Health Consultation

CHAUNCEY PCB SITE

CHAUNCEY, LOGAN COUNTY, WEST VIRGINIA

EPA FACILITY ID: WVN000305921

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

Health Consultation: A Note of Explanation

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In addition, consultations may recommend additional public health actions, such as conducting health surveillance activities to evaluate exposure or trends in adverse health outcomes; conducting biological indicators of exposure studies to assess exposure; and providing health education for health care providers and community members. This concludes the health consultation 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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HEALTH CONSULTATION

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Prepared by:

West Virginia Department of Health and Human Resources
Bureau for Public Health
Office of Environmental Health Services
Public Health Sanitation Division
Under a Cooperative Agreement with the
Agency for Toxic Substances and Disease Registry

Background and Statement of Issues

The Chauncey PCB Site—the site under consideration in this health consultation—comprises about 20 acres in various areas of the town and in nearby locations. The site is not centered at any point, but involves places in and near the community where residents suspect chemical dumping occurred in the past. The site includes parts of the unnamed hollow containing the Miller Branch of Island Creek. It also includes Middle Fork, Chaffin Hollow, the residences in Chauncey, a former power plant and surrounding grounds, Omar Elementary School, the playground areas of the school, a UPS facility, and Island Creek (Figures 1, 2 & 3). The site supports residential, commercial, educational, and recreational uses. The USEPA used the GPS coordinates (37.76608° North; 81.96054° South) at the UPS facility to identify the location of the site [1].

The town of Chauncey, West Virginia is approximately 8.5 road miles south of Logan, WV at the intersection of State Route 44 and County Route 119/18. Miller Branch and Middle Fork flow into Island Creek at Chauncey. Island Creek flows north beside Route 44, entering the Guyandotte River at Logan. All residential and commercial development is confined to narrow flood plains bounded by steep, forested hillsides. Several streams in the area originate from water percolating from abandoned underground coal mines. The prevailing winds are from the southwest to the northeast [1].

Local residents suspect that 1) the possible dumping of hazardous material into a gas well 15 years ago in Chaffin Hollow, 2) releases of unknown materials into Middle Fork, and 3) the dumping of transformer oils in a so-called pit located near to the Omar Elementary School have resulted in environmental contamination. No official record documents such activity by any known individual or corporation. The residents believe that alleged environmental contamination could be related to the number of persons in their community who have cancer. The types of cancers of concern to the community are lung, colon, breast, prostate, pancreas, stomach, ovaries, skin, esophagus, and thyroid [1]. The West Virginia Cancer Registry confirmed that Logan County has a higher rate of cancer than West Virginia as a whole.

The majority of persons in this area now obtain water for household use from the Logan County Public Service District (PSD). The water intake and treatment plant is located along the Guyandotte River, downstream from Logan at Henlawson. The water intake is approximately 13 miles downstream from the Chauncey site. Private drilled wells and hand-dug wells provide household water for some in the area. Before January 2000, public drinking water came from two inactive underground coal mines and from two drilled wells along Middle Fork. The water was supplied by the Enaloc Public Water Corporation. The drilled wells were used a few times a year when the mine water was insufficient to meet the demand. When the Logan County PSD took over the system these sources were abandoned, and the Enaloc Public Water Corporation was unincorporated.

The Omar Elementary School is in Chauncey, east of St. Rt. 44. The area around the school is flat, with nonstressed vegetation. Island Creek is approximately 130 feet east of the school. The former coal-fired power plant is approximately 260 feet southeast of the

school. The facility has been used as a mining equipment recycling facility and for storage. Currently the facility is used as a flea market, and the owner is living in a travel trailer parked inside the building. The area known as the pit—adjacent to the former power plant—is a 7' x 20' concrete-sided area. The pit is approximately 325 feet south east of the school. The USEPA reported the presence of dark soils in the pit and leachate on the exterior pit wall. The land surrounding this building and the pit is covered with debris and weeds [1]. No fences limit access to these facilities. The UPS facility is southeast of the school, and east of the former power plant. A paved lot surrounds the UPS facility (Figure 1).

The mines and wells that supplied the public water supply until 2000 are located along Middle Fork. Several mine seeps, so-called pop-outs (mine runoff streams), and impoundments are located along Middle Fork. Seventeen residences are located along the banks of Middle Fork (Figure 2).

The gas well suspected of being contaminated with hazardous materials is in the Miller Branch drainage, approximately 1 mile northeast of the school and past a locked gate. The well is up a steep hollow, at an elevation of about 800 feet above the school. The nearest residence to the gas well is about 0.8 miles away. Approximately 20 residences are located along the banks of Miller Branch (Figure 3).

Hydrology and Geology

Chauncey is geologically located in the Appalachian Plateau, which consists of nearly horizontal shale, sandstone and coal. The predominant rock type in the Chauncey area is Pennsylvanian aged sandstone. These rocks make up the Kanawha formation. Associated coals in the area are Stockton, Coalburg, Winifrede, Chilton, Williamson, Cedar Grove, Alma, Peerless, Campbell Creek, Powellton, Eagle, Gilbert, and Douglas. The groundwater close to the surface is likely to flow in the same direction as the surface water. Underground coal mining has created voids that have changed the flow of groundwater. Further study would be needed to determine groundwater flow in the deeper strata.

