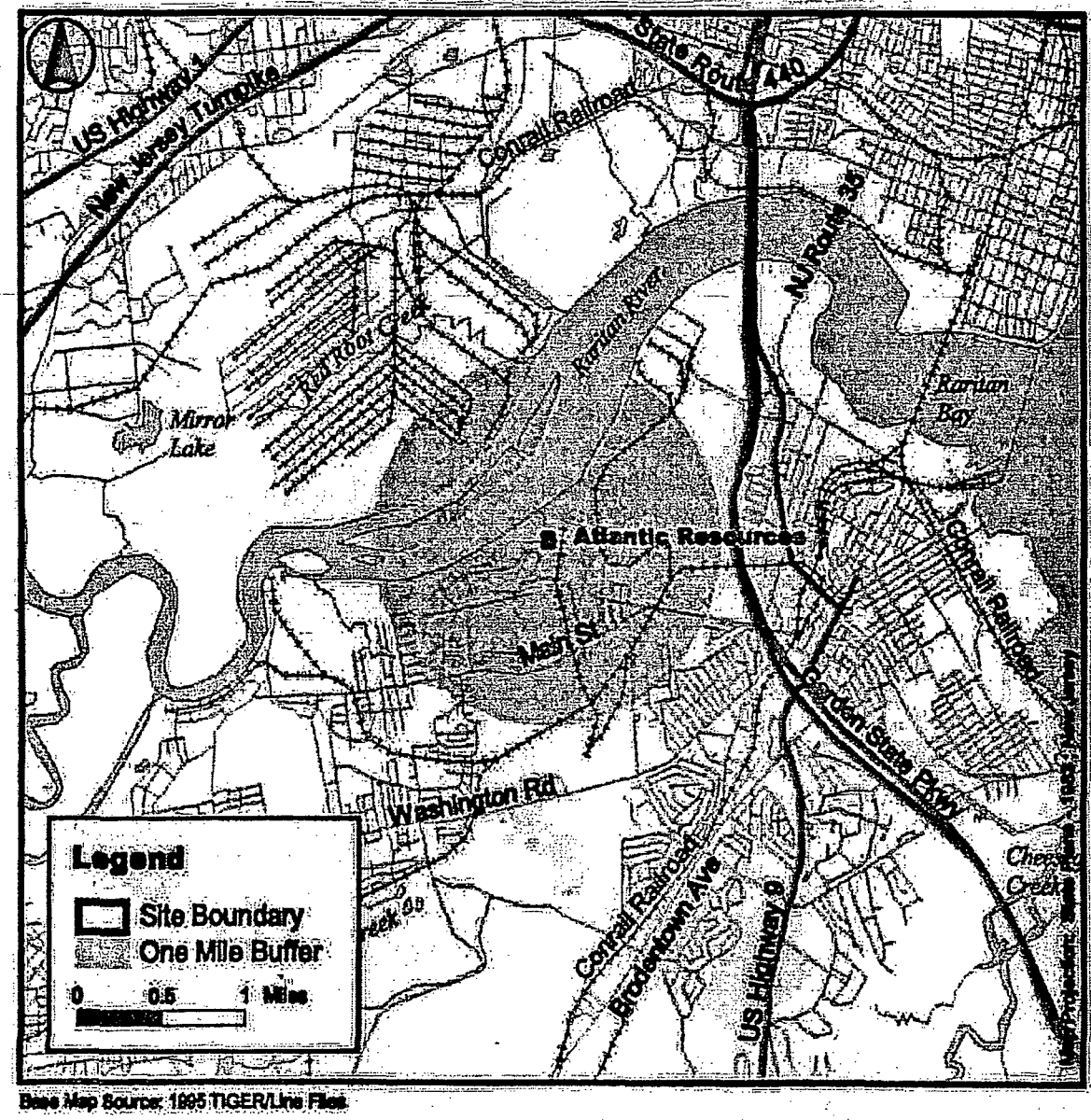

Figure 1. Atlantic Resources Corporation (ARC) Site Map.

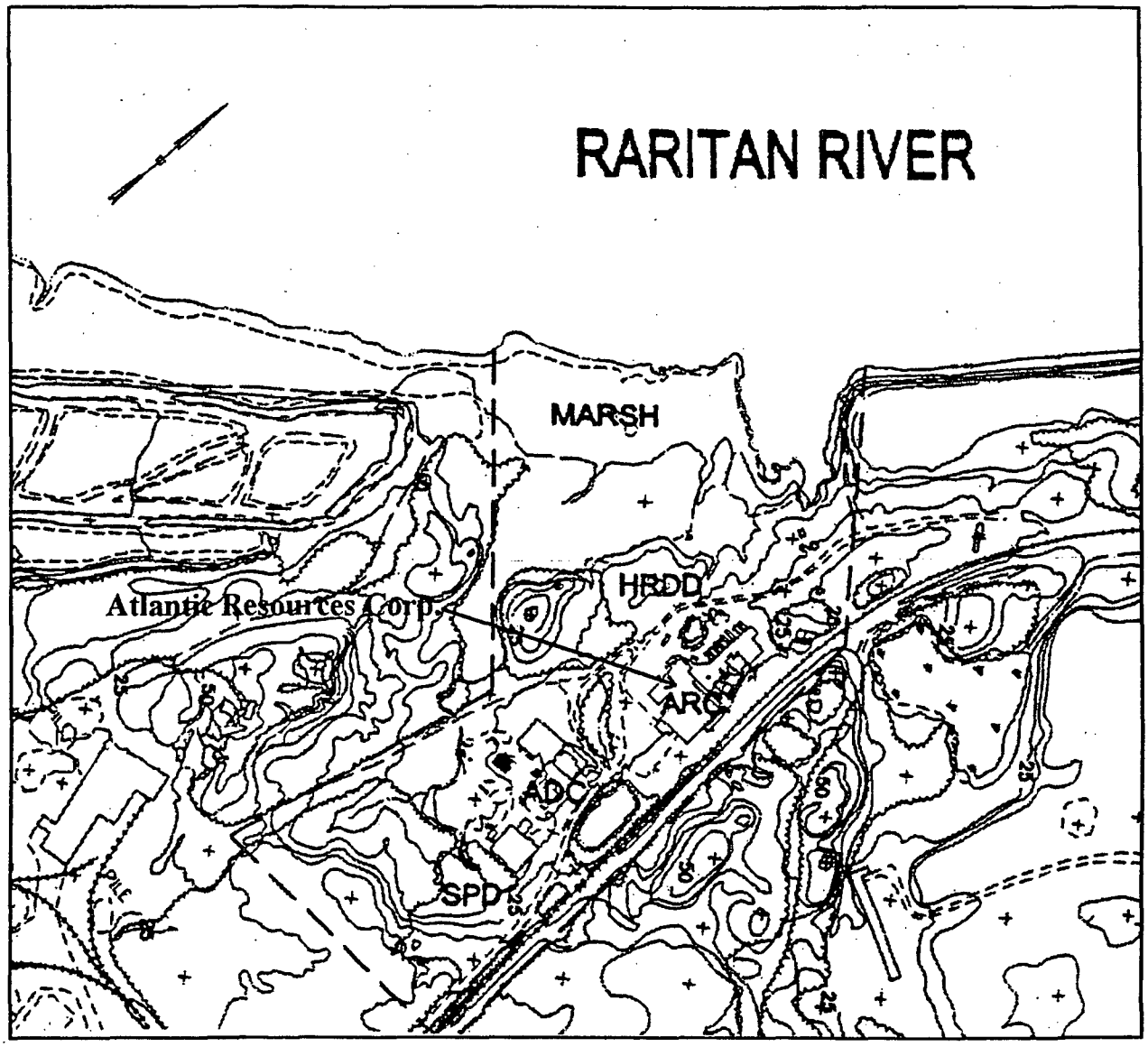

Figure 2 ARC Site Map Detail

Legend

HRDD	Horsehoe Road Drum Dump Dump
ARC	Atlantic Resources Corporation
ADC	Atlantic Development Corporation
SPD	Sayreville Pesticide Dump

Adapted from CDM [2]

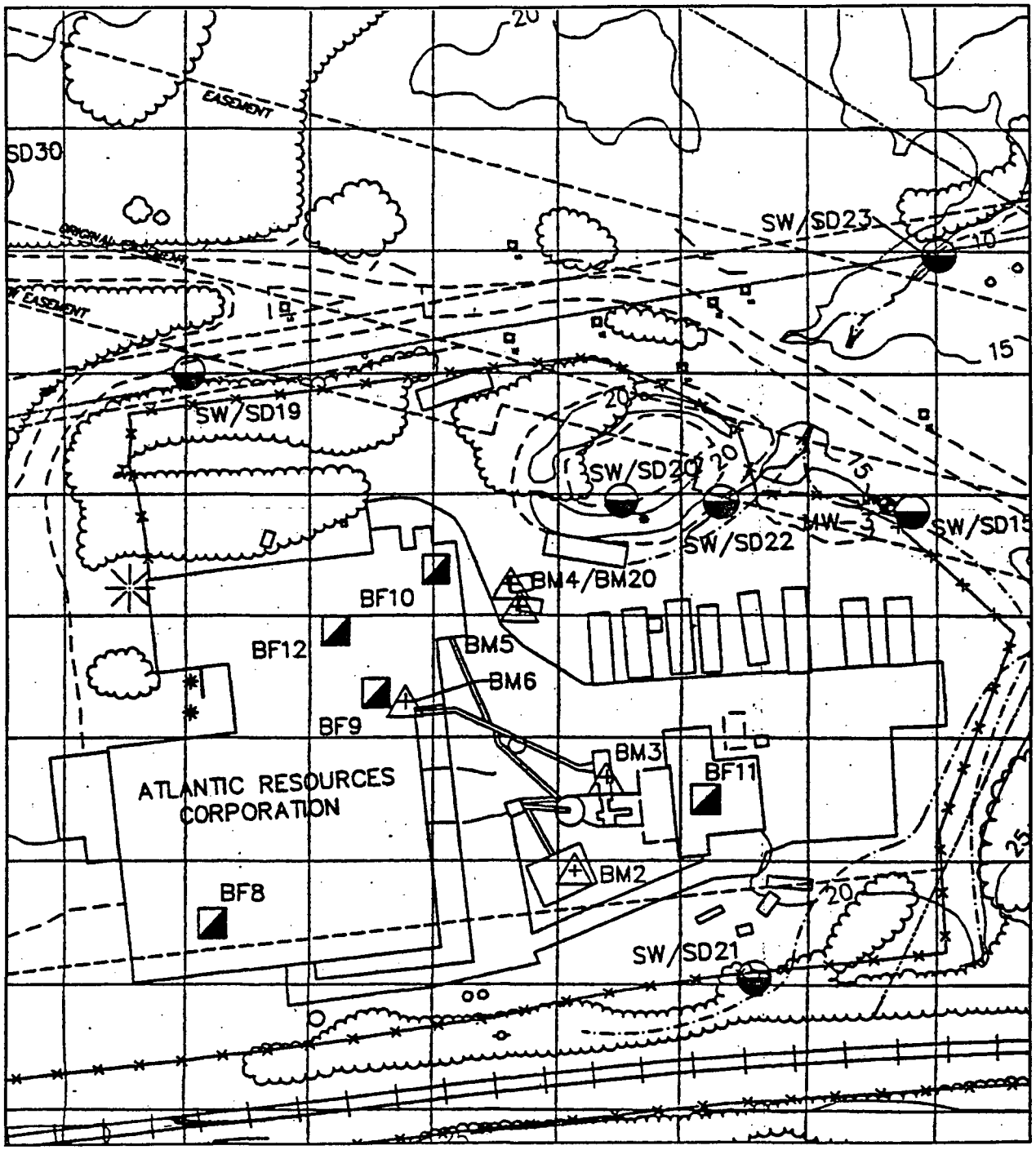

Figure 3a. Atlantic Resources Corporation (ARC) Site Detail Map with Some On-Site Sampling Locations Marked (CDM, 1999).

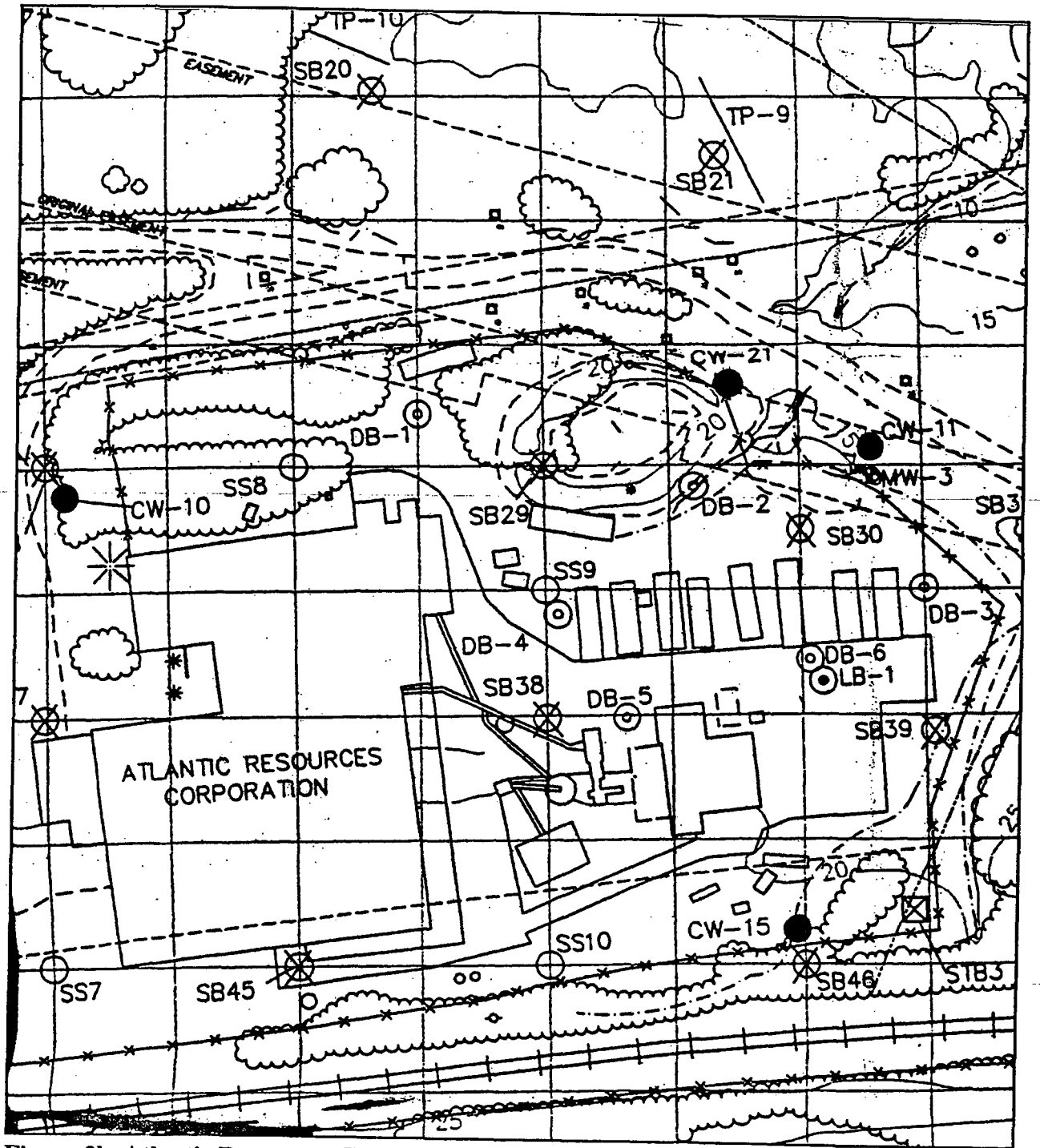

Figure 3b. Atlantic Resources Corporation (ARC) Site Detail Map with Some On-Site Sampling Locations Marked (CDM, 1999).

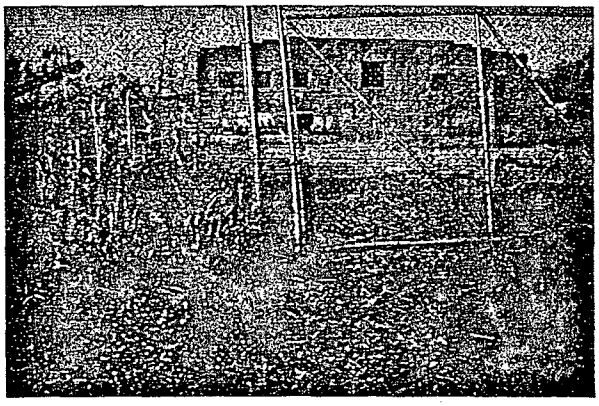

Figure 4. A chain link fence installed surrounding the Atlantic Resources Corporation (ARC) facility.

