ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

Public Health Assessment for

SAUER DUMP LANDFILL SUPERFUND SITE
DUNDALK, BALTIMORE COUNTY, MARYLAND

SEPTEMBER 4, 2012

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 0-day public comment period. Subsequent to the public comment period, ATSDR addressed all public comments and revised or appended the document as appropriate. The public health assessment has now been reissued. This concludes the public health assessment process for this site, unless additional information is obtained by ATSDR which, in the agency's opinion, indicates a need to revise or append the conclusions previously issued.

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PUBLIC HEALTH ASSESSMENT

SAUER DUMP LANDFILL SUPERFUND SITE

DUNDALK, BALTIMORE COUNTY, MARYLAND

Prepared by:

Eastern Branch
Division of Community Health Investigations (proposed)
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 Environmental Protection Agency, the U.S. EPA, and the individual states regulate the investigation and clean up of the sites.

Since 1986, ATSDR has been required by law to conduct a public health assessment at each of the sites on the EPA National Priorities List. The aim of these evaluations is to find out if people are being exposed to hazardous substances and, if so, whether that exposure is harmful and should be stopped or reduced. If appropriate, ATSDR also conducts public health assessments when petitioned by concerned individuals. Public health assessments are carried out by environmental and health scientists from ATSDR and from the states with which ATSDR has cooperative agreements. The public health assessment 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 EPA, other government agencies, businesses, and the public. When there is not enough environmental information available, the report will indicate what further sampling data is needed.

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

ATSDR uses existing scientific information, which can include the results of medical, toxicologic and epidemiologic studies and the data collected in disease registries, to 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 EPA 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 send them to us.

Letters should be addressed as follows:

Attention: Manager, ATSDR Record Center Agency for Toxic Substances and Disease Registry, 1600 Clifton Road (F-09), Atlanta, GA 30333.

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Introduction

The Agency for Toxic Substances and Disease Registry's (ATSDR) top priority is to ensure that the people living in Dundalk, Maryland have the best information possible to safeguard their health.

Man-made chemicals, construction debris, and metals were disposed of in the Sauer Landfill Dump Site. As a result of environmental sampling and extensive physical hazards, the U.S. Environmental Protection Agency (USEPA) has added the Sauer Landfill Dump Site to the National Priorities List (NPL, or "Superfund"). ATSDR is required to conduct public health activities on all sites proposed for the NPL. USEPA is working with the state of Maryland to continue investigating the site.

The purpose of this Public Health Assessment (PHA) is to determine whether the community was harmed by exposure to VOCs in municipal well water and what public health actions need to be taken to reduce harmful exposures. Because of limited available data, ATSDR focused its evaluation on exposure to VOCs in municipal well water. Other potential exposure pathways may be evaluated as more data are collected from the site.

Conclusions

ATSDR reached two conclusions regarding this site.

Conclusion 1

The Back River is contaminated with heavy metals that may be migrating from the Sauer Landfill Dump Site or from other locations upstream of the sampling locations.

Basis for Concluson

A data review and pathway analysis indicated that metals were present in the surface waters at levels above comparison values.

Conclusion 2	ATSDR concludes that people may accidentally drink contaminated surface water while boating and swimming on the Back River near the Sauer Landfill Dump Site. We don't expect that these accidental exposures would harm people's health. ATSDR classifies this site as a No Apparent Public Health Hazard.
Basis for Concluson	The reason for this classification is that individuals will spend a limited time in the surface water and the ingestion of the potentially contaminated water is well below levels that are known to cause adverse health effects.
For More Information	For further information about this public health assessment, please call ATSDR at 1-800-CDC-INFO (1-800-232-4636) and ask for information about the "Sauer Landfill Dump Site." If you have concerns about your health, you should contact your health care provider

Background

The Sauer Dump Landfill Site (Site) is situated off Lynhurst Road in a marshy area on the Back River, a tributary to the Chesapeake Bay. The Site was active from perhaps as early as the 1950s to as late as 1990 thus it is considered an inactive landfill and former dump. Previous site investigations, conducted by the Maryland Department of the Environment (MDE) and the United States Environmental Protection Agency (USEPA) indicated that concentrations of several hazardous contaminants in soils and sediments exceeded various human health and ecological risk-based screening levels.

In or around April 1984, the Baltimore County Department of Health (County) conducted an inspection at the Site and found a large quantity of building and miscellaneous debris including automobile parts, empty drums, wood, and plastic products which were partially buried. In June 1985, the USEPA and the County conducted an inspection at the Site and took samples. Analytical results at that time revealed, among other things, polychlorinated biphenyl (PCB) contamination in sediments, soil, and surface water; mercury (up to 5.8 micrograms per liter; µg/L) in surface water; and lead (up to 546 µg/L) in surface water. In February 1991, USEPA conducted reconnaissance in the vicinity of the dump and found that a large portion of the Site had been covered with about 10 feet of fill consisting of soil and debris. USEPA also observed possible leachate seeps with oily sheens in the southern (Back River) boundary of the Site at low tide and a leaky drum surrounded by stained vegetation.

In March 1991, the USEPA and State personnel returned to conduct a removal assessment. The assessment revealed approximately 50 empty drums at the property. USEPA, through its contract options, performed an expanded site inspection focusing on the contaminant movements into the Back River.

In January 1992, the County received a citizen complaint of burning at the dump and then conducted an inspection at the Site and found an old curing oven being used to burn wooden pallets, a trailer used to store furniture, numerous piles of demolition debris, tires, and a 1,000-gallon storage tank in a ravine.

Later, that same year in December 1992, USEPA's contractor collected surface water, sediment, and soil samples during expanded site inspection activities and observed additional site conditions. These included among other things, vast quantities of debris on the surface including scrap metal, concrete pipe, broken concrete and asphalt, railroad ties, treated lumber, wire, and cable; 12 rusty 55-gallon drums in various locations including the wetlands; a sulfide-type odor at various locations; and an oily sheen on surface water. Analytical results from the samples revealed, among other things, PCBs, pesticides, metals, and various organic and inorganic compounds.

The State collected more samples from the Site in December 2001, June 2002, January 2004, and February/March 2005. In or around June 2005, the State issued a Remedial Investigation report in which it concluded that various contaminants at the Site pose human health and ecological hazards and that PCBs were the primary contaminant of concern.

In January 2003, the Agency for Toxic Substances and Disease Registry (ATSDR) prepared a public health consultation as requested by the USEPA. That document concluded that lead and PCBs detected in surface soil samples at the Site pose a public health hazard for a residential setting and that PCBs detected in sub-surface soil samples may pose a public health hazard if gardening, or construction activities involving digging or trenching, bring contaminated soil to the surface.

On or about December 8, 2005, USEPA issued an Administrative Order for Removal Response Action (2005 Order). This order directed the potentially responsible parties (PRPs) for the site, Smurfit-Stone, APU, and Wittstadt to, among other things, erect a fence at the Site to restrict access, install a temporary cover system atop contaminated areas to mitigate erosion of surface soils, and take steps to protect the shoreline from erosion. As a result of the 2005 Order, a chain link fence now restricts access to most of the Site, 6 mil (6/1000 inch) plastic nylon reinforced polyethylene sheeting covers a small area of the Site disturbed during the State's remedial investigation, and coir (coconut fiber) logs have been installed at the shoreline protecting the Site shoreline from erosion. These measures did not eliminate the risks to public health and to the environment presented by, among other things, soils at the Site that are contaminated with lead and PCBs.

The USEPA announced in March 2011 that it was proposing to add the Sauer Dump Site to the National Priorities List because of high levels of semi-volatile organic chemicals, metals, PCBs, and pesticides. The USEPA, in their announcement, indicated that the primary contaminants of concern were lead and PCBs in soil and sediment[1].

Site Description

The Sauer Dump is an inactive, unpermitted, privately owned landfill located at 4225 Lynhurst Road in Dundalk, Baltimore County, Maryland. The dump is about 1 mile from the nearest high density population center of Dundalk and about 4 miles from the city center. The nearest road is less than 0.1 miles from the site which is bordered on the west and south by heavy vegetation.

[1] http://www.epa.gov/superfund/sites/narr/nar1833.pdf (last accessed on August 6, 2012)

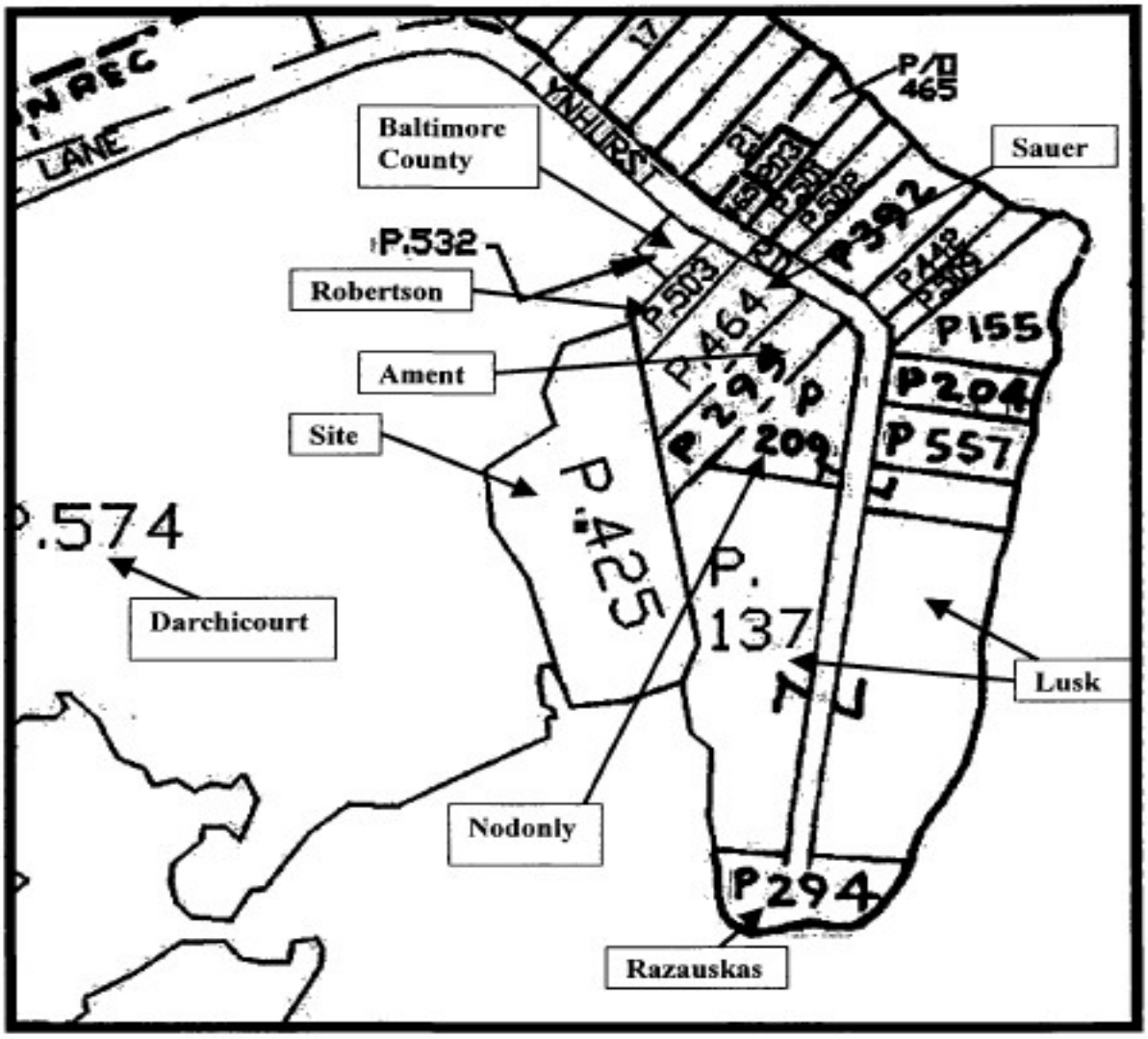
Located south of Stansbury Point in the Lynhurst area; the site is bordered by the Back River. The site area sits on reclaimed land which was once marshy and stabilized by filling with various waste materials, in this case primarily plasterboard, demolition debris, and other wastes, as well as soil. The resulting operations covered many acres raising the land several feet above the water level and beyond the normal banks of the river. Some residences have been built on the stabilized area, adjacent to the landfill. The Site covers approximately 2 acres of this area (1). There are no schools in the vicinity and the only access is through private property.