Demographics

In and near Chauncey some 110 residences house 280 persons. The median age of persons in this area is 39.1. Twenty-five percent of those living near this site are 19 years of age and below, 60% are 20 to 65, and 15% are 65 and older. The median age for persons in Logan County is 40.7. The median age of both those living near the site and in Logan County is greater than the median age of persons in the United States—36.5 [2].

Two hundred and sixty-seven children attend the Omar Elementary School in grades kindergarten through 4th grade. Some of the children are residents of Chauncey. Until 1997 the children at the school were in grades kindergarten through 9th grade. The children are in school 180 days a year. The school district employs the school staff for 200 days a year.

Discussion

Data

This health consultation reviewed the data collected by the USEPA in April 2003 and the West Virginia Department of Environmental Protection (WVDEP) in October and November of 2003. To determine if contamination existed in these media, the USEPA sampled and tested drinking water, surface waters, and sediments and surface soils at various places at the site where contamination was suspected [1]. Surface soil samples were not collected at the site of the gas well where the dumping was alleged (Well #790) because the site was not close to any drinking water sources and it was so remote that the potential for regular human exposure was unlikely [1]. A soil sample was taken 0.83 miles northeast of the former power plant, in the direction of the prevailing winds, to determine whether the power plant emissions could have included dioxin. Background samples of water, sediment and soil were taken at an elevation of 2000 feet, in an area believed to be unaffected by the reported events involving hazardous chemicals.

The WVDEP sampled soils in and around a buried underground storage tank found alongside Island Creek, upstream from—and south of—the former power plant, the UPS facility, and the school. Samples taken by the WVDEP were composites of the soil around and under the underground storage tank. Oil and organic chemicals consistent with diesel fuel were found in soil in and around the tank. No polychlorinated biphenyls (PCBs) were detected in these soils. Because human contact with this soil was impossible before the tank was uncovered, direct exposure to chemicals found in these soil samples was not considered in this report. All references to samples in this report are to the USEPA samples.

Past water testing data available for the Enaloc Public Water Corporation for 1991 through 1998 in the WVDHHR offices indicated no violations of the National Primary Drinking Water Regulations chemical standards. The system was, however, cited several times for failing to monitor the chemicals in the water in a manner consistent with the regulatory requirements.

Samples were tested for 25 inorganic chemicals, 50 volatile chemicals, 66 semi-volatile chemicals, and 25 dioxin and dioxin-like compounds (furans). Not all samples were tested for all chemicals. Test results from 16 drinking water samples were reviewed. The drinking water samples included water from a hand-dug well from a private residence downgradient from an alleged PCB dumping incident. All other water samples were from the Logan PSD. The West Virginia Department of Health and Human Resources (WVDHHR) reviewed data from the 12 surface water samples collected from Miller Branch, Middle Fork, Island Creek, from water in the sub-basement of the former power plant, and from background locations. Data from 11 sediment samples and 21 surface soil samples from Miller Branch, Middle Fork, Island Creek, the pit, residential yards, the school yard, and background locations were also reviewed.

In this health consultation WVDHHR's conclusions were affected by the availability and reliability of the information it reviewed. WVDHHR assumed that all data in the report underwent adequate quality assurance and control measures during chain-of-custody, laboratory procedures, and data reporting. The data review did not include results noted

in the data package as being affected by laboratory contaminants or data that were considered unreliable.

WVDHHR could not evaluate air emissions of tetrachloroethylene from the Stirrat Coal Processing Plant as reported to the USEPA in 1990 through 1992. Exposure doses could not be calculated without more information about the circumstances of these releases. This situation is, however, being evaluated as part of the larger report done by the WVDHHR entitled "Logan County, West Virginia—Cancer Concern Investigation Preliminary Summary."

Selection of Chemicals of Concern

The first step in the assessment of human health risk is the selection of chemicals of concern. This process compares data from the site to environmental guideline comparison values (CVs). Comparison values are very conservative (i.e., protective of public health). Many safety factors are included in the derivation of these values. Chemicals of concern are chemicals that *have not necessarily* caused adverse health effects. Chemicals of concern are chemicals that *need further evaluation* to determine if they *could have caused* adverse health effects at this site. For chemicals with multiple CVs, the most conservative CV (i.e., the lowest) was selected. Comparison values for carcinogenic (cancer-causing) and noncarcinogenic effects were used for the selection of chemicals of concern.

If test results indicated that the chemical was in the environment in amounts above the selected CV, if there were no established CVs for that chemical, or if the chemical was of particular concern to the community, then the chemical was selected as a chemical of concern (Table 1). Because of community concerns, WVDHHR considered polychlorinated biphenyls (PCBs), lead, and dioxin as chemicals of concern (Table 1).

Calcium, iron, magnesium, and potassium were found in surface water, sediment and soil at this site. Small amounts of these chemicals are needed for adequate human health. The amounts of calcium, iron, magnesium or potassium found at this site were not at levels that would require an analysis of potential adverse health effects. Test results for these chemicals were not included in this health consultation.

Exposure Pathway Analysis

An exposure pathway consists of five parts:

1. a source of contamination,
2. movement of the contaminant(s) into and through the environment,
3. a place where humans could be exposed to the contaminant(s),
4. a way for humans to be exposed to the contaminant(s) (such as by drinking the water or breathing the air), and
5. the existence of one or more persons who may have been in contact with the contaminant(s).