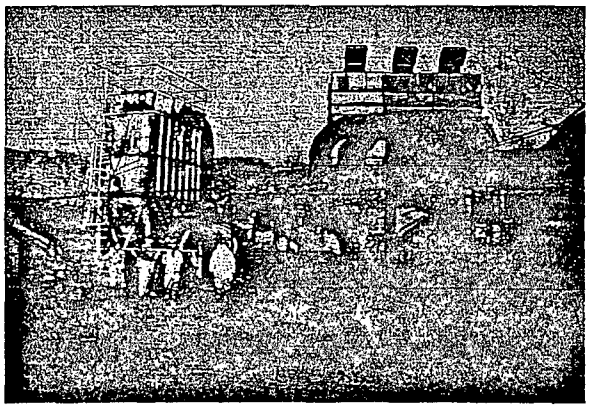

Figure 5. Abandoned ARC facility.

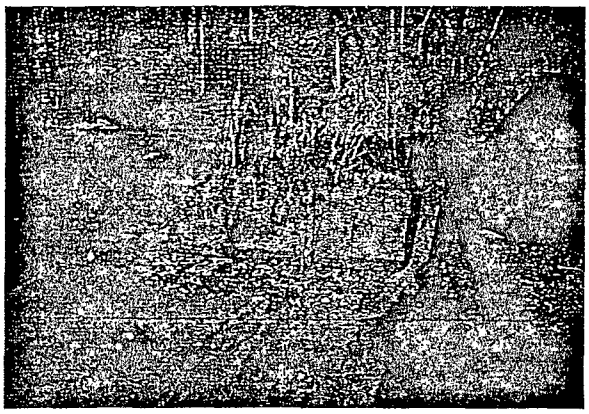

Figure 6. Debris from the ARC previous operation.

Appendix B - Tables

Table 1. Demographic Statistics within One Mile of the Atlantic Resources Corporation (ARC)

Demographic Statistics Within One Mile of Site*	
Total Population	3599
White alone	2813
Black alone	251
Am. Indian, Eskimo, Aleut	8
Asian alone	363
Native Hawaiian and Other Pacific Islander alone	1
Some other race alone	89
Two or More Races	73
Hispanic Origin	312
Children Aged 6 and Younger	323
Adults Aged 65 and Older	372
Females Aged 15 - 44	854
Total Housing Units	1319

Demographics Statistics Source: 2000 US Census
*Calculated using an area-proportion spatial analysis technique

Appendix C- 2000 ATSDR Health Consultation

Health Consultation

Evaluation of Public Health Implication of Trespassing

HORSESHOE ROAD

SAYREVILLE, MIDDLESEX COUNTY, NEW JERSEY

CERCLIS NO. NJD980663678

JUNE 28, 2000

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
Agency for Toxic Substances and Disease Registry
Division of Health Assessment and Consultation
Atlanta, Georgia 30333

HEALTH CONSULTATION

Evaluation of Public Health Implication of Trespassing

HORSESHOE ROAD

SAYREVILLE, MIDDLESEX COUNTY, NEW JERSEY

CERCLIS NO. NJD980663678

Prepared by:

New Jersey Department of Health and Senior Services
Under Cooperative Agreement with the
Agency for Toxic Substances and Disease Registry

BACKGROUND AND STATEMENT OF ISSUES

Statement of Issues

In January of 1999, the Edison Wetlands Association (EWA) requested that the Agency for Toxic Substances and Disease Registry (ATSDR) and the New Jersey Department of Health and Senior Services (NJDHSS) perform an evaluation of the potential health threat posed by trespassing at the site and to consumers of edible biota (mostly blue crabs) from commercial fishing that occurs on the Raritan River adjacent to the site. The Environmental Protection Agency (EPA) has performed surface water, sediment, and biota sampling (blue crabs and mummichogs, a forage fish) adjacent, upstream, and downstream of the site (CDM, 1999a). Once these data are available, ATSDR and the NJDHSS will evaluate the results of this sampling to determine the public health implications of persons consuming blue crabs from the Raritan River adjacent to the site. The purpose of this health consultation is to evaluate the public health significance of persons trespassing on the site, by evaluating the data generated during the remedial investigation (RI) (CDM, 1999b), and other potential hazards posed by the Horseshoe Road Complex (HRC) site.

Background

The HRC site is an area of about 17 acres located on Horseshoe Road near the Raritan River in northern Sayreville, Middlesex County, New Jersey. Specifically, the site is located at a relatively remote location at the end of Horseshoe Road along the south shore of the Raritan River (see Appendix A--Figure). The former chemical processing site includes three areas: (1) the Horseshoe Road Drum Dump (HRDD); (2) the former Atlantic Development Corporation (ADC); and (3) the Sayreville Pesticide Dump (SPD). These three areas have been grouped together as one site on EPA's National Priorities List (NPL), based on the proximity and the assumption that the contaminants are co-mingled and threatening the same resources. The former Atlantic Resources Corporation (ARC) is also located on the HRC site but is not part of the NPL site. However, portions of the ARC will be included in EPA's investigation of the site (EPA, 1999a).

The site's predominant features include the deteriorated structures, which comprise the defunct ADC and ARC facilities. The SPD and HRDD are contiguous with the ADC and ARC properties and are relatively inconspicuous. The site is bounded by the Raritan River and its wetlands to the north and west, railroad tracks to the south and east, and woodlands to the west (EPA, 1999b).

For over 30 years, various operations were conducted at the HRC site, including manufacture of epoxy resins, roofing materials, paint pigments, and pharmaceuticals, as well as solvent reclamation, hazardous waste incineration and precious metal recovery. Poor waste management

practices and dumping of waste material resulted in site-wide contamination of soil, sediment, and groundwater with hazardous substances. Releases of hazardous substances to the Raritan River, adjacent to the site, have been reported (EPA, 1999b).

EPA has performed several actions at the site. The most recent EPA removal action included addressing the following issues (EPA, 1999b):

1. removal of potentially contaminated surface debris from several areas (fragments of tar-like solids, resinous/gelatinous, glue-like material, glass containers, corroded/rusted drum carcasses, and other miscellaneous debris) found outside the fence, including areas adjacent to the Horseshoe Road and SPD;
2. removal of ash (primarily contaminated with dioxin and metal compounds) on concrete pads, in open kilns, and other contaminated materials in buildings at the ARC facility;
3. posting of signs along the river adjacent to the site summarizing the State health advisory regarding fish and crab consumption;
4. repair/re-installation of damaged sections of fencing around the site; and,
5. drainage control to minimize off-site migration of contaminated sediments.

The above removal actions were completed by June 7, 1999.

Past ATSDR/NJDHSS Activities

The New Jersey Department of Health and Senior Services (NJDHSS), under cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR), prepared a Preliminary Public Health Assessment for the Horseshoe Road Complex (HRC) site (ATSDR, 1995). In addition, the ATSDR prepared a Health Consultation for the site in 1991 (ATSDR, 1991). Since the issuance of these documents, the U.S. Environmental Protection Agency (EPA) completed a Remedial Investigation (RI) of the site in 1999.

Site Visits

ATSDR and NJDHSS personnel have visited the site on several occasions beginning in December of 1993. The most recent visits occurred on March 3, 1999 and July 28, 1999. Gregory Ulirsch and Arthur Block, ATSDR, and James Pasqualo and Jeffrey Winegar (July 1999 site visit only), NJDHSS, were shown the site by both representatives of the EWA and the EPA during the March 3, 1999 visit and by the EPA during the July 28, 1999 visit. Please see Appendix B for a delineation of the observations made during the March 1999 site visit. The following are the observations made during the July 1999 site visit:

- During the March 1999 site visit, just outside the fenced area for the SPD, an area with bottles filled with colored liquids and sludges were observed. This area was cleaned-up during the last removal action performed by EPA on June 7, 1999. The area was covered

by hay and, according to the EPA Remedial Project Manager (RPM), no surface debris remains.

- The ash (containing dioxin and other contaminants) was removed as noted above.
- The buckets of a gelatinous material (outside the fence in and around the SPD and ADC), as noted during the March 1999 site visit (see Appendix B), were no longer present--they were removed by the EPA.
- Check dams, put in place during the last removal action by EPA, to help prevent the off-site migration of contaminants to the Raritan River, were observed at two locations (the main drainage areas noted during the March 1999 site visit--see Appendix B).
- The purple puddle observed in the HRDD area during the March 1999 site visit was not present, presumably because of the dry conditions at the site during the visit.
- No unusual odors were noted during the visit; however, the site visit team did not access the ADC fenced area (where odors were noted during the March 1999 visit).
- Although the conditions at the site were very dry, it was not unusually dusty during the visit.

DISCUSSION--Children and Adult Health Issues

Assessment Methodology

To determine whether trespassers are exposed to contaminants from the site, ATSDR evaluates the environmental and human components that lead to human exposure. This pathways analysis consists of five elements: (1) a **source** of contamination; (2) transport through an **environmental medium**; (3) a **point** of human exposure; (4) **route** of human exposure; and, (5) an **receptor population**. ATSDR classifies exposure pathways into three groups: (1) **"completed pathways"**, that is, those in which exposure is reasonably likely to have occurred, to occur, or to occur in the future; (2) **"potential pathways"**, that is, those in which exposure might have occurred, may be occurring, or may yet occur; and, (3) **"eliminated pathways"**, that is, those that can be eliminated from further analysis because one of the five elements is missing and will never be present, or in which no contaminants of concern can be identified.

After the pathways are designated as completed, potential, or eliminated, ATSDR usually follows a two-step methodology to comment on public health issues related to exposure pathways at hazardous waste sites. First, ATSDR obtains representative environmental monitoring data for the site of concern and compiles a list of site-related contaminants. ATSDR compares this list of contaminants to health-based values (health comparison values or HCVs) to identify those contaminants that do not have a realistic possibility of causing adverse health effects. Second, for the remaining contaminants, ATSDR evaluates site-specific conditions to determine what exposure scenario is realistic for a given exposure pathway. Given this exposure scenario, ATSDR determines a dose and compares this dose to scientific studies to determine whether the extent of exposure indicates a public health hazard.

The health-based comparison values used in this report are concentrations of contaminants that the current public health literature suggest are "safe" or "harmless." These comparison values are quite conservative, because they include ample safety factors that account for most sensitive populations. ATSDR typically uses HCVs as follows: if a contaminant is never found at levels greater than its comparison value, ATSDR concludes the levels of corresponding contamination are "safe" or "harmless." If, however, a contaminant is found at levels greater than its HCV, ATSDR designates the pollutant as a contaminant of concern and examines it further in the assessment. Because HCVs are based on extremely conservative assumptions, the presence of concentrations greater than an HCV does not necessarily suggest that adverse health effects will occur among the exposed population. More information on the comparison values can be found in Appendix C.

Site Contaminants of Concern

The primary source of data for the evaluation of trespasser exposures was provided by the Remedial Investigation (RI) performed by EPA's contractor (CDM, 1999b). In addition, ATSDR did receive and review data from the EWA. Although ATSDR used the data provided in the RI to make its conclusions regarding the public health implications of trespassing on the site, the data provided by EWA were evaluated to determine how consistent their results were compared to the RI's (see below).

Tables 1 and 2 (see Appendix D) lists contaminants of concern for completed and potential exposure pathways to on-site trespassers (see Discussion Section below for a description of the completed and potential exposure pathways)--these are based on a comparison with health-based environmental media values. These contaminants of concern will be further discussed in the public health implications section below. It is important to note that the levels of contaminants detected in HRDD surface soils (especially arsenic) for the RI were appreciably lower than the levels detected in HRDD soil results provided by the EWA.

EPA performed extensive analysis of water samples from the purple puddle located in the HRDD area but did not identify any contaminants on EPA's Hazardous Substances List (HSL) or known dyes (John Osolin, EPA RPM, personal communication). Therefore, it is impossible, despite several attempts by EPA, to determine the chemical-specific nature of the material that makes the puddle purple.

As indicated above, the EPA removed several piles of contaminated ash from concrete pads, from open kilns, and other contaminated materials in the building at the ARC facility. The sampling of building material for the RI included samples of four ash piles and samples of two visibly contaminated areas within the ARC building. During the June 1999 EPA removal action, the visibly contaminated material located in the northwest corner of the building (sample #BM06) was cleaned-up. The only known contaminated material (dusts), based on the RI sampling, that remain within and near the ARC building are the one area in the southeast corner

of the building (sample #BM01) and any contaminated soil under the ash pile that was on the ground (sample #BM02).

Exposure Pathways

For the Horseshoe Road Complex site, ATSDR/NJDHSS has determined that on-site surface soils and sediments located outside the fenced areas, except for the marsh because of its natural access barriers, are reasonably accessible to those persons who may trespass on the site. In the past, trespassers on the site are known to have used ATVs, fished, and hunted on the site; moreover, it is unlikely that very young children would access the site, mostly due to the remoteness of the site. In addition, it is likely that trespassers would either be adults or older children (weighing greater than or equal to 35 kilograms). Therefore, ATSDR/NJDHSS has determined that a completed exposure pathways exists for those who may trespass on the site in accessible areas (HRDD). Exposure to persons who trespass on the HRDD may have been occurring for several days up to more than one year.

Despite the fence and other natural access barriers, it is possible that some exposure may occur within the fenced areas and marsh. The occasional trespasser, however, is unlikely to either inadvertently or intentionally come in contact with contamination inside the two fenced areas and the marsh. Moreover, since there is strong evidence that a certain group(s) of persons have frequented the ARC building for possibly several years, ATSDR/NJDHSS have determined that the potential exists for long-term (chronic) exposure to building dust and soil within and near the building. However, besides vandalism, it is not known what type of activities the group engages in during its visits to the ARC building. In addition, the likelihood of future chronic exposures to this group, at levels of health concern, have been reduced since EPA's June 1999 removal action was completed. Therefore, given the uncertainty as to this group's activities in the ARC building and the reduced potential for exposure, it would be difficult to determine the likelihood of chronic exposure and to quantify exposure levels. Therefore, for these reasons, ATSDR/NJDHSS have determined that contaminated media inside the fence and marsh areas, including the ARC building dusts remaining, represent a potential exposure pathway for acute and intermediate exposures only.

Routes of exposure include ingestion of surface soils, sediment, and dusts and inhalation of volatile gases and dusts. In addition, since the area known as the purple puddle is in an accessible area and is probably an attraction to trespassers who may enter the site, it is reasonable to assume that exposure to the unknown constituents in the puddle is occurring. Contaminant levels in other accessible surface water bodies in the HRDD are not above levels of concern for the occasional trespasser. Given the relatively low levels of contaminants (maximum and average) detected in HRDD surface soils, ATSDR does not consider dermal exposures to be a significant pathway to those who trespass in this area. Quantifying dermal exposures in the potential exposure pathways would be problematic given the unknown nature of activities engaged in by persons who trespass at the ARC building.

To estimate exposure doses of persons hunting and/or trespassing on the site, the following conservative assumptions were made. It was assumed that the site was visited by children (weighing 35 kilograms), two times per week, for a period of six months per year, and that they would ingest either 200 or 100 milligrams (mg) of soil during each visit. An ingestion rate of 200 mg per visit was assumed for the short-term (less than one year) exposure scenario and an ingestion rate of 100 mg per visit was assumed for the long-term (greater than one year) exposure scenario. Because of their increased body weight, adults generally have a less toxic response than do children. Therefore, adults exposures will be evaluated only if is determined that adverse health effects are likely in children. Given the current site conditions, ATSDR and NJDHSS have determined that chronic exposures to site contaminants, by the occasional trespasser, is only likely in the HRDD area. However, as indicated above, chronic exposures to those who frequent the ARC building is possible but difficult to quantify.

The short-term exposure scenarios assume that a person could be acutely exposed (1 to 14 days) to the highest levels of contaminants present at the site or intermediately exposed (about 15-60 days) to a reasonable average of the contaminant concentrations present. In addition, the long-term exposure scenario assumes that a person could be exposed chronically (greater than 365 days or one year) to the contaminants found in surface soil at the HRDD. For the intermediate exposure and chronic exposure scenarios, ATSDR and NJDHSS have averaged several of the highest concentrations for a given area of the site to obtain a more reasonable level that a person would be exposed to during several visits. It is also important to note that because some sediment samples obtained during EPA's Remedial Investigation may be more accessible during dry conditions at the site (i.e., may be more like surface soils than sediments), contaminant concentrations found in sediment will be considered surface soils for the analysis below.

In evaluating the data presented in the EPA's RI for the site, it is evident that most of the contaminants are present in subsurface soils. Moreover, most of the volatile organic compounds (VOCs) are found in subsurface soils. In general, the levels of VOCs in surface media (surface soils and waters) are relatively low. The most significant levels of contaminants, relatively speaking, in the surface media were in the semi- or non-volatile fraction. As noted above, ATSDR and NJDHSS personnel did detect odors at the ADC during the March 1999 site visit. Given the levels of VOCs in the subsurface soils and sediments at the ADC, it is not surprising to have detected gaseous contaminants above the odor threshold. However, odors were not detected in other parts of the site during the March or July 1999 site visits. Therefore, given the levels of contaminants in the surface media, it is not likely that the levels of VOCs in the air would accumulate to appreciable levels resulting in widespread air contamination at the site. Exposures to the occasional trespasser are likely to be of short duration and at low levels.

