Public Health Assessment for

AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

68TH STREET DUMP
ROSEDALE, BALTIMORE COUNTY, MARYLAND
EPA FACILITY ID: MDD980918387
NOVEMBER 23, 2009

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
PUBLIC HEALTH SERVICE
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.

Agency for Toxic Substances & Disease Registry..Thomas R. Frieden, M.D., M.P.H., Administrator
Howard Frumkin, M.D., Dr.P.H., Director

Division of Health Assessment and Consultation…. .... William Cibulas, Jr., Ph.D., Director
Sharon Williams-Fleetwood, Ph.D., Deputy Director

Health Promotion and Community Involvement Branch………………………………………..Hilda Shepeard, Ph.D., M.B.A., Chief

Exposure Investigations and Consultation Branch.. Susan M. Moore, M.S., Chief

Site and Radiological Assessment Branch .... Sandra G. Isaacs, B.S., Chief

Cooperative Agreement and Program Evaluation Branch ....Richard E. Gillig, M.C.P., Chief

Additional copies of this report are available from:
National Technical Information Service, Springfield, Virginia
(703) 605-6000

You May Contact ATSDR Toll Free at
1-800-CDC-INFO
or
Visit our Home Page at: http://www.atsdr.cdc.gov

PUBLIC HEALTH ASSESSMENT

68TH STREET DUMP

ROSEDALE, BALTIMORE COUNTY, MARYLAND

EPA FACILITY ID: MDD980918387

NOVEMBER 23, 2009

Prepared by:

U.S. Department of Health and Human Services
Agency for Toxic Substances and Disease Registry

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 U.S. Environmental Protection Agency (USEPA) 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 USEPA 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 process allows ATSDR scientists and public health assessment cooperative agreement partners flexibility in document format when presenting findings about the public health impact of hazardous waste sites. The flexible format allows health assessors to convey to affected populations important public health messages in a clear and expeditious way.

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 USEPA, 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.

Chemical and Exposure Pathway Screening: ATSDR uses several screening values that are derived from human and animal exposure studies. The screening values are meant to be protective of health and to allow scientists to eliminate further analysis of those chemicals that could not pose a hazard. Further analysis of the pathway is necessary when a chemical exceeds a health-based screening value. The pathway analysis may use other situation-specific screening values or may involve actual health effects data.

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 evaluate the possible 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.

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 public comments that related to the document are addressed in the final version of the report.

Conclusions: The report presents conclusions about the public health threat posed by a site. 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 USEPA or other responsible parties. However, if there is an urgent health threat, ATSDR can issue a public health advisory warning people of the danger. ATSDR can also recommend health education or pilot studies of health effects, full-scale epidemiology studies, disease registries, surveillance studies or research on specific hazardous substances.

Comments: If, after reading this report, you have questions or comments, we encourage you to contact ATSDR toll free at 1-800-CDC-INFO or visit our home page at http://www.atsdr.cdc.gov

Table of Contents

Foreword ii
Summary 5
Purpose and Health Issues 6
Background 6
Site Description 6
Site Operations and History 7
Regulatory History and Activities 8
Regulatory Designation 8
ATSDR Site Visit 9
Land Use and Natural Resources Information 9
Discussion 11
Environmental Contamination 11
Exposure Pathways 12
Toxicological Evaluation 17
Public Health Implications 22
Child Health Considerations 24
Community Health Concerns 24
Conclusions 26
Recommendations 28
Public Health Action Plan 29
For More Information 30
Authors, Technical Advisors 31
References 32
Appendix A. Maps and Charts 36
Appendix B. Contaminant and Exposure Information 45
Table B.1. Contaminant Information 45
Table B.2. Future Use Site Conceptual Model 49
Table B.3. Evaluation of Exposure Pathways at 68th Street Dump 50
Appendix C. Contaminant Screening 54
Appendix D. Quantitative Screening Analysis for Exposure Groups 68
Appendix F. Public Health Hazard Categories 76
Category 1: Urgent Public Health Hazard 76
Category 2: Public Health Hazard 76
Category 3: Indeterminate Public Health Hazard 76
Category 4: No Apparent Public Health Hazard 76
Category 5: No Public Health Hazard 76
Appendix G. Resources for Local Fish, Shellfish and Recreational Water Use 77

Summary

The 68th Street Dump site encompasses approximately 150 acres with about 90% of the property in Rosedale, Baltimore County and the remaining 10% in the city of Baltimore, Maryland. Nearby neighborhoods are present to the north-west and directly on the north-east boundary of the site, whereas the remaining areas around the site are industrial. Much of the site was formerly wetland, and areas not suitable for development will be remediated for ecological and recreational purposes as appropriate. Past operations involved landfilling and disposal of a variety of wastes, including industrial and commercial wastes, municipal incinerator ash and waste oils. Cover soil was subsequently placed over many of the landfilled areas. Landfill operations ceased several decades ago, but random unauthorized dumping continues to occur. The property is observed to be heavily overgrown with grass, brush and trees. The site is crossed by streams that join and form the Back River, which ultimately discharges into Chesapeake Bay. An equipment maintenance facility and recycling facility operate on a small area of the property amongst the defined site areas. Baltimore County's Redhouse Run Pumping Station and sewer pipeline are also located adjacent to the site.

The U.S. Environmental Protection Agency (USEPA) performed Expanded Site Investigations at the 68th Street Dump in the spring of 2000 and February of 2001. Since then, the responsible parties for the site have developed an USEPA approved Site-Wide Program Management Plan (Feb 23, 2007) that identifies additional sampling needed to remediate and redevelop the site for productive reuse in the future. The site contains five source areas where landfill materials are known to have been deposited based on historical records. Future use of the site is being evaluated for each of the areas, which are separated by surface-water features and flood-plain. Possible future uses are evaluated based on accessibility by vehicles or train and availability of utilities.

ATSDR has reviewed available environmental health concerns of the community related to the 68th Street Dump site to determine whether adverse health effects are possible. In addition, evaluations considered whether actions are needed to reduce, prevent, or further identify the possibility for people to come into contact with site-related contaminants such that their health could be harmed.

ATSDR determined that current contact with contaminants in soil and sediment at the site are not expected to occur at levels that cause health effects. However, health effects could occur should conditions change where future recreational users or workers have frequent access to soil "hot spots," if soil pica (eating behavior) of young children occurs on hot spots, or if site redevelopment causes contact with subsurface contamination. Lead is of particular concern because children sometimes have elevated blood levels from other sources, such as contact with lead based paint. Approximately 20% of homes in Baltimore County, Maryland were built before 1950[1] and may have utilized lead based paint. Swallowing soil containing more than 400 ppm of lead during recreational activities could be harmful in children that already have elevated blood lead levels.

Current recreational use of the site would not likely involve the repeated contact with harmful substances assumed in this worse case scenario determination. However, remediation and reuse

of the site should account for potential hazards. Future disturbance during site excavation or redevelopment activities could result in movement of subsurface landfill materials to the surface resulting in higher levels of exposed contamination than are currently present. However, the USEPA approved remediation plan is intended to prevent future hazards. Redevelopment of the site for mixed-use, non-residential purposes is planned in this rapidly growing, north-eastern quadrant of Baltimore. ATSDR anticipates the remediation and future use to benefit the local residents and patrons of the area and to incur no public health effects, if the recommendations herein are recognized and observed.

Sampling information is inadequate to evaluate the potential for health effects from eating fish from on-site waters and vapor intrusion into nearby resident and future on-site buildings. No recent sampling of fish has been performed at the site. Additionally, the potential for vapor intrusion into structures has not been well characterized at the site. Contact with surface water is not expected to result in harm to people's health due to low contaminant levels and the nonuse of surface water as a source of drinking water. Two past situations at the site lack sufficient sampling data and/or information to evaluate health effects: past use of private well water off-site and past breathing of air contamination during on-site fires.

Purpose and Health Issues

The Agency for Toxic Substances and Disease Registry (ATSDR) is a federal agency within the U.S. Department of Health and Human Services and is headquartered in Atlanta, Georgia. ATSDR is required to conduct public health assessments of sites proposed for the National Priorities List (NPL), under authorities provided by the Superfund law (Comprehensive Environmental Response, Compensation, and Liability Act of 1980 [CERCLA]) and its amendments. In 1999 and 2003 the USEPA proposed that the 68th Street Dump site near Rosedale, Maryland (Figure A.1) be added to the NPL. An agreement was reached in 2004 to evaluate and remediate the site under the USEPA Superfund Alternative Site process.[2]

In this public health assessment, ATSDR evaluates the public health significance of the site using investigation data that were available as of spring 2007. This public health assessment focuses on evaluating human exposure and health effects that may be associated with releases of inorganic and organic compounds from the dump site during and following its operations. Data from over 200 samples are currently available for the soil, sediment, surface water and groundwater at the site. This public health assessment addresses exposures to on-site soil, sediment, air, surface water, groundwater, fish and shellfish.

Background

Site Description

The 68th Street Dump site encompasses approximately 150 acres in Rosedale, Baltimore County, Maryland that have been used for several separate landfilling operations and other activities from the 1940s to the 1970s.[3] Approximately 90% of the site is within the jurisdiction of Baltimore County east of I-95. The small area of the site under and west of I-95 is within the Baltimore City limits. Much of the site is wetland and floodplain area, due to the run-off of a portion of Baltimore City. Past operations involved landfilling and disposal of a variety of wastes, including industrial and commercial wastes. Soil was used as cover material, yet refuse and drums are exposed at many locations where cover is now missing. Permits for the landfill operations were issued through at least the 1960s. A detailed listing of site-related waste generators, wastes generated, and hazardous substances is available from the USEPA website in Appendix B of the Hazard Ranking System (HRS) Documentation Record.[4] A significant amount of unauthorized dumping continues to occur at the site. The property is observed to be heavily overgrown with grass, brush, and trees. The Settling Parties plan to initiate comprehensive sampling of the site as agreed in the Administrative Settlement Agreement and Order on Consent for Remedial Investigation/Feasibility Study (ASAOC).[2] The Site-Wide Program Management Plan (SWPMP) was approved by USEPA on Feb 23, 2007 and identifies the remediation and redevelopment strategy to revitalize the site for productive reuse in the future.[3]

Site Operations and History

The principal areas with historical sources of contamination are described below (from information in references 1, 2 and 3 and are shown in Figure A.2):

Source Area 1 - Original Landfill (including the Rob Tyler Landfill and the Colgate Pay Dump)

This area includes approximately 68 acres North of Herring Run on the west side of the site and ranges from near mean sea level (MSL) to about 80' above MSL elevation. Historically the area contained two primary operations that contributed to contamination at the site from at least 1946 to 1971: the Original Landfill and the Colgate Pay Dump. A variety of municipal solid, industrial and commercial wastes were received in the area. Inspection reports identify numerous past problems including uncontrolled fires, inadequate cover, odors, improper disposal of drums, oil pits, and migration of oil and refuse into Herring Run and Moore’s Run. Portions of Source Area 1 were excavated and redeposited on-site during the 1970’s by the Maryland State Highway Administration to topographically reconstruct the area where the Windlass-Moravia Interchange of I-95 was built.

Source Area 2 - Horseshoe Landfill

Approximately 15 acres in the north-central region of the site constitutes Source Area 2 and ranges from near MSL to about 30' above MSL. The area included the Horseshoe Landfill from the mid-1960's and a radio transmitter station from 1954. Control of the landfill parcels was passed to several other companies from 1972 through the early 1990's. The types of wastes received in Source Area 2 are largely unknown. A pond and wetlands, which feed the unnamed tributary onsite, are surrounded by the landfill. The radio transmitter station in the area once housed containers of PCB oils and empty transformers.

Source Area 3 - Island Area Landfill

Source Area 3 is approximately 6 acres on the west side of the island surrounded by Herring Run in the center of the 68th Street Dump site. The elevation ranges from near MSL to about 20' above MSL. The area includes the dumping grounds for 55-gallon drums filled with industrial wastewater treatment sludge, incinerator ash, paint sludge, solvents and waste oils. At least 40 surficial drums were removed from the area by USEPA in 1985 after an emergency response to fire from solvents in the drums.

Source Area 4 - Redhouse Run Landfill

The area comprises approximately 4 acres and ranges from near MSL to about 20' above MSL. The fill for the area included incinerator ash, industrial waste and commercial waste from the early 1960's or before. In 1984, approximately ten drums were removed, one reportedly containing paint sludge and others empty and badly deteriorated.

Source Area 5 - Industrial Enterprises and Unclaimed Landfills

In 1956, the original landfill operator expanded landfill and disposal operations on approximately 60 acres of Source Area 5. The area currently ranges from near MSL to about 40' above MSL. Inspection reports indicate that operations included refuse disposal in wetlands in and along Herring Run and dumping waste oil into a pit near Herring Run. Automobile disposal was also observed on part of the site. Drums were excavated and transported off site in 1981/1982 from an affected area of about one acre.

Other Areas

An area exists that is technically not one of the 68th Street Dump properties, but may impact remediation and redevelopment of the site. The location is an area adjacent to Source Areas 3, 4 and 5 and contained a waste transfer operation, a recycling facility, warehouse-type buildings, a storage yard, an equipment maintenance area and a short term incinerator. The investigation and remediation of this area may be undertaken in cooperation with the 68th Street Dump under the Maryland Voluntary Cleanup Program. Groundwater has been impacted at the site by benzene, toluene, ethylbenzene and xylene (BTEX) from previous refueling operations of Browning Ferris Industries (BFI, now owned by Allied Waste) vehicles in this area. ATSDR was provided written confirmation from MDE that the BFI refueling underground storage tanks (USTs) have been removed from the site and the groundwater sampled. The post removal sampling indicated no elevated levels of naphthalene or total petroleum hydrocarbons remained in the area. However, BTEX was not sampled for specifically. A 1986 site inspection[5] noted that a well in the area was used to wash trash trucks, and a 1994 report[6] noted that there was an on-site well used by employees for washing their vehicles and hands.

Regulatory History and Activities

Regulatory Designation

The site was proposed to the National Priorities List in 1999 and again in 2003. However, the USEPA and nineteen Settling Parties have entered into the ASAOC to evaluate and remediate the site as dictated by USEPA's Superfund Alternative Site (SAS) process.[7] This is the first site to be handled by the SAS process in Region 3. The goal of following the SAS process is to achieve thorough, rapid cleanup of NPL caliber sites that includes remedies consistent with anticipated future use of the land. USEPA has enforcement authority and Maryland's applicable regulatory agencies are requested to review and comment on all stages of the process.

Additionally, comparable opportunities for community involvement should be provided as at NPL sites.

ATSDR Site Visit

ATSDR representatives visited the site and community on March 20 and 21, 2007. Community health concerns and other information obtained during the visit are described in appropriate sections of this document.

Land Use and Natural Resources Information

The site is in an area that has commercial and light industrial activities and residential properties. A municipal incinerator, located north of the site on Pulaski Avenue, operated in the past. Residential properties are near the northwest boundary and adjoin the northeast boundary. The SWPMP includes a reuse evaluation of the site and characterized Management Areas, along with the potential for vehicular and rail access, utilities, topographical features and extent of the flood-plain. Much of the area surrounding the surface waters on the site is in the flood plain. Plans are to restore these areas ecologically as required by the Natural Resources Trustees, and perhaps to make them available for passive recreation uses such as canoeing, walking and wildlife observation.

- Groundwater and Water Supply

During a prior site visit, an ATSDR representative and a water department meter reader conducted a building-by-building review in the immediate site vicinity and determined that all units are connected to the public water system. The public system obtains its water from separate reservoirs. Some residences were connected to the public water system within the last 4 or 5 years. Therefore, private wells did exist in the site vicinity during and following landfill operations.

A well west of Source Area 4 is being used by the currently operating facility for non-potable purposes. ATSDR is uncertain if this is one of the wells referred to in the SWPMP[3] on page 40 stating: "Although potable water is supplied by public water supply, one groundwater drinking well and other test wells have been reported within the area. The status of these wells will be confirmed and corresponding exposure scenarios, if any, considered."

A well survey indicated that no domestic wells are present within 1/2 mile of the site (SWPMP, pg 14), and surficial aquifers in the immediate vicinity of the site are not used for drinking water purposes. Additionally, Baltimore County regulations restrict construction of wells for the property (SWPMP, pg 42).

- Surface Water

Herring Run crosses the property from west to east and becomes Back River, which discharges into Chesapeake Bay. Moore’s Run and Redhouse Run are tributaries that discharge into Herring Run within the site boundary. Additionally, there are five unnamed tributaries that discharge to Herring Run on-site.

- Recreation

The USEPA HRS investigations found previous recreational uses by site trespassers.[8] Reports of fishing nets and lines in streams on-site and multiple statements attesting to onsite fishing in the past suggest that a significant amount of fishing has occurred previously at the site. Residents also have reported swimming in on-site waters. Downstream, the Back River and Chesapeake Bay are used extensively for recreational activities, e.g., fishing, boating, and swimming.

MDE reports that fish advisories have been in place for Back River since February 1986. The advisories seek to limit consumption of several species of fish and eels due to pesticides, polychlorinated biphenyls (PCBs) and methylmercury contamination. However, many types of fish common in the Back River have no consumption limitations. Appendix G provides resources for obtaining current information on Maryland's recommendations for recreational activities in the Back River.

Evidence of significant trespassing was observed on the site visit by ATSDR personnel in March 2007. Numerous well-worn ATV paths were observed at Source Area 1. Evidence of a significant amount of trespassing and extensive illegal dumping was present in Source Areas 2 and 5. A structure that appeared to be a temporary shelter was observed in Source Area 5, but no occupant(s) of the shelter were observed at the site. ATSDR recommends that ATV activities be halted until the surface soils of the area are demonstrated to be safe from metallic debris and the surface soil "cap" for the landfill is determined to be adequate for such uses.

- Illegal Dumping

Illegal dumping at the facility was extensive in Source Areas 2 and 5 due to relatively uninhibited access to the dirt roads through the site as noted during the site visit. A sofa, mattress box springs, 55 gallon plastic drums, a satellite dish and large amounts of other municipal waste were observed. The potential for unregulated dumping to occur increases the likelihood that the site may be further contaminated by hazardous materials, in addition to creating a potential safety hazard. Restricting access to the site would decrease the potential for further unregulated dumping to occur. Additionally, Baltimore residents are advised to report illegal dumping by calling 410-396-4707 or 311. Further information can be obtained from the following website: http://www.ci.baltimore.md.us/government/dpw/waste.html

- Future Reuse

The SWPMP discusses the possible re-use of the site for industrial, self-storage, contractor yard, impound lot, passive greenway, and/or open space purposes. Road access and the availability of utilities are considered in the development of Management Area’s (MAs) at the site to determine the most appropriate future reuses. Owners of adjoining areas may also influence future reuses. In addition reuse decisions may cause upstream and downstream effects on site surface waters, wetlands and flood plains.

- Demographic Information

According to 2000 census data, about 12,000 people live within one mile of the site (Figure A.1). The population in the site vicinity is about 90% Caucasian. About 8 percent are children, age 6 or younger, about 19% are women of child-bearing age and about 20% are age 65 or older. The census also shows that Rosedale's largest international community is Asian (1.9%) with Hispanic residents falling in the next largest category (1.4%).

Discussion

Environmental Contamination

ATSDR reviewed the environmental sampling data available to date (August 27, 2007) assembled in the Site-Wide Management Plan. The data included over 200 samples from soil, sediment, surface water and groundwater at the site. A more comprehensive sampling event is planned in which confirmatory sampling of some areas will be performed along with more widespread sampling across the site. The resulting site characterization will be used to develop future site remediation and redevelopment plans. Previous sampling across the site was targeted to evaluate the areas considered to have the highest potential for contamination. ATSDR considered it prudent to evaluate the current data in order to determine if there are urgent health hazards that need immediate attention and to coordinate our efforts with the ongoing regulatory site evaluation and remediation process.

During its data review, ATSDR selected contaminants of potential concern that warranted further evaluation for exposure and public health significance by noting the contaminants exceeding ATSDR's Comparison Values (CVs). EPA or other alternate screening values were used for screening when CVs were not available. Media-specific contaminants with concentrations above screening values do not necessarily represent a health threat but are selected for further evaluation (listed below). The screening criteria for these constituents and maximum detected levels are shown in Appendix C. The contaminants and pathways that required a more in-depth evaluation are discussed below.