Exposure pathways are considered *complete* when all five of these elements existed at some point in the past, exist in the present, or are likely to occur in the future. Exposure pathways are considered *potential* when one or more of the elements are missing or

uncertain but could have existed in the past, could be occurring now, or could exist in the future. Pathways are considered *eliminated* when one or more of these five items do not exist or where conditions make exposures highly unlikely. The exposure pathways considered in this health consultation are listed below.

A completed pathway means that people have been exposed to chemicals. That said, however, the existence of a completed pathway *does not necessarily mean that a public heath hazard existed* in the past, exists currently, or is likely to exist in the future. Chemicals found in the completed pathways were evaluated to determine whether adverse health effects could have occurred in the past, are occurring in the present, or could occur in the future.

Drinking Water—Completed Exposure Pathway

Water in the hand-dug well sampled from an area near Rt 44 and the underground storage tank could have been contaminated by chemicals leaching from chemicals in the environment and entering the groundwater. Hand-dug wells can receive water from the surface. Thus this well could have been contaminated by surface water.

Chemicals found in the Logan County PSD water cannot, however, be assumed to have a source at this site. Any contaminant from this area would have been substantially diluted in the streams between the site and the water system intake and the Guyandotte River receives water from a large drainage area..

Exposures occur when people drink water containing chemicals. Chemicals were found in drinking water from a hand-dug well at a private residence and in the Logan County PSD above the corresponding environmental CV (Table 1.) A completed exposure pathway for drinking water is present at this site.

Exposures to Surface Water or Sediments of Middle Fork, Miller Branch and Island Creek downstream from the mouth of Middle Fork and Miller Branch—Completed Exposure Pathway

Local residents expressed concern about contaminants that might have been pumped into the gas well at the head of Miller Branch or that were released directly into Miller Branch or Middle Fork. An underground storage tank and drums were recently uncovered near Island Creek upstream from the former power plant. The tank and drums were found to contain organic chemicals consistent with diesel fuel. Contaminants from these sources could have drained into the surface water or could reside in the sediment in these streams. Contaminants could have moved with the water, the sediment, or both toward the residential and commercial areas downstream, where residents in the Chauncey area could have been exposed to them. Man-made and naturally occurring chemicals were found in the surface waters and sediments of these streams (Table 1). Therefore a completed pathway for ingestion of contaminated surface water or sediment is present along the surface drainage downstream from Middle Fork, Miller Branch, and Island Creek

Exposures to soils in residential yards and the Omar Elementary School – Completed Exposure Pathway

Soils in this area could have become contaminated through direct deposit of chemicals or through airborne or waterborne deposition (e.g., flooding). Soils at the Omar Elementary School are immediately downstream from the former power plant and the UPS facility. Flooding events could have deposited contaminants from these facilities and from the drainage from Middle Fork and Miller Branch at the Omar Elementary School. Exposures to these chemicals could occur by incidental ingestion of the contaminated soil. Because of the presence of chemicals in these areas above environmental CVs (Table 1), a completed exposure pathway will be considered for incidental ingestion of soil in residential yards and at the school in Chauncey.

Exposures to Sediment or Soils in the area around the Former Power Plant and the nearby UPS Facility – Completed Exposure Pathway

Residents report that transformer oils and other potentially hazardous chemicals could have been dumped into the pit next to the former power plant. These chemicals could have moved from the pit toward Island Creek during natural rainfall or flooding events. Several chemicals above the CVs were found in this area (Table 1). Exposures to these soils could have occurred by ingestion of small amounts of soils (i.e., incidental ingestion) by residents of this area. Therefore, a completed exposure pathway is assumed to exist for exposures to the sediment or soils in the area around the former power plant and around the nearby UPS facility.

Exposures to Water in the Sub-Basement of the Former Power Plant—Completed Exposure Pathway

The sub-basement in the former power plant contains water at all times. Chemicals were found above the environmental CVs in this water (Table 1). Exposures to these chemicals could have occurred by incidental ingestion. Because of this possibility, a completed exposure pathway to chemicals in the water found in the sub-basement of the former power plant will be considered.

Drinking Water from the Enaloc Public Water Corporation – Potential Exposure Pathway

The primary source of water for the now-defunct Enaloc Public Water Corporation was from two inactive underground coal mines along Middle Fork. If contaminants were introduced into the environment during the suspected dumping activities, it would have been possible to leach into the mine water and be ingested by drinking the water. No test results reviewed were found to be over the environmental CVs. Therefore, because there is no data to establish if there was contamination or not, this pathway was classified as a potential pathway.

Exposure to Water in the Pit that was located behind the Former Power Plant—Potential Exposure Pathway

Local residents report that another pit was located behind the former power plant. This pit was used as a swimming hole and recreational area by children. This pit has been paved

over. Because no test results from water in the pit were available, the potential exposures from swimming in this area could not be evaluated. Lack of data prevented evaluation of this exposure pathway.

Exposure to Soil near the Gas Well reported to have been contaminated— Eliminated Exposure Pathway

Due to the remote location of the gas well in the Miller Fork drainage above Chauncey, any human contact was assumed to be occasional and intermittent. The potential for significant human exposure to contaminants in the soil at the gas well is considered unlikely. Thus the exposure pathway to soil at the gas well is eliminated.

Exposure to Soil around the Underground Storage Tank and Drums found near Island Creek—Eliminated Exposure Pathway

Contaminated soil was found in and around the underground storage tank and drums uncovered recently near Island Creek. Because this contaminated soil was buried and no human contact occurred until the tanks were uncovered, this exposure pathway was eliminated.