Inhalation of dust particles from the mechanical disturbance of surface soils, dry sediments, or building materials, could result in persons being exposed to contaminants attached to dust particles. The most likely location of mechanical dust generation would be in accessible areas where ATVs are used. However, as shown above in Table 1, the levels of contaminants in surface soils at the HRDD are relatively low and not likely to result in appreciable levels of

contaminants in airborne dusts. Moreover, it is well established in the literature that the mechanical generation of dusts produces particles that can enter the upper portions of the lungs but are unlikely to reach the lower or respirable regions. Evidence from numerous scientific studies indicates that particles generated by combustion sources (e.g., car exhaust, wood stoves, etc.) are more likely to reach the lower reaches of the lungs (USEPA, 1996). The most likely fate of mechanically generated dust particles is for them to be trapped by mucus in the respiratory system and be either swallowed or otherwise removed from the body. Since we used conservative rates for the ingestion of soil and/or sediment, any contribution to the oral dose provided by contaminants trapped in mucus would be accounted for. In the final analysis, it does not appear that the exposure to either volatile or dust-laden contaminants is an important exposure pathway at the HRC site under present conditions; therefore, it will not be further analyzed in this health consultation.

The public health implication of ingestion of contaminated surface soils and sediments and the hazards posed by persons who use the ARC building are discussed below.

Public Health Implications

Completed and Potential Exposure Pathways

For the contaminants of concern listed in Tables 1 and 2, specific ingestion exposure doses were calculated for a chronic (HRDD surface soils only), intermediate, and acute scenarios based on the exposure assumption (see Assessment Methodology Section above). A comparison of the calculated dose to ATSDR's Minimum Risk Level (MRL), the U.S. EPA's Reference Dose (RfD), or the Lowest Observed Adverse Effect Level (LOAEL) for a given contaminant, found in the most recent ATSDR toxicological profile for that contaminant (ATSDR, 1992; ATSDR, 1994; ATSDR, 1995; ATSDR, 1998a,b; and, ATSDR, 1999a,b,c) was performed for the chronic (for HRDD surface soils only), intermediate, and acute exposure scenarios. The results of the intermediate and acute comparisons are presented in Table 3 (see Appendix D). As can be seen from the data in Table 3, except for lead and total PCBs, the calculated doses were much lower than the lowest level in the literature that has produced an adverse health effect in either human or animal studies. Therefore, acute or intermediate completed or potential exposures to all these contaminants were not at levels that are likely to result in adverse health effects for the occasional trespasser at the site. The lead and total PCB exposure, however, need additional analysis to determine the public health implications of exposure these contaminants. The evaluation of the intermediate and acute exposures to lead and PCB's (non-carcinogenic only) and the chronic exposures (carcinogenic and non-carcinogenic) to contaminants found in the surface soils at the HRDD are presented below.

Lead

The lowest LOAEL for acute lead exposures (at the HRDD and other areas of the HRC), that the analysis in Table 3 was based on, is a human study that showed a decreased enzyme activity. ATSDR has determined in the toxicological profile for lead (ATSDR, 1999c) that this health outcome is considered to be a less serious effect. When comparing the calculated doses for the

lowest LOAEL for serious effects cited in the toxicological profile, the calculated dose is about 758 times lower. Therefore, it is not likely that acute lead exposures at the site would result in a serious adverse health effect. For intermediate exposures, the lowest LOAEL used in the comparison presented in Table 3 is based on a human study that showed some hematological effects. As with the acute study LOAEL above, this effect is considered by ATSDR to be a less serious one (ATSDR, 1999c). However, the lowest intermediate exposure LOAEL for serious health effects (reproductive effects in rats) found in the literature (ATSDR, 1999c) is only 12 times higher than the calculated dose. This lead exposure may be of concern if it were to occur on a frequent basis. However, the likelihood of these exposures are reduced because of the access barriers present at the ARC facility.

PCBs

The lowest LOAEL for acute PCB exposures, that the analysis in Table 3 was based on, is an animal study that showed a developmental effect in rats (lower liver weight) (ATSDR, 1998a). ATSDR has determined in the toxicological profile for PCBs (ATSDR, 1998a) that this health outcome is a less serious effect. When comparing the calculated doses for the lowest LOAEL for serious effects, cited in the toxicological profile, the calculated dose is 7,000 times lower for the exposures at the HRDD and at least 1,150 times lower for the exposures at the rest of the site . Therefore, it is not likely that serious adverse health effects would result from acute PCB exposures at the site. For the intermediate exposure scenario, as seen from Table 3, the calculated doses were well below the LOAEL; therefore, adverse health effects are not likely.

As indicated above, ATSDR also evaluated the long-term or chronic exposures to surface soil contaminants at the HRDD–this evaluation included a look at both non-carcinogenic and carcinogenic adverse health effects. For non-carcinogenic effects, ATSDR determined that all of the doses calculated for the contaminants found in HRDD surface soils (see Table 1 for list of contaminants) were well below levels that are likely to result in adverse health effects from long-term exposures to trespassers. The exposure doses were compared to their respective MRL, RfD, or LOAEL. Moreover, ATSDR calculated the theoretical lifetime excess cancer risk (LECR) for those who may have trespassed at the HRDD for more than one year. This evaluation indicated that person who chronically trespass at the HRDD would have a very low increased risk of cancer from their exposures.

Use of the ARC Building

As indicated above, it is possible for the group(s) of persons who frequent the ARC building to be exposed to the remaining contaminants within and near the building. However, it is difficult to determine what activities they may engage in that would bring them into contact with the remaining contamination. From a public health perspective, the greatest **known** risk for this group is the physical hazards posed by the dilapidated building and equipment.

CONCLUSIONS

Based on these data and information from the EPA's Remedial Investigation for the Horseshoe Road site, trespasser exposures to the ***known*** contaminants at the HRC site, would not likely result in serious adverse health effects. Therefore, ATSDR/NJDHSS has determined that this exposure is a ***no apparent public health hazard***. However, the chemical-specific nature of the water in the purple puddle is not known; therefore, the public health significance of exposure to this surface water (soil, if dry) cannot be evaluated. This exposure would be considered by ATSDR/NJDHSS to present an ***indeterminate public health hazard***. Because of the physical hazards present at the ARC and ADC facilities, ATSDR/NJDHSS has determined that these buildings represent a ***public health hazard*** to the most determined trespasser who may gain access to these areas--this hazard is probably greatest for the group(s) who frequent the ARC building on a regular basis.

The evaluation of potential exposure pathways at the HRC site indicate that only intermediate exposures to lead in surface soils at ARC facility may result in a serious adverse health effect if exposure would occur on a frequent basis. However, the likelihood of these exposures are reduced because of the access barriers present at the ARC facility. Potential exposures to the group(s) who frequent the ARC building is difficult to quantify because it is not known what activities this group(s) engages in during their visits to the building.

In the absence of remediation at the HRC site, the contaminants present in surface soil, sediment, and building material (dust) are at levels of potential public health concern for chronic, long-term exposures, if the land use were to change or access limitations were not maintained.

Given the levels of contaminants in the surface media, it is not likely that the levels of VOCs in the air at the site would accumulate to appreciable levels resulting in widespread air contamination. Air exposures to the occasional trespasser are likely only in localized areas and to be of short duration and at low levels.

Inhalation of dust particles from the mechanical disturbance of surface soils, dry sediments, or building materials, could result in persons being exposed to contaminants attached to dust particles. The most likely location of mechanical dust generation would be in accessible areas where ATVs are used. However, the levels of contaminants in surface soils at the HRDD are relatively low and not likely to result in appreciable levels of contaminants in airborne dusts. Moreover, it is well established in the literature that the mechanical generation of dusts produces particles that can enter the upper portions of the lungs but are unlikely to reach the lower or respirable regions. The most likely fate of mechanically generated dust particles is for them to be trapped by mucus in the respiratory system and be either swallowed or otherwise removed from the body.

The primary source of data for the evaluation of trespasser exposures was provided by the Remedial Investigation (RI) performed by EPA's contractor. In addition, ATSDR did receive

and review data from the EWA. Although ATSDR used the data provided in the RI to make its conclusions regarding the public health implications of trespassing on the site, the data provided by EWA were evaluated to determine how consistent their results were compared to the RI's. It was determined that some of the soil samples taken by the EWA at or adjacent to the HRDD were consistently higher for some contaminants, especially arsenic, than were detected in surface soil samples from the HRDD taken during the RI.

RECOMMENDATIONS

Measures should be taken to eliminate the physical hazards posed by the ARC and ADC facilities.

Access restrictions to the ARC and ADC facilities should be maintained and monitored.

Measures should be taken to eliminate the potential for exposure to the unknown contaminants in the purple puddle area of the HRDD.

PUBLIC HEALTH ACTION PLAN

The Public Health Action Plan (PHAP) for the Horseshoe Road Complex site contains a description of the actions to be taken at or in the vicinity of the site. The purpose of the PHAP is to ensure that this health consultation not only identifies public health hazards, but provides a plan of action designed to mitigate and prevent adverse human health effects resulting from exposure to hazardous substances in the environment. This report will be placed in repositories that contain copies of this health consultation, and will be provided to persons who request it. The public health actions taken or to be implemented are as follows:

Actions Planned

1. The public health significance of the bioaccumulation of site-related contaminants in edible biota (blue crabs, mostly) from the Raritan River has not been evaluated and will be the subject of an ATSDR/NJDHSS health consultation after the current biota and environmental sampling results are available.

2. ATSDR/NJDHSS will continue to work with the Edison Wetlands Association and the U.S. EPA to evaluate the public health implications of actual and potential exposures to contaminants associated with the Horseshoe Road Complex site.

3. If the U.S. EPA were to resample surface soil from the HRDD to validate the levels of contamination detected in the EWA's soil samples, ATSDR would revisit the public health implications of these exposures to those who trespass in this area.

ATSDR will reevaluate and expand the Public Health Action Plan (PHAP) when needed. New environmental, toxicological, health outcome data, or the results of implementing the above proposed actions may determine the need for additional actions at this site.

CERTIFICATION

The Health Consultation for the Horseshoe Road Complex site was prepared by the New Jersey Department of Health and Senior Services 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 Health Consultation was initiated.

Gregory V. Ulirsch
Technical Project Officer, SPS, SSAB, DHAC

The Division of Health Assessment and Consultation (DHAC), ATSDR, has reviewed this Health Consultation and concurs with its findings.

for Lora C Hayes
Acting Chief, SSAB, DHAC, ATSDR

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Office of Regional Operations

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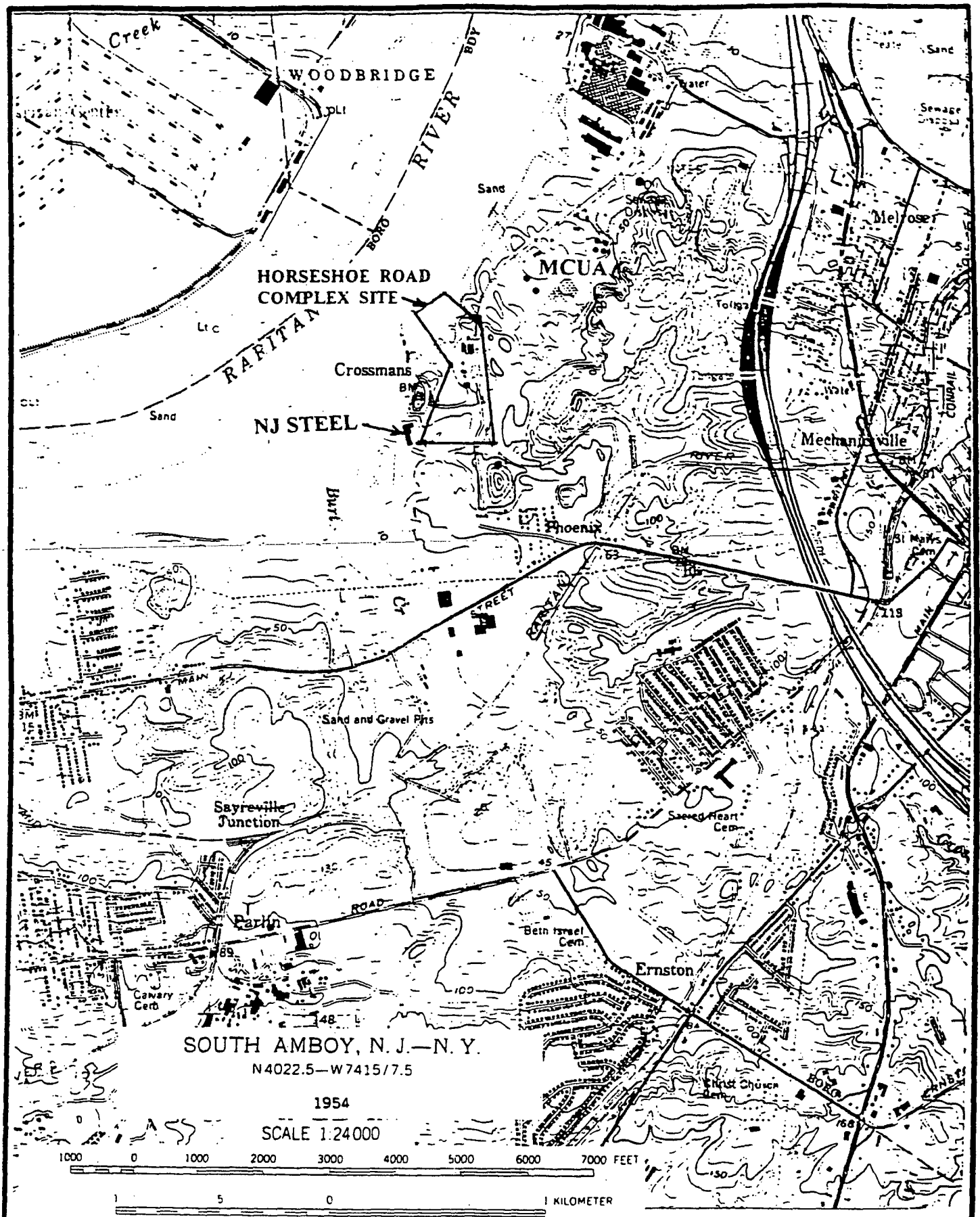
APPENDIX A
FIGURE



HORSESHOE ROAD SITE LOCATION MAP

APPENDIX B
ATSDR RECORD OF ACTIVITY REPORT

ATSDR Record of Activity

UID #: __ Date:3/3/99 Time: 10:00 am X pm _

Site Name: Horseshoe Road site City: Sayreville Cnty: Middlesex County State: NJ

CERCLIS #: N/A Cost Recovery #: 20BT__ Region: 2

Site Status (1) X NPL _ Non-NPL _ RCRA _ Non-Site specific _ Federal
(2) _ Emergency Response _ Remedial _Other

Activities

_ Incoming Call
_ Outgoing Call
_ Conference Call
_ Incoming Mail
_ Public Meeting
_ Other Meeting
_Data Review
_ Other
X Health Consult
_ Health Referral
_ Written Response
X Site Visit
_ Info Provided
_ Training

Requestor and Affiliation: Robert Spiegel, Director, Edison Wetlands Association

Phone: (732) 661-9630 Address: 1115 Inman Avenue, Suite 180

City: Edison State: NJ Zip Code: 08820

Contacts and Affiliation

(1) Arthur Block, ATSDR _____ (9) James Pasqualo, NJDHSS (2) John Osolin, EPA _____ ( ) _____

1=ATSDR 2=EPA 3=USCG 4=DOD 5=DOE 6=NOAA 7=Natl Respns Ctr 8=other Fed
9=State Hlth 10=State Env 11=other state 12=County Hlth 13=other county 14=City Hlth 15=other city
16=Hospital 17=Poison Ctr 18=Fire Dept 19=Law Enf 20=Priv Citzn 21=Ctzn Group 22=Elected Off
23=Priv Co. 24=News Media 25=Internatl 26=Other_____ 27=Unknown

Program Areas

_ Health Assessment
_ Petition Assessment
_ Emergency Response
X Health Consultation
_ Health Studies
_ Health Surveilnc
_ Disease Regstry
_ Exposr Regstry
_ Tox Info-profile
_ Tox Info-Nonprofile
_ Subst-Spec Resch
_ Health Education
_ Worker Hlth
_ Admin
_ Other

Site Visit Summary

Mr. Robert Spiegel, Director, Edison Wetlands Association (EWA), in a letter to Mr. Arthur Block, ATSDR, Region 2, requesting that ATSDR evaluate potential health issues at the Horseshoe Road

site in Sayreville, Middlesex County, New Jersey. Mr. Spiegel specifically requested that ATSDR look into the issues regarding exposure to trespassers on-site (hunters, etc) and to the consumption of blue claw crabs from the Raritan River (from recreational or commercial fishing). Mr. Spiegel also requested that ATSDR visit the site in the company of an EWA representative. A site visit was conducted with Mr. Spiegel, Jim Pasqualo, NJDHSS, John Osolin, EPA, and Arthur Block, ATSDR on March 3, 1999. The following are the observations made and information learned during the site visit:

- The site is located in a relatively isolated area, only those with previous knowledge about the site would be able to gain access.