Contaminants of Potential Concern		
Soil	Inorganics:	Aluminum, Antimony, Arsenic, Barium, Cadmium, Chromium, Cobalt, Copper, Lead, Mercury, Vanadium, Zinc
	Organics:	4-Nitroaniline, Carbazole, Chlordanes, 4-Chlorophenyl Phenyl Ether, Di(2-Ethylhexyl)Phthalate, Dieldrin, N-Nitrosodi-N-Propylamine, Polycyclic Aromatic Hydrocarbons (PAHs), Polychlorinated Biphenyl (PCBs), Dioxins/Furans
Sediment	Inorganics:	Aluminum, Antimony, Arsenic, Chromium, Cobalt, Copper, Lead, Vanadium, Zinc
	Organics:	Aldrin, PAHs, PCBs, Dioxins/Furans
Surface Water	Inorganics:	Aluminum, Antimony, Arsenic, Beryllium, Cadmium, Chromium, Copper, Lead, Manganese, Nickel, Vanadium, Iron†
	Organics:	Trans-1,3-Dichloropropene, Chlordanes, Di(2-ethylhexyl)phthalate, Heptachlor, Heptachlor Epoxide, Beta-Hexachlorocyclohexane,

Contaminants of Potential Concern		
		Trichloroethylene, PAHs, PCBs
Ground Water	Inorganics:	Antimony, Beryllium, Cadmium, Manganese, Iron† and Magnesium†
	Organics:	1,1,2,2-Tetrachloroethane, 1,1-Dichloroethene, Cis-1,2-Dichloroethene, Ammonia, Benzene, Cyanide, Ethylbenzene, Delta-Hexachlorocyclohexane, Toluene

† A certain amount of these minerals are required in the diet for good health. However, the minerals are listed here because they are higher than normal and could pose health effects in large quantities. The exposure levels of minerals from the 68th Street Dump site in relation to recommended dietary levels is discussed in the following sections.

Exposure Pathways

ATSDR examined past, current and future plausible exposure pathways and associated contaminants that could be a health hazard. The past exposures are discussed at the end of this section, whereas current exposures are relatively limited and are discussed below. The Future Use Site Conceptual Model in Table B.2 illustrates the future pathways considered. Evaluation of the plausible pathways is performed by estimating exposure doses for each chemical and comparing them to health guidelines for cancer and noncancer effects. The exposure dose is the amount of a contaminant that gets into a person's body. Health guidelines are doses below which health effects are not expected. Exposure doses are calculated for child and adult exposures that are specific for this site. An exposure situation for which the exposure dose is lower than a corresponding health guideline dose typically is eliminated from further evaluation.

The following is a discussion of the contamination in each media at the site. The distributions of the concentrations of heavy metals in soil and sediment are shown in Figures A.3 to A.9. The theoretical exposure calculations for the 68th Street Dump are described in Appendix D and consider hypothetical site and construction workers and adult, teenage and child recreators. The exposure doses were calculated using the maximum detected concentrations or 95% upper confidence limit, as appropriate, for incidental soil, sediment and surface water ingestion and are discussed below. Exposure doses were not calculated for lead exposure, as is customary; the potential for health effects from lead are evaluated for combined exposures from different sources and are discussed below.

Soil

Soil samples were obtained in all Source Areas of the 68th Street Dump. The number of surface soil samples was not extensive, with a limited number of onsite data points available for review. However, the surface soil sample data that was reviewed, in combination with the historical knowledge that the landfill areas were covered with soil, indicated that significantly less contamination is likely present at the surface than in the subsurface. Future earth moving activities at the site should be performed with the understanding that transferring subsurface soils to the surface may result in higher environmental exposure to landfill contaminants at the surface. Additionally, disturbance of contaminated soils may increase the bioavailability of metals within the soil matrix.

Environmental sampling of on-site soil to date focused on areas which, based on historical information, were the most likely to be contaminated. Surface and subsurface soil sample data were reviewed, in addition to samples in which depth was not specified, and calculations were performed to estimate exposure doses. For contact with on-site soil, the exposure doses for adult workers and adult, teen and child recreational users were calculated. Recreational users may visit the site without working there, but their exposure would be less than that of a full-time worker. Adult workers were assumed to spend 40 hours per week on the site, for 25 years. Recreational users were assumed to spend up to two days per week on the site throughout the year. These and other standard assumptions for calculating the exposure doses are listed in the calculation spreadsheets in Appendix D.

The worker and recreator scenarios result in doses that are below levels that result in adverse health effects. In fact, only repeated exposures to the highest levels over years would be likely to result in adverse effects. Such exposure would be highly unusual and is not expected to occur. Should conditions change where recreational users or workers frequent access to "hot spots," or if the site is redeveloped allowing for exposure to subsurface contamination, then the site could pose a public health hazard. One example of future use that should be avoided, unless the "hot spots" are addressed, is pica[*] exposures of small children. Health effects could result if children happen to engage in ingestion of site soils in an excess amount characteristic of pica behavior. Pica behavior is an abnormal consumption of non-food materials, such as soil, most often seen in children below 5 years of age.

Exposure doses for locations with the highest Toxic Equivalent Dose (TEQ) are elevated above the health guideline comparison values for PAHs. It is not possible to calculate a 95% Upper Confidence Limit (UCL) average for PAH TEQs to develop a practical estimate of exposure dose. Therefore, exposure doses were calculated using maximum TEQ concentrations. Further analysis and discussion will take the contaminant distribution into consideration. Lead was significantly elevated in a number of onsite soil samples. The maximum concentrations of these three types of chemicals are listed in the table below, and analysis of the potential health effects from lead and PAHs are presented in the Toxicological Evaluation section.

Soil Contaminant	***Concentration Used to Evaluate Theoretical Risk (mg/kg)***
PAHs	TEQ=210*
Lead	Max Detect = 2990

* Values are from the location with the highest TEQ.

Childhood Pica Exposures

A child that exhibits pica behavior, a purposeful eating of soil up to 5000 milligrams (about a teaspoon) at a time, could become sick if such ingestion occurred at the more contaminated areas of the site. The following inorganic compounds were determined to have a hazard quotient

[*] In addition to accidental ingestion, some toddlers (typically 1 to 3 years old) intentionally eat large amounts of soil. This intentional soil ingestion is called soil-pica behavior. Soil pica behavior is rare though happens occasionally in young children, possibly due to normal exploratory behavior.

greater than one when compared with the acute MRL, or the intermediate/chronic MRL when no acute MRL was available.

Chemical	***Maxiumum Surface Soil Concentration (mg/kg)***	***Estimated Pica Exposure Dose (mg/kg-day)***	***Health Guideline (mg/kg-day)***	***Hazard Quotient***
Aluminum	10,500	5.3	1 (intermediate EMEG)	5
Cadmium	0.95	4.8E-4	2E-4 (chronic EMEG)	2
Chromium	58.1	2.9E-2	3E-3 (chronic EMEG)	10
Copper	86.5	4.3E-2	1E-2 (acute EMEG)	4
Vanadium	40.2	2.0E-2	3E-3 (chronic EMEG)	7

Ingestion of enough contaminated soil at once could cause side effects, such as nausea, vomiting and/or abdominal pain. Therefore, children should be supervised to prevent pica-type soil exposures to contamination at the site. Additionally, preventing excessive soil eating behavior is a prudent public health practice to minimize ingestion of microbes and other hazardous materials from the ground.

Sediment

Elevated levels of lead were found in sediment at the site. The maximum detected concentration of lead was 933 mg/kg. The potential health effects of exposure to lead at the site will be discussed in the Toxicological Evaluation section.

Fish Consumption from Onsite Surface Waters

Herring Run and Back River potentially receive contaminants from a variety of industrial and urban sources. A Maryland Biological Stream Survey[9] has been performed evaluating the streams in the Back River watershed. The study concluded that extensive restoration efforts would be necessary to improve the ecological condition of the watershed. Redevelopment of areas like the 68th Street Dump have the potential to play a vital role in the revitalization of the watershed.

Methylmercury is of particular concern at some sites because it can build up in certain edible freshwater and saltwater fish and marine mammals to levels that are many times greater than levels in the surrounding water. Methylmercury is the form of mercury that is most easily absorbed by the body. Predatory fish at the top of the food chain, such as bass, bioaccumulate methylmercury up to 10 million times greater than dissolved methylmercury concentrations in the native waters.[10] Other forms of mercury do not pose a significant hazard to human health from consuming fish. The FDA action level for methylmercury is 1.0 mg/kg for fish available in supermarkets in the US.[11] ATSDR recommends lower levels for people who comsume fish regularly.[12] Jones and Slotten 1996 proposed that up to 85% of the mercury in fish was methyl mercury.[13] ATSDR found that it varied according to species and that most species were between 42-78%, where ranges for methyl mercury in fish were 0.018-0.0823 mg/kg wet weight (n=270).[14]

EPA recommends sampling different size classes of bottom-feeder and predatory species and sampling portions of the fish that reflect dietary practices of the local consumers of caught fish.[15] In 1994 MDE performed mercury analysis of fish tissue for pumpkin seed sunfish and white suckers from Herring Run. Sampling of fish and shellfish from site surface waters for other contaminants has not been performed. The highest concentration of mercury found in the four composite samples of fish (fillets) was 0.13 milligrams per kilogram (mg/kg), which does not exceed the USEPA Region III Risk Based Concentration of 0.14 mg/kg for methylmercury.[16] A national study from the 1980's found mercury in white suckers averaging 0.11 mg/kg.[17]. However, since sampling has not been performed for over a decade, current levels are unknown.

Vapor Intrusion from Groundwater

Since groundwater is not used as a source of drinking water on the site, direct exposure is not expected. The section of the site between Source Areas 3, 4 and 5 housed a maintenance building that used chlorinated VOC (Volatile Organic Compounds) solvents and petroleum containing Underground Storage Tanks (USTs). Groundwater analysis by GeoTrans in 1995[18] revealed that levels of chlorinated VOCs were detected above background but below ATSDR comparison values for drinking water. Removal of the five USTs was confirmed in a Notice of Compliance letter from the MDE Oil Control Program dated October 25, 1996.[19] The letter indicated that no corrective action or further monitoring was necessary at the site based on laboratory analysis of groundwater, the absence of liquid phase hydrocarbons and site characteristics. However, the previously detected BTEX petroleum constituents were not evaluated specifically during the post-removal analysis.

Migration of the contamination through groundwater could impact future sampling events and reuse of the site. Future groundwater sampling, and perhaps soil gas sampling, should be designed to detect any issues with remaining contamination. There is a significant likelihood that the BTEX has undergone natural bioattenuation, hydraulic flushing and dispersal of the aged plume and no longer poses a problem. However, the potential for intrusion of benzene and other potentially harmful volatiles from the petroleum contamination into future onsite buildings or the neighboring Rosedale Terrace residences should be addressed through additional site hydrogeology, contaminant level and vapor intrusion analysis using currently accepted protocols.[20,21]

Surface Water

Exposure dose calculations (Appendix D) revealed that incidental ingestion of surface water should not result in exposure to contaminants at levels that cause harm to human health. The exposures calculated were based on the assumption that construction workers at the site would accidentally ingest 10 mL of surface water per work day for one year and recreators at the site would accidentally ingest 10 mL of surface water per day for two days per week for 30 years. Levels of dietary minerals calcium, iron, magnesium, potassium, and sodium in surface water were evaluated and exposures were estimated to be within the Tolerable Upper Intake Levels of Dietary Reference Intakes from the Food and Nutrition Board, Institute of Medicine, National Academy of Sciences[22] for the exposure scenarios of concern. Although lead was found at elevated concentrations in some surface water samples, the small amount and infrequent ingestion rates result in estimated doses is not expected to cause harm. This does not constitute a recommendation for drinking site surface water, as microbes and pathogens may be present. The potential health effects associated with lead are discussed further in the toxicology section below.

Past Exposure to Contaminated Off-Site Private Well Water

Previously, lead was detected in water from a few private wells near the site at a concentration of 105 ppb (parts per billion), which is higher than the current USEPA action level of 15 ppb for lead in drinking water. It is not known whether the lead in the off-site well water was site-related or if 105 ppb represented an average daily concentration. However, exposure via these wells is no longer occurring, because all of the residences were connected to municipal water by 1995. It is not possible to determine if any health effects may have occurred in the past from exposure to lead in the well water, since the average concentration of lead in the drinking water is not known and other sources of lead may have contributed to a child's lead intake.

Past Air Exposures During Fires

A number of fires were reported on the site in the past. Since environmental data exist for only the 1985 fire, the discussion of the public health implications is restricted to this event. Of the VOCs measured in the air during the 1985 fire, the exposure doses for benzene, ethylbenzene, and styrene exceeded their health guidelines and are further evaluated. It is unclear where the samples were collected on the site and who was exposed at the time. The following discussion of health effects focuses on worker exposure, since there were no air data collected in the residential areas and the nearest homes were at least 500 feet away from reported burn areas. Nearby residents, who were downwind from the fires, were most likely exposed to some smoke and contamination; however, the concentrations of the contaminants and the duration of exposure are not known in those areas and cannot be evaluated.

Since it is not known where the samples were collected nor where the workers were stationed during this time, the following discussion assumes the most conservative (i.e. protective) scenario. It is assumed that workers breathed the highest recorded concentrations of contaminants. As this exposure occurred outdoors, the contaminant concentrations likely varied greatly from place to place and decreased quickly away from the source. Therefore, it is likely that workers would not have extensive exposure to the maximum levels measured. However, if they did, then temporary adverse health effects may have occurred from exposure to benzene and styrene.

- Benzene

Benzene was detected in on-site air in 1985 at a maximum concentration of 7 parts per million, ppm, (or 21,000 micrograms per cubic meter, $\mu g/m^3$). Several animal studies have shown adverse effects on the immune and blood systems at around 10 ppm of benzene in the air after exposures for 6 hours per day for 6 days[23] These types of exposures may not cause noticeable symptoms, but may temporarily reduce the number of blood cells. Mild neurological effects (such as dizziness) and respiratory effects (such as shortness of breath) have been observed in humans at slightly higher levels, around 60 ppm.[23] If workers were on the site during the 1985 fire and exposed to the maximum level of benzene for a few days, then temporary adverse health effects to the immune and blood systems may have occurred during that time.

- Ethylbenzene

No adverse health effects are expected from inhalation exposure to ethylbenzene during the 1985 fire. The maximum level of ethylbenzene detected in the air during the fire (5000 $\mu g/m^3$ or 1.1 ppm) was slightly higher than the health-based guideline of 4000 $\mu g/m^3$ (1 ppm) for intermediate duration exposure (14 days to 1 year). However, since the fire lasted only four days, the maximum level of ethylbenzene was compared to human and animal studies that were conducted for short time periods (acute exposure, less than 14 days). The maximum level of ethylbenzene measured during the fire was at least 100 times lower than the levels at which any health effects were seen in the experimental studies. The measured level of ethylbenzene in the air was also 100 times lower than the occupational standards set by the National Institute for Occupational Safety and Health (NIOSH) and the Occupational Safety and Health Administration (OSHA).[24]

- Styrene

The maximum concentration of styrene measured in the air, on-site, in 1985 was 4 ppm (17,000 $\mu g/m^3$). No intermediate or acute health guidelines are available. The chronic health guideline is listed as 0.06 ppm (300 $\mu g/m^3$). However, since the fire lasted only 4 days, it is more appropriate to look at the acute duration (less than 14 days) exposure studies than the chronic health guideline. In these acute duration studies, mild neurological effects, such as slowed reaction times and impaired balance, were observed in humans at levels above 50 ppm of styrene in the air.[25] Unless workers on the site during the 1985 fire were exposed to levels of styrene significantly higher than the maximum detected value, no health effects are expected to have occurred.

Toxicological Evaluation

Human, animal and laboratory toxicological studies may be considered for evaluating the potential for health effects and are summarized in the ATSDR Toxicological Profiles. The frequency of elevated contamination in samples and the potential for exposures to result in health effects for specific toxic substances are discussed below. Of all the chemicals detected in the soil and sediment only the exposure doses for lead and PAHs were significantly above their health based screening values and these are discussed below.

Lead

Prior to 1995, off-site well water was found to contain lead. It is not known whether the lead in the off-site well water was site-related (another source could be old plumbing which may contain lead in the pipes, faucets, and solder) or if 105 ppb represented an average daily concentration. The USEPA action level for lead in drinking water is 15 ppb. If the water tested was the first drawn from the tap that day, then the 105 ppb could be the maximum lead level and the average level could have been much lower. If 105 ppb was the *average* lead level in the water, preschool children who regularly drank this well water could have increased the amount of lead in their blood. Preschool children are more susceptible to the effects of lead and may also be exposed to lead in other unique ways, such as eating paint chips. Whether children from these households could have had elevated blood lead levels depends on a number of other factors, including other sources of lead ingested or inhaled, the age of the child, the nutritional status of the child, and the form and type of lead ingested. Since these factors cannot be evaluated from over a decade in the past, the potential for health effects from drinking well water during that time period cannot be determined.

The Centers for Disease Control and Prevention (CDC) had a childhood lead program in Baltimore that identified many children with Blood Lead Levels (BLLs) greater than 10 micrograms of lead per deciliter of blood (µg/dL). The U.S. Department of Housing and Urban Development (HUD) identified lead paint as the largest contributor to these levels. As a result of remediation, BLL's throughout Maryland have dropped. In 2005, 534 children of Baltimore County had confirmed elevated blood lead levels; 58,451 homes in the county were built before 1950.[1]

In 2000, site surface water was found to contain elevated levels of lead, and one sample had a concentration of 1540 µg/L. If incidental ingestion of 10 milliliters (mL) (as opposed to 1,000 or 2,000 mL) per day occurred at this maximum level, the amount of lead ingested would have been roughly equivalent to the amount allowed by the Maximum Contaminant Level (15 µg/L) at normal drinking water consumption rates. However, ingestion of surface water is likely an infrequent event. People should not drink the surface water. The incidental ingestion of lead in surface water alone is not expected to have caused health effects in the past or to cause health effects in the future, based on projected reuses of the site. Additionally, we would be more concerned for the possibility of microbes in the surface water to cause illness.

In recent sampling, soil and sediment were each analyzed in approximately 70 samples for lead, and elevated levels were found in both media on the site. The maximum level in most areas was around 2000-3000 mg/kg for soil and around 1000 mg/kg for sediment. In soil, almost half of the values were above the USEPA's screening level of 400 mg/kg and the average for the entire site was 510 mg/kg. The distribution of lead concentrations in soil is shown in Figure A.6. About 15% of the sediment samples were above 400 mg/kg and the average was 188 mg/kg. The site is believed to have been used solely for non-residential purposes since the landfilling activities began. Therefore, the average lead levels are not expected to have been high enough to have caused health effects to workers employed at the landfill or trespassers who intermittently wandered through the landfill in the past.

However, future activities at the site following redevelopment may include recreational and non-residential uses. If young children (less than 6 years old) were to have extensive contact with the elevated levels of lead in on-site soil during recreational or residential (in the case of rezoning) activities, the lead in the soil could pose a health hazard. The elevated concentrations in some locations are notably high for an area that could be used for recreational or residential purposes involving young children.

Harmful health effects from excess lead exposure in young children could include: [17]

- decreased growth
- anemia
- poor performance on neurodevelopmental tests
- lower intelligence (IQ)
- problems with hearing

Older children generally ingest less soil and less lead is absorbed into their body compared to younger preschool children. Future workers would spend the most time on-site, but would ingest less soil and are less susceptible to the effects of lead than children. However, older children and workers may still be susceptible to health effects at the site if they frequent exposure areas that contain elevated lead levels.

Polycyclic Aromatic Hydrocarbons

PAHs are a group of chemicals that are formed during the incomplete burning of coal, oil, gas, wood or garbage. Automobile exhaust and smoke from burning cigarettes also contain PAHs, in addition to grains, cereals and grilled meats. A comparison of cooking methods for steaks and hamburgers showed the highest benzo(a)pyrene (a key PAH) levels when they were cooked very well done when grilled or barbecued as opposed to pan fried and broiled.[26] Most other food groups also contain varying levels of PAHs from common environmental sources, processing or cooking. PAHs can either be synthetic or occur naturally. A few PAHs are used in medicines and to make dyes, plastics, and pesticides. Others are contained in asphalt used in road construction. They are found throughout the environment in the air, water, and soil. There are more than 100 different PAH compounds and the health effects of the individual PAHs are not exactly alike, though some are thought to be additive.

At the 68th Street Dump, PAHs in soil would not be expected to constitute a human health hazard, for the reasons stated below.

The main route of exposure to PAHs in environmental soils is through incidental ingestion. Ingesting water or food and breathing smoke from incomplete combustion that contains PAHs are other routes for these chemicals to enter your body, but absorption is generally slow when PAHs are swallowed. Under normal conditions of environmental exposure, PAHs could enter your body if your skin comes into contact with soil that contains high levels of PAHs. The rate at which PAHs enter your body by eating, drinking, or through the skin can be influenced by the presence of other compounds that you may be exposed to at the same time with PAHs. PAHs are changed by all tissues in the body into many different substances. Some of these substances are more harmful and some are less harmful than the original PAHs. Most PAHs that enter the body are excreted within a few days, primarily in the feces and urine.[25]

The metabolism of PAHs renders them more water-soluble and more excretable. Metabolism of PAHs occurs in all tissues. The metabolic process involves several pathways with varying degrees of enzyme activities. Enzymes in a given tissue determine which metabolic route will prevail. The major PAH metabolite is 1-hydroxypyrene. Excretion patterns of 1-hydroxypyrene in urine were studied in people with psoriasis being treated daily with coal tar pitch covering over 50% of their skin for 3 weeks.[27] After 1 week of treatment, the urinary concentration of 1-hydroxypyrene increased approximately 100 times. The concentration after 3 weeks of treatment was decreased to that observed before treatment, suggesting that the PAHs that were absorbed during the 3 weeks of treatment were quickly eliminated from the body. The authors speculate that the healing of the psoriatic lesions may have rendered the skin less permeable to the PAHs due to the treatment and the skin's healing.