The major portion of the site is currently owned by Wittstadt Hunting Club, Inc. which acquired the property on January 16, 1997 (2). The balance of the Site is made up of numerous residences which lie adjacent to the club (3). Residential properties border the Site to the northeast, east, and southeast. Undeveloped land borders the Site to the northwest, west, and southwest (4). A portion of the tax map showing the relationship between the Site and the adjacent properties is included as Figure 1 and Figure **2**. The Site, noted as Parcel 425, is land-locked (i.e., no direct access from public land) and can be accessed from Lynhurst Road via a driveway between 4225 and 4227 Lynhurst Road. Both of these residential properties are owned by descendants of the late Mr. Sauer. A gate extends across the driveway 40 to 50 feet northeast of the boundary between the Site and these residential properties. A garage on the 4227 Lynhurst Road property is located approximately 40 feet east of the property boundary. With the exception of the immediate area of the entrance to the Site, the Site is heavily overgrown with vegetation (primarily trees, shrubs, tall grasses, and reeds) and exhibits irregular surface topography. Portions of the Site continue to serve as storage space for large items (boats, vehicles, heavy construction equipment, and other large items) owned by Sauer family members. Accumulations of scrap metal are present in a number of areas on-site. Miscellaneous debris and domestic refuse, contained in a soil matrix, is present across most of the Site and extends off-site in some areas. Concrete construction demolition debris is present along the northern border of the Site, in the steep bank along the southwestern property line along portions of the wetlands called the Southwest Finger and the Southeast Finger. The elevation of the Site ranges from approximately mean sea level to nearly 17 feet above mean sea level (AMSL) (4).

Parcel 425 (Site) is essentially rectangular in shape and is on the former marshy land that was stabilized using fill material. There is a ponded area located to the northwest of Parcel 425. The southern boundary of the Site is a cove that is part of the Back River, a tributary of the Chesapeake Bay. Wetlands adjacent to this cove and extending along the east and west side of the former operational area are considered to be part of the impacted area. Previous Site investigations concluded that the wetlands onsite that are not tidally influenced were formed by fill operations within the Sauer Dump Site. Past Site operations have impacted an estimated 1.44 acres of wetlands surrounding the upland portions of the Site. The vegetation observed within the wetlands is predominantly an invasive species of reeds (5).

Part of the eastern border of the site is formed by a tidal channel that contains wetlands and leads south. Northwest of this area is the alleged former drum storage area. West of this drum area is the marsh, which runs from a pond at its northern end south to the Back River and serves as the western and northwestern borders of the site. The central portion of the site is graded and covered with gravel and debris. South of this area is an old burn area. The Back River forms the southern boundary of the site. The northwestern, western, southern, and eastern sides of the site are bounded by wetlands (5).

Five non-tidal and three tidal wetlands have been identified on the Sauer Dump Site. The wetlands were identified on the eastern, northwestern, western, and southern sides of the property during the 1992 expanded Site Investigation. The Back River is classified as a deepwater habitat rather than a wetland because water depth exceeds three meters. Because the Back River in the site area and the Chesapeake Bay are tidal, the surface water migration pathway extends up the Back River to the extent of tidal influence and to bay waters for a radius of 11.2 miles from the river's mouth (5).



Property map provided courtesy of the Maryland Department of Planning © 2000.
This map copied from the Maryland Department of Assessments and Taxation, Map reference, Map 104, Parcel 425.

Figure 1. Location of Sauer Dump NPL Site.

Although actual groundwater flow direction is not known, the USEPA site investigation reports suggest the flow direction could be based on the role of channels and rivers as discharge points for groundwater and the assumption that the water-table configuration is similar to the surface topography but with less variations. Groundwater flow under the site, based on EPA assumptions, is generally toward the channels to the east and west and the Back River to the south. Multiple on-site observations of numerous groundwater seeps associated with the site indicate the depth to groundwater to be no more than 15 feet and as little as one foot, corresponding to the observed maximum and minimum elevations of the site above the groundwater seeps. Furthermore, groundwater flow direction may be influenced by tidal fluctuations as the tidal flow extends to at least 4 miles upstream from the dump site (5).

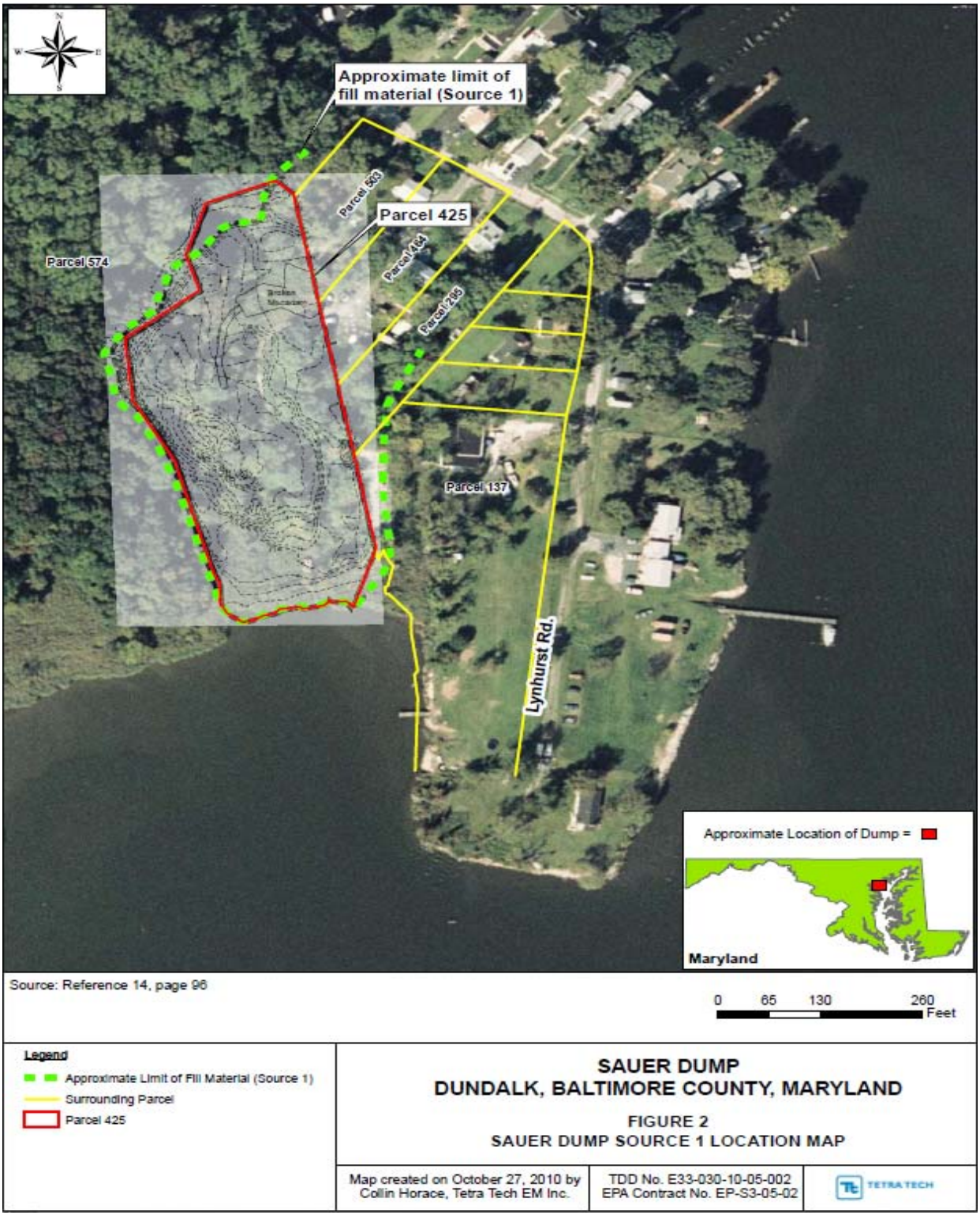


Figure 2. Satellite Map of Sauer Dump Site. Figure copied from Ref 1.

As previously mentioned, wetlands are associated with the site. Surface drainage flows either eastwardly into a tidal channel, toward the west into a tidal marsh, or toward the south, directly into the Back River. The channel and the marsh then discharge into the Back River, which forms the southern border of the site. The Back River then nominally flows to the south and east for 3.8 miles, until it discharges into the Chesapeake Bay. Other major surface waters within the study area are the Middle River (three miles northeast) and Bear Creek (1.5 miles west). All the surface waters in the area are drained by the Chesapeake Bay (5).