Dermal and Inhalation Pathways – Eliminated Exposure Pathways

None of the chemicals found at this site were of the type or were in amounts sufficient for possible adverse health effects from exposure through the skin (e.g., dermal exposure) or from breathing the chemicals (e.g., inhalation). The dermal and inhalation pathways were therefore eliminated at this site.

Exposure Analysis

Calculation of Exposure Doses

Estimated exposure doses (expressed as milligrams per kilogram per day or mg/kg/day) were calculated by multiplying

- the amount of media (water, sediment or soil) ingested in a day by
- the amount of the chemical found in that media (amounts from Table 1) by
- the absorption factor by
- the exposure factor, representing the amount of time over which the exposures occurred, and
- dividing all the above by the body weight of the person exposed (Tables 2 & 3).

The exposure factor is the time period that exposure to a chemical is assumed to occur divided by the total time period during which the exposures occur. For instance, an exposure factor for a person exposed 180 days a year for 30 years out of a lifetime of 70 years would be ([180/365] times [30/70] or 0.211). The absorption factor for arsenic is assumed to be 0.8 (i.e., 80% of the chemical ingested was absorbed into the blood stream) [3], while all other chemicals were assumed to be 100% absorbed, with an absorption factor of 1.

The assumptions used to calculate the exposure doses are noted in Tables 2 and 3. The assumptions used for the incidental ingestion pathways would require a persistent pattern of ingesting water, soil or sediment. The estimated exposure doses, therefore, are much more than would likely occur to any person at this site.

Selection of Chemicals to be Reviewed for Noncarcinogenic Effects

Estimated exposure doses were compared with health-based comparison values (Tables 2 and 3). Health-based comparison values, ATSDR Minimal Risk Levels (MRLs) and USEPA Reference Doses (RfDs) are comparison values containing exposure concentrations protective of public health. Chemicals of concern in which estimated exposure doses were below these health-based comparison values were eliminated from further review—exposures to chemicals at these levels are not expected to result in adverse health effects.

All chemicals of concern for which estimated exposure doses were over the health-based comparison value, or for which there was no health-based comparison value, were selected for further review for possible health consequences from exposures at this site (Table 2 and 3). This was done by comparing the estimated exposure doses for these chemicals to research such as that outlined in the ATSDR toxicological profiles, indicating possible health effects from chemical exposure in particular amounts. An exposure dose where no effects are observed is known as the no-observed-adverse effect level (NOAEL). The lowest exposure dose where an adverse health effect is observed is called the lowest-observed-adverse effect level (LOAEL). The results of the comparison to published NOAELs and LOAELs of the highest exposure doses at this site for the chemicals reviewed are noted in Table 4.

The type of mercury found in the school yard was unknown. The NOAEL selected for comparison purposes was for the organic form of mercury. This NOAEL is much lower than that for the inorganic form of mercury. Similarly, the amount of endrin ketone found in the residential surface soil was compared to the NOAEL for endrin. Endrin ketone is not considered to be as toxic as endrin. In these cases, the most conservative comparison was made to determine the potential for adverse health effects. The estimated exposure doses for mercury and endrin ketone were below the NOAELs for these chemicals (Tables 3 and 4). No environmental comparison values, health-based comparison values, NOAELs or LOAELs were found for 4,6-dinitro-2-methylphenol (4,6-dinitro-o-cresol). The United States Food and Drug Administration has established a tolerance of 0.02 ppm for this chemical on raw apples (40 CFR Chapter 1 Part 180). The amount of 4,6-dinitro-2-methylphenol found in the surface water of Island Creek was 0.0008 ppm (0.8 ppb.) No further analysis was done for these chemicals. The most conservative assumptions showed that the amount of mercury and endrin ketone that a person might be exposed to was below any level where adverse health effects would be expected. No opinion could be given about possible health effects of 4,6-dinitro-2-methylphenol.

Arsenic and lead were the only chemicals over the NOAEL or LOAEL levels requiring additional review for possible adverse health effects from exposures at this site.

Selection of Chemicals to be Reviewed for Carcinogenic Effects

Because cancers can develop over many years, past cancer risks based on current environmental sampling results are difficult to specify. No data for past exposures are available, therefore, the theoretical cancer risks were calculated based on current environmental data.

WVDHHR calculated a theoretical excess cancer risk for all those chemicals of concern where the USEPA has calculated a Cancer Slope Factor (CSF). To obtain the most conservative value—i.e., highest estimate of a theoretical excess cancer risk—estimated exposure doses for children were averaged over 70-years. This number was multiplied by the CSF (Tables 2 and 3). Because of the uncertainties and conservative assumptions made in calculating the CSFs, these numbers are only estimates of risk. The actual risk of cancer is probably lower than the calculated number. The true risk is unknown and could be as low as zero. The method assumed that a person would be exposed to a chemical over a lifetime at the same rate that they would as a child. The method also assumes no safe level for exposure to a carcinogen. Lastly, the method computes the 95% upper bound for the risk, rather than the average risk. This means that there is a very good chance that the risk of cancer is actually lower—perhaps by several orders of magnitude. One order of magnitude is 10 times greater or lower than the original number, two orders of magnitude are 100 times, and three orders are 1,000 times.

Finally, using a reasonable evaluation of the probable or actual exposure scenarios, WVDHHR decided whether the exposure doses or cancer risks might be a health hazard. Taking these uncertainties into account, theoretical cancer risks below 99 in a million were considered very low risk and are not discussed in the text. Theoretical cancer risks between 100 and 999 in a million were classified as a low risk, 1,000 and 9,999 as a moderate risk, and greater than 9,999 in a million as a significant risk.