PAHs exhibit low volatility and bind tightly to soils, properties which substantially reduce the bioavailability of PAHs in soil. Thus, any significant exposure to PAHs in soil will, necessarily, entail direct contact with or ingestion of the soil itself. The level established as showing no observed adverse effect is 1 milligram per kilogram body weight per day of the most toxic PAH, benzo(a)pyrene. In order to receive this equivalent dose, a 154 pound person (70 kg) would have to eat 350,000 mg of soil containing 200 mg/kg benzo(a)pyrene every day for 70 years. The highest concentration (TEQ) of PAH found at the site was 210 mg/kg. It is highly unlikely that someone would ingest that amount of soil on a daily basis. That amount of soil ingestion, however, would likely cause digestive complications.

Very few adverse health effects clearly attributable to PAHs have been demonstrated in humans. Workers exposed to very high levels of mixtures that contain PAHs and other compounds by breathing or skin contact for 6 to 20 years have developed cancer. Inhalation of complex PAH mixtures when heated (e.g., cigarette smoke, roofing tar or coal tar pitch volatiles, and coke oven emissions) are suspected of causing cancer in humans, but there are no studies that provide evidence of a direct association between inhalation, oral, or dermal exposure to PAHs and cancer in humans. A review of PAH-related occupational studies found increased occurrence of lung and bladder cancers.[28] However, these studies were not evaluated for confounding risk factors, such as smoking. Additionally, carcinogens other than PAHs are present in cigarette smoke, roofing tar and coke oven emissions and cannot be ruled out as causing the cancer in these worker studies. These studies all involved exposures thousands of times higher than possible at 68^{th} Street Dump.

PAHs effects on the human immune system are not clear due to many confounding high dose co-exposures in workers studied.[29] No adverse hepatic effects have been reported in humans following exposure to PAHs. Adverse renal effects associated with PAHs have not been reported in humans. Workers exposed to substances that contain PAHs (e.g., coal tar) have experienced chronic dermatitis and hyperkeratosis.[30] Smoking cigarettes and receiving excessive exposure to ultraviolet radiation (sunlight)[31] are other factors that may result in increased sensitivity to PAH exposure. Coal tar preparations containing PAHs are used in the therapeutic treatment of some skin disorders.

Diet is a common source of low-level PAH exposure. ATSDR reviewed dietary studies of PAH in food[32,33,34,35,36,26] and found a range of PAH intakes from approximately 0.000023 mg/kg-day[35] to 0.0015 mg/kg-day[32]. In the study that found 0.0015 mg/kg-day[†] by Chuang et al., samples of food from low-income families in Durham, NC were analyzed in the mid-1990's. In comparison, the highest estimate of environmental exposure at 68^{th} Street Dump (0.00068 mg/kg-day) is less than half the upper dietary intake estimated from Chuang's study. PAHs were quantified in most of the main food groups in a U.S. diet study.[26]

[†] Derived from 16.2 µg PAH/kg food and assuming 4.43 kg food consumed/day by a 70 kg person (USEPA, Health Effects Support Document for Naphthalene, Office of Water, EPA 822-R-03-005, Feb 2003).

The maximum benzo(a)pyrene TEQs of the PAH compounds at the 68th Street Dump in subsurface soil (210 mg/kg at Source Area 4) and surface soil (1.3 mg/kg at Source Area 1) were higher than ATSDR's screening comparison values, but lower than levels expected to cause health effects from scientific studies and estimates of exposure. The TEQ was calculated for each sample location at the site, and the distribution of TEQ concentrations are shown in Figure A.7. Further breakdown of the TEQ concentrations across the site is shown in the following table.

Source Area	*Maximum TEQ**	*Minimum TEQ**	*Average of TEQs**	*Standard Deviation**	*95% UCL Average**	*Number of Samples*
1	170	0.017	10	38	25	20
2	37	0.000053	3.0	8.9	12	17
3	0.064	0.051	0.058	no value**	no value**	2
4	210	0.035	32	no value**	no value**	8
5	16	0.029	2.7	no value**	no value**	8

* All units are in mg/kg.
** Standard Deviation and 95% UCL Average were not calculated when < 10 samples were available. Such small data sets are insufficient to perform statistically representative analyses.

Exposure doses were estimated for future adult exposures to all soil, since adult workers and recreators could possibly come into contact with subsurface soils by digging or earth-moving activities. The highest adult noncancer exposure dose calculated was for ingestion of subsurface soil with a TEQ of 210 mg/kg by a future construction worker (0.00068 mg/kg-day). This dose is well below the lowest level shown to cause noncancer effects in the ATSDR Toxicological Profile: pregnant mice dosed for 10 days with 40 mg/kg-day gave birth to pups with reduced weight at 20 days of development.[37] Children are assumed to only be exposed to surface soil. The highest calculated noncancer exposure dose at the site is for future children exposed from 1 to 3 years of age for two days per week, 0.0000049 mg/kg-day, which is also much lower than the lowest noncancer effect level (40 mg/kg-day). Therefore, no noncancer health effects are expected from the presence of PAHs at the site.

Studies have found that some PAHs can cause cancer in animals, but no studies have been done to prove that PAHs can cause cancer in humans.[38] BaP has been associated with a mutagenic mode of action.[39] USEPA currently classifies seven of the PAHs as probable human carcinogens on the basis of the weight of toxicological evidence. To estimate a theoretical increased cancer risk from ingestion of PAHs, the USEPA developed a cancer slope factor of 7.3 $(\text{mg/kg-day})^{-1}$. The highest cancer dose for adults is 0.000073 mg/kg-day for an on-site worker and for children is 0.00000034 mg/kg-day for a 3 to 12 year old child. These exposures are much lower than the lowest dose shown to cause cancer in the ATSDR Toxicological Profile: mice dosed with 2.6 mg/kg-day for 30 to 197 days developed gastric tumors. The estimated maximum theoretical excess cancer risk for lifetime exposure of incidental ingestion of PAHs is about 5 in 10,000 for an adult on-site worker and about 3 in 1,000,000 for a child aged 3 to 12 years. The highest theoretical cancer risk of 5 in 10,000 means that there is a 0.05% theoretical risk of getting cancer from this PAH exposure. In contrast, the normal probability that residents of the United

States will develop cancer at some point in their lifetime is 45% for men and 38% for women.[40] Estimates from other less exposed individuals are shown in the following table.

Population	***Soil Concentration***	***Risk***
1-3 Year Old Child	Surface Soil PAH TEQ = 1.3 mg/kg	1.1E-6
3-12 Year Old Child	Surface Soil PAH TEQ = 1.3 mg/kg	2.5E-6
On-site Worker	Surface & Subsurface Soil PAH TEQ = 210 mg/kg	5.4E-4
Construction Worker	Surface & Subsurface Soil PAH TEQ = 210 mg/kg	7.1E-5
Teen Recreator	Surface & Subsurface Soil PAH TEQ = 210 mg/kg	2.7E-4
Adult Recreator	Surface & Subsurface Soil PAH TEQ = 210 mg/kg	7.5E-5

The theoretical cancer risk calculation is based on the assumption there is no safe level of exposure to a chemical that causes cancer. The theoretical calculated risk is not exact and tends to overestimate the actual risk associated with exposures that may have occurred. This theoretical increased cancer risk estimate does not equal the increased number of cancer cases that will actually occur. However, theoretical excess cancer risks greater than 1 in 100,000 for exposed persons are regarded as excessive. Therefore, workers and recreators should minimize contact with subsurface soils on the site, and the on-site worker is deemed the most highly exposed individual. These scenarios are not currently occurring, but might if the property is put to other uses.

Public Health Implications

ATSDR categorizes exposure pathways (and sites) according to their level of public health hazard to indicate whether people could be harmed by exposure pathways and site conditions. The categories are shown in Appendix E.

The proposed soil sampling measurements in the SWPMP are expected to further characterize the potential for exposures to elevated contaminant levels in soil at the site. Identification of isolated areas of unusually elevated contamination would allow focused removal events to decrease the average levels of contaminant exposure. Current exposures to **contaminant levels in soil and sediment** at the site are expected to result in **no apparent public health hazard**, but could cause a **public health hazard** at the site **should the site use change to allow exposures to more highly contaminated subsurface soils.**

Two residential neighborhoods are within close proximity to the site: Maryland Manor and Rosedale Terrace. Concerns for exposure at these neighborhoods could include dust from earth moving activities and indoor air vapor intrusion from migration of VOC containing shallow groundwater {15'-25' onsite (SWPMP p12)} under residences from the site. ATSDR recommends using dust suppression methods during earth moving activities such as water spraying of exposed soil, covering of dump truck beds that contain site related materials and using truck washing stations at the entrance and exit of the site. The dust exposure pathway is not expected to cause human health effects, provided such precautionary procedures are followed.

The Maryland Department of the Environment (MDE) is the agency responsible for collecting and reviewing sediment, surface water, and fish/shellfish tissue data for water bodies throughout the state. ATSDR recognizes the importance of catching fish from local waters for consumption in local diets.[41] Evidence of a tradition of fishing at the 68th Street Dump site and current accessibility to the site waters indicate fishing may occur on site. Fish tissue samples have not been performed recently for fish from onsite waters. Hence, **eating fish caught from site waters** constitutes an **indeterminate health hazard**. MDE has designated a license free fishing area approximately 2.5 miles downstream of the site on Back River at Cox Point Park off of Riverside Drive south. Local fishermen are encouraged to utilize this and other MDE recommended areas for fishing. The MDE has issued fish consumption advisories for some types of fish in the Back River due to harmful levels of PCBs, pesticides and/or methylmercury. However, many types of fish common in the Back River have no consumption limitations. See Appendix G for resources on local fishing and recreational water use. Children and women of childbearing age may be more susceptible to some contaminants in select fish. However, fish are known to have significant health benefits when consumed as part of a healthy diet. Please refer to the guidelines for Recommended Maximum Meals Each Year for Maryland Waters at http://www.mde.state.md.us/CitizensInfoCenter/Health/fish_advisories/ or call the Maryland Department of the Environment at 410-537-3906 for the most recent recommendations.

No groundwater sampling has been performed in Source Areas 2 and 5 of the site.[3] Direct exposure to contaminants in site water from wells is not a concern, because the groundwater is not being used as a source of drinking water and groundwater wells are not permitted in the water service envelope of the site.[3] Migration of VOC vapors from groundwater into buildings could be a concern, if the plume has not attenuated significantly over the past decade. Elevated BTEX levels were detected in the area of the USTs between Source Areas 2 and 4 in 1995. Johnson and Ettinger modeling indicates that, if the level of benzene from groundwater (782 μg/L) in 1995 were still present, the concentration could be sufficient to migrate into surface structures at levels requiring additional investigation (Appendix E). However, the USTs serving as the source of contamination were removed in 1996, and the BTEX contamination has likely attenuated due to biodegradation, hydraulic flushing and dispersion.

The groundwater sampling, groundwater flow measurements and soil gas sampling proposed in the SWPMP are expected to contribute to the knowledge of the groundwater contamination and potential for vapor intrusion of volatiles. Characterization of the potential for groundwater migration is important because the Rosedale Terrace neighborhood exists about 500 feet to the east of Source Area 4. Groundwater will be further characterized by sampling in locations anticipated to have the potential to recharge to surface water. **Vapor intrusion** from groundwater into nearby residences and future on-site buildings poses an **indeterminate public health hazard** due to inadequate characterization of potential groundwater, soil gas and indoor air contamination.

Surface water contamination has been found previously at the site. However, contaminant levels were low. Exposure dose calculations indicate **no apparent health effects** are expected from incidental ingestion of **surface water**. Additionally, chemical degradation and hydraulic flushing has likely attenuated landfill-related contamination since the last data were collected.

Child Health Considerations

ATSDR recognizes that the unique vulnerabilities of infants and children demand special emphasis in communities faced with contamination of water, soil, air, or food. Children are at a greater risk than adults from certain kinds of exposures to hazardous substances emitted from waste sites and emergency events. They are more likely to be exposed because they play outdoors and they have more hand-to-mouth behaviors. They are more likely to come in contact with dust, soil, and heavy vapors close to the ground. Also, they receive higher doses of chemical exposure due to lower body weights. The developing body systems of children can sustain permanent damage if toxic exposures occur during critical growth stages.

The possibility of health effects in children due to exposures to site contaminants was carefully considered in this public health assessment. Currently, young children are not expected to have access to contaminated areas. Future use of the site is being considered for recreational use that could include children. Remediation of contamination to levels not expected to pose a risk to children, with particular consideration for *hot spots*, is recommended before the site is designated for recreational use by children.

Community Health Concerns

ATSDR held a public availability session on June 10, 1999, to meet with area residents and gather any health concerns the community might have concerning the site. The following public health concerns were posed:

1. Some citizens were concerned about the high number of cancers in the area. They said that the county rates were the highest in the country.

Not all states yet have cancer incidence data, therefore it is not possible to compare Baltimore County with all other counties. However, according to the Maryland Cancer Registry, the 2000 cancer incidence (new cases) rate for Baltimore County was significantly higher than the national rate [as estimated by SEER (Surveillance, Epidemiology, and End Results) data].[42]

From the information available for the 68th Street Dump site, ATSDR has not identified any contaminant exposures that would cause an increase in cancer risk.

The state of Maryland has reviewed cancer mortality and incidence rates in a smaller subset of the county, the Rosedale area, a few years ago. It was concluded that no increase in cancer incidence in the Rosedale area was observed.[43]

2. Some citizens were concerned about the high rate of asthma in the area.

ATSDR is not aware of any report regarding asthma in the area nor are we aware of any existing database that would allow us to calculate the rate of asthma in the Rosedale area. In the country as a whole, the number of people with asthma (*prevalence* of asthma) has increased since the 1980s.[44] Maryland appears to have similar prevalence rates of asthma estimated to be about 8% in 2003 as compared to the other states.[45] The rates for Baltimore City and Baltimore County did not differ significantly from the rates in Maryland on a whole. However, the asthma rates for non-white or Hispanic adults is 36% higher in Baltimore (9.9%) compared to the nation's rate (7.3%).[46]

The causes of asthma are not completely understood, but an asthma attack can be induced by many environmental factors. These include air pollution, chemical odors, hair sprays, cigarette smoke, and even changes in the weather. ATSDR is aware that the former city incinerator and on-site burning emitted pollutants that may have exacerbated asthma symptoms, but the extent of exposure cannot be evaluated because of a lack of pertinent data.

3. Concerns were raised about the soil incinerator operation on Todd Avenue. A resident reported receiving a letter 3 years ago from the company saying that they should not grow vegetables.

ATSDR learned from MDE that TSP Technologies operates a soil remediation plant equipped with a baghouse and an afterburner to treat soil contaminated with petroleum products. MDE has received a complaint about smoke and odor. The facility is inspected periodically. Groundwater and stack air samples have met agency requirements. Noise monitoring found no violations. The facility has told MDE that it has not sent letters to residents. For information on the soil incinerator, contact Mr. Kim Lemaster of MDE (phone: 410-537-3394).

However, when citizens wish to grow vegetables in their gardens in the vicinity of any industrialized areas, ATSDR recommends replacing the soil with healthy compost. Healthy plants growing in well-balanced soils will preferentially uptake useful minerals.

4. Concerns were raised about eating shellfish and fish from the Back River and also the exposure from wading in contaminated areas.

Recommendations on fishing and recreational water uses are best obtained from local agencies that regularly monitor and manage these natural resources. Information on websites and phone numbers are provided in Appendix G from the Maryland Department of Natural Resources, the Maryland Department of the Environment, and the Baltimore County Environmental Protection and Resource Management Agency. The information includes nearby License Free Fishing Areas, Recommended Maximum Meals Each Year for Maryland Waters for fish consumption, Maryland Shellfish Harvesting Areas and Recreational Water Contact Alerts, Water Quality Advisories and Public Beach Area Closings.

5. Some community members were concerned about past exposures to surface waters that ran near their home. Childhood exposures to the water were common.

From the 1993 sampling data of the on-site surface waters, no adverse health effects would be expected for children playing in these waters. The level of contamination before 1993 is not known and therefore, we cannot evaluate these exposures.

6. A few people expressed their concern about additional contamination being added to the Herring Run, which flows through the site.

ATSDR also would be concerned if substantive contamination is added to Herring Run. The 68th Street Dump coalition's planned site investigation should determine whether any mitigative measures are needed, such as the use of double silt fences during earth-moving activities in riparian areas.

7. Concerns were raise that the NPL (National Priorities List, or Superfund) process and investigation is too slow. Citizens were concerned that environmental cleanup and health-related problems associated with the site would not be addressed for many years.

Concerns about the environmental cleanup should be addressed to the Environmental Protection Agency. The community contact for this site is Carrie Deitzel; her telephone number is 1-800-553-2509 or 215-814-5525.

The contaminant exposure concerns related to the site are addressed in this document. If ATSDR had found any urgent public health hazards, then these would have been addressed immediately by issuing a public health advisory with recommendations to stop those exposures. However, no urgent public health hazards were found.

8. Residents expressed concern about current recycling on the site. They felt that crushing glass and other operations were a safety hazard.

Recycling worker safety concerns should be addressed to the Maryland Occupational Safety and Health Administration (410-767-7233). ATSDR did not witness glass crushing operations during the site visit. An area of the ground with small glass pieces was observed during the site visit. However, there is a wooded buffer zone between the area and residents that is expected to provide at least some protection to neighboring residents from silica dust from the operations and glass refuse.

8. Concerned citizens expressed a desire to see more barriers and signs around the site and more enforcement to keep people off of the site. Additionally, Korean fishermen have been seen on the site from time to time.

ATSDR has included recommendations below to restrict public access to the site. Additionally, as a result of this comment, ATSDR has recommended signage with international symbology at access points to site surface waters.

Conclusions

Investigations conducted to date provide considerable information about the character and extent of contamination upon which the following conclusions are based. Remediation is planned in the near future for the site under the Superfund Alternative Site process. Remediation will likely improve the conditions of the site and reduce the potential for public health effects expressed herein.

ATSDR supports the additional sampling and site characterization outlined in the SWPMP[3] report. The following conclusions are based on the current information available regarding site contamination. Revised conclusions and recommendations may be warranted if new information is gained that reveals contaminant levels are significantly different from those found in previous studies.

Conclusion 1. ATSDR concludes that **trespassing and operating ATVs at the site may cause harm to people's health. This physical hazard is a public health hazard.** Sharp debris has been observed at various locations of the site and erosion may cause new debris to become exposed from the subsurface over time. Sharp drop-offs are present and settling of landfill areas may cause localized elevation changes that are slip-trip-fall hazards.

Basis for Conclusion 1. Evidence of significant trespassing has been observed at the site. Numerous well-worn ATV paths were observed at Source Area 1. Evidence of a significant amount of trespassing and extensive illegal dumping was present in Source Areas 2 and 5. A structure that appeared to be a temporary shelter was observed in Source Area 5, but no occupant(s) of the shelter were observed at the site. ATSDR recommends that ATV and trespassing activities be halted until the surface soils of the area are demonstrated to be safe from sharp debris and the surface soil "cap" for the landfill is determined to be adequate for such uses.

Conclusion 2. ATSDR concludes that **contact with soil, surface water and sediment is not expected to harm people's health under current and projected future use following remediation.**

Basis for Conclusion 2. Current uses of the site only involve short periods of contact with soil, surface water and sediment and are not expected to cause illness. The EPA-supervised remediation and careful selection of future use at this site is an important part of protecting the health of children at the site in the future. Lead levels were found in soil up to 2990 mg/kg and the site average was 510 mg/kg. These levels are above EPA's action level of 400 mg/kg. Some land use situations could result in unnecessary lead and PAH exposures. If remediation and future use are not carefully considered, health effects from children swallowing too much lead-containing material could include developmental effects, lower intelligence (IQ), anemia and problems with hearing. PAHs were also found at levels that may pose an increased theoretical cancer risk up to 0.054%. However, the theoretical risk of getting cancer from PAH exposure at the site exceeds EPA's highest level allowed for any site: 0.01%.

Conclusion 3. ATSDR **cannot currently conclude whether eating fish caught from on-site streams could harm people's health.**

Basis for Conclusion 3. Sampling of mercury in fish from site waters was performed in 1994. More recent fish sampling for this and other contaminants found in site waters and sediments would be necessary to evaluate the potential for health effects to people eating fish caught from on-site streams.

Conclusion 4. ATSDR **cannot currently conclude whether breathing volatile chemicals by vapor intrusion into onsite buildings and in bordering Rosedale Terrace residences in**

the future could harm people's health. The vapor intrusion pathway has not been sufficiently sampled to assess this hazard.

Basis for Conclusion 4. The groundwater sampling, groundwater flow measurements and soil gas sampling proposed in the SWPMP[3] are expected to contribute to the knowledge of the groundwater contamination and potential for vapor intrusion into buildings. Characterization of the potential for groundwater migration is important because the Rosedale Terrace neighborhood exists about 500 feet to the east of Source Area 4. Groundwater will be further characterized by sampling in locations anticipated to have the potential to recharge to surface water.