The site area is served by the Baltimore Water Department (BWD) which obtains its supply from three bodies of surface water: the Loch Raven Reservoir; the Liberty Lake Reservoir, and; the Susquehanna River. These sources are located well outside the four-mile radius of the site and do not receive drainage from the site. Numerous designated water recreation areas exist within the approximate 15-mile surface water migration pathway. Surface water intakes neither were located within 15 downstream miles of the site nor within the tidal reach upstream (5).

At the time of the final expanded site inspection in 1994, no on-site monitoring, production, or potable water wells were installed. According to the state in a preliminary assessment of the dump, 20 wells were located within one mile of the site. The closest located about 0.5 mile northwest of the site, upgradient of the site. No private domestic wells were identified by USEPA contractors.

In 2007, a community group, the Sauer Dump Coalition released their Extent of Contamination Study. This investigation located 4 monitoring wells and observed that heavy vegetation was present at the site, especially in the wetlands areas. Final approvals also were received from the USEPA for the final locations of environmental sampling including the installation of replacement monitoring wells (6).

Demographics

Dundalk is an unincorporated suburb of Baltimore, MD and is considered a census designated place by the US Census. The 2000 census registered 62,306 people, 24,772 households, and 16,968 families residing in Dundalk. The population density was 4,689.5 people per square mile. The ATSDR Geospatial Research, Analysis, and Services Program (GRASP) generated a demographics map with the Sauer Dump as its center (Figure 3). The populations statistics within a one mile radius of the site indicated that about 2365 people lived within this area and about 10% were 6 years of age or younger and about 20% were females between 15 and 44 years of age. Of the total population, about 96% were classified as white, 2% black, with the remaining population consisting of Asians, Hispanics/Latino, and American Indian/Alaska Natives, Hawaiian/Pacific Islanders, or mixed racial composition.

Because the site is somewhat isolated from the major population area of Dundalk, GRASP also estimated the population immediately around the site as bounded by Interstate 695/Patapsco Freeway on the west, the Back River on the north, and east, Todd Point Lane on the south, and Bletzer Road on the northwest. In this area the population estimate was 683 individuals consisting of: 1) 676 white; 2) 1 black, 1 American Indian/Native Alaskan, and 3 Asians; 3) 121 females of childbearing age; and 4) 52 children under the age of 6.

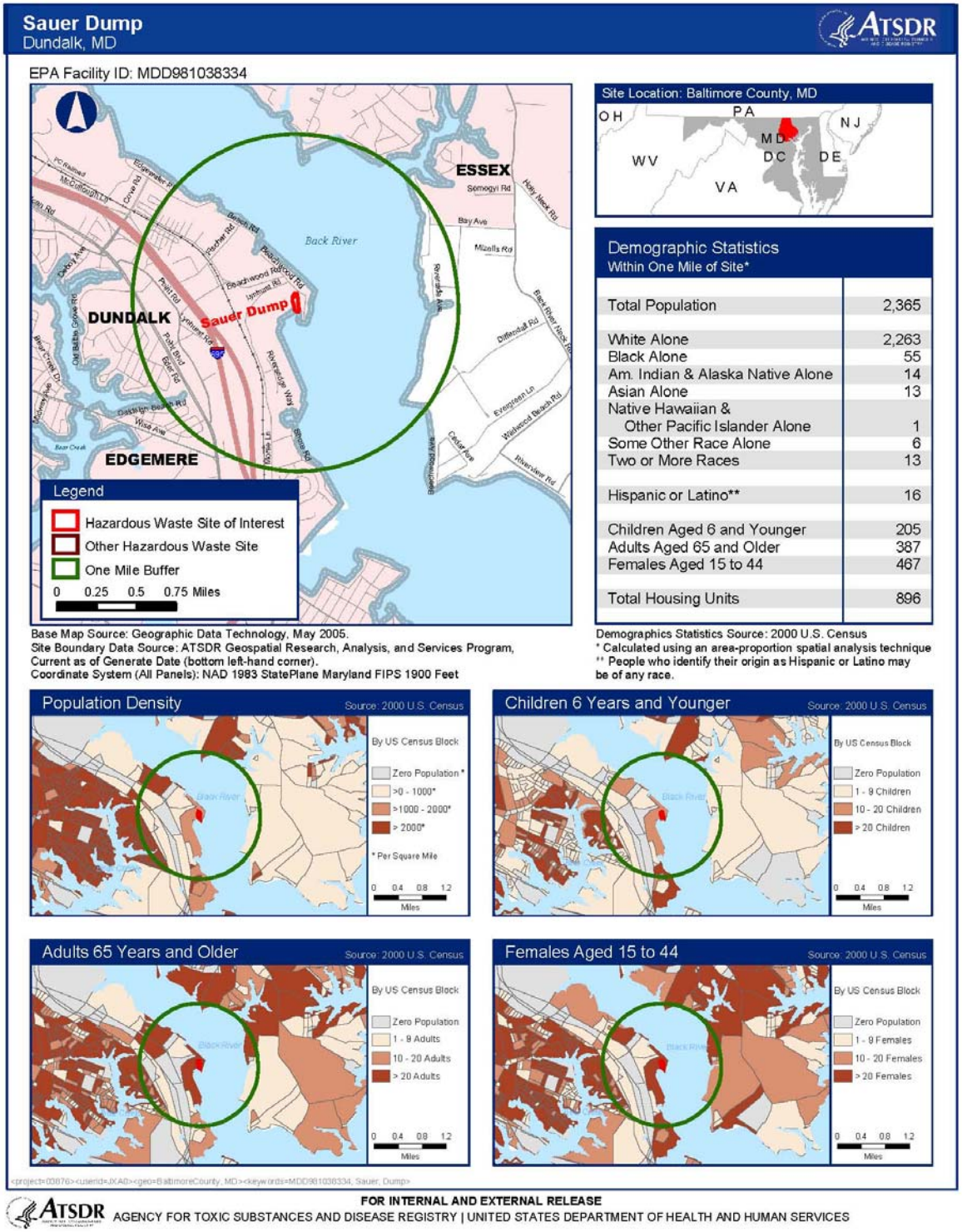


Figure 3. Demographs surrounding the Sauer Dump

Evaluation of Site Conditions

In July 2011, ATSDR visited the Sauer Dump Site, accompanied by representatives of the USEPA and representatives of one of the potentially responsible parties/land owners (PRP) and their legal representative. The purpose of this trip was to familiarize ATSDR public health assessors on the topography, site conditions, and site proximity to residential areas. ATSDR also received a briefing on historical use, sampling and characterization history, and remediation efforts and goals to date from the USEPA and the PRP. ATSDR used this visit and information to evaluate the detected contaminants with respect to potential exposure pathways and the potential for human health impacts.

During the site visit, ATSDR personnel observed the security fencing, access to the site, heavy vegetation, and ground surface conditions. ATSDR personnel was also informed and shown the location of monitoring wells, test pits, uncovered wastes inside the fence line, and the proximity of residences and businesses to the site. The site access was limited and the main access point from the road is behind residences in the area with the fence locked. The fence was in excellent condition along this portion of the site. The site itself was heavily vegetated with weeds, trees, numerous types of shrubbery and other plant materials (Figure **4**), contained many physical hazards such as rusted metal shards, portions of barrels, plastics, bucket remains, wooden boards and poles, and abandoned vehicle parts such as tires, car/truck parts, similar materials (Figure **5**). Along the southern portion of the site bordering the river, a thick stand of vegetation that the site visit team could not penetrate, limits access during the non-winter months. We did not detect any obvious signs of contamination such as odors, or discoloration nor did we observe any trespassing on the site nor were there signs of erosion or other pathways whereby contaminants might leave the site. Nonetheless, there was one access point to the site whereby trespass could occur. ATSDR observed an unpaved drive approximately 10 to 15 feet wide along the northern boundary of the site near the pond. This path originated behind land parcel 503 (see Figure 1).

The area around the site is a residential area with only one business observed to the east of the site. There were no schools, hospitals, or other major commercial ventures in the immediate area.

Figure 4. Heavy vegetation at the Sauer Dump Landfill Site.

Figure 5. Covered waste pit at the Sauer Dump Landfill Site.

Pathway Analyses

Pathways are those processes whereby chemical contaminants can move through the environment to a point of human contact. The contaminants have a source or release point and enter the various pathways from the release point. The pathways include ingestion of soil, surface water, or groundwater, dermal contact, and inhalation and combinations these processes such as the ingestion of groundwater via wells or dermal exposure through the surface water pathway. Regardless of the contaminant, if there is no pathway connecting the release point to the point of human contact, that specific pathway can be eliminated from the exposure assessment.

Not every release of a site-related contaminant negatively affects the off-site community. For a contaminant to pose a health problem, an exposure must first occur. That is, a person must come in contact with the contaminant by, for example, breathing, eating, drinking, or touching a substance containing the contaminant. If no one comes in contact with the contaminant, then no exposure occurs, and no health effects can occur. Still, even if the site is inaccessible to the public, contaminants can move through the environment to locations where people could come in contact with them. Examples of these movements include wind-borne dusts or drinking water

wells that intersect contaminated groundwater. In summary, there are 5 elements of an exposure pathway as defined by ATSDR as shown in Table 1.

Table 1. Elements of an exposure pathway*

Element	*Definition*	*Example*
1	Source or release	Drums, landfills, spills, air releases
2	Environmental fate and transport	Contaminant movement through the environment
3	Point of exposure	Location of exposure such as drinking water or soils
4	Exposure route	Ingestion, inhalation, dermal exposure
5	Potentially exposed population	Identification of those impacted

*Table derived from the ATSDR Public Health Assessment Guidance Manual (Update)

ATSDR evaluates site conditions to determine whether people could have been or could be exposed to site-related contaminants. When evaluating exposure pathways, ATSDR identifies whether, through ingestion, dermal (skin) contact, or inhalation, exposure to contaminated media (e.g., soil, water, air, waste, or biota) has occurred, is occurring, or could occur. ATSDR also identifies an exposure pathway as completed or potential, or, if neither, eliminates the pathway from further evaluation. Exposure pathways are complete if all human exposure pathway elements are present. A potential pathway is one that ATSDR cannot rule out because one or more of the pathway elements cannot be definitely proved or disproved. If one or more of the elements is definitely absent, a pathway is eliminated. The pathways for the Sauer Dump Landfill Site where that pathway may come into contact with people and during what time frame are shown in Table 2.