Possible Health Consequences from Chemical Exposures

Chemicals Selected for Review for Noncarcinogenic or Carcinogenic Effects

Based on these criteria, WVDHHR selected two chemicals for further evaluation for noncarcinogenic effects: arsenic in the sediment of Island Creek, and lead in the surface soil of the pit adjacent to the former power plant. A review of potential carcinogenic effects from arsenic in the sediment of Island Creek. Due to community concern about PCBs, and dioxins, these chemicals were similarly selected for additional review.

No chemicals were found in sufficient amounts to have estimated exposure doses or theoretical excess cancer risks above a low risk for the completed pathways for

- drinking water,
- exposure to surface water or sediments of Miller Branch or Middle Fork,
- exposure to surface water of Island Creek,
- exposure to soils at the Omar Elementary School,
- exposure to soils in the residential yard, or
- exposure to water in the sub-basement of the former power plant.

Exposures to Sediments of Island Creek Near the Former Power Plant

The only chemical found to be at concentrations requiring additional review in this pathway was the arsenic found in the Island Creek sediment. Arsenic is a naturally occurring element and is found in coal. Soils in West Virginia have an average of 8.64 milligrams of arsenic in each kilogram of soil. Arsenic can also be introduced into the environment through human activities, such as burning coal in power plants.

Arsenic—Noncarcinogenic Effects

The highest estimated exposure dose to arsenic, from sediment in Island Creek, 0.00411 mg/kg/day, was calculated for a small child who would have eaten small amounts of sediment nearly every day for several (e.g., 6) years. This exposure dose estimate was based on one sample of sediment that was much higher than all other test results for the sediment in Island Creek. This estimate probably overestimates the exposures, unless the person was exposed exclusively to the sediment at the point where this sample was taken.

Looking at combined exposures, it is possible that a child could have been exposed to the Island Creek sediment (0.00411 mg/kg/day), to arsenic from soil in this area (0.00022 mg/kg/day), and to arsenic from drinking water from the private hand-dug well (0.0003 mg/kg/day). Exposures to all three of these media could cause a child at this site to be exposed to 0.0046 mg/kg/day of arsenic.

Humans exposed continuously to arsenic at 0.005 mg/kg/day have experienced fatigue, headache, dizziness, insomnia, nightmares, numbness, a bluish color in fingers and toes, chest discomfort, keratosis of the skin (darkened "corns" or "warts" on the skin characteristic of arsenic exposure), increased prevalence of disease of the blood vessels in the brain, and an increased incidence of stroke due to blood clots [3].

These exposure doses would occur only with repeated and persistent eating of soil and sediment at the point where the highest concentrations of arsenic were found in this area. It was unlikely that sufficient exposures would occur to anyone at this site to cause these adverse health effects.

Arsenic—Carcinogenic Effects

Oral exposures to arsenic have been linked to basal and squamous cell skin cancers developing from areas of the skin that are darkened and have pre-cancerous corns or warts. Persons who have developed these skin cancers appear to be more prone to cancers of the liver, bladder, kidney, lung, and prostate [3].

Continuous (i.e., past, present, and future) ingestion of arsenic in the sediment in Island Creek under the assumptions used could have caused a low increased risk of developing cancer (529 in a million). For this estimated level of risk to occur, a person would need to ingest 0.002 kg of sediment containing 268 mg/kg arsenic per day, 350 days a year, over an estimated 70-year lifetime. The concentration of arsenic used for this calculation (268 mg/kg) was far higher than the next highest concentration in sediment (16.7 mg/kg.) It is unlikely that a person would be exposed to the sediment only at the point where this sample was taken. The theoretical excess cancer risk changes from 529 in a million using the 268 mg/kg value to 33 in a million using the 16.7 mg/kg value.

WVDHHR also calculated the risk for a child exposed to arsenic from more than one source. If nearly every day a small child was exposed to the highest amount of arsenic found in the sediment of Island Creek, the arsenic in the surface soil, and in the water found in the hand-dug well, the estimated exposure dose (0.00462 mg/kg/day) would have a theoretical excess cancer risk of 594 in one million. But few if any persons would be expected to have actually experienced the assumed levels of exposure to these arsenic-containing sediments and soils. Therefore, exposures to cancer-causing chemicals at this site would result in a very low if any increase in the risk of cancer to those who live and work in the Chauncey area.

Exposures to Soils in the Area around the Former Power Plant

Lead

Although lead is a naturally occurring element in the earth's crust, most of the high levels of lead found in the environment are the result of human activity.

The highest estimated exposure dose for lead in the soil in the pit—0.02436 mg/kg/day—was calculated for a small child who would have eaten a small amount of soil from the pit nearly every day of the year for several (e.g., 6) years. All other samples containing lead were from soil or sediment, except for the water in the sub-basement of the former power plant. WVDHHR does not expect that incidental ingestion would occur from these points simultaneously. Thus for this review of possible health effects the highest estimated exposure dose was used.

Children are the most sensitive group to the effects of lead. If babies or young children eat lead, they can have problems with brain and other organ development. The 0.014 mg/kg/day LOAEL for lead has been shown to raise blood pressure in rats [4]. If exposures to this soil occurred for 180 days a year, the estimated exposure dose would be reduced to the LOAEL level. Even this estimate of exposure is probably more than might be likely for anyone at this site. As it is unlikely that anyone would eat soil from the pit more than 180 days a year, exposures to lead at this site are considered to have caused no adverse health effects.