- The road that leads to the main part of the site is fenced (gate); however, persons walking, etc., can gain access by going around the gate.

- Just off the access road before reaching the Sayreville Dump are woods with several tree stands for hunters and an area with bottles filled with colored liquids and sludge.

- Atlantic Development and the Sayreville Pesticide Dump are fenced and appear to be secure. Chemical odors behind the Atlantic Development Building #3 were noted during the visit.

- Atlantic Resources is partially fenced. The Atlantic Resources Building is in great disrepair and appears to have been the location of trespassing by individuals using this building as a hangout. The degree to which this activity occurs currently is not know; however, it has been reported that the local police occasionally patrol the area looking for any activity at the site. As of the site visit, several piles of ash (containing some dioxin) remained on-site at the Atlantic Resources complex. According to John Osolin, EPA, Remedial Project Manger, these piles are scheduled to be removed and disposed of off-site.

- Access to the Horseshoe Road Dump area is open. This area contained circuit boards and a purple puddle.

- Gelatinous material (buckets) was found in and around the areas of Sayreville Pesticides and Atlantic Development (outside fence).

- Two distinct drainage areas were noted at the site. One drainage area was located along the northwest corner of Atlantic Resources which probably drained most of this complex. Water in this drainage channel is discharged to the Raritan River. Most of this drainage and areas it discharges to were devoid of vegetation. A duck blind is located next to this main drainage area.

- The other main drainage area comes out next to the Atlantic Development Corporation.

- Mr. Spiegel indicated that he has videotape on commercial fishing in proximity to the Horseshoe Road site. Mr. Spiegel gave ATSDR a copy of this videotape for review.

- Mr. Osolin indicated that EPA was planning to sample blue crabs from the Raritan River in proximity to the site during the summer months that the crabs are found in the river (around July-August).

- Besides clear evidence of hunters trespassing on the site, Mr. Spiegel indicated that ATV's and motorcyclists trespass on-site.

Follow-up Actions:

- ATSDR/NJDHSS will incorporate information learned and observations made at the site visit in a health consultation that will address the public health implications of potential exposures to trespassers at the site and the potential for blue crabs and other edible biota to bioaccumulate site-related contaminants.

- ATSDR/NJDHSS will evaluate tissue samples obtained from edible biota taken from the Raritan River in relation to the Horseshoe Road site for their public health significance.

Signature: Gregory V. Ulirsch Date: 5/4/99

cc: Arthur Block, ATSDR, Region 2
Jim Pasqualo, NJDHSS
Robert Spiegel, Director, Edison Wetlands Association

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APPENDIX C
DESCRIPTION OF HEALTH COMPARISON VALUES

Environmental Media Evaluation Guides (EMEGs) and Reference Dose Media Evaluation Guides (RMEG) are estimates of chemical concentrations that are not likely to cause an appreciable risk of deleterious, noncancerous health effects for fixed durations of exposure. These concentrations factor in estimates of receptor body weights and rates of ingestion. EMEGs might reflect several different types of exposure: acute (1-14 days), intermediate (15-364 days), and chronic (greater than 365 days). EMEGs are based on ATSDR's minimum risk level (see definition below) while RMEG's are based on U.S. EPA's reference dose (RfD).

Lowest-Observed-Adverse-Effect-Level (LOAEL) is defined as the lowest dose of chemical in a study, or group of studies, that produces statistically or biologically significant increases in the frequency or serverity of adverse effects between the exposed population and its appropriate control.

Minimum Risk Level (MRL) is defined as an estimate of daily human exposure to a substance that is likely to be without appreciable risk of adverse health effects (non-carcinogenic) over a specfied duration of exposure. MRLs are derived when reliable and sufficient data exist to identify the target organ(s) of effect or the most sensitive health effect(s) for a specified duration within a given route of exposure. MRLs are based only on noncancerous health effects, and do not consider carcinogenic effects. MRLs can be derived for acute, intermediate, and chronic durations of exposure for the inhalation route.

Other comparison values were based on New Jersey Department of Environmental Protection's (NJDEP) health-based soil clean-up criteria for non-residential contact.

APPENDIX D
TABLES

Table 1: Surface Soil Contaminants of Concern (COC)--Completed Exposure Pathways

COC	*HRDD Max. Level (ppm)*	*HRDD Max. Level Medium*	*HRDD Ave. Level[1] (ppm)*	*HRDD Ave. Level Medium*	*HCV*
Antimony	21.4	SS	11.1	SS	20 Child RMEG
Arsenic	68.4	SED	35.8	SED	20 Child RMEG
Mercury (inorganic)	114	SED	33.3	SED	None
Total PCBs	11.5	SS	3.3	SS	None
Total PAHs	2.48	SS	NA	NA	None

Source: Remedial Investigation for Horseshoe Road Complex (CDM, 1999b)

Notes:
1 - Based on an average of several of the highest levels obtained from the same location as the maximum level for that contaminant.
COC - Contaminant of Concern
HRDD - Horseshoe Road Drum Dump
ppm - Parts per million
HCV - Health comparison value
SS - Surface soil (0-1 foot)
SED - Sediment
RMEG - Reference Dose Media Evaluation Guide
PCBs - Polychlorinated Biphenyls
PAHs - Polynuclear Aromatic Hydrocarbons

Table 2: Surface Soil Contaminants of Concern (COC)--Potential Exposure Pathways

COC	*Max. Level (ppm)*	*Location of Max. Level*	*Max. Level Medium*	*Ave. Level[1] (ppm)*	*Ave. Level Medium*	*HCV*
Antimony	99.5	ADC	SS	31.9	BM	20 Child RMEG
Arsenic	4,030	DSM	SED	1,917	SED	20 Child RMEG
Cadmium	103	ARC	SS	32.6	SS	10 Child EMEG
Lead	11,600	ARC	SS	2,661	SS	600 NJDEP
Mercury[2] (inorganic)	NA	NA	NA	NA	NA	NA
Methoxychlor	980	ADC	SS	232	SS	300 Child RMEG
Total PCBs	71.2	ARC	SED	30.2	SED	None
Total PAHs	5,480	ADC	BM	NA	NA	None

Source: Remedial Investigation for the Horseshoe Road Complex (CDM, 1999b)

Notes:

1 - Based on an average of several of the highest levels detected from the same location as the maximum level for that contaminant

2 - Mercury levels for other areas were not reported because the maximum level on the site was found at the Horseshoe Road Drum Dump--see Table 1

COC - Contaminant of Concern

ppm - Parts per million

HCV - Health comparison value

SS - Surface soil (0-1 foot)

SED - Sediment

BM - Building Material (dust samples)

NA - Not applicable

RMEG - Reference Dose Media Evaluation Guide

EMEG - Environmental Media Evaluation Guide

NJDEP - Health-based NJDEP soil cleanup level for non-residential direct contact

PCBs - Polychlorinated Biphenyls

PAHs - Polynuclear Aromatic Hydrocarbons

ADC - Atlantic Development Corporation

DSM - Downstream Marsh

ARC - Atlantic Resources Corporation

Table 3. Comparison of Calculated Doses with Lowest Observed Adverse Effect Levels (LOAEL)[1,2]

COC	HRDD (Completed Pathway)		Others Areas of HRC (Potential Pathway)	
	Acute	*Intermediate*	*Acute*	*Intermediate*
Antimony	4,408B	4,156B	930B	1,432B
Arsenic	22,775B	38,333B	396B	346B
Cadmium	BHCV	BHCV	3,390B	1,321B
Lead	BHCV	BHCV	0.5B	2.3B
Mercury[3] (inorganic)	2,923B	20,370B	NA	NA
Methoxychlor	BHCV	BHCV	BMRL	BMRL
Total PCBs	3.8B	18,519B	1.6A	2,000B
Total PAHs	714,285B	NS	1,277B	NS

Notes:

1 - Values in table represent the number obtained by dividing the LOAEL by the calculated dose.
This is a measure of how far above or below the calculated dose is from the LOAEL (i.e., how many times above or below the LOAEL) . See Appendix C for a more detailed definition of a LOAEL.

2 - LOAEL's were obtained from ATSDR Tox profiles for each contaminant of concern (ATSDR, 1992; 1994, 1995, 1998a,b, 1999a,b,c).

3 - The comparison of the dose to the LOAEL for other areas of the Horseshoe Road Complex was not performed because the maximum value for inorganic mercury was detected at the Horseshoe Road Drum Dump.

COC - Contaminant of concern
HRDD - Horseshoe Road Drum Dump
HRC - Horseshoe Road Complex
B - Below LOAEL
A - Above LOAEL
BHCV - Maximum level detected below health comparison values
BMCL - Dose calculated below ATSDR's Minimum Risk Level (MRL) for acute/intermediate exposures--see Appendix C for description of ATSDR's MRL.

NS - No applicable intermediate toxicological studies for non-carcinogenic effects were available for comparison.

Appendix D- 2001 ATSDR Health Consultation

Health Consultation

Evaluation of Public Health Implications of Crabbing

HORSESHOE ROAD

SAYREVILLE, MIDDLESEX COUNTY, NEW JERSEY

EPA FACILITY ID: NJD980663678

FEBRUARY 16, 2001

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
Agency for Toxic Substances and Disease Registry
Division of Health Assessment and Consultation
Atlanta, Georgia 30333

HEALTH CONSULTATION

Evaluation of Public Health Implications of Crabbing

HORSESHOE ROAD

SAYREVILLE, MIDDLESEX COUNTY, NEW JERSEY

EPA FACILITY ID: NJD980663678

FEBRUARY 16, 2001

Prepared by:

Hazardous Site Health Evaluation Program
Consumer and Environmental Health Services
Division of Epidemiology, Environmental and Occupational Health
New Jersey Department of Health and Senior Services
Under a Cooperative Agreement with the
Agency for Toxic Substances and Disease Registry

Background

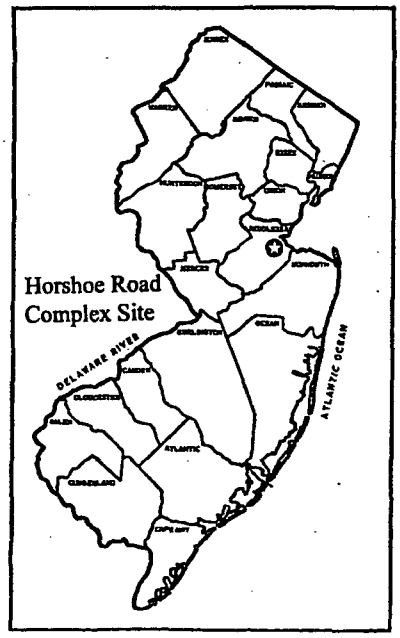
Statement of Issues

In January of 1999, the Edison Wetlands Association (EWA) requested that the Agency for Toxic Substances and Disease Registry (ATSDR) perform an evaluation of the potential public health threat posed by persons trespassing on the site, and, to consumers of edible biota (specifically "blue crabs": *Callinectes sapidus*) from commercial and subsistence fishing that occurs in the Raritan River adjacent to the Horseshoe Road Complex (HRC) site.

The U.S. Environmental Protection Agency (USEPA) has performed surface water, sediment, and biota sampling (among "blue crabs" and mummichogs, a forage fish) adjacent, upriver, and downriver of the site. The public health significance of potential exposures resulting from persons trespassing on the HRC site has been evaluated by the ATSDR/New Jersey Department of Health and Senior Services (NJDHSS) in a June 28, 2000 health consultation.[1] The purpose of this Health Consultation is to evaluate the public health significance of potential exposures to persons consuming "blue crabs" from the Raritan River adjacent to the HRC study area, by evaluating the data generated by the USEPA during the Remedial Investigation of the HRC site.[2]

Site Background

The HRC site occupies about 17 acres located on Horseshoe Road near the Raritan River in northern Sayreville, Middlesex County, New Jersey (see inset). Specifically, the site is located at a relatively remote location at the end of Horseshoe Road along the south shore of the Raritan River (see Appendix A, Figure 1). The former chemical processing site includes three sub-areas: (1) the Horseshoe Road Drum Dump (HRDD); (2) the former Atlantic Development Corporation (ADC); and (3) the Sayreville Pesticide Dump (SPD). These three areas have been grouped together as one site on USEPA's National Priorities List (NPL), based on the proximity and the assumption that the contaminants are co-mingled and threatening the same resources. The former Atlantic Resources Corporation (ARC) is also located on the HRC site but is not part of the NPL site. However, portions of the ARC are included in USEPA's investigation of the site.[3]



The site's predominant features include deteriorated structures, which comprise the defunct ADC and ARC facilities. The SPD and HRDD are contiguous with the ADC and ARC properties and are relatively inconspicuous. The site is bounded by the Raritan River and its wetlands to the north and northwest, railroad tracks to the south and east, and woodlands to the west.[3]

Over the last 30 years, various industrial operations were conducted at the sub-areas collectively referred to as the HRC site. Poor waste management practices and dumping of waste material resulted in site-wide contamination of soil, sediment, and groundwater with hazardous substances. Releases of hazardous substances to the Raritan River, adjacent to the site, have been reported.[4] The following summaries describe the contaminated environmental media associated with these areas.

Horseshoe Road Drum Dump and Atlantic Resources Areas [5,6]

Located at the end of Horseshoe Road, the Atlantic Resources Corporation (ARC) conducted various industrial operations from 1972 to August, 1985, including: solvent reclamation; hazardous waste incineration; and precious metal recovery (Appendix A, Figure 2). Between 1968 and 1972, the International Recycling Company conducted similar operations at the site. Operations at the Atlantic Resources site ended in 1985 soon after 2,3,7,8 TCDD (Dioxin) was found on the property by NJDEP. In addition to precious metal recovery by means of incineration, ARC received printed circuit boards, casting sweeps and fines for metal reclamation and refining. Fourteen "reverse platers" were used to dip circuit boards in a sodium cyanide acid baths to release metals into solution. The recovered metals were smelted into ingots. Employee documentation, collected by NJDEP, suggests that the ARC dumped drums of unknown materials into the Raritan River; disposed of drums of potassium cyanide, nitric, muriatic, and hydrochloric acids and hydrogen peroxide into the wooded area behind Horseshoe Road; and conducted precious metal recovery at night to minimize the visibility of "ruby red fumes" that are generated by the process.

In an area on the west side of ARC, known as The Horseshoe Road Dump (HRDD)(Appendix A, Figure 2), there is a fill area where it is suspected that drums were buried. Included in the Horseshoe Road Drum Dump area is a drainage swale to the northwest, and a wooded knoll which lies to the northeast. The Middlesex County Utilities Authority (MCUA), while installing a forced sewer main through the site, encountered numerous sub-surface drum fragments. Also noted was the presence of a strong organic/ester type odor, and the soil and groundwater was reported to be very acidic (pH ~ 2.0). Chemical analysis of drum samples taken from the HRDD, showed the presence of lead, chromium, cadmium, phenols, phthalates, PCB's, pesticides, acetonitrile and silver cyanide. In addition, there is some documentation that another company, Brodun Chemical, operated on the site in the early 1970's, and may have dumped ammonia into three lagoons.

The U.S. Environmental Protection Agency (USEPA) began limited remediation at these areas in early 1987. Remedial activities at the site have included: drum and storage tank removal; laboratory chemical removal; and the covering of dioxin contaminated soil. This section of the site was also stabilized by repairing and adding barbed wire to the fence.

Atlantic Development [5,7]

The Atlantic Development (ADC) area is comprised of three buildings (referred to as: Atlantic Development; Sayreville Compounding; and Clover Chemical), and numerous storage tanks

(Appendix A, Figure 2). Between the years 1965 and 1981, many companies conducted a variety of industrial operations at these sites. These operations have included manufacturers of chemical and insecticidal products, oils, paints, pigments and varnishes. In addition, some companies operating on the ADC study area produced polymers and resins, dyes, roofing materials (using coal tar and asbestos), and sealants and feedstock products.

On the ADC sub-site, there exist open floor drains leading from the process buildings which terminate in the wetlands to the west. There is documentation which indicates that hazardous materials have been discharged to the wetlands and river via these drains. Information available to the NJDHSS/ATSDR indicate that there may be underground storage tanks at various locations on the ADC property. Scattered drums can be observed throughout the site, and there are numerous 1-10 gallon pails strewn over the property. There are approximately 7-10 above ground storage tanks distributed throughout the area.