Table 2. Pathways of Exposure

Pathway	In the past	Current	Future
Air (inhalation)	During disposal activities	none	During remediation activities
Groundwater	Unknown but unlikely; public water may not have been available	None; all residences on public water	No; flow is toward the Back River away from homes
Vapor Intrusion	Unknown	None	None
Soil ingestion	Unknown; health and safety controls on site were probably not implemented	None ; site is heavily vegetated; secured	Potential during remediation
Surface Water (on-site)	No apparent surface water on site based on historical photographs	No surface water on site	No surface water on site
Surface Water (off-site) and related sediments	Unknown, however, historical photographs suggest this was a potential exposure pathway	Sampling in the river suggests that contaminants may be present from this site or other locations upstream	Potential exposures will continue during remediation activities.
Dermal contact	Unknown	None ; site is heavily vegetated; secured	Potential during remediation

Assessing Health Effects

As stated previously, exposure does not always result in harmful health effects. The type and severity of health effects that a person might experience depend on the dose, which is based on the person's age at exposure, the exposure rate (how much), the frequency (how often) or duration (how long), the route or pathway of exposure (breathing, eating, drinking, or skin contact), and the multiplicity of exposure (combination of contaminants). Once a person is exposed, characteristics such as age, sex, nutritional status, genetic factors, lifestyle, and health status influence how the contaminant is absorbed, distributed, metabolized, and excreted. An environmental concentration alone will not cause an adverse health outcome—the likelihood that adverse health outcomes will actually occur depends on site-specific conditions, individual lifestyle, and genetic factors that affect the route, magnitude, and duration of actual exposure.

The five elements of an exposure pathway are:
1) a source of contamination,
2) an environmental medium,
3) a point of exposure,
4) a route of human exposure, and
5) a receptor population.

The source of contamination is where the chemical material was released. The environmental medium (e.g., groundwater, soil, surface water, air) transports the contaminants. The point of exposure is where people come in contact with contaminated media. The route of exposure (e.g., ingestion, inhalation, dermal contact) is how the contaminant enters the body. The people actually exposed comprise the receptor population.

As a first step in evaluating exposures, ATSDR health assessors screen the detected chemical concentrations found in a particular media (i.e., soil, air,

or drinking water) against health-based comparison values (CVs). ATSDR develops comparison values from available scientific literature concerning exposure, dose, and health effects. Comparison values represent chemical concentrations that are lower than levels at which, in experimental animals or in human epidemiological studies, no effects were observed. CVs are not thresholds for harmful health effects; rather, they reflect an estimated chemical media concentration that is not expected to cause harmful health effects. Chemical media concentrations at or below the comparison values can reasonably be considered safe. When a comparison value is exceeded, exposures will not necessarily produce undesirable health effects. This screening process enables ATSDR to eliminate safely from further consideration contaminants not of health concern and to further evaluate potentially harmful contaminants.

If the estimated chemical media concentrations at a site are above selected health-based comparison values, ATSDR proceeds with a more in-depth health effects evaluation. ATSDR scientists now determine whether the doses are large enough to trigger public health action to limit, eliminate, or study further any potentially harmful exposures. ATSDR scientists conduct a health effects evaluation by 1) examining site-specific exposure conditions about actual or likely exposures, 2) conducting a critical review of toxicological, medical, and epidemiological information in the scientific literature to ascertain the levels of significant human exposure, and 3) comparing an estimate of possible chemical doses to situations that have been associated with disease and injury. This health effects evaluation involves a balanced review and integration of site-related environmental data, site-specific exposure factors, and toxicological, medical, epidemiological, and health outcome data to help determine whether exposure to contaminant levels might result in harmful, observable health effects. By weighing scientific evidence and keeping site-specific doses in perspective, the health effects evaluation determines whether harmful effects might be possible in the exposed population.

ATSDR uses comparison values to identify those site-related hazardous substances that are not considered health threats.

Additionally, information about the evaluation process can be found in the ATSDR Public Health Assessment Guidance Manual at http://www.atsdr.cdc.gov/HAC/PHAManual/index.html or by contacting ATSDR at 1-800-CDC-INFO. ATSDR's Web-based public health assessment training course is available at http://www.atsdr.cdc.gov/training/pha_professional1/ (Overview 1 - Mission and Community), http://www.atsdr.cdc.gov/training/pha_professional2/ (Overview 2 - Exposure Pathways and Toxicologic Evaluation), and http://www.atsdr.cdc.gov/training/pha_professional3/ (Overview 3 - Evaluating Health Effects Data and Determining Conclusions and Recommendations).

Non-Cancer Health Effects Evaluation

The second major phase of the public health assessment process involves comparing the doses calculated for exposure to each individual chemical to established health guidelines, such as ATSDR's Minimal Risk Levels (MRLs) or USEPA's Reference Doses (RfDs), in order to assess whether adverse non-cancer health impacts from exposure are expected. These health guidelines, described in more detail in the following text, are chemical-specific values that are based on the available scientific literature and are considered protective of human health.

Minimal Risk Levels (MRL)

ATSDR has developed MRLs for contaminants commonly found at hazardous waste sites. The MRL is an estimate of daily exposure to a contaminant below which non-cancer, adverse health effects are unlikely to occur. MRLs are developed for different routes of exposure, such as inhalation and ingestion, and for lengths of exposure, such as acute (less than 14 days), intermediate (15-364 days), and chronic (365 days or greater). At this time, ATSDR has not developed MRLs for dermal exposure. A complete list of the available MRLs can be found at http://www.atsdr.cdc.gov/mrls/index.asp

References Doses (RfD)

The USEPA estimate of the daily, lifetime exposure of human populations to a possible hazard that is not likely to cause non-cancerous health effects. RfDs consider exposures to sensitive sub-populations, such as the elderly, children, and the developing fetus. RfDs have been developed using information from the available scientific literature and have been calculated for oral and inhalation exposures. A complete list of the available RfDs can be found at http://www.epa.gov/iris.

Non-carcinogenic effects, unlike carcinogenic effects, are believed to have a threshold, that is, a dose below which no adverse health effects will be observed. As a result, the current practice for deriving health guidelines (ATSDR MRLs and USEPA RfDs) is to identify, usually from animal toxicology experiments, a No Observed Adverse Effect Level (or NOAEL), which indicates that no effects are observed at a particular exposure level. This is the experimental exposure level in animals (and sometimes humans) at which no adverse toxic effect is observed. The NOAEL is then modified with an uncertainty (or safety) factor, which reflects the degree of uncertainty that exists when experimental animal data are extrapolated (or applied) to the general human population. The magnitude of the uncertainty factor considers various factors such as sensitive subpopulations (for example; children, pregnant women, and the elderly), extrapolation from animals to humans, and the completeness of available data. Thus, exposure doses at or below the established health guideline are not expected to result in adverse non-cancer health effects.

When site-specific exposure doses exceed MRLs and RfDs, it does not necessarily indicate that health effects will occur. Rather, it indicates that a more thorough look at the known toxicological values for the chemical and the site-related exposures is needed. The known toxicological values are doses derived from human and animal studies that are presented in the ATSDR Toxicological Profiles and USEPA's Integrated Risk Information System (IRIS). A direct comparison of site-specific exposure doses to study-derived exposures and doses found to cause adverse health effects is the basis for deciding whether health effects are likely to occur. This final step in evaluating non-cancer health effects includes an in-depth evaluation performed by comparing calculated exposure doses with known toxicological values, such as the no-observed adverse-effect-level (NOAEL) and the lowest-observed-adverse-effect-level (LOAEL) from studies used to derive the MRL or RfD for a chemical.

It is important to consider that the methodology used to develop these health guidelines does not provide any information on the presence, absence, or level of cancer risk. Therefore, a separate

cancer evaluation is necessary for chemicals detected at the site. A more detailed discussion of the evaluation of cancer risks is presented in the following section.

Cancer Risk

As previously stated, cancer risk calculated for chemical exposures occurring during adulthood and childhood are combined and expressed as the risk of an individual developing cancer over his or her lifetime. An increased excess lifetime cancer risk is not a specific estimate of expected cancers. Rather, it is a mathematical estimate of the increase in the probability that a person may develop cancer sometime during his or her lifetime following exposure to a particular chemical. Therefore, the cancer risk calculation incorporates the equations and parameters (including the exposure duration and frequency) used to calculate the dose estimates, but the estimated value is divided by 25,550 days (or the averaging time), which is equal to a lifetime of exposure (70 years) for 365 days/year. The results of these mathematical estimates allow health officials to make certain health-protective decisions about chemicals present at a hazardous waste site, but do not indicate the actual number of cancer cases that may occur in a population following exposure.

There are varying suggestions among the scientific community regarding an acceptable excess lifetime cancer risk, due to the uncertainties regarding the mechanism of cancer. An important consideration when determining cancer risk estimates is that the risk calculations incorporate several very conservative assumptions that are expected to overestimate actual exposure scenarios. The USEPA calculates a Cancer Slope Factor (CSF) that assumes that high-dose animal data can be used to estimate the risk for low dose exposures in humans. As previously stated, the method also assumes that there is no safe level for exposure. Lastly, the method computes the 95% upper bound for the risk, rather than the average risk, suggesting that the cancer risk is actually lower, perhaps by several orders of magnitude. In summary, cancer estimation is a very conservative approach used to help make decisions about the exposures occurring at the site, but does not provide information on actual cases of cancer in a community nor can it be used to determine who might develop cancer.

In general, the target risk recommendations of many scientists, as well as ATSDR and USEPA, have been in the risk range of 1 in 1 million to 1 in 10,000 (as referred to as 1×10^{-6} to 1×10^{-4}) excess cancer cases.

- An increased lifetime cancer risk of 1 extra cancer case in 1 million people exposed (or 1×10^{-6}) is generally considered an insignificant increase in cancer risk. This risk estimate may also be expressed as having a 99.999% chance of not developing cancer from the specific chemical exposures.
- An increased lifetime cancer risk of 1 extra cancer case in 10,000 people exposed (or 1×10^{-4}) is generally considered a low increase in cancer risk. This risk estimate may also be expressed as having a 99.99% chance of not developing cancer from the specific chemical exposures.

As the final step in evaluating cancer risk, ATSDR also employs a qualitative approach in evaluating all relevant data. The actual environmental exposures have been given careful and thorough consideration in evaluating the assumptions and variables relating to both toxicity and exposure. A complete review of the toxicological data regarding the doses associated with the

production of cancer and the site-specific doses is an important element in determining the likelihood of exposed individuals being at a greater risk for cancer.

Discussion

Environmental Sampling

Environmental sampling has inherent errors associated with sample collections, laboratory preparation, and methods of analysis. In some cases this error can be substantial ranging from a minimum value of approximately 30% to over 100% of the measured value (7). In the case of the chemicals detected at this site, it appears that only a single sample was collected at any one time which would add to the error of each sample results.