Community Concerns

Health Concerns—Cancer

Community members are concerned about the number of persons in the community who have cancer. The specific types of cancers of concern are lung, colon, breast, prostate, pancreas, stomach, ovaries, skin, esophagus, and thyroid.

The West Virginia Cancer Registry determined that cancer incidence rates in Logan County are higher than those in WV as a whole. The most common types of cancer in Logan County are the same as those for West Virginia as a whole: cancer of the lung, colon and rectum, breast (women only), prostate, uterus and bladder. Logan County has particularly high rates of cancer of the lung, larynx, pancreas, and stomach. In the Chauncey area, the most common cancers for men are cancer of the lung, colon and rectum, prostate and bladder. The most common cancers in this area for women are lung,

colon and rectum, and breast. Lung cancer accounts for more than 2 of every 5 cancers in Chauncey-area men. This is nearly twice that seen among all West Virginia men. However, prostate cancer accounts for only about 1 in 10 of cancers among Chauncey-area men. This is less than half that seen among all West Virginia men.

Polychlorinated biphenyls (PCBs)

PCBs are man-made chemicals that formerly were widely used in electrical transformers and capacitors. PCBs were used as an oil additive because it was a good insulator and did not burn easily. PCBs can be released into the environment through direct dumping of PCB-containing materials or by burning PCB-laden wastes in municipal and industrial incinerators. Only a small amount of PCBs dissolve in water. Most of the PCBs stick to the organic material found in sediment and soil. For these reasons, PCBs would not be expected to be in groundwater [7].

PCBs were found at Chauncey Site in and around the former power plant. The highest amount of PCBs found at this site was in the soil at the pit. The estimated exposure dose for a person who ate small amounts of soil from the pit 350 days a year was calculated as more than 17 times less than the exposures observed to cause any noncarcinogenic effects in any studies (LOAEL) (Table 4). Consequently, no adverse noncarcinogenic health effects would be expected from exposure to PCBs at this site.

The type of PCBs found at this site—Arochlor 1260—is classified as reasonably anticipated to be a carcinogen. No cancer slope factor is available to calculate a theoretical excess cancer risk from the estimated exposure doses found at this site.

Dioxins

Chlorinated dibenzo-*p*-dioxins or polychlorinated dioxins, are commonly known as dioxins. Dioxins are a family of 75 different chemicals. Dioxin-like chemicals include furans (a group of 135 chemicals) and other chemicals that are structurally similar to the dioxins. There are many different sources of dioxins and dioxin-like chemicals in the environment. Dioxins are naturally produced from the incomplete combustion of organic materials by forest fires or volcanic activity. They are also unintentionally produced by industrial, municipal, and household incineration and burning of materials. Dioxins are even released from the exhaust of gasoline and diesel engines, and backyard burning barrels.

Dioxins accumulate in fat tissues. In the general population of the United States, fat-containing foods such as meat, fish and dairy products account for over 90% of dioxin exposure [5].

Dioxins do not dissolve easily in water. Thus most dioxins released into streams absorb onto particles of soil or organic matter and will settle to the bottom of the stream, in the sediment.

Although dioxins are the most potent carcinogens known in some animals, the effects in different species of animals and humans are highly variable. The most potent and studies dioxin is 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD). This chemical causes a wide variety of adverse health effects in humans and animals. In humans, one dioxin,

2,3,7,8-TCDD, has been termed a known human carcinogen, while other dioxins are classified as suspected human carcinogens.

The amount of dioxins and dioxin-like compounds are often expressed as TCDD equivalents for dioxin, or TEQs. A toxic equivalency factor or quotient (TEQ) is calculated by assigning the most toxic dioxin, 2,3,7,8-TCDD, a Toxic Equivalency Factor (TEF) of one. All other dioxins and dioxin-like compounds have a TEF of less than one. This is based on a ratio of the toxicity of the chemical to 2,3,7,8-TCDD. The toxicity of a mixture of dioxin and dioxin-like chemicals is expressed as a TEQ, which is the sum of the TEFs of the chemicals with a factor for the amount of chemical in the mixture. This approach assumes that the effects of the various compounds are additive and that they will all have the same type of toxicity.

The highest amount of TCDD equivalents for dioxins found at this site was in the water in the sub-basement of the former power plant. The estimated exposure dose for a 10-year-old child who drank small amounts of water from the sub-basement 60 days a year—calculated to be 0.000000006 mg/kg/day—was more than 20 times less than the lowest exposure needed to cause any observed effects (LOAEL) (Table 4). This LOAEL was based on a study of female rhesus monkeys that showed developmental behavioral effects in their offspring after long term exposure to dioxins in their food. Given the amount of dioxins and dioxin-like compounds that could have been ingested only with prolonged and persistent exposure to the water in the sub-basement of the former power plant, and the results of current research about the levels of dioxin needed to cause adverse health effects, the potential for adverse health effects from exposures at this site is very unlikely.