Removal activities, in the ADC area, were initiated by USEPA in October, 1991. These activities involved initial site stabilization which included: containment of surficial contamination; container staging, inventory and sampling; and, submission of samples for analysis. In addition, containers and drums were staged in the on-site buildings, while metal pails and empty drums were crushed and placed in roll-offs containers. By August 1992, most of these materials were shipped off-site to an approved disposal site.

The Sayreville Pesticide Dump[5,8]

The Sayreville Pesticide Dump (SPD) is located at the southern end of Horseshoe Road (Appendix A, Figure 2). The SPD is situated in a wooded area, and contains numerous exposed, partially buried and completely buried drums. The SPD area contained piles of a tar-like substance and in many areas an unknown gelatinous substance could be observed. The name of this area appears to be a misnomer because there is no information indicating pesticide dumping occurred there. Waste disposal in the SPD area began in the 1960's and continued through the early 1980's. The volume of the dump has been estimated to be about 50,000 square feet. This figure may be considerably underestimated because the entire perimeter of the dump has not been delineated. A fence encloses the majority of the visible dump; however, there was evidence of dumping beyond the fence, e.g. drum skeletons, tar-like piles, laboratory jars, gloves etc.

Remedial Activity

The USEPA has performed several actions at the site.[4] Most recently, the USEPA's removal actions have addressed the following issues:

- The removal of potentially contaminated surface debris from several areas (fragments of tar-like solids, resinous/gelatinous, glue-like material, glass containers, corroded/rusted drum

carcasses, and other miscellaneous debris) found outside the fence, including areas adjacent to the Horseshoe Road and SPD;

- The removal of ash (primarily contaminated with dioxin and metal compounds) on concrete pads, in open kilns, and other contaminated materials in building at the ARC facility;
- The posting of signs along the Raritan River adjacent to the site summarizing the State (NJDEP) health advisory regarding fish and crab consumption;
- The repair/re-installation of damaged sections of fencing around the site; and, drainage control to minimize off-site migration of contaminated sediments.
- The above removal actions were completed by June 7, 1999.
- USEPA began the removal of the HRC's buildings at the end of 2000.

Prior ATSDR/NJDHSS Activities

The New Jersey Department of Health and Senior Services (NJDHSS), under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR), prepared a Public Health Consultation for the HRC site in 1991.[12] In addition, the ATSDR prepared a Preliminary Public Health Assessment for the Horseshoe Road Complex (HRC) site in 1995.[13] The U.S. Environmental Protection Agency (EPA) completed a Remedial Investigation (RI) of the site in 1999. Following completion of the RI, the ATSDR conducted a Health Consultation dated June 28, 2000.[1] The June 28, 2000, Health Consultation served to evaluate the public health significance the actual and potential exposure to site-related contaminants by persons trespassing on the site.

Site Visit

ATSDR and NJDHSS personnel have visited the HRC site on several occasions beginning in December of 1993, with the most recent visit attended by J. Winegar, Sharon Kubiak and Stella Manchun Tsai. The NJDHSS staff were accompanied by representatives of the USEPA and the ATSDR. The following observations were made during the July 2000 site visit:

- The Horseshoe Road Site is currently abandoned. The main access road to the site is fenced with locked gates to prevent trespassers from walking on the site. Signs are posted along the fence line indicating the presence of a Superfund site.
- Check dams, put in place during the last removal action by the USEPA, to help prevent the off-site migration of contaminants to the Raritan River, were observed.
- The "purple" puddle observed in the HRDD area during the March 1999 site visit was present.

- It had rained at the site within the last few days and some puddles of water were noticed on the site. Several of these puddles had a "pink" tint.
- No unusual odors were noted during the visit; however, the site visit team did not access the ADC fenced area (where odors were noted during the March 1999 visit).
- Signs of wildlife were observed. Recent deer and racoon tracks were observed in the mud at the bottom of a few puddles.
- Several spent shotgun shell casings were observed.

Discussion

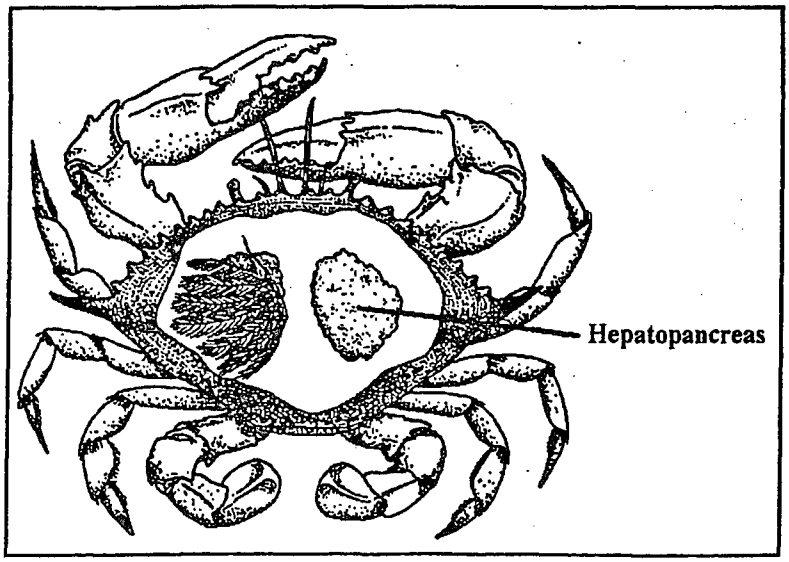
As previously noted, the purpose of this Health Consultation is to evaluate the potential public health significance of persons consuming blue crabs from the Raritan River adjacent to the HRC site. This discussion section, therefore, begins with a brief description of the blue crab, aspects of crabbing in New Jersey, and a discussion of the several NJDEP studies of blue crab contamination in the State.

The Blue Crab

The blue crab (*Callinectes sapidus*) is the most common edible crab along the eastern coasts of North and South America (Inset). Blue crabs are most commonly found in the protected waters of bays and estuaries on the Atlantic Coast. They range from Massachusetts all the way to Texas and a few have been reported as far north as Nova Scotia and as far south as Uruguay. They like to stay in brackish (mixed salt and fresh) water in the summer, and move on to the deeper ocean in winter.

Blue crabs are crustaceans with five pairs of legs. The first pair is modified as pinchers and the last four pairs are walking legs. Blue crabs have their last pair of legs modified into "paddles" so they can swim rapidly. Other common crustaceans are shrimps, lobsters, crayfish, and barnacles.

Blue crabs are omnivorous scavengers, feeding upon other aquatic plants and animals according to opportunity.



The "Blue" Crab (*Callinectes sapidus*)

"Crabbing" in New Jersey

Commonly referred to as "crabbing", fishing for the blue crab is a very popular activity in New Jersey. According to the NJDEP's Division of Fish, Game and Wildlife, of all of the State's marine fish and shellfish, more effort is expended in catching the blue crab than any other single species.[14] The State has conducted surveys which indicate that three-quarters of the State's saltwater fisherman go crabbing and that crabbing accounts for about 30 percent of all marine fishing activity.

Both commercial and recreational crabbing are known to take place in the Raritan Bay and the tidal portions of the Raritan River, which includes the area adjacent to the HRC site. This total area, known as the Raritan Bay Complex, is currently subject to a crab consumption advisory promulgated by the NJDEP. The consumption advisory states that the green gland (hepatopancreas) of the blue crab should not be consumed (see inset above). This recommendation is based on NJDEP research (see below) that has shown elevated levels of chemical contamination in the blue crab hepatopancreas. Further, the NJDEP advisory also recommends that the hepatopancreas be removed before cooking and that after cooking the cooking water should be discarded and not used for any juices, sauces or soups.[15] Signs warning people about the crab consumption advisory are posted by NJDEP along the banks of the river.

NJDEP Studies of Blue Crab Contamination

Between 1986 and 1988, the New Jersey Department of Environmental Protection (NJDEP) conducted studies of the bioaccumulation of polychlorinated biphenyls (PCBs), chlordane, and DDT in striped bass, white perch, blue fish and blue crabs from the Raritan River in areas at the Route 35 Bridge (downriver of the HRC site) and the Kin Buc Landfill (upriver of the site). The levels of contaminants detected in each species are listed in Appendix B. For the blue crab, the total PCB levels ranged from 0.14 to 0.6 mg/kg (ppm) in crab meat only, from 2.99 to 5.4 ppm in hepatopancreas tissue only, and from 1.06 to 2.07 ppm in whole blue crab samples. [9,10]

In 1999, the NJDEP conducted a study of 88 blue crabs from several Raritan River areas. The analysis results for these samples are expected by Spring 2001 (NJDEP, Personal communication, 2000). [11]

Environmental Contamination

Site-related contaminants are suspected to have migrated through environmental media and, potentially, into the biota (food chain) of the Raritan River. Contaminant summaries for on-site soils, marsh sediments, and water and sediments of the Raritan River are presented below.

On-Site Surface Soil Contamination

The June 2000 health consultation by ATSDR summarized the contaminants of concerns (COCs) detected from surface soil samples on site.[1] The COCs (for both completed and potential exposures pathways) from surface soil samples include antimony, arsenic, cadmium, lead, inorganic mercury, methoxychlor, PCBs and polynuclear aromatic hydrocarbons (PAHs).

Marsh Sediment Contamination

The HRC marsh (marsh) is a wetland located in the northwestern portion of the site adjacent to the Raritan River. From December 6 to December 8, 1999, the USEPA's contractor (CDM Federal) collected a total of 44 sediment samples from 11 locations in the marsh (Figure 3). The samples were collected for determining the vertical extent of site contamination. Samples were collected at each location from four depth intervals: 0 to 6, 6-18, 18-30, and 30-42 inches below the sediment surface. All marsh samples were analyzed for volatile organic compounds (VOCs), semi volatile organic compounds (SVOCs), pesticides, PCBs, metals and cyanide.[2]

The southern portion of the marsh, including sample locations #01 through #06, received surface water runoff from the ADC and SPD. The northern portion of the marsh, including sample locations #07 through #11, received surface water runoff primarily from the ARC.

Generally, the higher levels of detected VOCs were found at intervals of 6-18 and 18-30 inches. Sample location #11 yielded elevated levels of VOCs including; 1,4-dichlorobenzene of 79,000 ug/kg at 6-18 inches, methylcyclohexane of 6,700 ug/kg at 6-18 inches, chlorobenzene of 14,000 ug/kg at 18-30 inches, 1,2,4-trichlorobenzene of 4,400 ug/kg at 6-18 inches, and m-dichlorobenzene at 33,000 ug/kg at 6-18 inches.

Most detected SVOCs in marsh samples were PAHs including; naphthalene, 2-methylnaphthalene, acenaphthene, benzo[a]pyrene, benzo[a]anthracene, dibenzo[a,h]anthracene, benzo[b]fluoranthene, benzo[k]fluoranthene, chrysene, and indeno[1,2,3-cd]pyrene. Non-PAH SVOCs detected in marsh samples including phthalates, phenol, benzaldehyde, and acetophenone. At 0-6 inches, the higher concentrations of SVOCs were detected in the southern portion of the marsh from locations #01 through #04. Location #01 yielded a concentration of 420 ug/kg of 2-methylnaphthalene, and the highest non-PAH concentration of 52,000 ug/kg of bis(2-ethylhexyl) phthalate.

The distribution of pesticide and PCB contamination in marsh samples are similar to SVOC contamination. The highest concentrations of pesticides and PCBs were detected at locations #01 through #04 at the southern portion of the marsh, and at location #11. At the 0-6" interval, location #03 yielded heptachlor epoxide at 580 ug/kg, dieldrin at 380 ug/kg, endrin at 76 ug/kg, 4,4'-DDD at 130 ug/kg, Aroclor-1248 at 22,000 ug/kg and Aroclor-1260 at 5,300 ug/kg. At the same interval, location #01 yielded pesticide concentrations of endrin at 150 ug/kg, 4,4'-DDD at 420 ug/kg, and Aroclor-1248 at 32,000 ug/kg.

Metals were commonly detected in marsh samples. The highest concentrations were detected in samples #01 through #04 and #11. At 0-6" interval, sample #01 yielded a mercury level of 385 mg/kg.

Raritan River Surface Water and Sediment Contaminations

The Raritan River at this location is classified by the New Jersey Department of Environmental Protection (NJDEP) as SE1 with designated uses including shellfish harvesting. Samples of river surface water and sediment adjacent to the site were collected to evaluate the impacts from the site.[2] Reference sampling from about one-half mile upriver and downriver of the site was conducted to determine the general condition of the river.

A total of 64 sediment samples were collected from 16 locations near the HRC site at four depth intervals: 0-6, 6-18, 18-30 and 30-42 inches (Figure 3). All samples were analyzed for VOCs, SVOCs, pesticides/PCBs, metals, cyanide, and dioxin. Most contaminants were at higher concentrations in the interval of 0-6 inches. The highest concentrations of contaminants were commonly detected at location #03 through #10 which are immediately upriver of the principal drainageway that discharges site-derived surface runoff from the adjacent marsh. In the sediment samples collected from four background locations, the levels of VOCs, SVOCs, and most pesticides were low. Metals were consistently detected in background sediment samples, however, the levels of cadmium and chromium were not elevated.

A total of 22 surface water samples were collected from 20 locations in the Raritan River adjacent to the HRC site (Figure 3). The water sampling locations include the sediment sampling locations, two reference locations which are about one-half mile upriver and two were downriver of the Site. All samples were analyzed for VOCs, SVOCs, pesticides/PCBs, metals and cyanide. Higher arsenic levels exceeding the New Jersey surface water screening criteria were detected in several samples including background samples.

Biota Contamination

Blue crabs and forage fish samples were collected from the Raritan River adjacent to the Site and from two reference areas upriver and downriver of the site by CDM Federal in September and October in 1999. Using baited crabpots, muscle tissue and hepatopancreas tissue samples were obtained from blue crabs collected in the Raritan River. Forage fish samples were collected using baited minnow traps. All biota samples were analyzed for VOCs, SVOCs, pesticides/PCBs and metals. Figure 4 presents sampling locations.

A total of 24 blue crab samples were collected from 11 locations including two reference sites upriver and downriver of the Site. It included 12 crab muscle tissue samples and 12 crab hepatopancreas tissue samples. One crab muscle tissue sample and one hepatopancreas sample were

composited from three sampling locations (04, 05 and 07). Crab samples from two reference sites upriver and downriver of the Site were also collected. Some VOCs, SVOCs, heptachlor epoxide, diedrin, 4,4'-DDE, endosulfan II, 4,4'-DDD and metals were detected in crab muscle tissue. Some VOCs, SVOCs, heptachlor epoxide, diedrin, 4,4'-DDE, endosulfan II, 4,4'-DDD, endosulfan sulfate, 4,4'-DDT, Aroclor 1260 and metals were detected in crab hepatopancreas tissue.

Contaminant levels in blue crab muscle tissue samples collected during the recent RI were similar to levels detected in previous studies of the entire Raritan Bay Complex.

A total of 10 whole forage fish tissues were collected at nine locations from the Raritan River adjacent to the Site. One sample was composited from five sampling locations (04, 05, 11, 13 and 14). One reference sample was collected upriver of the Site. Some VOCs, SVOCs, heptachlor epoxide, diedrin, 4,4'-DDE, 4,4'-DDD, and Aroclor 1260 were detected in forage fish samples.

Biota samples collected from reference locations yielded pesticide levels similar to those locations adjacent to the Site.

Biota contamination vs. Environmental Contamination

Table 1 lists the maximum concentrations of VOCs, SVOCs, pesticides and metals detected in crab muscle tissue. This table also includes the maximum concentrations of these chemicals detected in crab hepatopancreas tissue, forage fish, the Raritan River sediment at the interval of 0-6 inches, the marsh sediment at the interval of 0-6 inches and the Raritan River surface water.

The maximum concentrations of VOCs, SVOCs, pesticides and metals detected in crab muscle tissue were compared with the USEPA Region III Risk-Based Concentrations (RBCs) for fish tissue.[16] RBCs are used as health comparison values in this health consultation. Those compounds with concentration above the RBCs will be discussed in the toxicological evaluation section. Sodium, calcium and potassium, which are commonly detected in diet and saline water, are not considered as the contaminants of concerns in this case. No available health comparison value is available for lead in the current public health literature. Therefore, further assessment for lead detected in crab muscle tissue will also be discussed in the toxicological evaluation section.