Many of these chemicals do not have a CV either from ATSDR or USEPA. Furthermore, some chemical determinations were in excess of their respective CV by very small amounts, in most cases less than 10% of the CV.

During the course of the site investigations carried by the interested parties, a full range of chemical analyses was performed on soils (surface and subsurface), groundwater, surface water, and sediments collected from the environs of the site. The chemicals sampled during these activities included volatile and semivolatile organic compounds, metals, pesticides, and polychlorinated biphenyls, also called PCBs. Table 3 gives the number of chemicals in each category for which analyses were performed and the number of chemicals that exceeded either an ATSDR, USEPA, or other health based screen value.

Of the 264 separate chemicals for which analyses were performed, 62 chemicals were detected in multiple media over a screening value used by ATSDR. These screening values were the ATSDR environmental media comparison values, the USEPA drinking water standards, or USEPA soil screening values. Also, these chemicals were screened prior to the selection of exposure pathways of concern.

Table 3. Environmental sampling parameters and total chemicals detected

Chemical family and number of different chemicals sampled	*Subsurface soils; number of detections*	*Surface soils; number of detections*	*Sediment; number of detections*	*Groundwater; number of detections*	*Surface water; number of detections*
Volatile organic compounds (VOC); 135	6	0	0	4	10
Semi-volatile organic compounds (sVOC); 72	23	14	10	0	29
Metals; 27	17	14	13	15	22
Pesticides; 22	0	9	8	0	4
Polychlorinated biphenyls (PCB); 8	8	5	3	0	2

Exposure Pathway Evaluations

During the ATSDR site visit previously discussed in this document, we did not observe any signs of unlawful entry into the site. Other than the uncontrolled entry from the north along the unpaved dirt drive which passes through private property, the site is not accessible. Therefore, we are eliminating all current and future pathways whereby people may come into contact with these contaminants that are directly on the site property.

There is no surface water on the site which would be available for public consumption. All surface water samples collected during the sampling events were collected from the Back River. Similarly, groundwater usage through residential well use is eliminated as its flow is toward the Back River. For their water usage, nearby residents are supplied with public water.

The site is heavily vegetated so the surface soils are covered with native grasses, shrubs, trees, and other plant life. Without any uncovered soils, there will be no dusts generated on the site that might blow into residential areas. Furthermore, no signs of trespass were observed so inadvertent soil ingestion is not a pathway of concern.

Based on this pathway analysis, the only pathway whereby members of the public may come into contact with site-related contaminants is via the Back River. The Back River and its watershed is a tidal estuary. The river is used for recreation, storm water run-off, and run-off from surface features. The river contains various types of waste products (8) and has been cited by the state of Maryland for chlordane contamination (9) which was not detected at the Sauer Dump Landfill Site. Evaluation of surface water samples is discussed in the following section.

Evaluation of Environmental Surface Water Samples

ATSDR evaluated the contaminants by comparing 3 measures: the maximum detected concentration, the average concentration, and the geometric mean of each contaminant listed in the environmental data reports. The geometric mean gives an estimate of the central tendency of the measured values; that is, it would indicate where most of the samples are centered, similar to the distribution of the samples. We also evaluated the ratio of these measures to the CV where a ratio of 1.0 would indicate that the measured value was the same as the CV. As previously discussed, the measurement error could be quite large so ATSDR used these ratios to set a lower level whereby the CV would have to be exceeded before a contaminant would be considered for additional evaluation prior to possible pathway elimination.

As there is no surface water specifically on the site, water samples were collected within the Back River. Numerous samples were collected by the USEPA or their contractors as well as the state or other concerned parties. The majority of laboratory results of these sampling efforts were assigned the data qualifier "U". Qualifiers are used as quality control and quality assurance indicators with the "U" indicating that the detected value was less than specified in the sampling contract documents or was not detected. Also, several samples were either qualified with "R" meaning they failed the quality assurance program, "B" indicating they were in present in the control samples or a "J" meaning they were laboratory estimations.

All the reported surface water sample results were supplied to ATSDR. Only those samples in which the reported concentrations were not qualified or those marked with a "J" qualifier were used for evaluation. That is, samples were rejected from our evaluation if they were qualified with a "U" (not detected or the sample concentration was below a valid detection limit), a "B" (present in a laboratory or field control sample), or a "R" (failed the laboratory's quality assurance). Using this process, only metals in the surface water met the quality control and assurance protocols. ATSDR next established the following parameters: maximum reported concentration; minimum concentration; average concentration with its standard deviation and; the geometric mean which gives an estimate of the distribution profile of the samples. For the evaluation of the samples, ATSDR used both the average concentrations and the geometric mean concentrations. Mathematical means can be used to characterize the central tendency of a set of numbers. According to the Buzzards Bay National Estuary Program, very low or very high values can artificially skew the average concentrations. Geometric means can be used to smooth or dampen the very low or high values and bring the data into a more useable format for statistical evaluations[2].

Once these parameters were calculated, the average concentrations and the geometric mean concentrations were evaluated with their respective comparison values. The results of this evaluation are shown in Table 4 for total metals in surface water and Table **5** for dissolved metals in surface water.

[2] http://www.buzzardsbay.org/geomean.htm (last accessed on August 6, 2012).

Table 4. Total metals in surface water

Metal	Maximum concentration	Minimum concentration	Average concentration	Geometric Mean	Comparison Value		CV Comparison	
	mg/L*	mg/L	mg/L		mg/L†	Source‡	Average Concentration	Geometric Mean Concentration
Aluminum	94.800	0.560	23.06	6.56	10	I	Exceeds	Below
Arsenic	0.069	0.013	0.03	0.02	0.00002	CREG	Exceeds	Exceeds
Barium	752.000	0.283	84.22	1.49	2	I	Exceeds	Below
Cadmium	0.052	0.005	0.03	0.02	0.001	I	Exceeds	Exceeds
Calcium	364.000	27.100	110.37	75.53	ND§	ND	ND	ND
Chromium	0.802	0.015	0.32	0.15	0.001	MCL	Exceeds	Exceeds
Cobalt	0.375	0.17	0.27	0.25	1	II	Below	Below
Copper	1.14	0.025	0.48	0.26	0.001	II	Exceeds	Exceeds
Iron	254.000	1.70	54.82	14.63	26	EPA	Exceeds	Below
Lead	2.760	0.006	0.57	0.10	0.015	AL	Exceeds	Exceeds
Magnesium	159.000	8.500	61.51	39.09	ND	ND	ND	ND
Manganese	13.24	0.119	2.11	0.90	0.5	RMEG	Exceeds	Exceeds
Nickel	1.110	0.198	0.53	0.43	0.2	RMEG	Exceeds	Exceeds
Potassium	54.500	3.400	25.43	20.25	ND	ND	ND	ND
Sodium	760.000	9.770	253.55	117.38	ND	ND	ND	ND
Vanadium	0.869	0.054	0.30	0.21	0.1	II	Exceeds	Exceeds

*mg/L – milligram per liter
†µg/L – microgram per liter
‡ RMEG – reference media evaluation guide; EMEG – environmental media evaluation guide; CREG – cancer risk evaluation guide; MCL – maximum contaminant level; AL -- Action Level requiring control by the water system; I, II, or III – hierarchy level for exposure evaluation, I being highest level; EPA – risk based concentrations established and used by USEPA Region 3 and; LTHA – long term health advisory.
§Not derived

Table 5. Dissolved metals in surface waters

Metal	Maximum concentration	Minimum concentration	Average concentration	Geometric Mean	Comparison Value		CV Comparison	
	mg/L*	mg/L	mg/L		mg/L†	Source‡	Average Concentration	Geometric Mean Concentration
Cadmium	0.001	0.001	0.001	0.001	0.001	I	Below	Below
Calcium	278	5.56	121.9	79.01	ND[§]	ND	ND	ND
Cobalt	0.002	0.002	0.002	0.002	1	II	Below	Below
Magnesium	132	10	85.13	70	ND	ND	ND	ND
Manganese	0.87	0.661	0.77	0.76	0.5	RMEG	Exceeds	Exceeds
Potassium	157	3.5	69	47.8	ND	ND	ND	ND
Sodium	1120	15.2	553.5	306	ND	ND	ND	ND

*mg/L – milligram per liter
†µg/L – microgram per liter
‡ RMEG – reference media evaluation guide; EMEG – environmental media evaluation guide; CREG – cancer risk evaluation guide; MCL – maximum contaminant level; I, II, or III – hierarchy level for exposure evaluation, I being highest level; EPA – risk based concentrations established and used by USEPA Region 3 and; LTHA – long term health advisory
§Not derived.

Evaluation of Contamination

The ATSDR evaluation of site specific contaminants involves both a screening process as well as an evaluation of the selected contaminants exceeding the screening criteria. The second step also includes a selection of site specific exposure factors and their use in calculations. The calculations result in a health comparison that ATSDR uses to determine the potential impact on public health. These processes are described in the following paragraphs.

Step 1 – Comparison Values and the Screening Process

To evaluate the available data, ATSDR used comparison values (CVs) to determine which chemicals to examine more closely. CVs are the contaminant concentrations found in a specific media (for example: air, soil, or water) and are used to select contaminants for further evaluation. CVs incorporate assumptions of daily exposure to the chemical and a standard amount of air, water, or soil that someone may inhale or ingest each day. CVs are generated to be conservative and non-site specific. These values are used only to screen out chemicals that do not need further evaluation; CVs are not intended as environmental clean-up levels or to indicate that health effects occur at concentrations that exceed these values.

When no comparison values are available, the contaminant is generally retained for further evaluation. Exceptions exist; however, essential nutrients (e.g., calcium, iron, magnesium) are typically not harmful under most environmental exposure scenarios and may not necessarily be retained for further analysis.

CVs can be based on either carcinogenic (cancer-causing) or non-carcinogenic effects. Cancer-based comparison values are calculated from the U.S. Environmental Protection Agency's (EPA) oral cancer slope factor (CSF) or inhalation risk unit. CVs based on cancerous effects account for a lifetime exposure (70 years) with an unacceptable theoretical excess lifetime cancer risk of 1 new case per 1 million exposed people. Non-cancer values are calculated from ATSDR's Minimal Risk Levels (MRLs), EPA's Reference Doses (RfDs), or EPA's Reference Concentrations (RfCs). When a cancer and non-cancer CV exists for the same chemical, the lower of these values is used in the comparison for conservatism.