Conclusion 5. ATSDR **cannot conclude whether drinking private well water off-site in the past could have harmed people's health.** Past sampling indicated that elevated lead levels were present in one or more private wells. However, information about the amount of water people drank and the ages of those people make it impossible to determine whether or not health effects were likely.

Basis for Conclusion 5. Lead was reported in an off-site well at 105 ppb, but it is unknown if this was the average daily concentration or a maximum value. The EPA action level for lead in drinking water is 15 ppb. Exposure by these wells is no longer occurring, because all of the residences were connected to municipal water by 1995. It is not possible to determine if any health effects may have occurred in the past from drinking the well water, because the average concentration of lead in the drinking water is not known and it is unknown whether or not the most susceptible age-group (children) were drinking the well water. Additionally a number of other factors, including other contact with lead, the age of the child, the nutritional status of the child, and the form and type of lead affect the potential for health effects. None of this information is available.

Conclusion 6. ATSDR **cannot conclude whether breathing air contaminated during on-site fires in the past could have harmed people's health** because of the lack of sufficient sampling data and knowledge of air movement in relation to people during the fires.

Basis for Conclusion 6. No air sampling data were available for review in the vicinity of the site. Additionally, characterization of the burning materials and wind speed and direction during the burnings were not available to estimate the likelihood of people breathing the emissions from the site. Other factors, such as the presence of trees and buildings, also can affect the movement of air contaminants.

Recommendations

1. Restriction of access by transient residents and recreational trespassers is advised until the illegal dumping on the site is properly mitigated and the remediation and reuse activities are completed. Baltimore residents are advised to report illegal dumping by calling 410-396-4707 or 311. Further information can be obtained from the following website: http://www.ci.baltimore.md.us/government/dpw/waste.html

2. Restriction of access by ATV users to the site is advised until the integrity of the landfill covering can be investigated for physical hazards, such as sharp debris, and chemicals becoming exposed from the subsurface.

3. Remediation and reuse planning should serve to minimize exposure to soil with elevated contamination. This may be achieved by removing, revegetating or paving surficial soil hot spots expected to be used frequently by recreators or workers. Current and future site workers should wear gloves and other appropriate personal protective equipment to reduce frequent contact with contaminants found in soil.

4. Groundwater sampling, groundwater flow measurements and soil gas sampling should be undertaken as proposed in the SWPMP[3] to evaluate the potential for vapor intrusion into buildings, recharge to surface water and any other exposures to groundwater that may be expected to occur in future use. Sampling for BTEX groundwater contamination should be performed in the area of where previous refueling operations and UST removal have occurred.

5. Dust suppression and silt control measures should be used during land disturbances. Consider installation of vapor barriers or other vapor intrusion mitigation technologies with buildings if volatile contaminants are found in soil gas or shallow groundwater.

6. Fishing is not advised in on-site waters, due to the lack of recent fish tissue analysis and previous detections of contaminants in surface waters and sediment onsite. Asian fishermen have been seen on the site from time to time by concerned citizens. Signs using international symbology are advised at access points to the waterways onsite stating that fishing in site waters is not advised.

   Fishing is encouraged in designated fishing areas on Back River in accordance with the local and regional fishing guidelines. A License Free Fishing Area is located about 2.5 miles downstream of the site on Back River at Cox Point Park off of Riverside Drive south. Additional information and resources for fishing and recreational surface water use are presented in Appendix G.

Public Health Action Plan

A Public Health Action Plan (PHAP) documents actions designed to mitigate or prevent adverse human health effects that might result from exposure to hazardous substances in the environment. At this time, ATSDR's evaluations of the site have lead to recommendations for further sampling and investigation. ATSDR is available to work with USEPA and MDE to develop sampling plans that will address public health concerns. No other exposures that warrant public health action have been identified.

ATSDR will consider revision of this document if environmental data become available in the future and analysis of the data establishes a health-related basis for action.

Future data will be evaluated by ATSDR and incorporated into revised conclusions and recommendations for the site upon availability, if review is requested and if analysis of the data is considered likely to impact the conclusions and recommendations presented herein.

For More Information

If you have concerns about your health, as it relates to lead or PAH, you should contact your health care provider. You can also call ATSDR at 1-800-CDC-INFO and ask for information on the 68th Street Dump site.

Authors, Technical Advisors

Authors

Tonia Burk, PhD
Environmental Health Scientist
Division of Health Assessment and Consultation

Reviewers

Gregory Zarus
Team Lead
Site and Radiological Assessment Branch
Division of Health Assessment and Consultation

Ana Pomales, MS
Regional Representative, Region III
Office of Regional Operations

Sandra Isaacs
Chief, Site and Radiological Assessment Branch
Division of Health Assessment and Consultation

Technical Assistance

Audra Henry, MS
Data Analyst
Division of Health Assessment and Consultation

References

[1] CBLS County-level Summary data for MD, 2005, http://www.cdc.gov/nceh/lead/grants/Maryland/MD_CountyLevelSummary_2005.xls

[2] Administrative Settlement Agreement and Order on Consent for Remedial Investigation/Feasibility Study, In the matter of 68th Street Dump Superfund Site, US EPA Region III, CERCLA Docket No. CERC-03-2006-0051 RF

[3] Site-Wide Program Management Plan, 68th Street Landfill Site, Rosedale, Maryland prepared for 68th Street Sites Coalition by Environmental Resources Management, Inc., Feb 23, 2007 approved by USEPA Region 3, Chris Corbett Mar 6, 2007.

[4] Hazard Ranking System Documentation Record. U.S. Environmental Protection Agency. Feb 3, 2003. http://epa.gov/reg3hwmd/super/sites/MDD980918387/index.htm

[5] Site Inspection of 68th Street Dump prepared by NUS Corporation, Superfund Division for the Hazardous Site Control Division, US Environmental Protection Agency, May 9, 1986.

[6] Expanded Site Inspection and SAS Report of Findings for the 68th Street Dump Site (MD-174) Vol. V prepared by Maryland Department of the Environment for US Environmental Protection Agency, September 1994.

[7] U.S. Environmental Protection Agency. OSWER Directive No. 9208.0-18. Revised Response Selection and Settlement Approach for Superfund Alternative Sites, June 17, 2004.

[8] Hazard Ranking System Documentation Record. U.S. Environmental Protection Agency. Feb 3, 2003, http://www.epa.gov/superfund/sites/docrec/pdo1680a.pdf

[9] Assessment and Prioritization of Streams in Back River, Jones Falls, Breton Bay, Bird River, Lower Pocomoke River, and South River Watersheds in Need of Restoration and Protection, Scott Stranko, Jay Kilian and Martin Hurd, Maryland Department of Natural Resources, Monitoring and Non-Tidal Assessment Division, Sept 2003 http://www.dnr.state.md.us/streams/pubs/ea-03-10_a-p2003.pdf

[10] U.S. Environmental Protection Agency, Mercury Update: Impact on Fish Advisories, Office of Water, EPA-823-F-01-011, June 2001.

[11] Mercury in Fish: Cause for Concern? US Food and Drug Administration, FDA Consumer magazine, Sept 1994. with revisions in May 1995. URL Accessed Oct 2, 2007: http://www.fda.gov/fdac/reprints/mercury.html

[12] Agency for Toxic Substances and Disease Registry, Toxicological profile for mercury, Atlanta: US Department of Health and Human Services; Mar 1999.

[13] Jones AB and Slotten DG. Mercury Effects, Sources, and Control Measures. A Special Study of the San Francisco Estuary Regional Monitoring Program. San Francisco Estuary Institute, Richmond, CA, 1996. http://www.sfei.org/rmp/reports/mercury/mercury.pdf

[14] Agency for Toxic Substances and Disease Registry (ATSDR). Public Health Assessment: Fish and Shellfish Evaluation, Isla de Vieques Bombing Range, Vieques, Puerto Rico, Atlanta: US Department of Health and Human Services; June 27, 2003. http://www.atsdr.cdc.gov/HAC/pha/viequesfish/viequespr-toc.html

[15] U.S. Environmental Protection Agency, Guidance for Assessing Chemical Contaminant Data for use in Fish Advisories, Volume 1: Fish Sampling and Analysis, Third Edition, Office of Water, EPA 823-B-00-007, Nov. 2000.

[16] U.S. Environmental Protection Agency Region III Risk Based Concentration Table, Updated Apr, 6 2007, http://www.epa.gov/reg3hwmd/risk/human/rbc/RBCapr07.pdf

[17] Bahnick D, Sauer C, A National Study of Mercury Contamination of Fish. IV: Analytical Methods and Results, Chemosphere, 29(3): 537-546, 1994.

[18] Site Investigation Report, 68th Street Site, Baltimore Maryland. prepared by GeoTrans, Inc., Project No 7670-001. Oct 17, 1995.

[19] Notice of Compliance Letter Re: Case No. 97-0189 BA4, Browning-Ferris, Inc., 68th Street, Baltimore from Maryland Dept. of the Environment, Thomas L. Walter, Region II Section Head, Oil Control Program to Mr..Kenneth Collison, Browning-Ferris, Inc. Oct 25, 1996.

[20] OSWER Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance), US EPA, Nov 2002. http://www.epa.gov/correctiveaction/eis/vapor.htm

[21] Vapor Intrusion Pathway: A Practical Guideline, Interstate Technology & Regulatory Council, Jan 2007. http://www.itrcweb.org/Documents/VI-1.pdf

[22] Dietary Reference Intakes (DRIs): Tolerable Upper Intake Levels, Elements,Food and Nutrition Board, Institute of Medicine, National Academy of Sciences, 2004 http://www.iom.edu/Object.File/Master/21/372/DRI%20Tables%20after%20electrolytes%20plus%20micro-macroEAR_2.pdf

[23] Agency for Toxic Substances and Disease Registry. Toxicological profile for benzene. Atlanta: US Department of Health and Human Services; Sept 1997.

[24] Agency for Toxic Substances and Disease Registry. Toxicological profile for ethylbenzene. Atlanta: US Department of Health and Human Services; July 1999.

[25] Agency for Toxic Substances and Disease Registry. Toxicological profile for styrene. Atlanta: US Department of Health and Human Services; Sept 1992.

[26] Kazerouni N, Sinha R, Hsu C, Greenberg A, Rothman N, Analysis of 200 Food Items for Benzo(a)pyrene and Estimation of Its Intake in an Epidemiologic Study, Food and Chemical Toxicology, 39:423-436, 2001.

[27] Hansen AM, Poulsen OM, Menne T, Longitudinal Study of Excretion of Metabolites of Polycyclic Aromatic Hydrocarbons in Urine from Two Psoriatic Patients, Acta Derm Venereol (Stockh) 73: 188-190 1993.

[28] Bosetti C, Boffetta P, La Vecchia C, Occupational Exposures to Polycyclic Aromatic Hydrocarbons, and Respiratory and Urinary Tract Cancers: A Quantitative Review to 2005, Annals of Oncology, 18: 431-446, 2007.

[29] Szczeklik A, Szczeklik J, Galuszka Z, Musial J, Kolarzyk E, Targosz D, Humoral Immunosuppression in Men Exposed to Polycyclic Aromatic Hydrocarbons and Related Carcinogens in Polluted Environments, Environmental Health Perspectives, 102(3): 302-304 1994.

[30] EPA. Drinking Water Criteria Document for Polycyclic Aromatic Hydrocarbons (PAHs). Cincinnati, OH, Environmental Criteria and Assessment Office, 1988.

[31] Wang S, Sheng Y, Feng M, Leszczynski J, Wang L, Tachikawa H, Yu H, Light-Induced Cytotoxicity of 16 Polycyclic Aromatic Hydrocarbons on the US EPA Priority Pollutant List in Human Skin HaCaT Keratinocytes: Relationship Between Phototoxicity and Excited State Properties, Environmental Toxicology, 22(3):318-327, 2007.

[32] Chuang JC, Callahan PJ, Lyu CW, Wilson NK, Polycyclic Aromatic Hydrocarbon Exposures of Children in Low-Income Families, Journal of Exposure Analysis and Environmental Epidemiology, 2:85-98, 1999.

[33] Larsson BK, Formation of Polycyclic Aromatic Hydrocarbons During the Smoking and Grilling of Food, Genetic Toxicology of the Diet, pp. 169-180, 1986.

[34] Li Z, Sandau CD, Romanoff LC, Caudill SP, Sjodin A, Needham LL, Patterson DG Jr, Concentration and Profile of 22 Urinary Polycyclic Aromatic Hydrocarbon Metabolites in the US Population, Environmental Research, 107: 320-331, 2008.

[35] Santodonato J, Howard P, Basu D, Health and Ecological Assessment of Polynuclear Aromatic Hydrocarbons, Journal of Environmental Pathology and Toxicology, Sept 5(1):1-364, 1981.

[36] Dennis MJ, Massey RC, McWeeny DJ, Knowles ME, Analysis of Polycyclic Aromatic Hydrocarbons in UK Total Diets, Food and Chemical Toxicology, 21(5):569-574, 1983.

[37] Agency for Toxic Substances and Disease Registry. Toxicological profile for polycyclic aromatic hydrocarbons. Atlanta: US Department of Health and Human Services; Aug 1995.

[38] Selected Non-heterocyclic Policyclic Aromatic Hydrocarbons, Environmental Health Criteria, International Programme on Chemical Safety, World Health Organization, Geneva, 1998. ISBN 92 4 157202 7.

[39] U. S. Environmental Protection Agency. Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens, Risk Assessment Forum, EPA, March 2005. Accessed Nov 23, 2009: http://epa.gov/raf/publications/pdfs/childrens_supplement_final.pdf

[40] American Cancer Society, *Lifetime Probability of Developing or Dying from Cancer*, Mar 31, 2008, Website accessed April 24, 2009: http://www.cancer.org/docroot/CRI/content/CRI_2_6x_Lifetime_Probability_of_Developing_or_Dying_From_Cancer.asp?sitearea=&level=

[41] Grosse C, Zarus G, Combining Various Resources to Characterize the Food Chain, Abstract ID 8370, Joint Services Environmental Management Training Conference & Exposition, Denver, CO, May 5-8, 2008. http://proceedings.ndia.org/jsem2008/abstracts/8370.pdf

[42] Maryland Cancer Registry. Annual Cancer Report 2003. Maryland Department of Health and Mental Hygiene; Sept 2003.

[43] Agency for Toxic Substances and Disease Registry. Rosedale/ Southeast Baltimore Petitioned Health Consultation. Atlanta: US Department of Health and Human Services; Sept 25, 1998.

[44] CDC. Surveillance for Asthma --- United States, 1980--1999. MMWR 2002; 51(SS01):1-13.

[45] CDC. Surveillance for Certain Health Behaviors Among States and Selected Local Areas --- Behavioral Risk Factor Surveillance System, United States, 2003. MMWR 2005; 54(SS08):1-116.

[46] CDC. Asthma Data and Surveillance --- Behavioral Risk Factor Surveillance System, United States, 2004. http://www.cdc.gov/asthma/brfss/default.htm

Appendix A. Maps and Charts

Figure A.1 - 68th Street Dump Site Location Map with Demographic Information

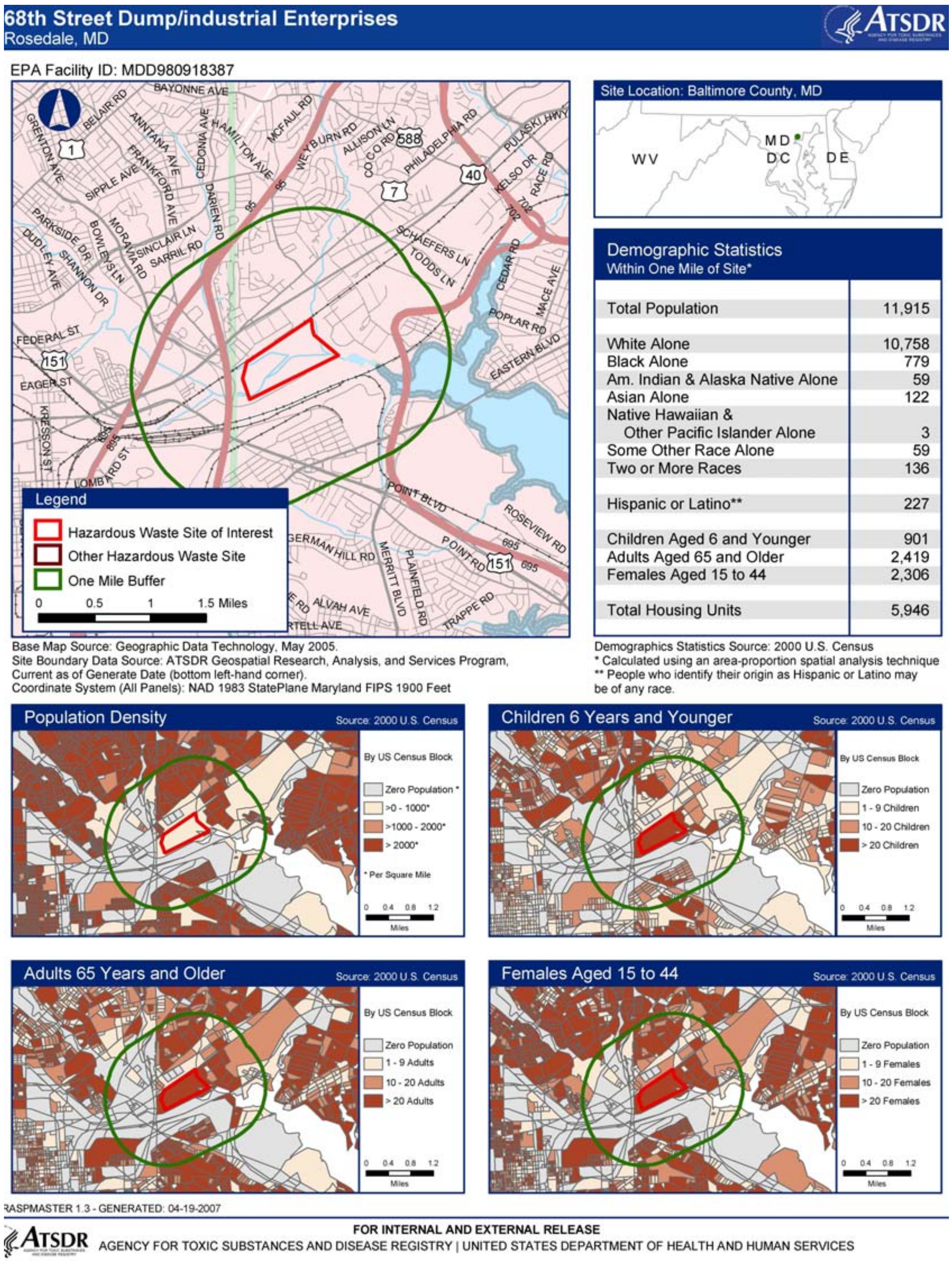


Figure A.2. Source Area Map (http://response.restoration.noaa.gov/book_shelf/276_68thDump.pdf)