Table 1. Maximum concentrations of VOCs, SVOCs, pesticides and metals detected in crab muscle*, hepatopancreas, forage fish, Raritan River sediments at 0 to 6 inches, the marsh sediments at 0-6 inches, and Raritan River surface water.[2] The USEPA Region III's Risk-Based Concentrations (RBCs) for fish were used as health comparison values. **Compounds above health comparison value are in bold face.**

Compounds	RBC	Muscle Tissue	Hepatopancreas Tissue	Forage Fish	River Sediment	Marsh Sediment	Surface River Water
VOCs	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/l
Acetone	140000 N	140	80	440	550	380	BDL
Carbon disulfide	140000 N	15	17	15	830	180	BDL
Dichloromethane	420 C	4	4	3	500	2	BDL
2-Butanone	81000 N	13	27	37	160	BDL	BDL
Xylenes, total	2700000 N	2	4	2	BDL	BDL	BDL
Semi VOCs							
Di-n-butylphthalate	14000 N	390	170	740	BDL	1300	1
2-Methylphenol	68000 N	34	BDL	BDL	BDL	BDL	BDL
Dimethylphthalate	14000000 N	35	BDL	BDL	BDL	BDL	BDL
2,2'-oxybis(1-Chloropropane)	45 C	29	BDL	BDL	BDL	BDL	BDL
Pentachlorophenol	26 C	20	16000	BDL	BDL	BDL	BDL
Pyrene	41000 N	60	BDL	BDL	2700	2200	BDL
bis (2-Ethylhexyl) phthalate	**230 C**	**350**	3300	BDL	16000	52000	2
Pesticides							
Heptachlor epoxide	**0.35 C**	**21**	32	21	20	580	0.054
Dieldrin	**0.2 C**	**9.7**	12	12	22	380	0.11
4,4'-DDE	**9.3 C**	**120**	180	120	59	16	0.11
Endosulfan II	8100 N	11	6.8	BDL	4.7	BDL	0.11
4,4'-DDD	**13 C**	**110**	160	110	30	420	0.11
Metals							
Aluminum	1400000 N	6	BDL	7.2	19900	18000	424
Antimony	540 N	0.14	0.22	0.23	18	33.7	BDL
Arsenic	2.1 C	1	1.6	0.77	654	8220	5.2
Barium	95000 N	0.58	4.7	2.4	117	182	42
Beryllium	2700 N	0.04	0.05	0.05	3.1	2.8	0.3
Cadmium	1400 N	0.08	0.55	0.03	6.6	5.6	1.8
Calcium metal	N/A	2700	7670	18900	43300	29700	150000
Chromium [1]	4100 N	0.19	0.54	0.93	214	4950	2.4
Copper	54000 N	17.3	41.7	4.2	417	4040	22.8
Iron	410000 N	18.1	89.9	42.7	77300	306000	3550
Lead	N/A	1.3	1.4	1.2	246	338	4.8
Magnesium	N/A	430	693	581	8150	6850	480000
Manganese	190000 N	2.3	9.3	9.7	316	2520	65.9
Mercury [2]	140 N	0.07	0.04	0.04	3.2	385	BDL
Nickel	27000 N	0.51	0.42	0.41	64.6	671	10.2
Potassium	N/A	2620	1450	2610	3530	3340	188000
Selenium	6800 N	1.3	0.84	0.96	20.4	7.9	BDL
Silver	6800 N	0.74	1.5	0.06	18.1	63	0.8
Sodium	N/A	5680	5590	2140	15100	15400	4220000
Zinc	410000 N	49.7	46.6	67	522	650	51.2

* A contaminant is not listed if it was not detected in muscle tissue (e.g., PCBs).
BDL=below method detection limit.
RBC=risk-based concentration.
C=carcinogenic effects.
N=noncarcinogenic effects.
(1) Chromium (VI) (2) methylmercury

Pathways Analysis and Public Health Implications

A completed exposure pathway consists of five elements: sources of contamination, environmental media and transport mechanisms, point of exposure, routes of exposure, and receptor population.[17] Blue crabs are taken from the Raritan Bay and the tidal portions of the Raritan River, including the area adjacent to the Site on a commercial and recreational (subsistence) basis. In addition, biota samples collected in the vicinity of the Site have shown that contaminants, principally metals and pesticides, are present in blue crab tissue samples. Based on the information available to the NJDHSS and the ATSDR, it is reasonable to assume that a completed exposure pathway exists to those individuals who consume blue crabs from the Raritan River adjacent to the Site.

Exposure Assessment

Health effect evaluations are accomplished by estimating the amount (or dose) of those contaminants that a person might come in contact with on a daily basis. This estimated exposure dose is then compared to established health guidelines. People who are exposed for some crucial length of time to contaminants of concern at levels above established guidelines are potentially more likely to have associated illnesses or disease.[17]

Health guidelines are developed for contaminants commonly found at hazardous waste sites. Examples of health guidelines are the ATSDR's Minimal Risk Level (MRL) and the USEPA's Reference Dose (RfD). MRLs are developed for each type of exposure, such as acute (less than 14 days), intermediate (15 to 364 days), and chronic (365 days and greater). ATSDR presents these MRLs in Toxicological Profiles. These chemical-specific profiles provide information on health effects, environmental transport, human exposure, and regulatory status. When exposure (or dose) is below the MRL or RfD, then non-cancer, adverse health effects are unlikely to occur.

The toxicological effects of the contaminants detected in the crab muscle tissue have been considered singularly. The cumulative or synergistic effects of mixtures of contaminants may serve to enhance their public health significance. Some research on the toxicity of mixtures indicates that adverse health effects are unlikely when the mixture components are present at levels well below their individual toxicologic thresholds.[23] Additionally, individual contaminants or mixtures of contaminants may have the ability to produce greater adverse health effects in children as compared to adults. This situation depends upon the specific chemical being ingested, its pharmacokinetics in children and adults, and its toxicity in children and adults.

The following section contains a discussion of health effects in both adults and children exposed to contaminated blue crab muscle tissue. The maximum levels of contaminants detected in crab muscle tissue were used in dose estimates (Table 1).

Dose Estimate

The maximum detected concentrations of five compounds (bis2(-ethylhexyl) phthalate, heptachlor epoxide, dieldrin, 4,4'-DDE and 4,4'-DDD) detected in crab muscle tissue were above the USEPA Region III Risk-Based Concentrations (RBCs) for fish tissue.[16]

To estimate exposure doses of persons consuming blue crabs harvested from the Raritan River adjacent to the site on the site, the following assumptions were made. It was assumed that the crabs were consumed by adults (weighing 70 kilograms) , one time per week, for a period of one year, and that they would ingest six (6) crabs or about 252 grams (g) of crab meat during each meal for nine years (the national median for time at one residence). In addition, it was assumed that the crabs were consumed by children (weighing 13.2 kilograms), one time per week, for a period of one year, and that they would ingest three (3) crabs or about 140 grams (g) of crab meat during each meal.

The primary source of data for the evaluation of potential health concerns from persons consuming blue crabs harvested from the Raritan River adjacent to the site was provided by the Remedial Investigation (RI) performed by USEPA's contractor CDM Federal.[2] To evaluate the worst-case exposure scenario, exposure doses for contaminants detected in crab muscle were calculated using the maximum concentrations detected. Toxicological evaluation will focus on compounds which are above available health comparison values, and compounds of concern with no available comparison values.

Bis(2-ethylhexyl)phthalate [18]

Bis(2-ethylhexyl)phthalate (also known as DEHP) is a colorless liquid chemical which is commonly used in the manufacture of plastics to increase flexibility. DEHP is not toxic at the low levels usually present in the environment. In animal studies, high levels of DEHP affected the liver and kidney functions, and reproductive ability. The maximum exposure dose to DEHP for adults and children were below the available chronic oral RfD (non-carcinogenic adverse health effects) reported by the USEPA. It is unlikely that non-carcinogenic adverse health effects would occur through ingestion of crab muscle tissue containing DEHP at this level. Therefore, ingestion of DEHP at the maximum detected level does not constitute a concern for non-carcinogenic adverse health effects.

The USEPA and the US Department of Health and Human Services (DHHS) have determined that DEHP may reasonably be anticipated to be a carcinogen based on animal studies. The USEPA and USDHHS have determined that DEHP is a probable human carcinogen. There is no evidence that DEHP causes cancer in humans, but high exposures in rats and mice increased liver cancer. The maximum concentration of DEHP detected in crab muscle tissue was above the risk-based concentration for fish based on carcinogenic effects. Based upon the chronic exposure scenario for adults consuming crab muscles from the Raritan River adjacent to the Site, estimations of the lifetime excess cancer risk indicate no apparent (10^{-5}) increased risk of cancer. Therefore,

carcinogenic adverse health effects are not likely to occur in the exposed population consuming crab muscle tissue.

Heptachlor epoxide [19]

Heptachlor epoxide is a chemical which was utilized extensively as a pesticide in homes and in agriculture, the use of which was discontinued 1988. Heptachlor epoxide has been demonstrated to be toxic to the human nervous system. Exposure to high levels of heptachlor epoxide for short periods of time can cause liver damage in rats and mice. Animal studies also associate exposure to heptachlor with adverse pregnancy outcomes.

The maximum exposure dose to heptachlor epoxide for adults and children were below the available chronic oral RfD for non-carcinogenic adverse health effects reported by the USEPA. It is unlikely that non-carcinogenic adverse health effects would occur through ingestion of crab muscle tissue containing heptachlor epoxide at this level based on the individual chemical evaluation. Therefore, ingestion of heptachlor epoxide at the maximum detected level does not constitute a concern for non-carcinogenic adverse health effects.

The USEPA classifies heptachlor epoxide as a probable human carcinogen based on animal studies, though the International Agency for Research on Cancer (IARC) has determined that heptachlor epoxide is not classifiable as a human carcinogen because insufficient data are available.

The maximum concentration of heptachlor epoxide detected in crab muscle tissue was above the risk-based concentration for fish based on carcinogenic effects. Based upon the chronic exposure scenario for adults consuming crab meat from the Raritan River adjacent to the Site, estimations of the lifetime excess cancer risk indicate no apparent (10^{-5}) increased risk of cancer. Therefore, carcinogenic adverse health effects are not expected to occur in the exposed population consuming crab muscle tissue.

Dieldrin [20]

Dieldrin is an insecticide which is commonly encountered in the form of a white powder having a mild chemical odor. Due to the concerns of damage to the environment and human health, the USEPA banned this insecticide in 1987. Dieldrin may affect the central nervous system. Studies on workers exposed to diedrin did not show increased cancers. However, mice exposed to high levels of dieldrin did develop liver cancers.

The maximum exposure dose to diedrin for adults and children were below the available chronic oral RfD for non-carcinogenic adverse health effects reported by the USEPA. It is unlikely that non-carcinogenic adverse health effects would occur through ingestion of crab muscle tissue containing dieldrin at this level based on the individual chemical evaluation. Therefore, ingestion of dieldrin at the maximum detected level does not constitute a concern for non-carcinogenic health effects.

The USEPA classifies dieldrin as a probable human carcinogen based on animal studies, though the International Agency for Research on Cancer (IARC) has determined that diedrin is not classifiable as a human carcinogen because no direct evidence is available. The maximum concentration of diedrin detected in crab muscle tissue was above the risk-based concentration for fish based on carcinogenic effects. Based upon the chronic exposure scenario for adults consuming crab meat from the Raritan River adjacent to the Site, estimations of the lifetime excess cancer risk indicate no apparent (10^{-5}) increased risk of cancer. Therefore, carcinogenic effects are not expected to occur in the exposed population consuming crab muscle tissue.

4,4'-DDE and 4,4'-DDD [21]

DDT (1,1,1-trichloro-2,2-bis(p-chlorophenyl)ethane) is a compound which was commonly used for insect control in the past. It was a manufactured chemical not occurring naturally in the environment. DDE (1,1-dichloro-2,2-bis(chlorophenyl) ethylene) and DDD (1,1-dichloro-2,2-bis(p-chlorophenyl)ethane) were commonly found as contaminants for a technical grade of DDT. DDT in soil usually breaks down to DDE or DDD.

The USEPA established a RfD for DDT of 0.0005 mg/kg/day, but no RfDs for either DDD or DDE. Based on limited animal studies, the lowest available LOAEL for chronic oral exposure to DDD is 12 mg/kg/day on rats for 78 weeks, and the lowest available NOAEL for chronic oral exposure to DDE is 85 mg/kg/day on rats for 78 weeks. The maximum exposure doses to DDE and DDD for adults and children were far below the available chronic NOAEL and LOAEL of these chemicals for non-carcinogenic adverse health effects in animal studies. It is unlikely that non-carcinogenic adverse health effects would occur through ingestion of crab muscle tissue containing DDD and DDE at levels based on the individual chemical evaluation. Therefore, ingestion of DDD and DDE at the maximum detected level does not constitute a health concern.

The USEPA has determined that DDD and DDE are probable human carcinogens. The maximum concentrations of DDE and DDD detected in crab muscle tissue were above the risk-based concentrations for fish based on carcinogenic effects. Based upon the chronic exposure scenario for adults consuming crab muscles from the Raritan River adjacent to the site, estimations of the lifetime excess cancer risk indicate no apparent (10^{-5}) increased risk of cancer. Therefore, carcinogenic adverse health effects are not expected to occur in the exposed population.

Lead [22]

The most sensitive organ to lead exposure is the central nervous system, especially for young children. The USEPA and DHHS have determined that lead is a probable human carcinogen based on studies in animals. However, quantitative estimation of carcinogenic effects from oral exposure to lead is not currently available. No MRL or RfD has been derived for lead because it was decided that no thresholds have been demonstrated for the most sensitive human effects. ATSDR developed a regression analysis method to estimate the blood lead level in the human body using environmental

lead concentrations. Based on the conservative assumptions, the increased blood lead level for adult consuming crab muscle from the Raritan River adjacent to the site is 0.2 ug/dL and for children is 0.8 ug/dL. The CDC level of concern for blood lead in young children is 10 ug/dL. Therefore, It is unlikely that non-carcinogenic adverse health effects would occur through ingestion of crab meat containing lead at levels documented.

ATSDR Child Health Initiative

ATSDR's Child Health Initiative recognizes that the unique vulnerabilities of infants and children demand special emphasis in communities faced with contamination in their environment. Children are at greater risk than adults from certain kinds of exposures to hazardous substances emitted from a waste site. They are more likely to be exposed because they play outdoors and they often bring food into contaminated areas. They are shorter than adults, which means they breathe dust, soil, and heavy vapors closer to the ground. Children are also smaller, resulting in higher doses of chemical exposure per body weight. The developing body systems of children can sustain permanent damage if toxic exposures occur during critical growth stages. Most important, children depend completely on adults for risk identification and management decisions, housing decisions, and access to medical care. NJDHSS/ATSDR evaluated the potential for children to be exposed to lead and other contaminants of concerns contained in samples of tissue from contaminated crabs in the Raritan River near the HRC site. As previously mentioned, it is not expected that adverse health effects would occur for the children who ingest crab meat containing lead and other contaminants of concerns at the concentrations cited above. However, for lead, it is prudent public health practice to minimize as much as possible the amount of lead children are exposed to.

Conclusions

Based on the data and information reviewed from the U.S. EPA's Remedial Investigation for the Horseshoe Road Complex site, exposures to the ***known*** contaminants detected in biota (blue crab muscle tissue) at the HRC site, would not likely result in serious adverse health effects. Therefore, ATSDR/NJDHSS has determined that, in this context, the HRC site represents no apparent public health hazard. This evaluation is based on the following:

- Although biota sampling near the HRC site has shown that the blue crab muscle tissue is contaminated, and several contaminants are present at levels above the USEPA Region 3 Risk-Based Concentrations, a toxicological evaluation, using known site data and standard assumptions, did show that human exposure is not at levels likely to result in adverse health effects.

- Compared to the blue crab muscle tissue samples, relatively higher levels of contaminants were detected in blue crab hepatopancreas tissue samples. The NJDEP has a blue crab consumption advisory for the Raritan Bay Complex that recommends against the

consumption of the hepatopancreas. The ATSDR/NJDHSS feel that the advisory is appropriate and protective of the public health.

- Although the HRC site is likely contributing to the contamination burden of the Raritan River, the blue crab muscle tissue samples collected during the recent RI were not unlike crab muscle tissue collected in previous studies of the Raritan Bay Complex and at the reference locations. Therefore, it does not appear that the crabs caught near the HRC site are substantially different from the rest of the crabs in the river or bay.

Recommendations

A. Cease/Reduce Exposure Recommendations

Based upon available data and information, there is a identifiable exposure pathway associated with the Horseshoe Road Complex (HRC) site. Persons consuming Blue Crabs captured near the HRC site should continue to follow NJDEP advisory recommendations concerning the consumption of Blue Crabs from the Raritan Bay Complex. This includes not eating the green gland (hepatopancreas) of the crab.

B. Site Characterization

Site data and information is currently available for review by the NJDHSS and the ATSDR is adequate for evaluation of the public health implications of the Horseshoe Road Complex (HRC) site with respect to the issue of bioaccumulation of contaminants in crabs.