Step 2a – Evaluation of Public Health Implications

The next step in the evaluation process is to take those contaminants that are above their respective CVs and further identify which chemicals and exposure situations are likely to be a health hazard. Separate child and adult exposure doses (or the amount of a contaminant that gets into a person's body) are calculated for site-specific exposure scenarios, using assumptions regarding an individual's likelihood of accessing the site and contacting contamination. A brief explanation of the calculation of estimated exposure doses is presented below. Calculated doses are reported in units of milligrams per kilograms per day (mg/kg/day). Separate calculations have been performed to account for non-cancer and cancer health effects, if applicable, for each chemical based on the health impacts reported for each chemical. Some chemicals are associated

with non-cancer effects while the scientific literature many indicate that cancer-related health impacts are not expected from exposure.

Step 2b – Exposure Rate Factors and Calculations

When chemical concentrations at the site exceed the established CVs, it is necessary for a more thorough evaluation of the chemical to be conducted. In order to evaluate the potential for human exposure to contaminants present at the site and potential health effects from site-specific activities, ATSDR estimates human exposure to the site contaminant from different environmental media by calculating exposures and the estimated chemical dose.

A discussion of the calculations and assumptions used in this assessment is presented below. The equations are based on USEPA risk methodologies or ATSDR's Public Health Guidance Manual (2005), unless otherwise specified. Assumptions used were based on default values, USEPA's Exposure Factors Handbook (2011) or professional (site-specific) judgment. When available, site-specific information is used to estimate exposures.

The ATSDR review of viable pathways of exposure suggested the only viable pathway of exposure was use of the Back River and that the only contaminants that passed the quality assurance tests and exceeded ATSDR screening values (CV) were metals. Therefore, only incidental ingestion is the pathway of concern. For the ingestion of materials in water, the following equation is used:

The exposure formula used for the incidental ingestion of chemicals in water is:

$$Exposure\ Rate\ (D) = \frac{C \times IR \times ET \times EF \times ED}{BW \times AT}$$

Where:
D *= exposure dose in milligrams per kilogram per day (mg/kg/day)*
C *= concentration of contaminant in water in milligrams per liter (mg/L)*
IR *= ingestion rate in liters per day (L/day)*
ET = exposure time (hours/event)
EF *= exposure frequency (days/year)*
ED *= exposure duration (years)*
BW *= body weight (kg)*
AT *= averaging time, days (equal to ED for non-carcinogens and 70 year lifetime for carcinogens, i.e., 70 years x 365 days/year)*

Note: In the intake equation, averaging time (AT) for exposure to non-carcinogenic compounds is always equal to D; whereas, for carcinogens a 70 year AT is still used in order to compare to EPA's cancer slope factors typically based on that value. Furthermore, the incidental ingestion pathway assumes that children under 18 years of age and adults would accidentally swallow 50 milliliters or 25 milliliters of water per hour, respectively, while swimming, wading or recreating in the Back River. These values were derived from recommendations listed in the USEPA Exposure Factor Handbook (10). In terms of exposure time and frequency, ATSDR conservatively assumed an adult and child resident would recreate in these waters for 4 hours per

day only during the summer months when the water temperature exceeded 70^{o} F as reported by the National Oceanographic Data Center[3], 3 days per week (or 55 days/year) for 30 years and 6 years, respectively. For average body weight, 75 kg and 20 kg were used for adults and children, respectively. For the purposes of this assessment, the summer months are considered to be June, July, August, and September when the water temperature historically is greater than 70^{o} F.

The results of this evaluation are shown in Table 6 for adults and Table 7 for children. In neither class of individuals did the concentration of the contaminants incidentally ingested during Back River water activities exceed any ATSDR public health guideline nor pose a health hazard. That is, using the river for various activities is not considered to be a public health concern for those contaminants associated with the Sauer Landfill Dump Site.

Community Health Concerns

ATSDR has not received any health concerns from residents who live around the Sauer Dump Landfill Superfund Site. However, ATSDR was able to find several newspaper articles in which local residents expressed concerns related to cleanup of the site. In the April 28, 2010 issue of the Dundalk Eagle, the president of the Wells-McComas Citizens Improvement Association spoke in favor of a more extensive cleanup at a meeting prior to the site being listed on the National Priorities List. At a meeting reported in the March 23, 2011, edition of the same newspaper, a local activist commented on the proposed NPL listing, thinking it was a downgrade of the proposed site cleanup. He stated that the "communities at large chose to have the site completely cleaned."

[3] Water temperatures were obtained from the National Oceanographic Data Center web site located at http://www.nodc.noaa.gov/dsdt/cwtg/catl.html. Last accessed August 6, 2012.

Table 6 Summary of exposure factors and doses for incidental ingestion of Back River surface water near the Sauer Dump Landfill Site

Adults								
Metal	Average concentration	Geometric Mean	**Daily Ingestion Rate**	**Exposure Frequency**	**Exposure Duration**	**Body Weight**	**Exposure (average)**	Health guideline
	mg/L	mg/L	Liters per day	Days per year	Years	Kilograms (kg)	**mg/kg/day**	**mg/kg/day**
Aluminum	23.06	6.56	0.025	55 (based on 17.5 weeks with water temperature above 70^{o} F, 3 days per week	30	75	1.16E-03	1.00E+00
Arsenic	0.03	0.02					1.51E-06	3.00E-04
Barium	84.22	1.49					4.23E-03	2.00E-01
Cadmium	0.03	0.02					1.51E-06	1.00E-04
Chromium	0.32	0.15					1.61E-05	1.00E-03
Copper	0.48	0.26					2.41E-05	1.00E-02
Iron	54.82	14.63					2.75E-03	7.00E-01
Lead	0.57	0.1					2.86E-05	4.2E-04*
Manganese	2.11	0.9					1.06E-04	5.00E-02
Manganese (dissolved)	0.77	0.766					3.86E-05	5.00E-02
Nickel	0.53	0.43					2.66E-05	2.00E-02
Vanadium	0.3	0.21					1.51E-05	1.00E-02

*Based on USEPA action level of 0.015 mg per liter and intake of 2 liters per day for a 70 kilogram individual; however, this is not a health based guideline.

Table 7 Summary of exposure factors and doses for incidental ingestion of Back River surface water near the Sauer Dump Landfill Site

children								
Metal	Average concentration	Geometric Mean	**Daily Ingestion Rate**	**Exposure Frequency**	**Exposure Duration**	**Body Weight**	**Exposure (average)**	Health guideline
	mg/L	mg/L	Liters per day	Days per year	Years	Kilograms (kg)	**mg/kg/day**	**mg/kg/day**
Aluminum	23.06	6.56	0.05	55 (based on 3 days per week when water temperature is above 70^{o} F.	6	20	8.68E-03	1.00E+00
Arsenic	0.03	0.02					1.13E-05	3.00E-04
Barium	84.22	1.49					3.17E-02	2.00E-01
Cadmium	0.03	0.02					1.13E-05	1.00E-04
Chromium	0.32	0.15					1.20E-04	1.00E-03
Copper	0.48	0.26					1.81E-04	1.00E-02
Iron	54.82	14.63					2.06E-02	7.00E-01
Lead	0.57	0.1					2.15E-04	1.5E-03*
Manganese	2.11	0.9					7.94E-04	5.00E-02
Manganese (dissolved)	0.77	0.766					2.90E-04	5.00E-02
Nickel	0.53	0.43					2.00E-4	2.00E-02
Vanadium	0.3	0.21					1.13E-4	1.00E-02

*Based on USEPA action level of 0.015 mg per liter and intake of 2 liters per day for a 20 kilogram individual; however, this is not a health based guideline.

Conclusions

A pathway analysis and evaluation of detected chemical contaminants associated with the Sauer Dump Landfill Superfund Site was performed by ATSDR. This activity which included a visit to the site by ATSDR staff, USEPA representatives, and representatives of one the land owners, identified areas of contamination and observed existing site conditions. ATSDR also received sampling data from the USEPA which included data collected by the state of Maryland and data collected by the PRPs.

After reviewing these data and comparing the data to the appropriate comparison values, ATSDR performed a pathway analysis which evaluates the fate and transport of contaminants that might come in contact with people who live around the site.

Based on ATSDR's analysis, the only potential pathway of exposure exists for this site is the use of surface water for recreational purposes. The only contaminants present above detection levels were metals and those were below ATSDR Comparison Values and levels established by the USEPA. Therefore, ATSDR concludes that people may accidentally drink contaminated surface water while boating and swimming on the Black River near the Sauer Landfill Dump Site. We don't expect that these accidental exposures would harm people's health. ATSDR classifies this site as a No Apparent Public Health Hazard.

The reason for this classification is that individuals will spend a limited time in the surface water and the ingestion of the potentially contaminated water is well below levels that are known to cause adverse health effects.

Recommendations

ATSDR recommends that the USEPA continue its efforts to cleanup the site while taking the appropriate measures to ensure there is no spread of contamination to those areas where people live. Furthermore, the recommendation is made that efforts are also taken to reduce the chance of contaminant migration toward the river.

An additional recommendation is made that during the present and future activities at this site, the vegetative cover should be maintained to prevent resuspension of contaminated soils. If the vegetative cover needs to be removed during remedial actions, appropriate means should be used to prevent the off-site migration of dusts, vapors, and other aerosols.

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Appendix A.

ATSDR Glossary of Environmental Health Terms

The Agency for Toxic Substances and Disease Registry (ATSDR) is a federal public health agency with headquarters in Atlanta, Georgia, and 10 regional offices in the United States. ATSDR's mission is to serve the public by using the best science, taking responsive public health actions, and providing trusted health information to prevent harmful exposures and diseases related to toxic substances. ATSDR is not a regulatory agency, unlike the U.S. Environmental Protection Agency (EPA), which is the federal agency that develops and enforces environmental laws to protect the environment and human health.
This glossary defines words used by ATSDR in communications with the public. It is not a complete dictionary of environmental health terms. Not all the terms in this glossary were used in this document. The terms are for informational purposes.

If you have questions or comments, call ATSDR's toll-free telephone number, 1-888-42-ATSDR (1-888-422-8737).

Absorption

The process of taking in. For a person or animal, absorption is the process of a substance getting into the body through the eyes, skin, stomach, intestines, or lungs.

Acute

Occurring over a short time [compare with **chronic**].

Acute exposure

Contact with a substance that occurs once or for only a short time (up to 14 days) [compare with **intermediate duration exposure** and **chronic exposure]**.

Additive effect

A biologic response to exposure to multiple substances that equals the sum of responses of all the individual substances added together [compare with **antagonistic effect** and **synergistic effect]**.

Adverse health effect

A change in body function or cell structure that might lead to disease or health problems.

Aerobic

Requiring oxygen [compare with **anaerobic**].

Ambient

Surrounding (for example, *ambient* air).