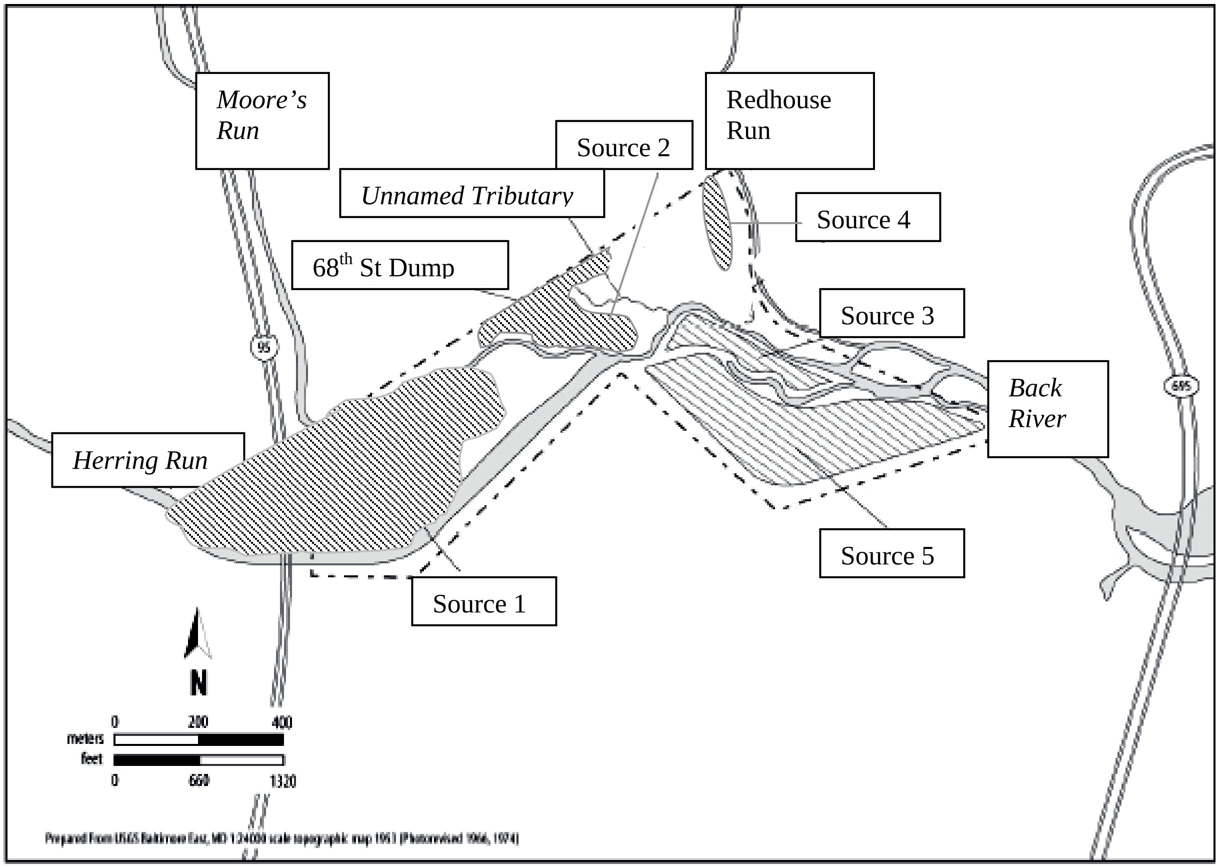


Figure A.3. Arsenic Concentration Distribution in Soil

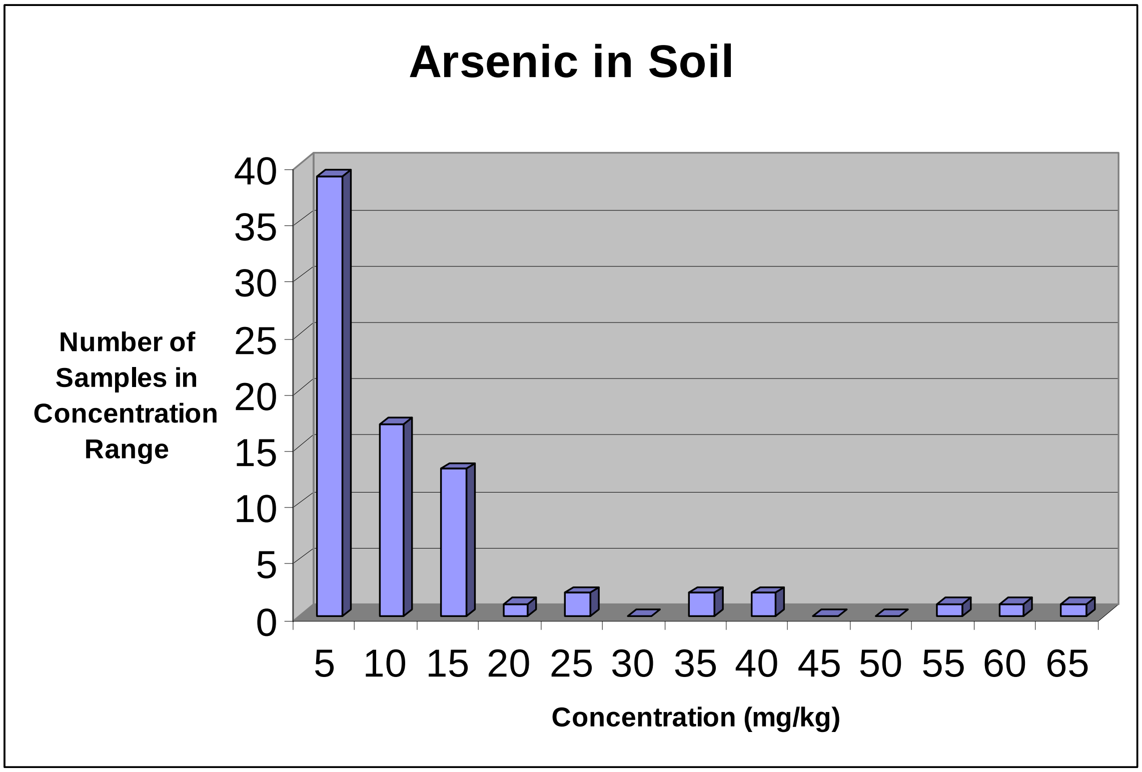


Figure A.4. Chromium Concentration Distribution in Soil

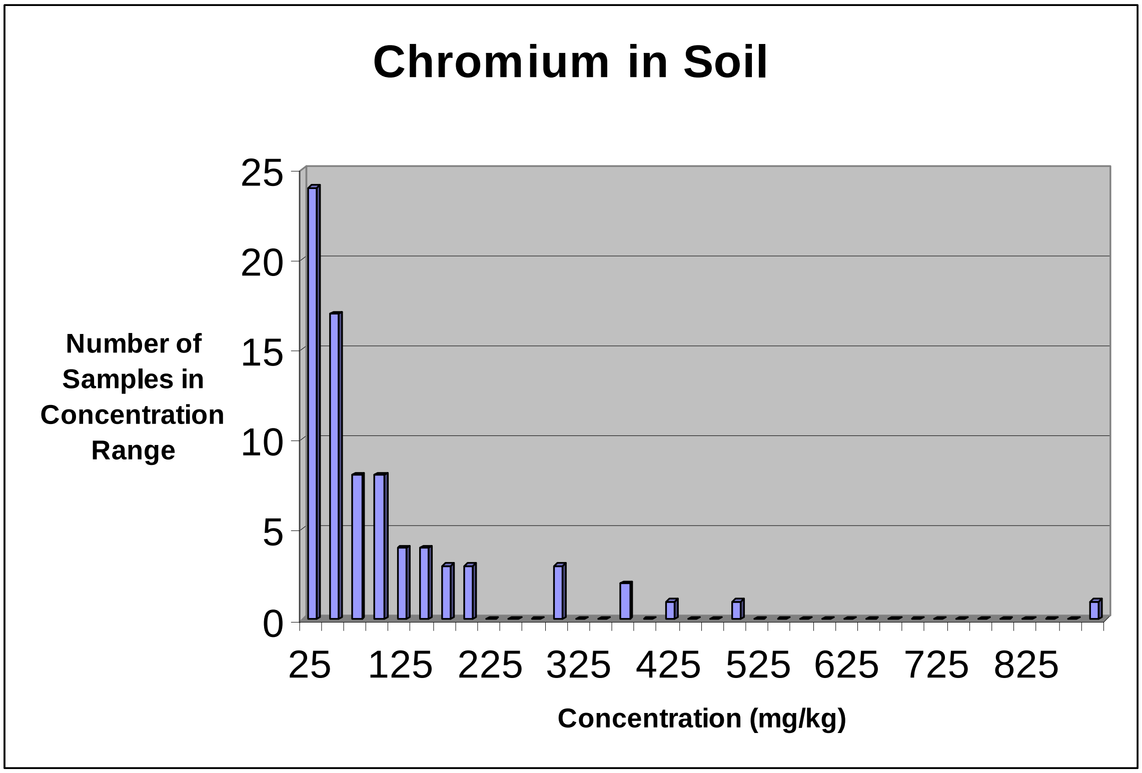


Figure A.5. Copper Concentration Distribution in Soil

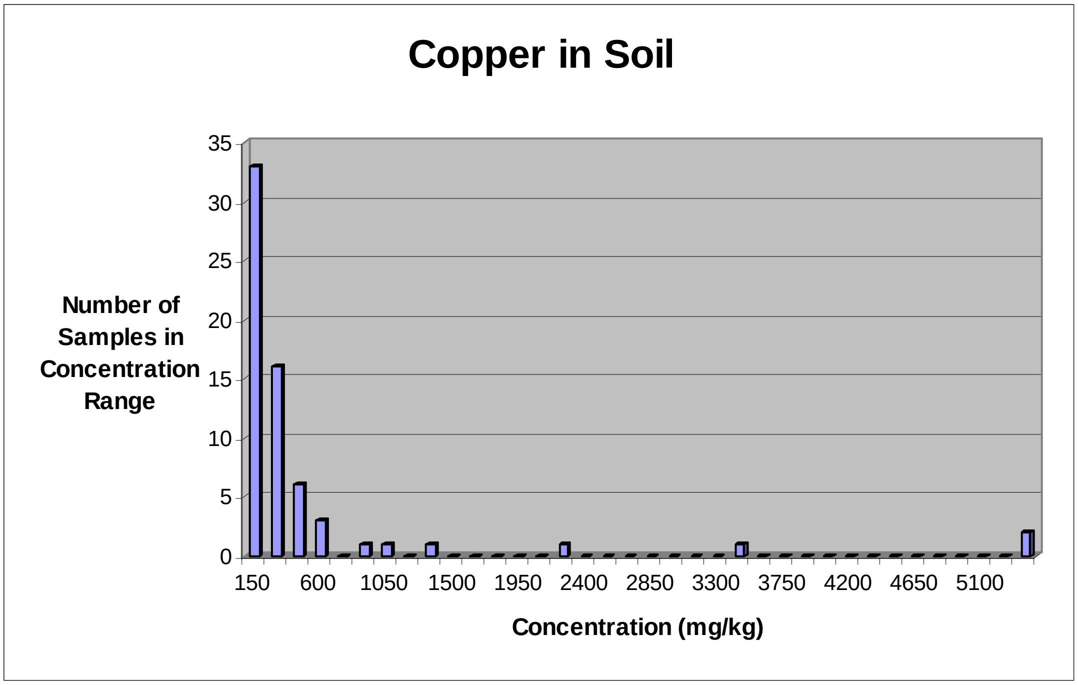


Figure A.6. Lead Concentration Distribution in Soil

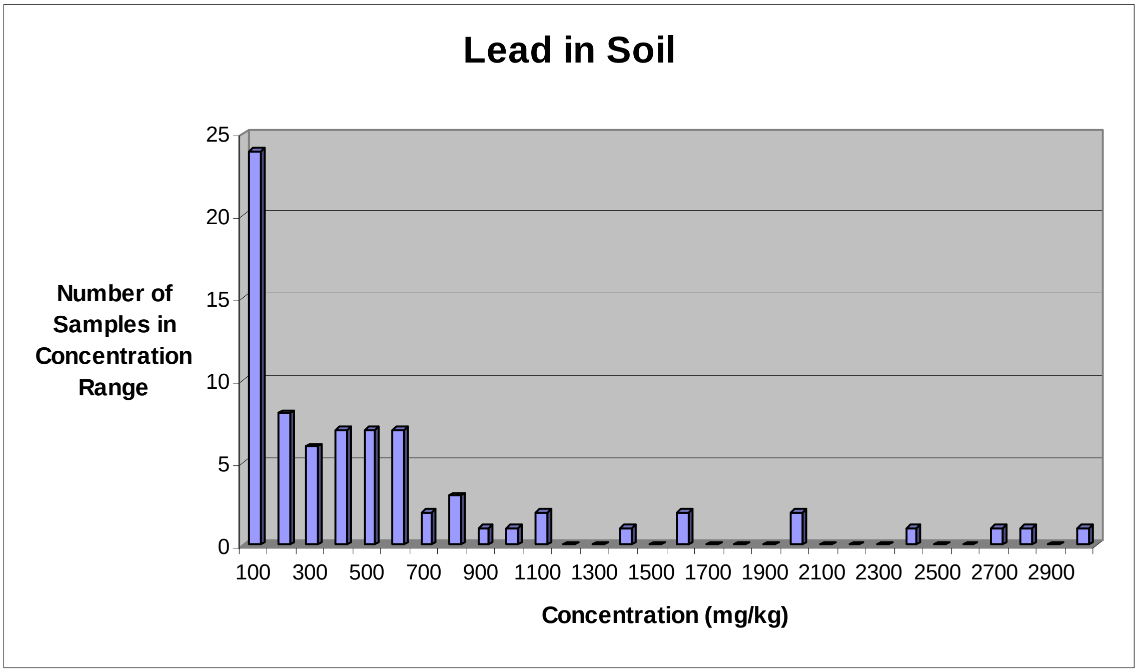


Figure A.7. Polycyclic Aromatic Hydrocarbon (PAH) Concentration Distribution in Soil

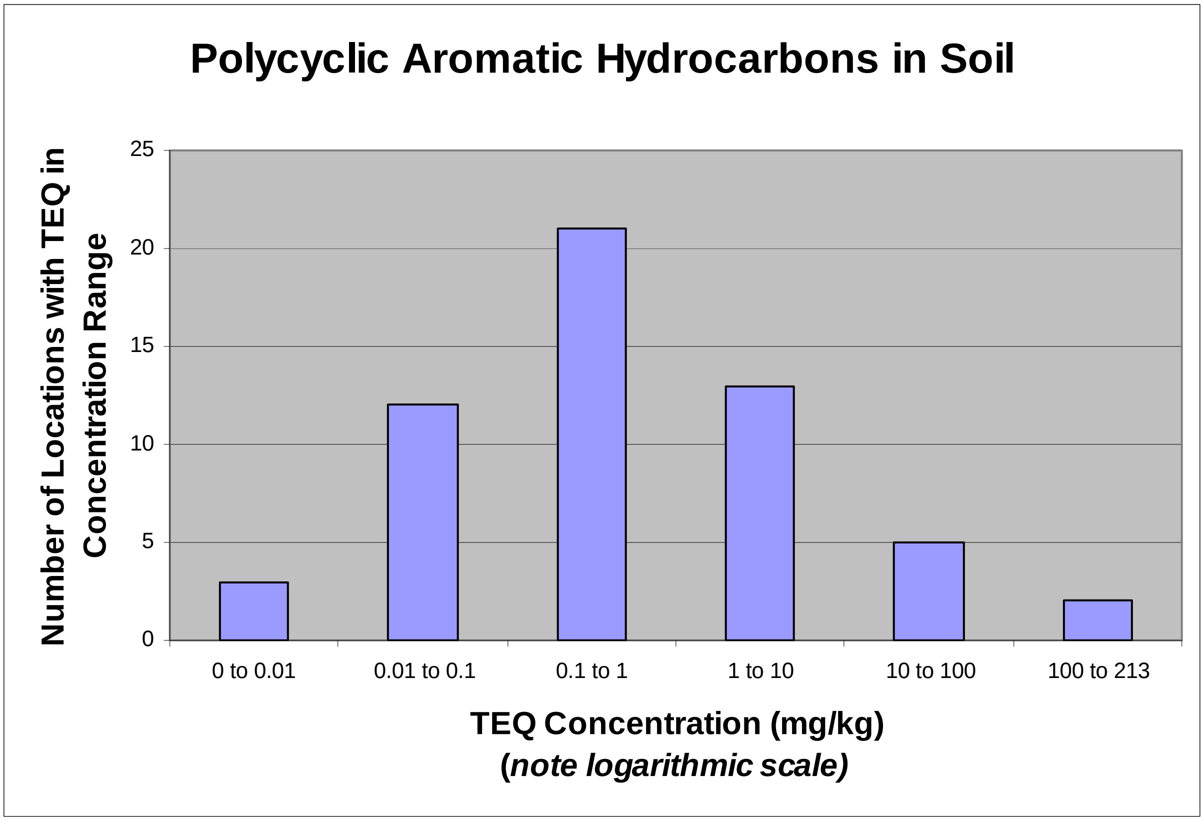


Figure A.8. Arsenic Concentration Distribution in Sediment

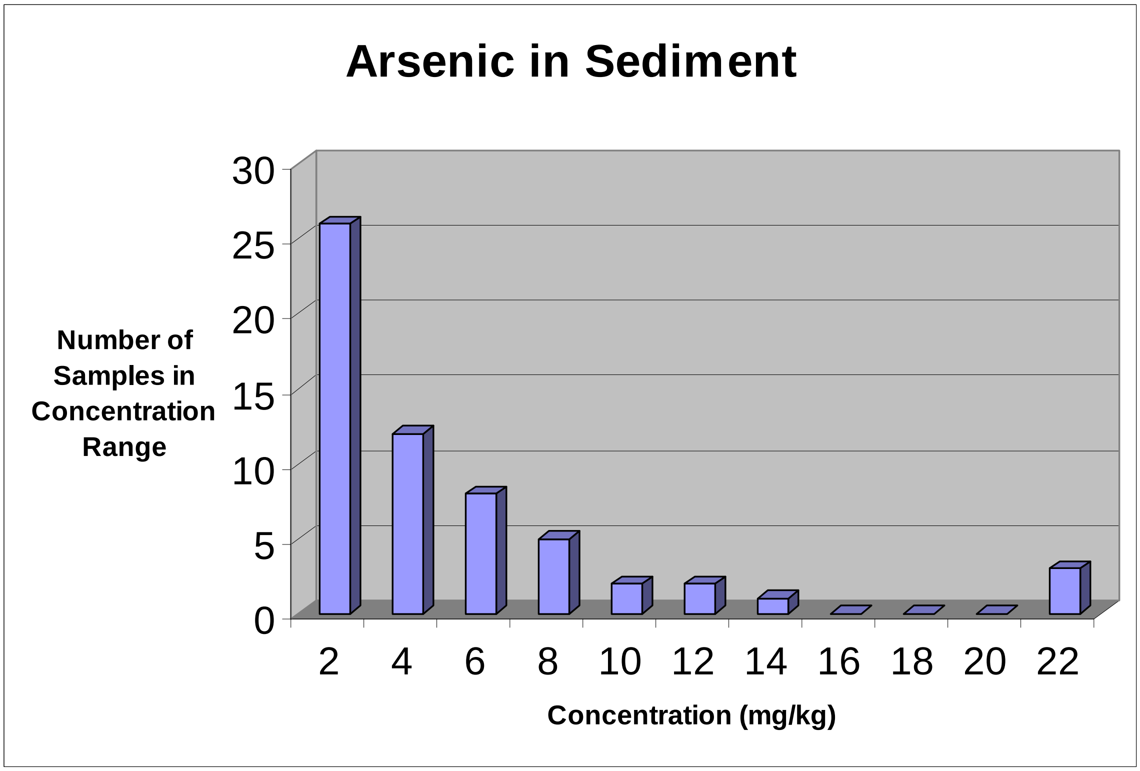
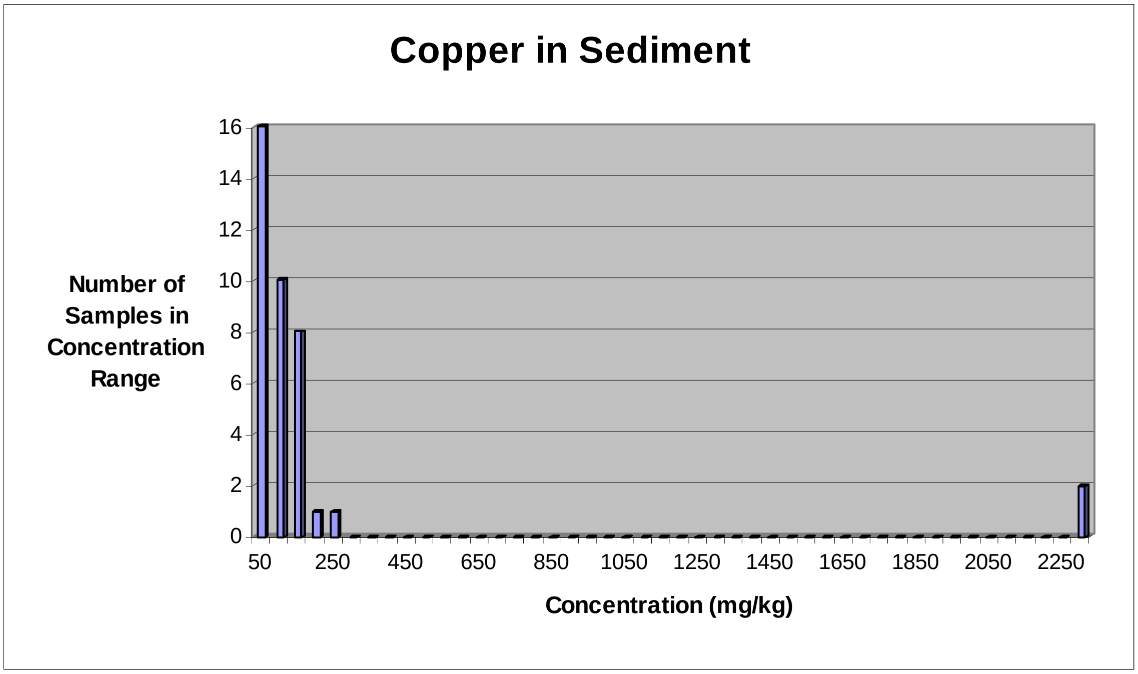


Figure A.9. Copper Concentration Distribution in Sediment



Appendix B. Contaminant and Exposure Information

Table B.1. Contaminant Information

Site	Site Description/Waste Disposal History	Investigation Results/Environmental Monitoring Results	Corrective Activities and/or Current Status
Source Area Activities			
Source Area 1	The "Original Robb Tyler Landfill" and "Colgate Pay Dumps East and West" (approximately 68 acres), includes portions of Parcels 213, 427, and 340 north of Herring Run; ranges from near to ~80' above mean sea level (MSL)	1985: Preliminary Assessment (PA) by Maryland Waste Management Administration (WMA) for USEPA Region III; sampled waste, soil, surface-water, leachate for various areas of site to address data gaps in the Site Investigation (SI); Colgate Pay Dump surface drum contents analyzed for extraction procedure toxicity metals 1989: SI of Colgate Pay Dump by Maryland Hazardous and Solid Waste Management Administration (HSWMA) for USEPA Region III; 3 shallow groundwater wells and 3 surface soil samples analyzed for metals, VOCs, SVOCs, PAHs, pesticides, PCBs	
Source Area 2	The "Horseshoe Landfill" (approximately 15 acres), includes portions of Parcels 405, 364, and 399 north of Herring Run; ranges from near to ~30' above MSL	1986: SI of 68th Street Dump: NUS Corporation for USEPA-Region III,. Soil, sediment, groundwater, surface-water, leachate samples from areas throughout the site were analyzed for metals, VOCs, SVOCs.	