Public Health Action Plan

The Public Health Action Plan (PHAP) for the Horseshoe Road Complex site contains a description of the actions to be taken at or in the vicinity of the site. The purpose of the PHAP is to ensure that this health consultation not only identifies public health hazards, but provides a plan of action designed to mitigate and prevent adverse human health effects resulting from exposure to hazardous substances in the environment. Included, is a commitment on the part of ATSDR and NJDHSS to follow-up on this plan to ensure that it is implemented. ATSDR will provide an annual follow-up to this PHAP, as needed, outlining the actions completed and those in progress. This report will be placed in repositories that contain copies of this health consultation, and will be provided to persons who request it. The public health actions taken or to be implemented are as follows:

Actions Planned

1. Additional biota data will be reviewed (when available) by the ATSDR/NJDHSS for potential public health implications. Should these data indicate a need, the public health implications of contaminated biota will be re-evaluated.

2. ATSDR/NJDHSS will continue to work with the Edison Wetlands Association and the U.S. EPA to evaluate the public health implications of completed and potential exposure pathways to contaminants associated with the Horseshoe Road Complex site.

3. ATSDR will provide follow up to this PHAP, as needed, outlining the actions completed and those in progress. This report will be placed in repositories that contain copies of this Health Consultation, and will be provided to persons who request it.

Certification

The Health Consultation for the Horseshoe Road Site was prepared by the New Jersey Department of Health and Senior Services 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 health consultation was initiated.

Technical Project Officer, SPS, SSAB, DHAC

The Superfund Site Assessment Branch (SSAB), Division of Health Assessment and Consultation (DHAC), ATSDR, has reviewed this health consultation and concurs with its findings.

Chief, SSAB, DHAC, ATSDR

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Appendix A
Figures

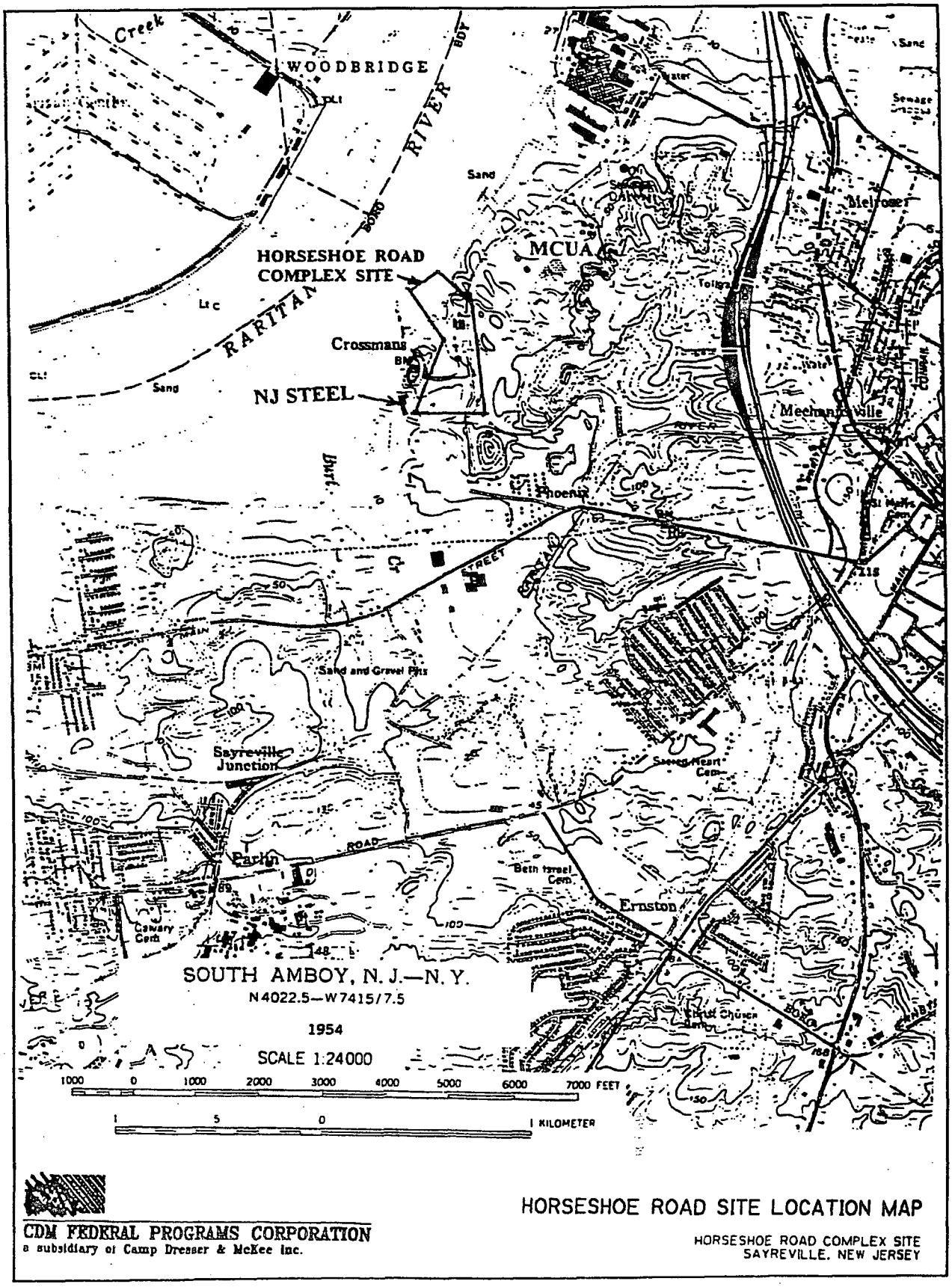

Figure 1 Horshoe Road Complex Site Map

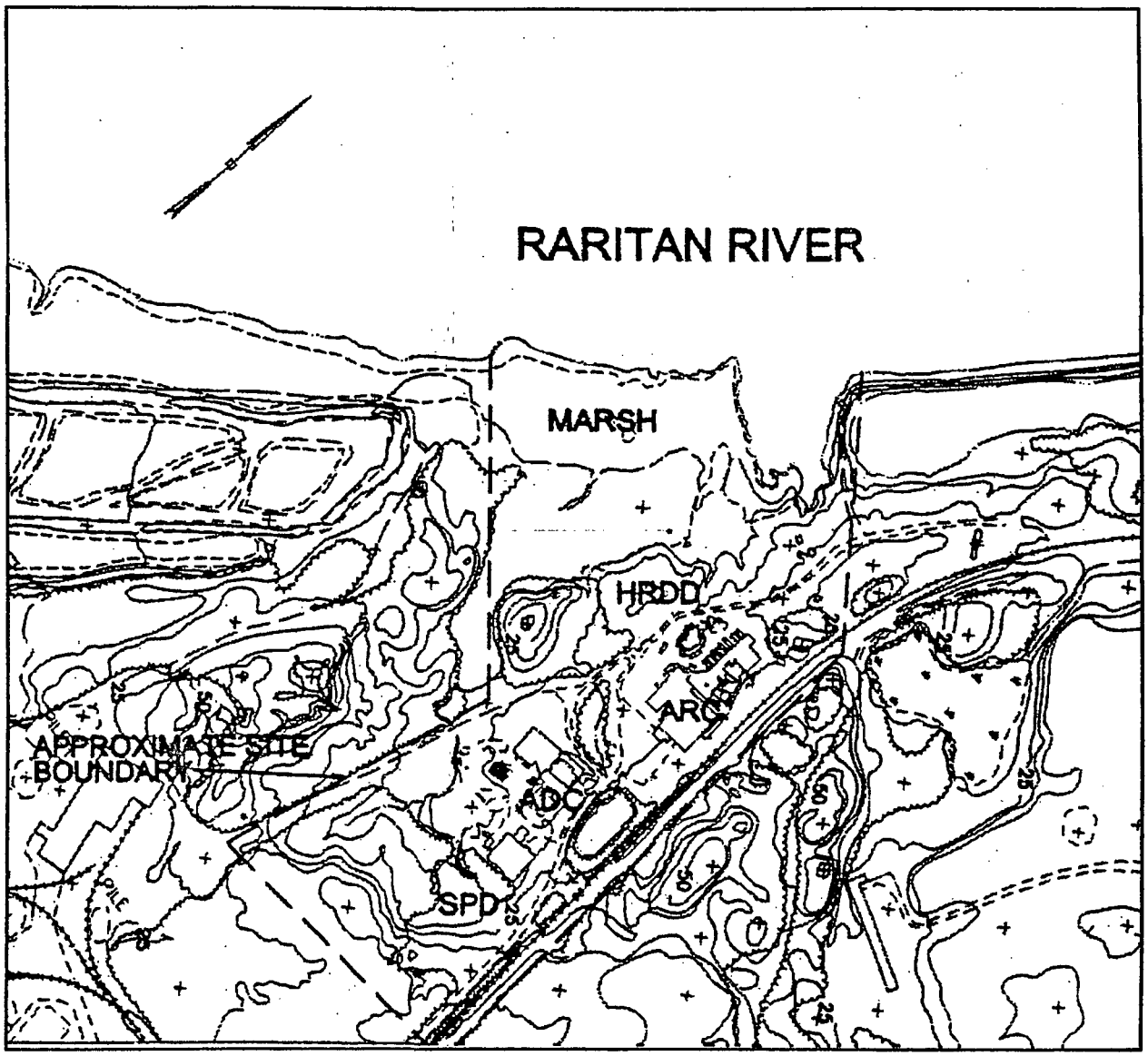

Figure 2 Site Map Detail

Legend

HRDD	Horsehoe Road Drum Dump Dump
ARC	Atlantic Resources Corporation
ADC	Atlantic Development Corporation
SPD	Sayreville Pesticide Dump

Adapted from CDM [2]

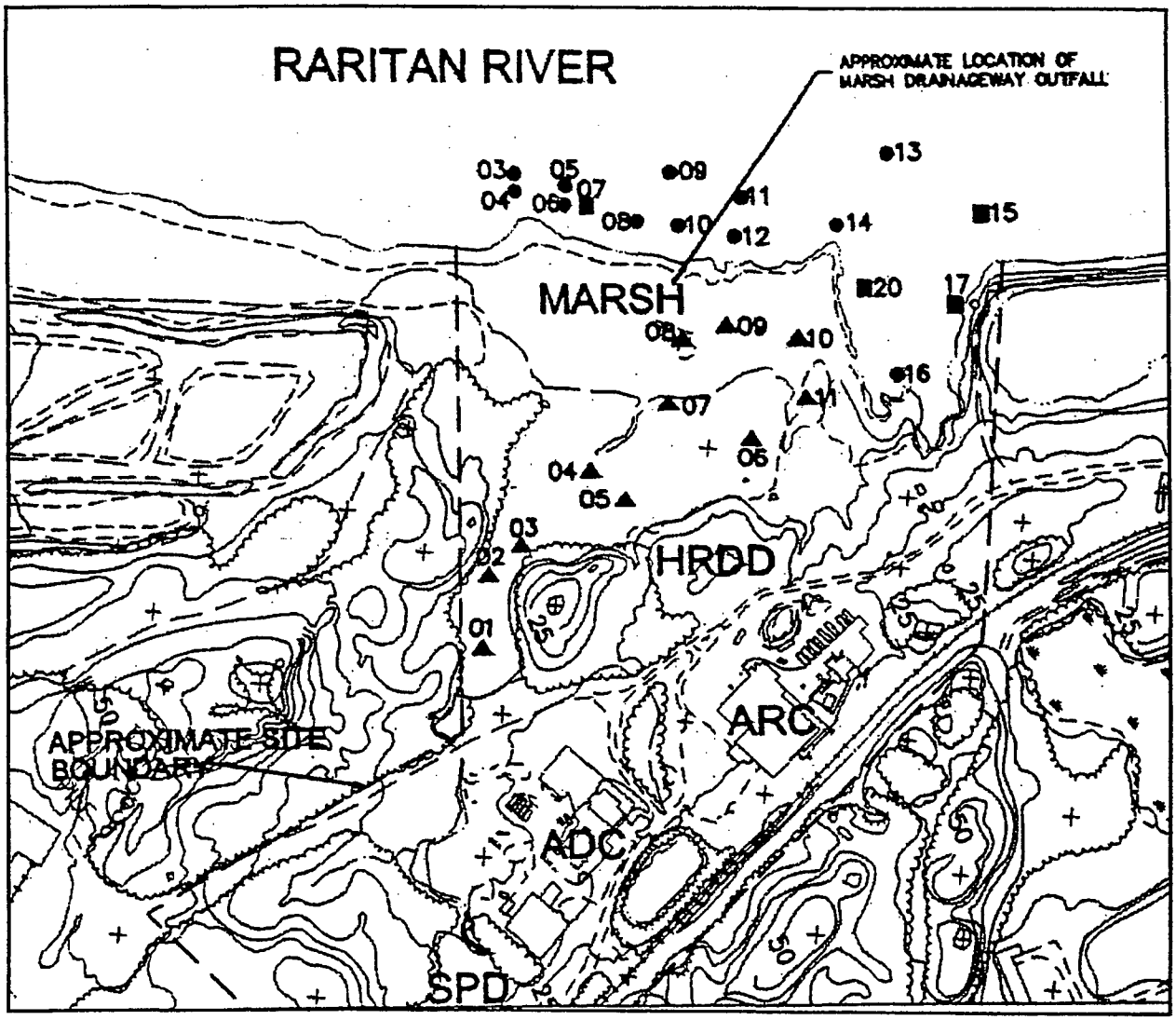

Figure 3 Sampling Map - Marsh Sediment, Raritan River Surface Water, and Sediment Sampling Locations

Legend

HRDD	Horsehoe Road Drum Dump Dump
ARC	Atlantic Resources Corporation
ADC	Atlantic Development Corporation
SPD	Sayreville Pesticide Dump
▲	Marsh Sediment
●	Surface Water/Sediment Only
■	Surface Water/Sediment and Dioxin

Adapted from CDM [2]

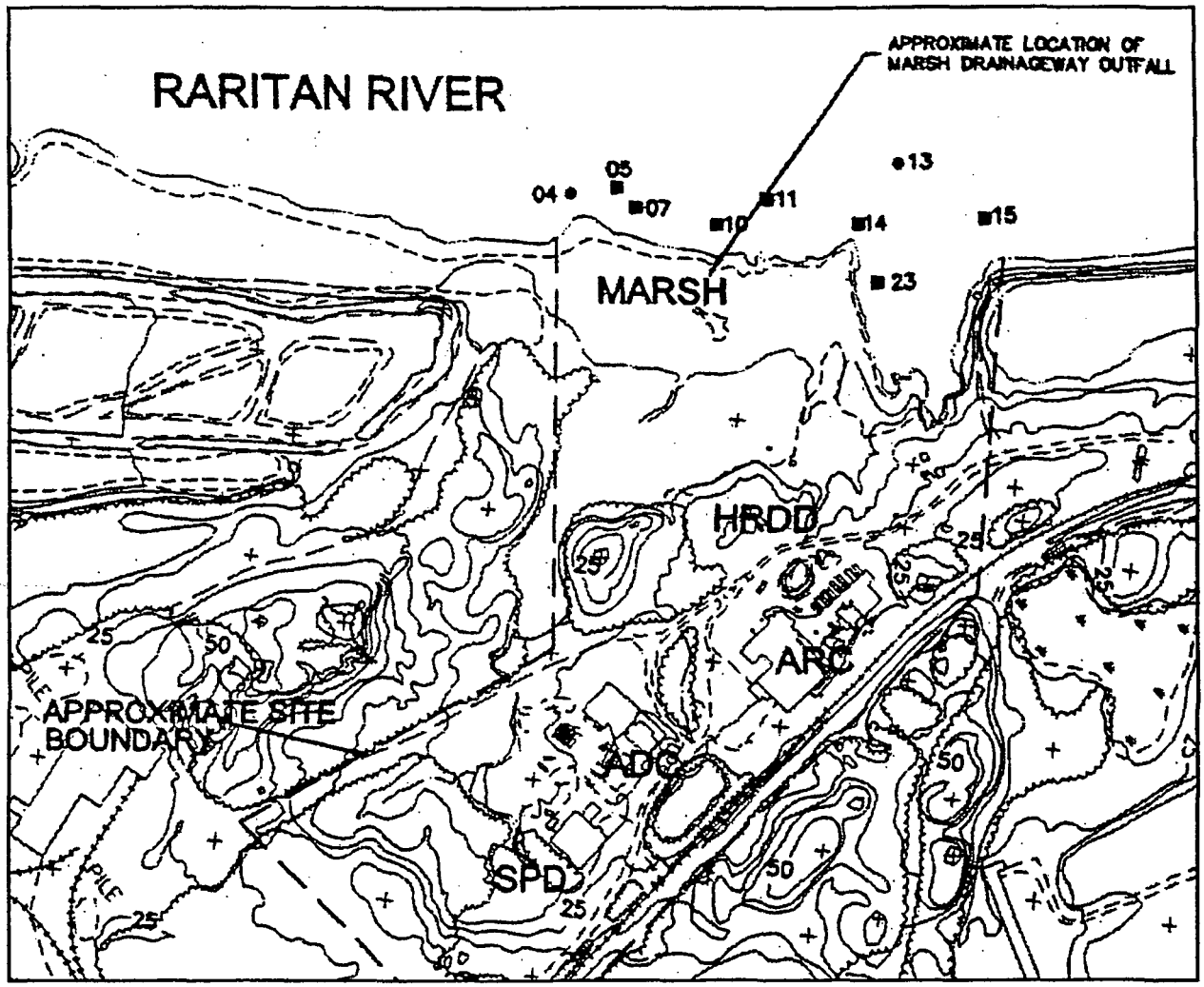

Figure 4 Sampling Map -Biota Sampling Locations

Legend

HRDD	Horseshoe Road Drum Dump
ARC	Atlantic Resources Corporation
ADC	Atlantic Development Corporation
SPD	Sayreville Pesticide Dump
● and ■	Biota

Adapted from CDM [2]

Appendix B. Polychlorinated Biphenyls (PCBs), Chlordane, and DDT in Selected Fish and Crabs from the Raritan River Areas Between 1986 and 1988. Data was Calculated Based on Wet Weight.