Anaerobic

Requiring the absence of oxygen [compare with **aerobic**].

Analyte

A substance measured in the laboratory. A chemical for which a sample (such as water, air, or blood) is tested in a laboratory. For example, if the analyte is mercury, the laboratory test will determine the amount of mercury in the sample.

Analytic epidemiologic study

A study that evaluates the association between exposure to hazardous substances and disease by testing scientific hypotheses.

Antagonistic effect

A biologic response to exposure to multiple substances that is **less** than would be expected if

the known effects of the individual substances were added together [compare with **additive effect** and **synergistic effect**].

Background level

An average or expected amount of a substance or radioactive material in a specific environment, or typical amounts of substances that occur naturally in an environment.

Biodegradation

Decomposition or breakdown of a substance through the action of microorganisms (such as bacteria or fungi) or other natural physical processes (such as sunlight).

Biologic indicators of exposure study

A study that uses (a) **biomedical testing** or (b) the measurement of a substance [an **analyte**], its **metabolite**, or another marker of exposure in human body fluids or tissues to confirm human exposure to a hazardous substance [also see **exposure investigation**].

Biologic monitoring

Measuring hazardous substances in biologic materials (such as blood, hair, urine, or breath) to determine whether exposure has occurred. A blood test for lead is an example of biologic monitoring.

Biologic uptake

The transfer of substances from the environment to plants, animals, and humans.

Biomedical testing

Testing of persons to find out whether a change in a body function might have occurred because of exposure to a hazardous substance.

Biota

Plants and animals in an environment. Some of these plants and animals might be sources of food, clothing, or medicines for people.

Body burden

The total amount of a substance in the body. Some substances build up in the body because they are stored in fat or bone or because they leave the body very slowly.

CAP

See **Community Assistance Panel**.

Cancer

Any one of a group of diseases that occurs when cells in the body become abnormal and grow or multiply out of control.

Cancer risk

A theoretical risk for getting cancer if exposed to a substance every day for 70 years (a lifetime exposure). The true risk might be lower.

Carcinogen

A substance that causes cancer.

Case study

A medical or epidemiologic evaluation of one person or a small group of people to gather information about specific health conditions and past exposures.

Case-control study

A study that compares exposures of people who have a disease or condition (cases) with people who do not have the disease or condition (controls). Exposures that are more common among the cases may be considered as possible risk factors for the disease.

CAS registry number

A unique number assigned to a substance or mixture by the American Chemical Society Abstracts Service.

Central nervous system

The part of the nervous system that consists of the brain and the spinal cord.

CERCLA [see **Comprehensive Environmental Response, Compensation, and Liability Act of 1980**]

Chronic

Occurring over a long time (more than 1 year) [compare with **acute**].

Chronic exposure

Contact with a substance that occurs over a long time (more than 1 year) [compare with **acute exposure** and **intermediate duration exposure**].

Cluster investigation

A review of an unusual number, real or perceived, of health events (for example, reports of cancer) grouped together in time and location. Cluster investigations are designed to confirm case reports; determine whether they represent an unusual disease occurrence; and, if possible, explore possible causes and contributing environmental factors.

Community Assistance Panel (CAP)

A group of people, from a community and from health and environmental agencies, who work with ATSDR to resolve issues and problems related to hazardous substances in the community. CAP members work with ATSDR to gather and review community health concerns, provide information on how people might have been or might now be exposed to hazardous substances, and inform ATSDR on ways to involve the community in its activities.

Comparison value (CV)

Calculated concentration of a substance in air, water, food, or soil that is unlikely to cause harmful (adverse) health effects in exposed people. The CV is used as a screening level during the public health assessment process. Substances found in amounts greater than their CVs might be selected for further evaluation in the public health assessment process.

Completed exposure pathway [see **exposure pathway**].

Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA)

CERCLA, also known as **Superfund**, is the federal law that concerns the removal or cleanup of hazardous substances in the environment and at hazardous waste sites. ATSDR, which was created by CERCLA, is responsible for assessing health issues and supporting public health activities related to hazardous waste sites or other environmental releases of hazardous substances.

Concentration

The amount of a substance present in a certain amount of soil, water, air, food, blood, hair, urine, breath, or any other media.

Contaminant

A substance that is either present in an environment where it does not belong or is present at levels that might cause harmful (adverse) health effects.

Delayed health effect

A disease or injury that happens as a result of exposures that might have occurred in the past.

Dermal

Referring to the skin. For example, dermal absorption means passing through the skin.

Dermal contact

Contact with (touching) the skin [see **route of exposure**].

Descriptive epidemiology

The study of the amount and distribution of a disease in a specified population by person, place, and time.

Detection limit

The lowest concentration of a chemical that can reliably be distinguished from a zero concentration.

Disease prevention

Measures used to prevent a disease or reduce its severity.

Disease registry

A system of ongoing registration of all cases of a particular disease or health condition in a defined population.

DOD

United States Department of Defense.

DOE

United States Department of Energy.

Dose (for chemicals that are not radioactive)

The amount of a substance to which a person is exposed over some time period. Dose is a measurement of exposure. Dose is often expressed as milligram (amount) per kilogram (a measure of body weight) per day (a measure of time) when people eat or drink contaminated water, food, or soil. In general, the greater the dose, the greater the likelihood of an effect. An Aexposure dose@ is how much of a substance is encountered in the environment. An Aabsorbed dose@ is the amount of a substance that actually got into the body through the eyes, skin, stomach, intestines, or lungs.

Dose (for radioactive chemicals)

The radiation dose is the amount of energy from radiation that is actually absorbed by the body. This is not the same as measurements of the amount of radiation in the environment.

Dose-response relationship

The relationship between the amount of exposure [**dose**] to a substance and the resulting changes in body function or health (response).

Environmental media

Soil, water, air, **biota** (plants and animals), or any other parts of the environment that can contain contaminants.

Environmental media and transport mechanism

Environmental media include water, air, soil, and **biota** (plants and animals). Transport mechanisms move contaminants from the source to points where human exposure can occur. The **environmental media and transport mechanism** is the second part of an **exposure pathway**.

EPA

United States Environmental Protection Agency.

Epidemiologic surveillance

The ongoing, systematic collection, analysis, and interpretation of health data. This activity also involves timely dissemination of the data and use for public health programs.

Epidemiology

The study of the distribution and determinants of disease or health status in a population; the study of the occurrence and causes of health effects in humans.

Exposure

Contact with a substance by swallowing, breathing, or touching the skin or eyes. Exposure may be short-term [**acute exposure**], of intermediate duration, or long-term [**chronic exposure**].

Exposure assessment

The process of finding out how people come into contact with a hazardous substance, how often and for how long they are in contact with the substance, and how much of the substance they are in contact with.

Exposure-dose reconstruction

A method of estimating the amount of people=s past exposure to hazardous substances. Computer and approximation methods are used when past information is limited, not available, or missing.

Exposure investigation

The collection and analysis of site-specific information and biologic tests (when appropriate) to determine whether people have been exposed to hazardous substances.

Exposure pathway

The route a substance takes from its source (where it began) to its end point (where it ends), and how people can come into contact with (or get exposed to) it. An exposure pathway has five parts: a **source of contamination** (such as an abandoned business); an **environmental media and transport mechanism** (such as movement through groundwater); a **point of exposure** (such as a private well); a **route of exposure** (eating, drinking, breathing, or touching); and a **receptor population** (people potentially or actually exposed). When all five parts are present, the exposure pathway is termed a **completed exposure pathway**.

Exposure registry

A system of ongoing followup of people who have had documented environmental exposures.

Feasibility study

A study by EPA to determine the best way to clean up environmental contamination. A number of factors are considered, including health risk, costs, and what methods will work well.

Geographic information system (GIS)

A mapping system that uses computers to collect, store, manipulate, analyze, and display data. For example, GIS can show the concentration of a contaminant within a community in relation to points of reference such as streets and homes.

Grand rounds

Training sessions for physicians and other health care providers about health topics.

Groundwater

Water beneath the earth=s surface in the spaces between soil particles and between rock surfaces [compare with **surface water**].

Half-life (t_2)

The time it takes for half the original amount of a substance to disappear. In the environment, the half-life is the time it takes for half the original amount of a substance to disappear when it is changed to another chemical by bacteria, fungi, sunlight, or other chemical processes. In the human body, the half-life is the time it takes for half the original amount of the substance to disappear, either by being changed to another substance or by leaving the body. In the case of radioactive material, the half life is the amount of time necessary for one half the initial number of radioactive atoms to change or transform into another atom (that is normally not radioactive). After two half lives, 25% of the original number of radioactive atoms remain.

Hazard

A source of potential harm from past, current, or future exposures.

Hazardous Substance Release and Health Effects Database (HazDat)

The scientific and administrative database system developed by ATSDR to manage data collection, retrieval, and analysis of site-specific information on hazardous substances, community health concerns, and public health activities.

Hazardous waste

Potentially harmful substances that have been released or discarded into the environment.

Health consultation

A review of available information or collection of new data to respond to a specific health question or request for information about a potential environmental hazard. Health consultations are focused on a specific exposure issue. Health consultations are therefore more limited than a public health assessment, which reviews the exposure potential of each pathway and chemical [compare with **public health assessment**].

Health education

Programs designed with a community to help it know about health risks and how to reduce these risks.

Health investigation

The collection and evaluation of information about the health of community residents. This information is used to describe or count the occurrence of a disease, symptom, or clinical measure and to estimate the possible association between the occurrence and exposure to hazardous substances.

Health promotion

The process of enabling people to increase control over, and to improve, their health.

Health statistics review

The analysis of existing health information (i.e., from death certificates, birth defects registries, and cancer registries) to determine if there is excess disease in a specific population, geographic area, and time period. A health statistics review is a descriptive epidemiologic study.

Indeterminate public health hazard

The category used in ATSDR=s public health assessment documents when a professional judgment about the level of health hazard cannot be made because information critical to such a decision is lacking.

Incidence

The number of new cases of disease in a defined population over a specific time period [contrast with **prevalence**].

Ingestion

The act of swallowing something through eating, drinking, or mouthing objects. A hazardous substance can enter the body this way [see **route of exposure**].

Inhalation

The act of breathing. A hazardous substance can enter the body this way [see **route of exposure**].

Intermediate duration exposure

Contact with a substance that occurs for more than 14 days and less than a year [compare with **acute exposure** and **chronic exposure**].

In vitro

In an artificial environment outside a living organism or body. For example, some toxicity testing is done on cell cultures or slices of tissue grown in the laboratory, rather than on a living animal [compare with **in vivo**].