Child Health Considerations

The many differences between children and adults demand special consideration. Children could be at greater risk than are adults from certain kinds of exposure to hazardous substances. Children play outdoors and often use hand-to-mouth behaviors that increase their exposure potential. Children are shorter than are adults. This means they breathe dust, soil, and vapors close to the ground. Children are smaller than adults which results in a greater dose of a substance per unit of body weight. If toxic exposure levels are high enough during critical growth stages, the developing body systems of children can sustain permanent damage. Finally, children are dependent on adults for access to housing, for access to medical care, and for risk identification. This health consultation considered potential health effects to children to give adults need as much information as possible to make informed decisions regarding their children's health.

Conclusions

WVDHHR and ATSDR conclude that the site represents *no apparent public health hazard for current exposures*. Based on the available data, adverse health effects are not expected from exposure to site related contaminants. Similarly, environmental exposures to current levels of chemicals at this site do not explain the high rate of cancer observed in this area.

There is no known source of ongoing chemical contamination present at this site so it is unlikely that the levels of contaminants will increase over time. Therefore, WVDHHR and ATSDR classify this site as *no apparent public health hazard for the future*.

Because of a lack of data about the level of chemicals at this site in the past, no opinion is expressed regarding whether past exposures to contaminants in this area caused adverse health effects. Therefore, this site is classified as an *indeterminate public health hazard for the past*.

Recommendations

WVDHHR does not recommend any public health actions to reduce or mitigate exposures to chemicals at this site. The USEPA, however, will take appropriate action to reduce the potential threat to human health and the environment in the pit area near the former power plant.

WVDHHR recommends continuation of the investigation of the cancers found in this community by the WVDHHR Cancer Cluster Workgroup. The WVDHHR Cancer Cluster Workgroup has prepared a document that examines cancer in Logan County. This document will be available to the public.

WVDHHR offers to work with the community to facilitate understanding of cancer incidence in their community and wherever possible to help them take positive steps to reduce known risk factors for the cancers of concern.

Public Health Action Plan

1. The WVDHHR will evaluate additional sample results for possible health effects when received from the USEPA.
2. The WVDHHR Cancer Cluster Workgroup will study the incidence of certain types of cancers found in this community.
3. The WVDHHR will provide health education opportunities to the community.
4. The WVDHHR will conduct a public availability session for concerned citizens to talk about this report and their concerns about chemical exposures in their community.
5. The WVDHHR will work with the community to identify potential cancer risks as well as methods to reduce the future occurrence of cancer in this community.

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CERTIFICATION

The Health Consultation on the Chauncey PCB Site, in Chauncey, Logan County, West Virginia was prepared by the West Virginia Department of Health and Human Resources under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with approved methodology and procedures existing at the time the Health Consultation was begun.

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

Roberta Erlwein
Section Chief, SPS, SSAB, DHAC, ATSDR

FIGURES

TABLES

Table 1. Chemicals of Concern for the Chauncey PCB Site								
	#	#	Maximum	Range of results over	# Samples	Background	Environmental Guideline CVs	
	Samples	Detects		the Comparison Value (CV)	over CV			Type
			ppb	**ppb**			**ppb**	
HAND DUG WELL - DRINKING WATER								
Arsenic	1	1	3.7	3.7	1		0.02	CREG
LOGAN COUNTY PSD - DRINKING WATER								
Dibromochloromethane	12	11	3.1	1.7 - 3.1	11		0.4	CREG
SURFACE WATER - MILLER BRANCH (UPSTREAM)								
4-Chloro-3-methylphenol	2	1	0.9	0.9				none
N-Nitroso-di-n-propylamine	2	1	0.7	0.7	1		0.005	CREG
Pentachlorophenol	2	1	0.6	0.6	1		0.3	CREG
SURFACE WATER - MIDDLE FORK								
delta-Benzene hexachloride (BHC)	2	2	0.018	0.0096 - 0.018				none
1,2-Dibromo-3-chloropropane	1	1	1	1	1		0.2	EPA MCL
Heptachlor	2	2	0.046	0.014 - 0.046	2		0.008	CREG
SURFACE WATER - ISLAND CREEK								
4,6-Dinitro-2-methylphenol	1	1	0.8	0.8				none
Pentachlorophenol	4	1	1	1	1		0.3	CREG
WATER - SUB-BASEMENT FORMER POWER PLANT								
Arsenic	2	1	17.6	17.6	1		0.02	CREG
Cadmium	1	1	4.8	4.8	1		2	ATSDR chron EMEG child
Lead	1	1	206	206				none
Manganese	12	12	1540	1540	1		500	ATSDR RMEG child
Arochlor - 1260	1	1	6.8	6.8				none
gamma-Chlordane	11	11	0.12	0.12	1		0.1	CREG
delta-Benzene hexachloride (BHC)	1	1	0.017	0.017				none
Dieldrin	1	1	0.083	0.083	1		0.002	CREG
Endrin aldehyde	1	1	0.16	0.16				none
Heptachlor epoxide	1	1	0.064	0.064	1		0.004	CREG
TCDD equivalents	4	1	0.137	0.13700	1		0.00001	ATSDR chron EMEG child