Site	Site Description/Waste Disposal History	Investigation Results/Environmental Monitoring Results	Corrective Activities and/or Current Status
Source Area 3	The "Island Landfill" (approximately 6 acres), includes a portion of Parcel 151 located in the western portion of the island in Herring Run; ranges from near to ~20' above MSL		At least 40, 55-gallon drums were removed following USEPA emergency response to fire from solvents in drums in 1985.
Source Area 4	The "Redhouse Run Landfill" (approximately 4 acres), includes portions of Parcels 403 and 405; ranges from near to ~20' above MSL	1986: SI of R.M. Winstead: NUS Corporation for USEPA-Region III. Soil, sediment, ash samples from areas throughout the site analyzed for metals, VOCs, SVOCs, Pesticides/PCBs.	Ten 55-gallon drums protruding from the hillside of the Redhouse Run Landfill were removed from the Site in 1984. One of the drums contained paint sludge. The rest were empty and badly deteriorated.[3,ŧ]
Source Area 5	The "Unclaimed Landfill" (approximately 60 acres), includes Parcels 16 East, 15 (Par. 4), 117, and 135 (operational areas also include the Parcel 16 East). ranges from near to ~40' above MSL	1985: PA of Industrial Enterprises: Maryland WMA for USEPA Region III. 3 sediment samples, 2 waste samples were collected Sampling Plan for SI of Industrial Enterprises: MDE HSWMA proposed soil, sediment, surface-water and groundwater sampling and a metal detector survey to delineate areas of alleged buried drums and debris. 1989: SI of Industrial Enterprises: MDE	A drum removal action was conducted in 1981/1982, affecting about one acre of land, in the northwestern quadrant of the Unclaimed Landfill, between the industrial firm at the northeastern end of Quad Avenue and Herring Run, and bounded by the unnamed stream to the east;[3] included up to 23 drums of hazardous waste due to lead and cadmium.[ŧ]

[ŧ] *NPL Site Narrative for 68th Street Dump, Baltimore, MD, Federal Register Notice:* ***April 30, 2003****, http://www.epa.gov/superfund/sites/npl/nar1680.htm*

Site	Site Description/Waste Disposal History	Investigation Results/Environmental Monitoring Results	Corrective Activities and/or Current Status
		HSWMA for USEPA-Region III. 19 surface soil, surface-water, sediment and groundwater sampling	
		Other Activities	
Site-wide sampling		1995: GeoTrans, Inc. 15 site-wide groundwater samples. 2 samples showed free-phase petroleum hydrocarbons and 7 other samples contained dissolved VOCs; contamination associated with 3 USTs and a maintenance garage	Further site characterization and remediation are planned with provisions for re-use/ revitalization of portions of the site by the 68th Street Sites Coalition.
Site-wide sampling		2000: ESI by USEPA Region III Site Assessment Technical Assistance Team, USEPA contractor TetraTech comprehensively sampled all 5 source areas; majority of data used in the April 2003 HRS evaluation included 24 waste source surface soil samples, 102 waste source subsurface soil samples, 1 groundwater well , 46 surface waters, 69 sediment samples. The samples were analyzed for SVOCs, PCBs/pesticides, metals and a limited number of samples for dioxins/furans	
Domestic wells	1995: MDE Waste Management Administration reported 6 domestic wells within one mile of site	1993: 4 of the domestic wells sampled by Baltimore County DEP. No organic contaminants were detected (MDE WMA	Presence and current use of domestic wells will be confirmed during the MA-specific

Site	Site Description/Waste Disposal History	Investigation Results/Environmental Monitoring Results	Corrective Activities and/or Current Status
		1995).	investigations. Groundwater wells not permitted in the water service envelope. Additional data will be required to comprehensively describe the site hydrogeology.[3]
Surface water and wetlands	Prior to dumping activities, the entire area of the 68th Street Dump site was covered with wetland vegetation. Historical aerial photographs show the filling of these wetlands and adjacent stream channels, documenting observed releases by direct observation. Surface water bodies that flow through the site include Herring Run, Moore's Run, Redhouse Run, and unnamed tributaries to Herring Run. The Back River and Chesapeake Bay are located along the 15-mile surface water pathway target distance limit (TDL) for the site. Targets within the 15-mile TDL include the Herring Run, Back River, and Chesapeake Bay fisheries and over 23 miles of wetland frontage.	Analytical results of sediment samples collected from the Herring Run fishery downstream of the site document contamination with PAHs, lead, and zinc.[ŧ] Analytical results of samples collected from wetlands remaining at the 68th Street Dump site document elevated concentrations of PAHs, PCBs, and metals.[ŧ]	

Table B.2. Future Use Site Conceptual Model

Environmental Medium and Transport	Exposure Point	Exposure Route	Potentially Exposed Population	Comments	Future Use Recommendation
Surface and Subsurface Soil	On-site	Ingestion Inhalation Dermal	Workers Recreators	Exposure Doses Calculated	Yes
Sediment	On-site	Ingestion Dermal	Workers Recreators	Exposure Doses Calculated	No
Surface Water	On-site	Incidental Ingestion	Workers Recreators	Exposure Doses Calculated	No
Groundwater	On-site Nearby Residences	VOC Vapor Intrusion	Workers Residents	Vapor Intrusion Modeled	Yes
Biota	Fish and Shellfish	Ingestion	Fishermen	Qualitatively Evaluated	Yes

Table B.3. Evaluation of Exposure Pathways at 68th Street Dump

Pathway	Elements of an Exposure Pathway						Public Health Evaluation
	Source	Media	Point of Exposure	Route of Exposure	Time Frame	Exposed Population	
Direct exposure to contaminated soil	Industrial and municipal wastes disposed at the site	Surface and subsurface soil	On-site soil	Incidental ingestion, Dermal absorption	Past Current Future	Workers, Recreators (adults and children)	Limited exposure is currently expected for trespassing ATV users and transients. Future recreational uses may include ATV users, hikers and pick-nickers. No observable health effects are expected to be attributable to the site, unless frequent exposure to hot spots occurs at the site.
Exposure to contaminated airborne dust during earthmoving activities (remediation, construction, ATV use)	Industrial and municipal wastes disposed at the site	Airborne dust from surface and subsurface soil	On-site and at the site boundary	Inhalation	Past Current Future	Construction workers, Recreators, Off-site residents (adults and children)	ATSDR does not expect harmful health effects to occur if proper dust suppression procedures are followed during remediation and construction. Dust monitoring in the neighboring areas could alleviate community concerns, if expressed. Exposure to contaminants in dust from ATV use is expected to be limited and not to cause health effects.

Pathway	Elements of an Exposure Pathway						Public Health Evaluation
	Source	**Media**	**Point of Exposure**	**Route of Exposure**	**Time Frame**	**Exposed Population**	
Sediment	Deposition of eroded site soils in stream beds, sediment transport onsite from upstream sources	Stream-bed sediment	On-site or down-stream	Incidental ingestion, Dermal absorption	Paste, Current, Future	Workers, Recreators, Off-site residents downstream (adults and children)	Sediment sampling revealed levels similar to or lower than soil levels. Exposure to sediment is expected to be less than exposure to soil. Sediment exposure is not expected to result in health effects.
Surface water	Runoff of surface leachate, groundwater to surface water transport	Streams	On-site or down-stream	Incidental ingestion, Dermal absorption	Past, Current Future	Workers, Recreators, Off-site residents downstream (adults and children)	Incidental ingestion from recreational uses is not expected to result in chemical exposures in adequate amounts to cause health effects. Dermal exposure to contaminants in surface water is not expected to result in health effects.
Groundwater consumption and domestic uses	Industrial and municipal waste leachate	Ground-water	On-site or off-site well water	Ingestion, Inhalation of volatiles	Past Current Future	On-site workers, Off-site residents (adults and children)	Past exposures are an indeterminate health hazard. Restrictions against the use of wells in the future should prevent exposures.

Pathway	Elements of an Exposure Pathway						Public Health Evaluation
	Source	Media	Point of Exposure	Route of Exposure	Time Frame	Exposed Population	
Vapor Intrusion	Industrial and municipal waste leachate plumes and soils under structures	Ground-water, Soil	On-site and off-site enclosed structures	Inhalation	Past Current Future	On-site workers, Off-site residents (adults and children)	Indeterminate public health hazard because of a lack of sufficient sampling data and/or exposure information. Collection of soil vapors is planned at locations relevant for evaluating the vapor intrusion pathway for subsequent re-use. Groundwater plumes should be characterized to evaluate potential offsite migration. Vapor barriers may be advisable for new structures to prevent vapor intrusion.
Air Pollutants	Previous fires onsite from solvents exposed at surface	Source exposed at surface	On and off-site	Down-wind	Past	On-site workers, Off-site residents (adults and children)	Indeterminate public health hazard because of a lack of sufficient sampling data and/or exposure information

Pathway	Elements of an Exposure Pathway						Public Health Evaluation
	Source	**Media**	**Point of Exposure**	**Route of Exposure**	**Time Frame**	**Exposed Population**	
Fish Ingestion	Contaminated from site wastes, potential bio-accumulation, may be confounded by potential for contamination from upstream and downstream of site	Surface water and sediment	On-site, up-stream and down-stream waters	Fish Ingestion	Past Current Future	Recreational, Subsistence Fishermen (adults and children)	Limited historical and no recent data for onsite fish are available for review. Hence, this is an indeterminate exposure pathway. Groundwater will be sampled in locations where there is the potential for discharge to surface-water bodies. Fish advisories downstream, tidal influx from downstream and contamination from upstream may confound determination of source of water contamination.

Appendix C. Contaminant Screening

Public health evaluation Comparison Values used for contaminant screening:

Environmental Media Evaluation Guide (EMEG)

An estimated comparison concentration for which exposure is unlikely to cause adverse noncancer health effects, determined by ATSDR from its Toxicological Profiles for specific chemicals.

Cancer Risk Evaluation Guide (CREG)

CREGs are estimated comparison concentrations for specific chemicals based on an excess cancer rate of one in a million persons and are calculated by ATSDR using USEPA's cancer slope factors. CREGs serve only as a screening tool and not as an indication that cancer is expected or predicted.

Reference Dose Media Evaluation Guide (RMEGs)

RMEGS are based on USEPA's estimate of the daily dose below which exposure to a contaminant is unlikely to cause adverse noncancer health effects.

Maximum Contaminant Levels (MCLs)

MCLs represent contaminant concentrations that USEPA deems protective of public health (considering the availability and economics of water treatment technology).

Lifetime Health Advisory (LTHAs)

LTHAs represent contaminant concentrations in drinking water that USEPA deems protective of public health

Minimal risk level (MRL)

An ATSDR estimate of daily human exposure to a hazardous substance at or below which that substance is unlikely to pose a measurable risk of harmful (adverse), noncancerous effects. MRLs are calculated for a route of exposure (inhalation or oral) over a specified time period (acute, intermediate, or chronic). MRLs should not be used as predictors of harmful (adverse) health effects

Region 9 Residential PRGs

Region 9 Residential Preliminary Remediation Goals are media specific environmental screening values provided by the Region 9 Environmental Protection Agency in evaluation of hazardous waste sites.

Unit abbreviations used in this assessment include the following:

mg/kg = milligrams per kilogram (= parts per million)

µg/L = micrograms per liter

The following data summary tables exclude samples with data qualifiers of B (detection not substantially greater than the blank).

Table C.1.a. Soil Sample Data - Inorganic and Organic Constituents Exceeding Comparison Values

Soil Contaminant	Media	Maximum Concentration (ppb)	Minimum Comparison Value (CV) (ppb)	Type of CV
Inorganics				
Aluminum	Surface Subsurface Unknown	10,500 14,500 119,000	50,000 700,000 2000	Child Chronic EMEG Adult Chronic EMEG Intermediate EMEG Pica
Antimony	Surface Subsurface Unknown	- 142 273	20 300	Child RMEG Adult RMEG
Arsenic	Surface Subsurface Unknown	4.1 51.6 64.1	0.5 20 200 10	CREG Child Chronic EMEG Adult Chronic EMEG Intermediate EMEG Pica
Barium	Surface Subsurface Unknown	148 1220 2250	30,000 400,000 1,000	Child Chronic EMEG Adult Chronic EMEG Intermediate EMEG Pica
Cadmium	Surface Subsurface Unknown	0.95 19.9 101	10 100	Child Chronic EMEG Adult Chronic EMEG
Chromium	Surface Subsurface Unknown	58.1 199 925	200 2,000 80,000 1,000,000	Child RMEG (Cr VI) Adult RMEG (Cr VI) Child RMEG (Cr III) Adult RMEG (Cr III)
Cobalt	Surface Subsurface Unknown	16.8 13.6 35.7	500 7000 20	Child Intermediate EMEG Adult Intermediate EMEG Intermediate EMEG Pica
Copper	Surface Subsurface	86.5 467	500 7,000	Child Intermediate EMEG Adult Intermediate EMEG

Soil Contaminant	Media	Maximum Concentration (ppb)	Minimum Comparison Value (CV) (ppb)	Type of CV
Copper	Unknown	5270	20	Acute, Intermediate EMEG Pica
Lead	Surface Subsurface Unknown	236 2770 2990	400	USEPA Residential Soil Screening Level
Mercury	Surface Subsurface Unknown	0.73 1.4 14.6	100 1000 10 4	Child Intermediate EMEG Adult Intermediate EMEG Acute EMEG Pica Intermediate EMEG Pica
Vanadium	Surface Subsurface Unknown	40.2 188 126	200 2,000 6	Child Intermediate EMEG Adult Intermediate EMEG Intermediate EMEG Pica
Zinc	Surface Subsurface Unknown	360 2010 4560	20,000 200,000 600	Child Chronic EMEG Adult Chronic EMEG Intermediate EMEG Pica
Organics				
4-Nitroaniline*	Subsurface Unknown	- 32	23	Region 9 Residential PRG
Carbazole**	Subsurface Unknown	82 19	24	Region 9 Residential PRG
Chlordanes	Surface Subsurface	0.023 2.4	2 30 400 2 1	CREG Child Chronic EMEG Adult Chronic EMEG Acute EMEG Pica Intermediate EMEG Pica
4-Chlorophenyl phenyl ether***	Subsurface Unknown	- 12	0.8	TCEQ-TRRP Residential PRG
2-Diethylhexyl phthalate	Surface Subsurface Unknown	1.8 72 58	3,000 40,000 50	Child Chronic EMEG Adult Chronic EMEG CREG

Soil Contaminant	Media	Maximum Concentration (ppb)	Minimum Comparison Value (CV) (ppb)	Type of CV
2-Diethylhexyl phthalate			2,000	Intermediate EMEG Pica
Dieldrin+	Surface Subsurface Unknown	- 0.18 0.96	0.04 3 40 0.2	CREG Child Chronic EMEG Adult Chronic EMEG Intermediate EMEG Pica
N-Nitrosodi-n-propylamine++	Subsurface Unknown	- 1.1	0.1 200	CREG Acute EMEG Pica
Polychlorinated Biphenyls				
Aroclor 1242+++	Subsurface Unknown	1.8 3.3	0.4	PCBs general: CREG
Aroclor1254+++	Subsurface Unknown	1.2 2.9	1 10 0.06	Child Chronic EMEG Adult Chronic EMEG Intermediate EMEG pica
Aroclor 1260+++	Subsurface Unknown	0.75 6.5	0.4	PCBs general: CREG

* The rate of detection for 4-Nitroaniline was low. The two detects out of 80 samples were at location S-21.
** Approximately 75% of the 80 samples were non-detect. The maximum concentration is greater than 4 times all other detects, indicating this is an outlier "hot spot" location
*** More than 95% of the 84 samples were non-detect. The maximum concentration is greater than 200 times all other detects, indicating this is an outlier "hot spot" location
+ More than half of the samples were non-detect and 73 of the 83 samples did not exceed the lowest CV.
++ Only a single detect occurred for N-Nitrosodi-n-propylamine, indicating this is an outlier.
+++ The rate of detection for Aroclors was low, between 5% and 20%.

Table C.1.b. Soil Sample Data - Toxic Equivalent Factor Analysis

Polycyclic Aromatic Hydrocarbons			
Surface and Subsurface Soils (Concentrations below are from the location with the highest TEQ of all soils: S25)			
Contaminant	**Max Detect (mg/kg)**	**TEF[iii]**	**TEQ (mg/kg)**
2-Methylnaphthalene	132	1	132
Acenaphthene	42	0.001	0.042
Acenaphthylene	9.2	0.001	0.0092
Anthracene	75	0.01	0.75
Benzo(a)anthracene	90	0.1	9
Benzo(a)pyrene	55	1	55
Benzo(b)-Fluoranthene	0	0.1	0
Benzo(ghi)perylene	42	0.01	0.42
Benzo(k)-fluoranthene	95	0.1	9.5
Chrysene	74	0.01	0.74
Fluoranthene	80	0.001	0.08
Fluorene	70	0.001	0.07
Indeno(1,2,3-cd)-pyrene	55	0.1	5.5
Naphthalene	290	0.001	0.29
Phenanthrene	14	0.001	0.014
Pyrene	67	0.001	0.067
		TEQ:	**214**
		Benzo(a)pyrene CREG=0.1	

[iii] Selected Non-heterocyclic Policyclic Aromatic Hydrocarbons, Environmental Health Criteria, International Programme on Chemical Safety, World Health Organization, Geneva, 1998. ISBN 92 4 157202 7.

Surface Soil Values* (Concentrations below are from the location with the highest TEQ: S32)			
Contaminant	**Max Detect (mg/kg)**	**TEF[iii]**	**TEQ (mg/kg)**
Benzo(a)anthracene	0.72	0.1	0.072
Benzo(a)pyrene	0.93	1	0.93
Benzo(b)fluoranthene	2.3	0.1	0.23
Benzo(ghi)perylene	0.92	0.01	0.0092
Benzo(k)fluoranthene	0.043	0.1	0.0043
Chrysene	0.8	0.01	0.008
Fluoranthene	1.6	0.001	0.0016
Indeno(1,2,3-cd)pyrene	0.74	0.1	0.074
Phenanthrene	0.71	0.001	0.00071
Pyrene	1.1	0.001	0.0011
		TEQ:	**1.33**
			Benzo(a)pyrene: CREG=0.1

Dioxins/Furans			
Surface and Subsurface Soils (Concentrations below are from the location with the highest TEQ: HSLF/WS05B)			
Contaminant	**Max Detect (mg/kg)**	**TEF[iv]**	**TEQ (mg/kg)**
1,2,3,7,8-Pentachlorodibenzofuran	0.000443	0.03	0.0000133
1,2,3,6,7,8-Hexachlorodibenzofuran	0.000559	0.1	0.0000559
1,2,3,6,7,8- Hexachlorodibenzo-p-dioxin	0.000882	0.1	0.0000882
1,2,3,4,6,7,8-Heptachlorodibenzofuran	0.000913	0.01	0.00000913
Octachlorodibenzo-p-dioxin	0.0138	0.0003	0.00000414
		TEQ:	0.000171
Dioxins/Furans, Cont'd			
	Dioxin CVs:	**0.00005 Child Chronic EMEG 0.0007 Adult Chronic EMEG 0.0004 Acute EMEG Pica 0.000045 Intermediate EMEG Pica**	

[iv] Van den Berg, M, Birnbaum, LS, Denison, M, De Vito, M, Farland, W, Feeley, M, Fiedler, H, Hakansson, H, Hanberg, A, Haws, L, Rose, M, Safe, S, Schrenk, D, Tohyama, C, Tritscher, A, Tuomisto, J, Tysklind, M, Walker, N, Peterson, RE. The 2005 World Health Organization Reevaluation of Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-Like Compounds. Toxicological Sciences 93(2):223-241. 2006.