Year	Sampling Location	Fish/Crab Tissue Tested	A1248 (ppm)	A1254/ 1260 (ppm)	Total PCBs (ppm)	Alpha- (ppb)	Beta- (ppb)	Chlordane (ppb)	DDT (ppb)	DDD (ppb)	DDE (ppb)	DDT (ppb)
1986	Route 35 Bridge	Blue Crab (H/M)	0.74	0.74	1.44	28.74	5.91	34.65	<10	95.66	96.39	192.05-202.05
	Kin Buc Landfill	Blue Crab (H/M)	0.51	0.7	1.21	25.45	2.67	28.12	<10	62.33	78.39	140.72-150.72
		Striped Bass	0.38-0.98	0.34-1	0.72-1.98	19.43-39.79	13.49-14.72	33.33-54.51	<10-16.23	55.8-66.96	49-96.43	115.96-168.46
		White Perch	0.89	0.54	1.43	45.61	14.72	60.33	12.18	63.24	44.64	120.06
1987	Route 35 Bridge	Blue Crab (H/M)	0.72	0.69	1.41	15.63	3.31	18.94	<10	85.69	117.5	203.19-213.19
		Blue Crab (H)	3.47	0.71	4.18	16.54	12.87	29.41	<10	21.17	22	43.17-53.17
		Blue Crab (M)	<0.1	0.14	0.14-0.24	<2.5	3.49	3.49-5.99	<10	11.09	12.5	23.59-33.59
		Bluefish	<0.1	<0.1	0-0.2	<2.5	<2.5	0-5	<10	<10	<5	0-25
	Kin Buc Landfill	Blue Crab (H/M)	0.91	1.16	2.07	30.35	9.06	39.41	<10	65.92	109.1	174.99-184.99
		Blue Crab (H)	3	2.4	5.4	130.21	42.61	172.82	26.04	334.8	429.7	790.55
		Blue Crab (M)	0.18	0.1	0.28	6.94	<2.5	6.97-9.44	<10	24.8	30.73	55.53-65.53
		Striped Bass	0.98	1.49	2.47	35.71	19.93	55.64	20.16	58.59	100.5	179.24
		White Perch	2.93	4.19	7.12	93.75	29.41	123.16	45.96	277.2	372.5	695.68
1988	Route 35 Bridge	Blue Crab (H/M)	0.6	0.46	1.06	6.25	5.79	12.04	<10	40.06	52.88	92.94-102.94
		Blue Crab (H)	1.23	1.76	2.99	66.49	18.9	85.39	<10	125.9	178	303.84-313.84
		Blue Crab (M)	0.5	<0.1	0.5-0.6	3.99	<2.5	3.99-6.49	<10	11.29	12.71	24-34
		Bluefish	1.21	1.6	2.81	85.1	37.79	122.89	29.56	147.6	167.4	344.5
		Striped Bass	0.63-1.47	0.5-1.26	1.13-2.73	30.36-35.16	7.63-26.47	42.79-56.53	<10-34.72	46.88-60.42	48.36-104.53	95.23-199.67
	Kin Buc Landfill	Blue Crab (H/M)	0.78	1.29	2.07	33.24	7.26	40.5	<10	58.59	103.8	162.4-172.4
		Blue Crab (H)	1.66	1.86	3.52	60.64	21.41	82.05	15.85	197.8	206	419.62
		Blue Crab (M)	0.13	0.14	0.27	3.71	<2.5	3.71-6.21	<10	15.14	15.97	31.11-41.11
		Bluefish	0.7	0.64	1.34	32.67	16.16	48.83	10.86	73.24	73.15	157.25
		Striped Bass	0.36-0.78	0.37-1	0.73-1.78	10.42-36.93	10.29-19.81	30.23-47.22	<10-13.02	58.3-75.76	58.11-85.65	116.41-174.43
		White Perch	0.74	0.87	1.61	56.11	20.58	76.69	32.55	127.8	95.59	255.98

H: Hepatopancreas tissue only

M: Muscle tissue only

H/M: Hepatopancreas and muscle tissues

APPENDIX C
DESCRIPTION OF HEALTH COMPARISON VALUES

Environmental Media Evaluation Guides (EMEGs) and Reference Dose Media Evaluation Guides (RMEG) are estimates of chemical concentrations that are not likely to cause an appreciable risk of deleterious, noncancerous health effects for fixed durations of exposure. These concentrations factor in estimates of receptor body weights and rates of ingestion. EMEGs might reflect several different types of exposure: acute (1-14 days), intermediate (15-364 days), and chronic (greater than 365 days). EMEGs are based on ATSDR's minimum risk level (see definition below) while RMEG's are based on U.S. EPA's reference dose (RfD).

Lowest-Observed-Adverse-Effect-Level (LOAEL) is defined as the lowest dose of chemical in a study, or group of studies, that produces statistically or biologically significant increases in the frequency or severity of adverse effects between the exposed population and its appropriate control.

Minimum Risk Level (MRL) is defined as an estimate of daily human exposure to a substance that is likely to be without appreciable risk of adverse health effects (non-carcinogenic) over a specified duration of exposure. MRLs are derived when reliable and sufficient data exist to identify the target organ(s) of effect or the most sensitive health effect(s) for a specified duration within a given route of exposure. MRLs are based only on noncancerous health effects, and do not consider carcinogenic effects. MRLs can be derived for acute, intermediate, and chronic durations of exposure for the inhalation route.

Other comparison values were based on New Jersey Department of Environmental Protection's (NJDEP) health-based soil clean-up criteria for non-residential contact.

Appendix E
ATSDR Plain Language Glossary of Environmental Health Terms

Absorption: How a chemical enters a person's blood after the chemical has been swallowed, has come into contact with the skin, or has been breathed in.

Acute Exposure: Contact with a chemical that happens once or only for a limited period of time. ATSDR defines acute exposures as those that might last up to 14 days.

Additive Effect: A response to a chemical mixture, or combination of substances, that might be expected if the known effects of individual chemicals, seen at specific doses, were added together.

Adverse Health Effect: A change in body function or the structures of cells that can lead to disease or health problems.

Antagonistic Effect: A response to a mixture of chemicals or combination of substances that is less than might be expected if the known effects of individual chemicals, seen at specific doses, were added together.

ATSDR: The Agency for Toxic Substances and Disease Registry. ATSDR is a federal health agency in Atlanta, Georgia that deals with hazardous substance and waste site issues. ATSDR gives people information about harmful chemicals in their environment and tells people how to protect themselves from coming into contact with chemicals.

Background Level: An average or expected amount of a chemical in a specific environment. Or, amounts of chemicals that occur naturally in a specific environment.

Biota: Used in public health, things that humans would eat – including animals, fish and plants.

CAP: See Community Assistance Panel.

Cancer: A group of diseases which occur when cells in the body become abnormal and grow, or multiply, out of control.

Carcinogen: Any substance shown to cause tumors or cancer in experimental studies.

CERCLA: See Comprehensive Environmental Response, Compensation, and Liability Act.

Chronic Exposure: A contact with a substance or chemical that happens over a long period of time. ATSDR considers exposures of more than one year to be *chronic.*

Completed Exposure Pathway: See **Exposure Pathway.**

Community Assistance Panel (CAP): A group of people from the community and health and environmental agencies who work together on issues and problems at hazardous waste sites.

Comparison Value: (CVs) Concentrations or the amount of substances in air, water, food, and soil that are unlikely, upon exposure, to cause adverse health effects. Comparison values are used by health assessors to select which substances and environmental media (air, water, food and soil) need additional evaluation while health concerns or effects are investigated.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA): **CERCLA** was put into place in 1980. It is also known as **Superfund.** This act concerns releases of hazardous substances into the environment, and the cleanup of these substances and hazardous waste sites. ATSDR was created by this act and is responsible for looking into the health issues related to hazardous waste sites.

Concern: A belief or worry that chemicals in the environment might cause harm to people.

Concentration: How much or the amount of a substance present in a certain amount of soil, water, air, or food.

Contaminant: See **Environmental Contaminant.**

Delayed Health Effect: A disease or injury that happens as a result of exposures that may have occurred far in the past.

Dermal Contact: A chemical getting onto your skin. (see **Route of Exposure**).

Dose: The amount of a substance to which a person may be exposed, usually on a daily basis. Dose is often explained as "amount of substance(s) per body weight per day".

Dose / Response: The relationship between the amount of exposure (dose) and the change in body function or health that result.

Duration: The amount of time (days, months, years) that a person is exposed to a chemical.

Environmental Contaminant: A substance (chemical) that gets into a system (person, animal, or the environment) in amounts higher than that found in **Background Level**, or what would be expected.

Environmental Media: Usually refers to the air, water, and soil in which chemcials of interest are found. Sometimes refers to the plants and animals that are eaten by humans. **Environmental Media** is the second part of an **Exposure Pathway**.

U.S. Environmental Protection Agency (EPA): The federal agency that develops and enforces environmental laws to protect the environment and the public's health.

Epidemiology: The study of the different factors that determine how often, in how many people, and in which people will disease occur.

Exposure: Coming into contact with a chemical substance.(For the three ways people can come in contact with substances, see **Route of Exposure**.)

Exposure Assessment: The process of finding the ways people come in contact with chemicals, how often and how long they come in contact with chemicals, and the amounts of chemicals with which they come in contact.

Exposure Pathway: A description of the way that a chemical moves from its source (where it began) to where and how people can come into contact with (or get exposed to) the chemical.

ATSDR defines an exposure pathway as having 5 parts:

1. Source of Contamination,
2. Environmental Media and Transport Mechanism,
3. Point of Exposure,
4. Route of Exposure, and
5. Receptor Population.

When all 5 parts of an exposure pathway are present, it is called a **Completed Exposure Pathway**. Each of these 5 terms is defined in this Glossary.

Frequency: How often a person is exposed to a chemical over time; for example, every day, once a week, twice a month.

Hazardous Waste: Substances that have been released or thrown away into the environment and, under certain conditions, could be harmful to people who come into contact with them.

Health Effect: ATSDR deals only with **Adverse Health Effects** (see definition in this Glossary).

Indeterminate Public Health Hazard:
The category is used in Public Health Assessment documents for sites where important information is lacking (missing or has not yet been gathered) about site-related chemical exposures.

Ingestion: Swallowing something, as in eating or drinking. It is a way a chemical can enter your body (See **Route of Exposure**).

Inhalation: Breathing. It is a way a chemical can enter your body (See **Route of Exposure**).

LOAEL: Lowest Observed Adverse Effect Level. The lowest dose of a chemical in a study, or group of studies, that has caused harmful health effects in people or animals.

Malignancy: See **Cancer**.

MRL: Minimal Risk Level. An estimate of daily human exposure – by a specified route and length of time -- to a dose of chemical that is likely to be without a measurable risk of adverse, noncancerous effects. An MRL should not be used as a predictor of adverse health effects.

NPL: The National Priorities List. (Which is part of **Superfund.**) A list kept by the U.S. Environmental Protection Agency (EPA) of the most serious, uncontrolled or abandoned hazardous waste sites in the country. An NPL site needs to be cleaned up or is being looked at to see if people can be exposed to chemicals from the site.

NOAEL: No Observed Adverse Effect Level. The highest dose of a chemical in a study, or group of studies, that did not cause harmful health effects in people or animals.

No Apparent Public Health Hazard: The category is used in ATSDR's Public Health Assessment documents for sites where exposure to site-related chemicals may have occurred in the past or is still occurring but the exposures are not at levels expected to cause adverse health effects.

No Public Health Hazard: The category is used in ATSDR's Public Health Assessment documents for sites where there is evidence of an absence of exposure to site-related chemicals.

PHA: Public Health Assessment. A report or document that looks at chemicals at a hazardous waste site and tells if people could be harmed from coming into contact with those chemicals. The PHA also tells if possible further public health actions are needed.

Plume: A line or column of air or water containing chemicals moving from the source to areas further away. A plume can be a column or clouds of smoke from a chimney or contaminated underground water sources or contaminated surface water (such as lakes, ponds and streams).

Point of Exposure: The place where someone can come into contact with a contaminated environmental medium (air, water, food or soil). For examples: the area of a playground that has contaminated dirt, a contaminated spring used for drinking water, the location where fruits or vegetables are grown in contaminated soil, or the backyard area where someone might breathe contaminated air.

Population: A group of people living in a certain area; or the number of people in a certain area.

PRP: Potentially Responsible Party. A company, government or person that is responsible for causing the pollution at a hazardous waste site. PRP's are expected to help pay for the clean up of a site.

Public Health Assessment(s): See **PHA**.

Public Health Hazard: The category is used in PHAs for sites that have certain physical features or evidence of chronic, site-related chemical exposure that could result in adverse health effects.

Public Health Hazard Criteria: PHA categories given to a site which tell whether people could be harmed by conditions present at the site. Each are defined in the Glossary. The categories are:

1. Urgent Public Health Hazard
2. Public Health Hazard
3. Indeterminate Public Health Hazard
4. No Apparent Public Health Hazard
5. No Public Health Hazard

Receptor Population: People who live or work in the path of one or more chemicals, and who could come into contact with them (See **Exposure Pathway**).

Reference Dose (RfD): An estimate, with safety factors (see **safety factor**) built in, of the daily, life-time exposure of human populations to a possible hazard that is <u>not</u> likely to cause harm to the person.

Route of Exposure: The way a chemical can get into a person's body. There are three exposure routes:
- breathing (also called inhalation),
- eating or drinking (also called ingestion), and
- or getting something on the skin (also called dermal contact).

Safety Factor: Also called **Uncertainty Factor**. When scientists don't have enough information to decide if an exposure will cause harm to people, they use "safety factors" and formulas in place of the information that is not known. These factors and formulas can help determine the amount of a chemical that is <u>not</u> likely to cause harm to people.

SARA: The Superfund Amendments and Reauthorization Act in 1986 amended CERCLA and expanded the health-related responsibilities of ATSDR. CERCLA and SARA direct ATSDR to look into the health effects from chemical exposures at hazardous waste sites.

Sample Size: The number of people that are needed for a health study.

Sample: A small number of people chosen from a larger population (See **Population**).

Source (of Contamination): The place where a chemical comes from, such as a landfill, pond, creek, incinerator, tank, or drum. Contaminant source is the first part of an **Exposure Pathway**.

Special Populations: People who may be more sensitive to chemical exposures because of certain factors such as age, a disease they already have, occupation, sex, or certain behaviors (like cigarette smoking). Children, pregnant women, and older people are often considered special populations.

Statistics: A branch of the math process of collecting, looking at, and summarizing data or information.

Superfund Site: See **NPL**.

Survey: A way to collect information or data from a group of people (**population**). Surveys can be done by phone, mail, or in person. ATSDR cannot do surveys of more than nine people without approval from the U.S. Department of Health and Human Services.

Synergistic effect: A health effect from an exposure to more than one chemical, where one of the chemicals worsens the effect of another chemical. The combined effect of the chemicals acting together are greater than the effects of the chemicals acting by themselves.

Toxic: Harmful. Any substance or chemical can be toxic at a certain dose (amount). The dose is what determines the potential harm of a chemical and whether it would cause someone to get sick.

Toxicology: The study of the harmful effects of chemicals on humans or animals.

Tumor: Abnormal growth of tissue or cells that have formed a lump or mass.

Uncertainty Factor: See **Safety Factor**.

Urgent Public Health Hazard: This category is used in ATSDR's Public Health Assessment documents for sites that have certain physical features or evidence of short-term (less than 1 year), site-related chemical exposure that could result in adverse health effects and require quick intervention to stop people from being exposed.