In vivo

Within a living organism or body. For example, some toxicity testing is done on whole animals, such as rats or mice [compare with **in vitro**].

Lowest-observed-adverse-effect level (LOAEL)

The lowest tested dose of a substance that has been reported to cause harmful (adverse) health effects in people or animals.

Medical monitoring

A set of medical tests and physical exams specifically designed to evaluate whether an individual=s exposure could negatively affect that person=s health.

Metabolism

The conversion or breakdown of a substance from one form to another by a living organism.

Metabolite

Any product of **metabolism**.

mg/kg

Milligram per kilogram.

mg/cm^2

Milligram per square centimeter (of a surface).

mg/m^3

Milligram per cubic meter; a measure of the concentration of a chemical in a known volume (a cubic meter) of air, soil, or water.

Migration

Moving from one location to another.

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 [see **reference dose**].

Morbidity

State of being ill or diseased. Morbidity is the occurrence of a disease or condition that alters health and quality of life.

Mortality

Death. Usually the cause (a specific disease, condition, or injury) is stated.

Mutagen

A substance that causes **mutations** (genetic damage).

Mutation

A change (damage) to the DNA, genes, or chromosomes of living organisms.

National Priorities List for Uncontrolled Hazardous Waste Sites

(National Priorities List or **NPL)**

EPA=s list of the most serious uncontrolled or abandoned hazardous waste sites in the United States. The NPL is updated on a regular basis.

No apparent public health hazard

A category used in ATSDR=s public health assessments for sites where human exposure to contaminated media might be occurring, might have occurred in the past, or might occur in the future, but where the exposure is not expected to cause any harmful health effects.

No-observed-adverse-effect level (NOAEL)

The highest tested dose of a substance that has been reported to have no harmful (adverse) health effects on people or animals.

No public health hazard

A category used in ATSDR=s public health assessment documents for sites where people have never and will never come into contact with harmful amounts of site-related substances.

NPL [see **National Priorities List for Uncontrolled Hazardous Waste Sites]**

Physiologically based pharmacokinetic model (PBPK model)

A computer model that describes what happens to a chemical in the body. This model describes how the chemical gets into the body, where it goes in the body, how it is changed by the body, and how it leaves the body.

Pica

A craving to eat nonfood items, such as dirt, paint chips, and clay. Some children exhibit pica-related behavior.

Plume

A volume of a substance that moves from its source to places farther away from the source. Plumes can be described by the volume of air or water they occupy and the direction they move. For example, a plume can be a column of smoke from a chimney or a substance moving with groundwater.

Point of exposure

The place where someone can come into contact with a substance present in the environment [see **exposure pathway**].

Population

A group or number of people living within a specified area or sharing similar characteristics (such as occupation or age).

Potentially responsible party (PRP)

A company, government, or person legally responsible for cleaning up the pollution at a hazardous waste site under Superfund. There may be more than one PRP for a particular site.

ppb

Parts per billion.

ppm

Parts per million.

Prevalence

The number of existing disease cases in a defined population during a specific time period [contrast with **incidence**].

Prevalence survey

The measure of the current level of disease(s) or symptoms and exposures through a questionnaire that collects self-reported information from a defined population.

Prevention

Actions that reduce exposure or other risks, keep people from getting sick, or keep disease from getting worse.

Public comment period

An opportunity for the public to comment on agency findings or proposed activities contained in draft reports or documents. The public comment period is a limited time period during which comments will be accepted.

Public availability session

An informal, drop-by meeting at which community members can meet one-on-one with ATSDR staff members to discuss health and site-related concerns.

Public health action

A list of steps to protect public health.

Public health advisory

A statement made by ATSDR to EPA or a state regulatory agency that a release of hazardous substances poses an immediate threat to human health. The advisory includes recommended measures to reduce exposure and reduce the threat to human health.

Public health assessment (PHA)

An ATSDR document that examines hazardous substances, health outcomes, and community concerns at a hazardous waste site to determine whether people could be harmed from coming into contact with those substances. The PHA also lists actions that need to be taken to protect public health [compare with **health consultation**].

Public health hazard

A category used in ATSDR=s public health assessments for sites that pose a public health hazard because of long-term exposures (greater than 1 year) to sufficiently high levels of hazardous substances or radionuclides that could result in harmful health effects.

Public health hazard categories

Public health hazard categories are statements about whether people could be harmed by conditions present at the site in the past, present, or future. One or more hazard categories might be appropriate for each site. The five public health hazard categories are **no public health hazard**, **no apparent public health hazard**, **indeterminate public health hazard**, **public health hazard**, and **urgent public health hazard**.

Public health statement

The first chapter of an ATSDR **toxicological profile**. The public health statement is a summary written in words that are easy to understand. The public health statement explains how people might be exposed to a specific substance and describes the known health effects of that substance.

Public meeting

A public forum with community members for communication about a site.

Radioisotope

An unstable or radioactive isotope (form) of an element that can change into another element by giving off radiation.

Radionuclide

Any radioactive isotope (form) of any element.

RCRA [see **Resource Conservation and Recovery Act (1976, 1984)**]

Receptor population

People who could come into contact with hazardous substances [see **exposure pathway**].

Reference dose (RfD)

An EPA estimate, with uncertainty or safety factors built in, of the daily lifetime dose of a substance that is unlikely to cause harm in humans.

Registry

A systematic collection of information on persons exposed to a specific substance or having specific diseases [see **exposure registry** and **disease registry**].

Remedial investigation

The CERCLA process of determining the type and extent of hazardous material contamination at a site.

Resource Conservation and Recovery Act (1976, 1984) (RCRA)

This Act regulates management and disposal of hazardous wastes currently generated, treated, stored, disposed of, or distributed.

RFA

RCRA Facility Assessment. An assessment required by RCRA to identify potential and actual releases of hazardous chemicals.

RfD

See **reference dose**.

Risk

The probability that something will cause injury or harm.

Risk reduction

Actions that can decrease the likelihood that individuals, groups, or communities will experience disease or other health conditions.

Risk communication

The exchange of information to increase understanding of health risks.

Route of exposure

The way people come into contact with a hazardous substance. Three routes of exposure are breathing [**inhalation**], eating or drinking [**ingestion**], or contact with the skin [**dermal contact**].

Safety factor [see **uncertainty factor]**

SARA [see **Superfund Amendments and Reauthorization Act**]

Sample

A portion or piece of a whole. A selected subset of a population or subset of whatever is being studied. For example, in a study of people the sample is a number of people chosen from a larger population [see **population**]. An environmental sample (for example, a small amount of soil or water) might be collected to measure contamination in the environment at a specific location.

Sample size

The number of units chosen from a population or environment.

Solvent

A liquid capable of dissolving or dispersing another substance (for example, acetone or mineral spirits).

Source of contamination

The place where a hazardous substance comes from, such as a landfill, waste pond, incinerator, storage tank, or drum. A source of contamination is the first part of an **exposure pathway**.

Special populations

People who might be more sensitive or susceptible to exposure to hazardous substances because of factors such as age, occupation, sex, or behaviors (for example, cigarette smoking). Children, pregnant women, and older people are often considered special populations.

Stakeholder

A person, group, or community who has an interest in activities at a hazardous waste site.

Statistics

A branch of mathematics that deals with collecting, reviewing, summarizing, and interpreting data or information. Statistics are used to determine whether differences between study groups are meaningful.

Substance

A chemical.

Substance-specific applied research

A program of research designed to fill important data needs for specific hazardous substances identified in ATSDR's **toxicological profiles**. Filling these data needs would allow more accurate assessment of human risks from specific substances contaminating the environment. This research might include human studies or laboratory experiments to determine health effects resulting from exposure to a given hazardous substance.

Superfund Amendments and Reauthorization Act (SARA)

In 1986, SARA amended CERCLA and expanded the health-related responsibilities of ATSDR. CERCLA and SARA direct ATSDR to look into the health effects from substance exposures at hazardous waste sites and to perform activities including health education, health studies, surveillance, health consultations, and toxicological profiles.

Surface water

Water on the surface of the earth, such as in lakes, rivers, streams, ponds, and springs [compare with **groundwater**].

Surveillance [see **epidemiologic surveillance**]

Survey

A systematic collection of information or data. A survey can be conducted to collect information from a group of people or from the environment. Surveys of a group of people can be conducted by telephone, by mail, or in person. Some surveys are done by interviewing a group of people [see **prevalence survey**].

Synergistic effect

A biologic response to multiple substances where one substance worsens the effect of another substance. The combined effect of the substances acting together is greater than the sum of the effects of the substances acting by themselves [see **additive effect** and **antagonistic effect**].

Teratogen

A substance that causes defects in development between conception and birth. A teratogen is a substance that causes a structural or functional birth defect.

Toxic agent

Chemical or physical (for example, radiation, heat, cold, microwaves) agents that, under certain circumstances of exposure, can cause harmful effects to living organisms.

Toxicological profile

An ATSDR document that examines, summarizes, and interprets information about a hazardous substance to determine harmful levels of exposure and associated health effects. A toxicological profile also identifies significant gaps in knowledge on the substance and describes areas where further research is needed.

Toxicology

The study of the harmful effects of substances on humans or animals.

Tumor

An abnormal mass of tissue that results from excessive cell division that is uncontrolled and progressive. Tumors perform no useful body function. Tumors can be either benign (not cancer) or malignant (cancer).

Uncertainty factor

Mathematical adjustments for reasons of safety when knowledge is incomplete. For example, factors used in the calculation of doses that are not harmful (adverse) to people. These factors are applied to the lowest-observed-adverse-effect-level (LOAEL) or the no-observed-adverse-effect-level (NOAEL) to derive a minimal risk level (MRL). Uncertainty factors are used to account for variations in people=s sensitivity, for differences between animals and humans, and for differences between a LOAEL and a NOAEL. Scientists use uncertainty factors when they have some, but not all, the information from animal or human studies to decide whether an exposure will cause harm to people [also sometimes called a **safety factor**].

Urgent public health hazard

A category used in ATSDR=s public health assessments for sites where short-term exposures (less than 1 year) to hazardous substances or conditions could result in harmful health effects that require rapid intervention.

Volatile organic compounds (VOCs)

Organic compounds that evaporate readily into the air. VOCs include substances such as benzene, toluene, methylene chloride, and methyl chloroform.

Other Glossaries and Dictionaries

Environmental Protection Agency	http://www.epa.gov/OCEPAterms/
National Center for Environmental Health (CDC)	http://www.cdc.gov/nceh/dls/report/glossary.htm
National Library of Medicine (NIH)	http://www.nlm.nih.gov/medlineplus/dictionaries.html

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