Table C.2.a. Sediment Data- Inorganic and Organic Constituents Exceeding Comparison Values

Sediment Contaminant	Maximum Concentration (ppb)	Health-Based Comparison Value (CV) (ppb)	Type of CV
Aluminum	20,000	50,000 700,000 2000	Child Chronic EMEG Adult Chronic EMEG Intermediate EMEG Pica
Antimony	120	20 300	Child RMEG Adult RMEG
Arsenic	21.9	0.5 20 200 10	CREG Child Chronic EMEG Adult Chronic EMEG Intermediate EMEG Pica
Chromium	262	200 2,000 80,000 1,000,000	Child RMEG (Cr VI) Adult RMEG (Cr VI) Child RMEG (Cr III) Adult RMEG (Cr III)
Cobalt	52.6	500 7000 20	Child Intermediate EMEG Adult Intermediate EMEG Intermediate EMEG Pica
Copper	2270	500 7,000 20	Child Intermediate EMEG Adult Intermediate EMEG Acute and Intermediate EMEG Pica
Lead	933	400	USEPA Residential Soil Screening Level
Vanadium	70.7	200 2,000 6	Child Intermediate EMEG Adult Intermediate EMEG Intermediate EMEG Pica
Zinc	15,000	20,000 200,000	Child Chronic EMEG Adult Chronic EMEG

Sediment Contaminant	Maximum Concentration (ppb)	Health-Based Comparison Value (CV) (ppb)	Type of CV
Zinc		600	Intermediate EMEG Pica
Organics			
Aldrin	0.077	0.04 2 20 4	CREG Child Chronic EMEG Adult Chronic EMEG Acute EMEG Pica
Polychlorinated Biphenyls			
Aroclor1254	5.1	1 10 0.06	Child Chronic EMEG Adult Chronic EMEG Intermediate EMEG pica

Table C.2.b. Sediment Data - Toxic Equivalent Factor Analysis

Polycyclic Aromatic Hydrocarbons (Concentrations below are from the location with the highest TEQ: SED45)			
Sediment Contaminant	**Max Detect (mg/kg)**	**TEF[iii]**	**TEQ (mg/kg)**
Benzo(a)anthracene	1.8	0.1	0.18
Benzo(a)pyrene	2.2	1	2.2
Benzo(b)-fluoranthene	2.6	0.1	0.26
Benzo(ghi)perylene	2.3	0.01	0.023
Benzo(k)-fluoranthene	2.2	0.1	0.22
Chrysene	2.7	0.01	0.027
Fluoranthene	3.8	0.001	0.0038
Sediment Contaminant	**Max Detect (mg/kg)**	**TEF[iii]**	**TEQ (mg/kg)**
Indeno(1,2,3-cd)-pyrene	2.0	0.1	0.2
Phenanthrene	2.2	0.001	0.0022
Pyrene	3.6	0.001	0.0036
		TEQ	**3.1**
		Benzo(a)-pyrene CREG=0.1	

Dioxins/Furans

(Concentrations below are from the location with the highest TEQ: SED39)

Sediment Contaminant	Max Detect (mg/kg)	TEF[iv]	TEQ (mg/kg)
1,2,3,4,6,7,8,9-Octachlorodibenzofuran	0.00032	0.0003	0.000000096
1,2,3,4,6,7,8-Heptachlorodibenzofuran	0.00019	0.01	0.0000019
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	0.00068	0.01	0.0000068
1,2,3,4,7,8,9-Heptachlorodibenzofuran	0.000013	0.01	0.00000013
1,2,3,4,7,8-Hexachlorodibenzofuran	0.000019	0.1	0.0000019
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	0.000015	0.1	0.0000015
1,2,3,6,7,8-Hexachlorodibenzofuran	0.000016	0.1	0.0000021
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	0.000042	0.1	0.0000042
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	0.000029	0.1	0.0000029
1,2,3,7,8-Pentachlorodibenzofuran	0.0000062	0.03	0.000000186
1,2,3,7,8-Pentachlorodibenzo-p-dioxin	0.000012	1	0.000012
2,3,4,6,7,8-Hexachlorodibenzofuran	0.000028	0.1	0.0000028
2,3,4,7,8-Pentachlorodibenzofuran	0.0000093	0.3	0.00000279
2,3,7,8-Tetrachlorodibenzofuran	0.0000072	0.1	0.00000072
2,3,7,8-Tetrachlorodibenzo-p-dioxin	0.0000013	1	0.0000013
Octachlorodibenzo-p-dioxin	0.011	0.0003	0.000003300
		Dioxin TEQ:	**0.0000441**
	Dioxin CVs: 0.00005 Child Chronic EMEG 0.0007 Adult Chronic EMEG 0.0004 Acute EMEG Pica 0.00004 Intermediate EMEG Pica		

Table C.3.a. Surface Water Data-Inorganic and Organic Constituents Exceeding Comparison Values

Surface Water Contaminant	Maximum Concentration (µg/L)	Health-Based Comparison Value (CV) (µg/L)	Type of CV
Inorganics			
Aluminum	54,500	10,000 40,000	Child Chronic EMEG Adult Chronic EMEG
Antimony	42.8	6 4 10	LTHA, MCL Child RMEG Adult RMEG
Arsenic	24.5	0.02 3 10	CREG Child Chronic EMEG Adult Chronic EMEG, MCL
Beryllium	4.4	20 70 4	Child Chronic EMEG Adult Chronic EMEG MCL
Cadmium	3.3	2 7 5	Child Chronic EMEG Adult Chronic EMEG LTHA, MCL
Chromium	424	30 100 20,000 50,000	Child RMEG (Cr VI) Adult RMEG (Cr VI) Child RMEG (Cr III) Adult RMEG (Cr III)
Copper	582	100 400 1,300	Child Intermediate EMEG Adult Intermediate EMEG MCLG
Lead	1540	15	MCL
Manganese	7850	300 500 2000	LTHA Child RMEG Adult RMEG

Surface Water Contaminant	Maximum Concentration (µg/L)	Health-Based Comparison Value (CV) (µg/L)	Type of CV
Nickel	238	100 200 700	LTHA Child RMEG Adult RMEG
Vanadium	183	30 100	Child Intermediate EMEG Adult Intermediate EMEG
Organics			
Trans-1,3-Dichloropropene	5	0.4 300 1000	CREG Child Chronic EMEG Adult Chronic EMEG
Chlordane (gamma + cis)	0.167	0.1 6 20 2	CREG Child Chronic EMEG Adult Chronic EMEG MCL
Di(2-ethylhexyl) phthalate	27	3 600 2000 6	CREG Child Chronic EMEG Adult Chronic EMEG MCL
Heptachlor	0.013	0.008 1 4 0.4	CREG Child Intermediate EMEG Adult Intermediate EMEG MCL
Heptachlor Epoxide	0.1	0.004 0.1 0.5 0.2	CREG Child RMEG Adult RMEG MCL
Beta-hexachlorocyclohexane	0.036	0.02 6 20	CREG Child Intermediate EMEG Adult Intermediate EMEG

Surface Water Contaminant	Maximum Concentration (µg/L)	Health-Based Comparison Value (CV) (µg/L)	Type of CV
Trichloroethylene	8.4	5	MCL
Aroclor 1260	0.8	0.02 0.5	PCBs general: CREG PCBs general: MCL

* 1 detect was offsite and the other detect was at SW-25 at 3.3 µg/L

Table C.3.b. Surface Water Data - Toxic Equivalent Factor Analysis

Polycyclic Aromatic Hydrocarbons (Concentration below is from the location with the highest TEQ: SW 34)			
Surface Water Contaminant	**Max Detect (µg/L)**	**TEF[iii]**	**TEQ (µg/L)**
Benzo(ghi)perylene	1	0.01	0.01
Fluoranthene	1	0.001	0.001
		TEQ:	**0.011**
		CREG:	**0.005**

Table C.4. Groundwater Data- Inorganic and Organic Constituents Exceeding Comparison Values

Groundwater Contaminant	Maximum Concentration (µg/L)	Health-Based Comparison Value (CV) (µg/L)	Type of CV
Antimony	17	6 4 10	LTHA Child RMEG Adult RMEG
Beryllium	4.9	4 20 70	MCL Child Chronic EMEG Adult Chronic EMEG
Cadmium Cadmium	5.5	5 2 7	LTHA, MCL Child Chronic EMEG Adult Chronic EMEG
Manganese	4680	300	LTHA

Groundwater Contaminant	Maximum Concentration (µg/L)	Health-Based Comparison Value (CV) (µg/L)	Type of CV
Manganese		500 2000	Child RMEG Adult RMEG
1,1,2,2-Tetrachloroethane	1	0.2 5000 20,000 0.3	CREG Child Intermediate EMEG Adult Intermediate EMEG LTHA
1,1-Dichloroethene	38.5	90 300 7	Child Chronic EMEG Adult Chronic EMEG MCL
Cis-1,2-Dichloroethene	76.4	3000 10,000 70	Child Intermediate EMEG Adult Intermediate EMEG LTHA, MCL
Ammonia	71,100	30,000	LTHA
Benzene	782	0.6 40 100 5	CREG Child RMEG Adult RMEG MCL
Cyanide	267	200 700 200	Child RMEG Adult RMEG LTHA, MCL
Ethylbenzene	3720	1000 4000 700	Child RMEG Adult RMEG LTHA, MCL
Delta-hexachlorocyclohexane	0.06	0.02	CREG for technical hexachlorocyclohexane
Toluene	4800	200 700 1000	Child Intermediate EMEG Adult Intermediate EMEG LTHA, MCL

Appendix D. Quantitative Screening Analysis for Exposure Groups

The chemicals of potential concern that were identified by comparison to the media specific comparison values were more rigorously evaluated by calculating exposures expected at the 68th Street Dump. Expected future use of the site includes exposures to On-site Workers, Construction Workers, Adult Recreators and Child Recreators.

The exposure levels calculated for these populations were then compared to the intake levels found in ATSDR's list of Health Guidelines Comparison Values for noncancer and cancer effects. Theses calculations are summarized below.

$$\text{Non-cancer Hazard Quotient} = \frac{\text{Appropriate Noncancer}}{\text{Health Guideline (MRL or Reference Dose)}} \div \frac{C * IR * EF * ED}{BW * AT * CF}$$

$$\text{Cancer Risk} = \frac{\text{Appropriate Cancer}}{\text{Health Guideline (Slope Factor)}} * \frac{C * IR * EF * ED}{BW * AT * CF}$$

where: C = Concentration in Media of Concern (mg/kg or µg/L)
IR = Intake Rate
EF = Exposure Frequency (days/year)
ED = Exposure Duration (years)
BW = Body Weight (kg)
AT = Averaging Time (years)
CF = Conversion Factor (1.0E-06 kg/mg for soil or 1.0E-03 mg/µg for water)

Noncancer hazard quotients (HQs) greater than one are further evaluated using site-specific exposure parameters to determine if exposures at the site pose a public health hazard. Cancer risk levels greater than 1.0E-05 indicate a theoretical risk of greater than one excess case of cancer is estimated in 100,000 exposed people. These indicators are based upon extremely conservative assumptions regarding health effects and uncertainty factors and are used as a standardized method of evaluating relative health hazards and risks rather than predicting absolute health effects.

In cases where HQ > 1 or cancer risk > 1.0E-05 and a statistically representative distribution of concentrations was available, the 95% UCL of the mean was obtained and used to recalculate the HQ and cancer risk levels. The concentrations calculated as the 95% UCL of the mean were obtained using the recommended algorithm of USEPA's ProUCL statistical software package. Non-detect data were omitted in calculating the 95% UCL of the mean for simplicity. Hence, values used for the 95% UCL of the mean are highly biased towards the more contaminated sampling. This approach conservatively eliminated chemicals from further evaluation.

All chemicals of concern at the site fell below the HQ of 1 or a cancer risk level of 1.00E-05, except for polycyclic aromatic hydrocarbons (PAHs) and lead, which was evaluated separately. The 95% UCL of the mean cannot be calculated for PAHs because they are evaluated using the TEQ. Therefore, the maximum TEQ values were used in the following spreadsheets to calculate the HQ and cancer risk levels for these chemicals. Average exposures to these chemicals would be much lower than these maximum levels.

	Site Worker	Construction Worker	Adult Recreat	Teen Recreat	
IR (mg/d)	100	330	100	100	
EF(d/yr)	250	250	104	104	104 d/yr =(2 days/week)
ED (yr)	25	1	30	6	
BW (kg)	70	70	70	50	
(NC.) AT(d)	9125	365	10950	2190	
(Ca.) AT(d)	25550	25550	25550	25550	

Surface & Subsurface Soil	Exposure Dose On-site Worker	Exposure Dose Constr Worker	Exposure Dose Adult Recreat	Exposure Dose Teen Recreat	SFo
	mg/kg-day	mg/kg-day	mg/kg-day	mg/kg-day	1/(mg/kg-day)
PAH TEQ: 210 mg/kg	7.3E-05	9.7E-06	3.7E-05	1.0E-05	7.3

Surface & Subsurface Soil	Ca Risk On-site Worker	Ca Risk Constr Worker	Ca Risk Adult Recreat	Ca Risk Teen Recreat
	unitless	unitless	unitless	Unitless
PAH TEQ: 210 mg/kg	5.4E-04	7.1E-05	2.7E-04	7.5E-05

	Child 3-12 yrs	Child 1-3 yrs	Pica Child	
IR (mg/d)	200	200	5000	
EF(d/yr)	104	104	1	104 d/yr =(2 days/week)
ED (yr)	9	2	1	
BW (kg)	28	15	10	
(NC.) AT(d)	3285	730	365	
(Ca.) AT(d)	25550	25550	25550	

Surface Soil	Exposure Dose Child 3-12 yrs	Exposure Dose Child 1-3 yrs	Exposure Dose Pica Child	SFo
	mg/kg-day	mg/kg-day	mg/kg-day	1/(mg/kg-day)
PAH TEQ: 1.3 mg/kg	3.4E-07	1.4E-07	2.5E-08	7.3

Surface Soil	Ca Risk Child 3-12 yrs	Ca Risk Child 1-3 yrs	Ca Risk Pica Child
	unitless	unitless	unitless
PAH TEQ: 1.3 mg/kg	2.5E-06	1.0E-06	1.9E-07

Appendix E. Vapor Intrusion Modeling

DATAENTER WORKSHEET::

GW-ADV

Version 3.1; 02/04

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

Reset to Defaults

YES [ ]

OR

LATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box
al groundwater conc. below)

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (mg/L)
71432	7.82E+02

Chemical	
Benzene	

MORE
ê

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Totals must add up to value of L_{WT} (cell G28) Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
10	200	305	305	0	0	a	S	S		

MORE ê

ENTER Stratum A SCS soil type	ENTER Stratum A soil dry bulk density, r_b^A (g/cm^3) n	ENTER Stratum A soil total porosity, ^{A} (unitless) q	ENTER Stratum A soil water-filled porosity, $_w^A$ (cm^3/cm^3)	ENTER Stratum B SCS soil type	ENTER Stratum B soil dry bulk density, (g/cm^3) n	ENTER Stratum B soil total porosity, ^{B} (unitless) q	ENTER Stratum B soil water-filled porosity, $_w^B$ (cm^3/cm^3)	ENTER Stratum C SCS soil type	ENTER Stratum C soil dry bulk density, r_b^C (g/cm^3) n	ENTER Stratum C soil total porosity, ^{C} (unitless) q	ENTER Stratum C soil water-filled porosity, $_w^C$ (cm^3/cm^3)
Lookup Soil Parameters				Lookup Soil Parameters				Lookup Soil Parameters			
S	1.66	0.375	0.054	C	1.43	0.459	0.215	C	1.43	0.459	0.215

MORE

ê

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, (g/cm-s^2)	ENTER Enclosed space floor length, L_B (cm) W	ENTER Enclosed space floor width, $_B$ (cm) H	ENTER Enclosed space height, $_B$ (cm) w	ENTER Floor-wall seam crack width, (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10 DP	40	1000	1000	366	0.1	0.25	5

MORE

ê

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	30	30	350	1.0E-06	1
				Used to calculate risk-based groundwater concentration.	

END

CHEMPROPS WORKSHEET:

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, $_w$ (cm^2/s)	Henry's law constant at reference temperature, $(atm\text{-}m^3/mol)$	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $_{v,b}$ (cal/mol)	Normal boiling point, $_B$ (^oK)	Critical temperature, $_C$ (^oK)	Organic carbon partition coefficient, $_{oc}$ (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF $(g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
8.80E-02	9.80E-06	5.54E-03	25	7,342	353.24	562.16	5.89E+01	1.79E+03	7.8E-06	3.0E-02

END

INTERCALCS WORKSHEET:

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
9.46E+08	105	0.321	0.244	0.244	0.003	9.92E-08	0.998	9.91E-08	17.05	0.375	0.122	0.253	4,000

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
2.54E+04	1.80E+06	2.22E-04	200	8,122	2.68E-03	1.15E-01	1.75E-04	1.42E-02	0.00E+00	0.00E+00	5.70E-04	2.91E-03	105

Convection path length,	Source vapor conc.,	Crack radius,	Average vapor flow rate into bldg.,	Crack effective diffusion coefficient,	Area of crack,	Exponent of equivalent foundation Peclet number,	Infinite source indoor attenuation coefficient,	Infinite source bldg. conc.,	Unit risk factor,	Reference conc.,

L_p (cm)	source (µg/m³)	crack (cm)	soil (cm³/s)	crack (cm²/s)	crack (cm²)	exp(Pe^f) (unitless)	α (unitless)	$C_{building}$ (µg/m³)	URF (µg/m³)⁻¹	RfC (mg/m³)
C	r	Q	D	A						
200	9.01E+04	0.10	8.33E+01	1.42E-02	4.00E+02	3.99E+63	1.23E-03	1.11E+02	7.8E-06	3.0E-02

END

RESULTS WORKSHEET:

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (mg/L)	Indoor exposure groundwater conc., noncarcinogen (mg/L)	Risk-based indoor exposure groundwater conc., (mg/L)	Pure component water solubility, S (mg/L)	Final indoor exposure groundwater conc., (mg/L)
	NA	NA	1.79E+06	NA

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
3.5E-04	3.5E+00

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

SCROLL DOWN TO "END"

NA

END

Appendix F. Public Health Hazard Categories

Category 1: Urgent Public Health Hazard

Sites that pose a serious risk to the public's health as the result of short-term exposures to hazardous substances.

Category 2: Public Health Hazard

Sites that pose a public health hazard as the result of long-term exposures to hazardous substances.

Category 3: Indeterminate Public Health Hazard

Sites for which no conclusions about public health hazard can be made because data are lacking.

Category 4: No Apparent Public Health Hazard

Sites where human exposure to contaminated media is occurring or has occurred in the past, but the exposure is below a level of health hazard.

Category 5: No Public Health Hazard

Sites for which data indicate no current or past exposure or no potential for exposure and therefore no health hazard.

Appendix G. Resources for Local Fish, Shellfish and Recreational Water Use

The following resources are provided to assist in obtaining updated information on local fish, shellfish and recreational water use. Following this list of weblinks is information from these websites accessed in July 2007. Please access the current version of the website for up-to-date information.

Maryland Department of Natural Resources:

Recreational Fisheries, License Free Fishing Areas – Map
http://www.dnr.state.md.us/fisheries/recreational/freefishmap.html

Maryland Department of Natural Resources, Fisheries Service: 800-688-FINS

Maryland Department of the Environment:

Recommended Maximum Meals Each Year for Maryland Waters
http://www.mde.state.md.us/assets/document/Fish_Advisory_Table_2007(2).pdf#Recommended_Meals_Per_Year

Maryland Shellfish Harvesting Areas
http://www.mde.state.md.us/CitizensInfoCenter/FishandShellfish/harvesting_notices/index.asp

Maryland Department of the Environment, 410-537-3906

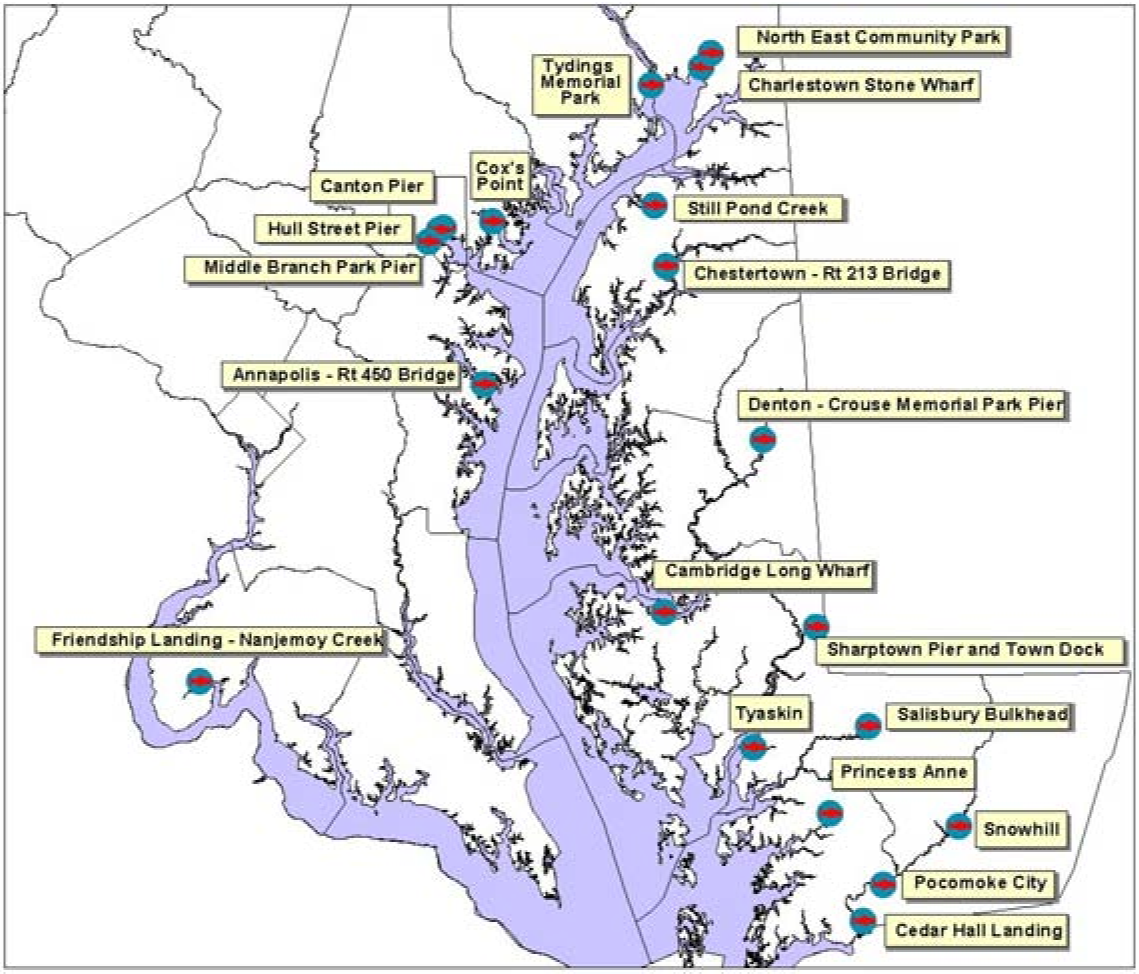
Baltimore County, Maryland, Environmental Protection and Resource Management Agency:

Recreational Water Contact Alerts, Water Quality Advisories and Public Beach Area Closings
http://www.baltimorecountymd.gov/Agencies/environment/watersampling/alertadvisory.html

Baltimore County, Environmental Concerns - 410-887-3733

http://www.dnr.state.md.us/fisheries/recreational/freefishmap.html
(accessed Jan 8, 2009)

License Free Fishing Areas - Map

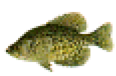


http://www.mde.state.md.us/assets/document/Fish_Advisory_Table_2007(2).pdf#Recommended_Meals_Per_Year (accessed Jan 8, 2009)

Recommended Maximum Meals Each Year for Maryland Waters

Recommended Meal Size: 8 oz - General Population; 6 oz - Women; 3 oz - Children

NOTE: Consumption recommendations based on spacing of meals to avoid elevated exposure levels

Species	Waterbody	Recommended Meals/Year: General Population (8 oz meal)	Women* (6 oz meal)	Children** (3 oz meal)	Contaminants
 American Eel	Anacostia River	15	11	8	PCBs - risk driver & Pesticides***
	Back River	AVOID	AVOID	AVOID	
	Bush River	47	35	27	
	Middle River	13	9	7	
	Northeast River	28	21	16	
	Patapsco River/Baltimore Harbor	AVOID	AVOID	AVOID	
	Patuxent River	26	20	15	
	Middle Potomac River: MD 301 Bridge to DC Line	19	15	11	
	South River	37	28	22	
 Black Crappie	Centennial Lake	No Restrictions	No Restrictions	No Restrictions	Methylmercury - risk driver
	Lake Roland	12	12	12	Pesticides*** - risk driver
	Liberty Reservoir	96	48	48	Methylmercury - risk driver
	Tuckahoe Lake	No Restrictions	93	56	
	Upper Potomac River:				
	DC Line to Dam #3	65	49	38	PCBs - risk driver
	Dam #4 to Dam #5	77	59	45	
 Blue Crab (1 meal equals 9 crabs for general population & women (4 crabs for children))	**Crab meat**				
	Patapsco River/Baltimore Harbor	96	72	55	PCBs - risk driver
	Other Areas of the Bay	No Restrictions	No Restrictions	No Restrictions	
	Crab "mustard"				
	Middle River	DO NOT CONSUME "MUSTARD"			PCBs - risk driver
	Mid Bay: Middle to Patapsco River	DO NOT CONSUME "MUSTARD"			
	Patapsco River/Baltimore Harbor	DO NOT CONSUME "MUSTARD"			
	Other Areas of the Bay	Eat Sparingly			

'No Restrictions' equals more than 96 meals per year

* Women = of childbearing age (women who are pregnant or may become pregnant, or are nursing)

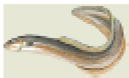
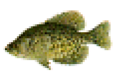
** Children = all young children up to age 6

*** Pesticides = banned organochlorine pesticide compounds (include chlordane, DDT, dieldrin, or heptachlor epoxide)

Recommended Maximum Meals Each Year for Maryland Waters

Recommended Meal Size: 8 oz - General Population; 6 oz - Women; 3 oz - Children

NOTE: Consumption recommendations based on spacing of meals to avoid elevated exposure levels

Species	Waterbody	Recommended Meals/Year: General Population 8 oz meal	Recommended Meals/Year: Women* 6 oz meal	Recommended Meals/Year: Children** 3 oz meal	Contaminants
 American Eel	Anacostia River	15	11	8	PCBs - risk driver & Pesticides***
	Back River	AVOID	AVOID	AVOID	
	Bush River	47	35	27	
	Middle River	13	9	7	
	Northeast River	28	21	16	
	Patapsco River/Baltimore Harbor	AVOID	AVOID	AVOID	
	Patuxent River	26	20	15	
	Middle Potomac River: MD 301 Bridge to DC Line	19	15	11	
	South River	37	28	22	
 Black Crappie	Centennial Lake	No Restrictions	No Restrictions	No Restrictions	Methylmercury - risk driver
	Lake Roland	12	12	12	Pesticides*** - risk driver
	Liberty Reservoir	96	48	48	Methylmercury - risk driver
	Tuckahoe Lake	No Restrictions	93	56	
	Upper Potomac River:				PCBs - risk driver
	DC Line to Dam #3	65	49	38	
	Dam #4 to Dam #5	77	59	45	
 Blue Crab 1 meal equals 9 crabs for general population & women (4 crabs for children)	**Crab meat**				
	Patapsco River/Baltimore Harbor	96	72	55	PCBs - risk driver
	Other Areas of the Bay	No Restrictions	No Restrictions	No Restrictions	
	Crab "mustard"				PCBs - risk driver
	Middle River	DO NOT CONSUME "MUSTARD"			
	Mid Bay: Middle to Patapsco River	DO NOT CONSUME "MUSTARD"			
	Patapsco River/Baltimore Harbor	DO NOT CONSUME "MUSTARD"			
	Other Areas of the Bay	Eat Sparingly			

'No Restrictions' equals more than 96 meals per year

* Women = of childbearing age (women who are pregnant or may become pregnant, or are nursing)

** Children = all young children up to age 6

*** Pesticides = banned organochlorine pesticide compounds (include chlordane, DDT, dieldrin, or heptachlor epoxide)

Recommended Maximum Meals Each Year for Maryland Waters

Meal Size: 8 oz - General Population; 6 oz - Women; 3 oz - Children

NOTE: Consumption recommendations based on spacing of meals to avoid elevated exposure levels

Species	Waterbody	Recommended Meals/Year: General Population (8 oz meal)	Women* (6 oz meal)	Children** (3 oz meal)	Contaminants
 Brown Bullhead	Anacostia River	51	33	30	PCBs - risk driver & Pesticides***
	Back River	33	25	20	
	Middle River	38	28	22	
	Northeast River	29	22	17	
	Patapsco River/Baltimore Harbor	17	13	10	
	South River	No Restrictions	No Restrictions	85	
 Channel Catfish	Anacostia River	9	7	AVOID	PCBs - risk driver & Pesticides***
	Back River	7	AVOID	AVOID	
	Bohemia River	12	9	7	
	Bush River	13	10	8	
	Chester River and Tributaries	29	22	17	
	Choptank River	52	39	30	
	Elk River (incl. C&D Canal)	8	6	AVOID	
	Gunpowder River	15	11	9	
	Middle River	AVOID	AVOID	AVOID	
	Monocacy River	59	45	35	
	Nanticoke River	90	68	53	
	Northeast River	19	14	11	
	Patapsco River/Baltimore Harbor	AVOID	AVOID	AVOID	
	Patuxent River	37	28	22	
	Pocomoke River	96	74	57	
	Upper Potomac River: DC Line to Dam #3	27	20	16	PCBs – risk driver & Methylmercury
	Upper Potomac River: Dam #4 to Dam #5	37	28	22	
	Upper Potomac River: Dam #3 to Dam #4 < 18"	72	55	42	
	Middle Potomac River: DC Line to MD 301 Bridge < 18"	8	6	AVOID	PCBs - risk driver
	Middle Potomac River: DC Line to MD 301 Bridge > 18"	7	AVOID	AVOID	
	Sassafras River	9	6	AVOID	
	Susquehanna River below Conowingo Dam	19	14	11	
	Susquehanna River above Conowingo Dam	27	20	16	

"No Restrictions" equals more than 96 meals per year

* Women = of childbearing age (women who are pregnant or may become pregnant, or are nursing)

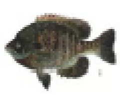
** Children = all young children up to age 6

*** Pesticides = banned organochlorine pesticide compounds (include chlordane, DDT, dieldrin, or heptachlor epoxide)

Recommended Maximum Meals Each Year for Maryland Waters

Recommended Meal Size: 8 oz - General Population; 6 oz - Women; 3 oz - Children

NOTE: Consumption recommendations based on spacing of meals to avoid elevated exposure levels

Species	Waterbody	Recommended Meals/Year: General Population (8 oz meal)	Recommended Meals/Year: Women* (6 oz meal)	Recommended Meals/Year: Children** (3 oz meal)	Contaminants
 Common Carp	Back River	AVOID	AVOID	AVOID	PCBs - risk driver
	Lake Roland	29	22	17	PCBs - risk driver & Pesticides***
	Middle Potomac River: DC Line to MD 301 Bridge	11	8	6	PCBs - risk driver
	Apply Middle Potomac River advisory for carp to Bohemia, Bush, Elk (C&D Canal), Gunpowder, Northeast, Patapsco, and Potomac Rivers since elevated PCB levels in these locations may be anticipated.				
 Spot	South River	50	38	29	PCBs – risk driver
 Striped Bass	Chesapeake Bay and Tributaries	USE SEASONAL INFORMATION			PCBs - risk driver & Methylmercury – low levels
	< 28" May 16 - December 15	25	19	15	
	> 28" April 15 - May 15	9	6	AVOID	
 Sunfish including Bluegill	**Statewide:** all publicly accessible lakes and impoundments	96	96	96	Methylmercury – risk driver
	Anacostia River	35	27	21	PCBs - risk driver
	Antietam River	27	20	16	
	Middle Potomac River: DC Line to MD 301 Bridge	44	33	26	
	Susquehanna River above Dam	88	67	52	
	Centennial Lake	70	57	34	Methylmercury – risk driver
	Lake Habeeb	No Restrictions	No Restrictions	74	
	Statewide: all rivers and streams	No Restrictions	No Restrictions	No Restrictions	

'No Restrictions' equals more than 96 meals per year

* Women = of childbearing age (women who are pregnant or may become pregnant, or are nursing)

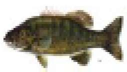
** Children = all young children up to age 6

*** Pesticides = banned organochlorine pesticide compounds (include chlordane, DDT, dieldrin, or heptachlor epoxide)

Recommended Maximum Meals Each Year for Maryland Waters

Recommended Meal Size: 8 oz - General Population; 6 oz - Women; 3 oz - Children

NOTE: Consumption recommendations based on spacing of meals to avoid elevated exposure levels

Species	Waterbody	Recommended Meals/Year			Contaminants
		General Population	Women*	Children**	
		8 oz meal	6 oz meal	3 oz meal	
 Small and Largemouth Bass	Statewide: all publicly accessible waters, except those listed below	48	48	24	Methylmercury – risk driver
	Big Piney (Frostburg) Reservoir Lake Lariat Potomac River @ Spring Gap Savage Reservoir St. Mary's Lake	12	10	AVOID	Methylmercury - risk driver
	Cash Lake Deep Creek Lake Loch Raven Reservoir Millington Wildlife Mngmt. Area Prettyboy Reservoir Tuckahoe Lake	36	30	18	
	Big Pool Broadford Lake Youghiogheny River Lake	48	42	24	
	Blair Valley Lake Clopper Lake Cunningham Falls Lake Liberty Reservoir Rocky Gorge Reservoir	60	50	30	
	Johnson's Pond Little Seneca Lake Piney Run Lake Tridelphia Reservoir Upper Potomac: Dam #4 to Dam #5	72	60	35	
	Centennial Lake Greenbelt Lake Lake Habeeb Jennings Randolph Reservoir Unicorn Lake	96	85	50	
	Lake Linganore Myrtle Grove Lake Smithville Lake Susquehanna River above Conowingo Dam Urieville Community Lake Wye Mills Community Lake	No Restrictions	96	60	
	Bynum Run Community Lake Gilbert Run Lake Lake Elkhorn Lake Frank Lake Kittamaqundi Leonards Mill Pond Schumaker Pond	No Restrictions	No Restrictions	No Restrictions	
	Lake Roland	24	24	24	PCBs & Pesticides*** - risk driver

"No Restrictions" equals more than 96 meals per year

* Women = of childbearing age (women who are pregnant or may become pregnant, or are nursing)

** Children = all young children up to age 6

*** Pesticides = banned organochlorine pesticide compounds (include chlordane, DDT, dieldrin, or heptachlor epoxide)

Recommended Maximum Meals Each Year for Maryland Waters

Recommended Meal Size: 8 oz - General Population; 6 oz - Women; 3 oz - Children

NOTE: Consumption recommendations based on spacing of meals to avoid elevated exposure levels

Species	Waterbody	Recommended Meals/Year: General Population (8 oz meal)	Recommended Meals/Year: Women* (6 oz meal)	Recommended Meals/Year: Children** (3 oz meal)	Contaminants
	Antietam Creek: Funkstown Bridge to Mouth	12	12	6	PCBs – risk driver
	Jones Falls	No Restrictions	No Restrictions	85	
Trout	Savage River	88	72	43	Methylmercury – risk driver
	Apply Jones Falls advisory for Trout to waters that have Stocked Trout from hatcheries. To view a list of these areas go to: http://www.dnr.state.md.us/fisheries/				
	Jennings Randolph Reservoir	No Restrictions	No Restrictions	81	
	Savage River Reservoir	15	12	7	Methylmercury – risk driver
Walleye	Youghiogheny River Lake	25	20	12	
	Patapsco River/Baltimore Harbor	AVOID	AVOID	AVOID	PCBs - risk driver & Pesticides***
	Lower Potomac River: DC Line to MD 301 Bridge				
	< 18"	17	13	10	
White Catfish	> 18"	12	AVOID	AVOID	
	Frostburg Reservoir and Deep Creek Lake	48	48	24	
	Piney Run Lake	No Restrictions	No Restrictions	67	Methylmercury – risk driver
	Youghiogheny River Lake	No Restrictions	80	48	
	Bush River	49	37	29	
Yellow Perch	Gunpowder River	28	22	17	
	Middle River	9	7	AVOID	PCBs - risk driver
	Susquehanna River below Dam	29	22	17	

'No Restrictions' equals more than 96 meals per year

* Women = of childbearing age (women who are pregnant or may become pregnant

** Children = all young children up to age 6

*** Pesticides = banned organochlorine pesticide compounds (include chlordane, DDT, dieldrin, or heptachlor epoxide)

Recommended Maximum Meals Each Year for Maryland Waters

Recommended Meal Size: 8 oz - General Population; 6 oz - Women; 3 oz - Children

NOTE: Consumption recommendations based on spacing of meals to avoid elevated exposure levels

Species	Waterbody	Recommended Meals/Year			Contaminants
		General Population	Women*	Children**	
		8 oz meal	6 oz meal	3 oz meal	
	Back River	14	11	8	
	Bohemia River	23	17	13	
	Bush River	16	12	9	
	Mid Chesapeake Bay: Middle through Patapsco River	14	10	8	
	Chester River and Tributaries	No Restrictions	No Restrictions	88	PCBs - risk driver
	Choptank River	No Restrictions	No Restrictions	77	
	Eastern Bay: Miles & Wye River	No Restrictions	No Restrictions	No Restrictions	
	Elk River (including C&D Canal)	9	7	AVOID	
	Gunpowder River	23	17	13	
	Herring Bay	30	23	18	
	Liberty Reservoir	67	54	33	Methylmercury – risk driver
	Magothy River	28	21	16	
White Perch	Manokin River	No Restrictions	No Restrictions	No Restrictions	
	Middle River	12	9	7	
	Nanticoke River	No Restrictions	No Restrictions	No Restrictions	
	Northeast River	16	12	9	
	Patapsco River/Baltimore Harbor	7	AVOID	AVOID	
	Patuxent River	No Restrictions	79	61	PCBs - risk driver
	Pocomoke River	No Restrictions	No Restrictions	79	
	Potomac River:				
	Mouth to MD 301 Bridge	No Restrictions	No Restrictions	84	
	MD 301 Bridge to DC Line	35	26	20	
	Rhode & West Rivers	32	24	19	
	Sassafras River	24	18	14	
	Severn River	34	26	20	
	South River	46	35	27	

"No Restrictions" equals more than 96 meals per year

* Women = of childbearing age (women who are pregnant or may become pregnant, or are nursing)

** Children = all young children up to age 6

*** Pesticides = banned organochlorine pesticide compounds (include chlordane, DDT, dieldrin, or heptachlor epoxide)

http://www.mde.state.md.us/CitizensInfoCenter/FishandShellfish/harvesting_notices/index.asp (accessed Jan 8, 2009)

Maryland Shellfish Harvesting Areas

- **Daily Advisory on Conditionally Approved Shellfish Harvesting Areas**

Maryland's Chesapeake Bay waters have long been known for their plentiful shellfish. To protect this valuable resource and safeguard public health the Maryland Department of the Environment is responsible for regulating shellfish harvesting waters.

Shellfish include clams, oysters, and mussels. The term shellfish does not include crabs, lobsters, or shrimp. Shellfish are filter-feeding animals: they strain the surrounding water through their gills which trap and transfer food particles to their digestive tract. If the water is contaminated with disease-causing bacteria, the bacteria are also trapped and consumed as food. If shellfish are harvested from waters which the Department has restricted (closed) and eaten raw or partially cooked, they have the potential to make people sick. Therefore, it is mandatory for oysters and clams to be harvested from approved (open) shellfish waters only.

Shellfish harvesting waters which are open or approved for harvesting are those where harvesting is permitted anytime. Areas which are conditionally approved mean that shellfish harvesting is permitted except for the three days following a rain event of greater than one inch in a twenty-four hour period. Runoff from such a rainfall can carry bacteria into surface waters from adjacent land. Information about which areas have conditional closures is updated daily on the web and via a recording. Click here to find out which conditional closures are in effect or call 1-800-541-1210.

Maryland's Shellfish Harvesting and Closure Area Maps

These maps summarize the Maryland Department of the Environment's (MDE) classification status of oyster & clam harvesting waters as of June 1, 2007. The maps depict the classification of shellfish growing waters of the State as restricted, conditionally approved, or approved.

Also shown in the maps are Shellfish areas closed as reserves and sanctuaries by the Department of Natural Resources (DNR). Sanctuaries are areas which are closed to shellfish harvest and often contain oyster restoration projects to help enhance oyster populations for their environmental benefits. These areas are permanent closures. Reserves are areas which are restored, then opened for periodic harvest when certain criteria are met.

- Interactive or "Clickable" Map of Maryland Shellfish Harvesting and Closure Areas
- MDE Executive Summary
- DNR Executive Summary
- Detailed Descriptions MDE's Shellfish Harvesting Areas
- Detailed Coordinate Information for DNR Closures

For more information concerning shellfish harvesting contact the MDE Shellfish Certification Division at (410) 537-3608 or the Natural Resources Police at (410) 260-8880. For interstate shellfish sanitation information, visit http://www.issc.org.

http://www.baltimorecountymd.gov/Agencies/environment/watersampling/alertadvisory.html (accessed Jul 29, 2009)

Recreational Water Contact Alerts, Water Quality Advisories and Public Beach Area Closings

July 29, 2009 2:26 PM

Current Alerts/Advisories

Water Contact Alerts Currently in Effect:

None

Beach Area Closures:

None

Water Quality Advisories Currently in Effect:

None

Alert/Advisory Procedures

DEPRM closely monitors and samples recreational waters and beach areas for water quality, posts sampling results, and issues beach closure notices, Water Contact Alerts and Water Quality Advisories.

When recreational water conditions exceed standards and sewage contamination is suspected or evident, Water Contact Alerts are issued or public bathing beaches are closed. Contaminated conditions can be produced by storm water run-off from severe storms, sanitary sewage overflows, or marine accidents. After the storms have passed, local wind and tide conditions can result in the intermittent re-intensification of those conditions for extended periods in in tidal waters. When water quality parameters are generally elevated or abnormal, but no sewage contamination is present, a Water Quality Advisory will be issued.

However, recreational water users are reminded:

- Be observant for cloudy or discolored water in streams, rivers, or the bay, and of waters that are laden with debris. Water quality may have been negatively impacted.
- Do not drink stream water.
- Avoid contact with potentially contaminated water if you have open cuts or bandaged wounds. If accidental contact with contaminated water occurs, wash any damaged skin areas as soon as possible.
- Minimize hand to mouth contact and be sure to wash your hands thoroughly before eating.