Table 1. Chemicals of Concern for the Chauncey PCB Site								
	#	#	Maximum	Range of results over	# Samples	Background	Environmental Guideline CVs	
	Samples	Detects		the Comparison Value (CV)	over CV			Type
			ppm	**ppm**		**ppm**	**ppm**	
SEDIMENT - MILLER BRANCH								
Arsenic	2	2	2.8	2.7 - 2.8	2	5.4	0.5	CREG
Lead*	2	2	136	12.4 - 136	0	12.2	400	EPA Guidance
Benzo(g,h)perylene (PAH)	2	1	0.11	0.11				none
Di-n-butylphthalate	1	1	0.11	0.11				none
Phenanthrene (PAH)	2	2	0.16	0.11 -0 .16				none
SEDIMENT - MIDDLE FORK								
Arsenic	5	5	16.7	2.4 - 16.7	2	5.4	0.5	CREG
Manganese	4	4	11,500	11,500	1	566	3000	ATSDR RMEG child
Lead*	5	5	20	6.1 - 20	0	12.2	400	EPA Guidance
Thallium	1	1	20.1	20.1	1		5.5	EPA RBC
Phenanthrene (PAH)	5	5	0.760	0.087 - 0.76				none
SEDIMENT - ISLAND CREEK								
Arsenic	4	4	268	3.2 - 268	3	5.4	0.5	CREG
Lead*	4	4	29.7	9.7 - 29.7	0	12.2	400	EPA Guidance
Thallium	3	1	34.1	34.1	1		5.5	EPA RBC
Di-n-butylphthalate	1	1	0.031	0.031				none
Benzo(a)pyrene (PAH)	3	3	0.43	0.43	1		0.1	CREG
Phenanthrene (PAH)	3	3	2	0.190 - 2				none
TCDD equivalents*	3	3	0.000001736	0.000000825 - 0.000001736	0	0.000000050	0.001	ATSDR Action Level (TCDD)
SURFACE SOIL - ISLAND CREEK (ADJACENT TO THE FORMER POWER PLANT)								
Arsenic	5	5	14.5	8.3 - 14.5	5	4.3	0.5	CREG
Cadmium	5	5	26.7	26.7	1		10	ATSDR chron EMEG child
Lead	5	5	438	438	1	21.4	400	EPA Guidance
Arochlor - 1260 (PCB)	4	4	4.3	.490 - 4.3	3		0.319	EPA RBC
Benzo(a)pyrene (PAH)	5	5	0.16	0.16	1		0.1	CREG
Benzo(g,h,i)perylene (PAH)	4	4	0.17	.069 - .17				none
Phenanthrene (PAH)	5	5	1.5	.770 - 1.5		0.04		none

Table 1. Chemicals of Concern for the Chauncey PCB Site								
	#	#	Maximum	Range of results over	# Samples	Background	Environmental Guideline CVs	
	Samples	Detects		the Comparison Value (CV)	over CV			Type
			ppm	**ppm**		**ppm**	**ppm**	
SURFACE SOIL - PIT (ADJACENT TO THE FORMER POWER PLANT)								
Arsenic	4	4	29.1	9.2 - 29.1	4	4.3	0.5	CREG
Lead	4	4	1270	1,270	1	21.4	400	EPA Guidance
Manganese	4	4	4220	4,220	1	762	3000	ATSDR RMEG child
Thallium	4	1	6.4	6.4	1		5.5	EPA RBC
Arochlor - 1260 (PCB)	4	4	15	2 - 15	4		0.319	EPA RBC
Benzo(a)pyrene (PAH)	4	4	0.25	.12 - .25	3		0.1	CREG
Benzo(g,h,i)perylene (PAH)	4	4	0.31	0.064 - .31				none
Dibenzo(a,h)anthracene (PAH)	4	3	0.12	0.12	1		0.087	EPA RBC
Phenanthrene (PAH)	4	4	1.5	.22 - 1.5		0.04		none
TCDD equivalents*	2	2	0.00000244	0.000000687 - 0.00000244	0	0.00000072	0.001	ATSDR Action Level (TCDD)
SURFACE SOIL - RESIDENTIAL YARD								
Arsenic	2	2	8.9	3.5 - 8.9		4.3	0.5	CREG
Benzo(a)pyrene (PAH)	2	2	0.54	.14 - .54	2		0.1	CREG
Dibenzo(a,h)anthracene (PAH)	2	2	0.16	0.16	1		0.087	EPA RBC
Benzo(g,h,i)perylene (PAH)	2	2	0.48	.11 - .48				none
Endrin ketone	2	2	0.0093	0.0027 - 0.0093				none
Phenanthrene (PAH)	2	2	0.97	.51 - .97		0.04		none
SURFACE SOIL - SCHOOL YARD								
Arsenic	8	8	3.9	2.1 - 3.9	8	4.3	0.5	CREG
Lead*	8	8	32.5	8.1 - 32.5	0	21.4	400	EPA Guidance
Mercury	1	1	1.6	1.6				none
Aldrin	3	3	0.099	0.049 - 0.099	2		0.04	CREG
Benzo(g,h,i)perylene (PAH)	6	3	0.11	0.025 - .11				none
Endrin ketone	1	1	0.0068	0.0068				none
Phenanthrene (PAH)	8	8	0.46	0.031 - .46		0.04		none
TCDD equivalents*	1	1	0.00000082	0.00000082	0	0.00000072	0.001	ASTDR Action Level (TCDD)

Table 1. Chemicals of Concern for the Chauncey PCB Site								
	#	#	Maximum	Range of results over	# Samples	Background	Environmental Guideline CVs	
	Samples	Detects		the Comparison Value (CV)	over CV			Type
ppb = parts per billion								
ppm = parts per million								
CREG= ATSDR Cancer Risk Evaluation Guide								
ATSDR chron EMEG child= Environmental Media Evaluation Guide for a child exposed over 365 days								
EPA Guidance *(Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities (US EPA 1994))*								
ATSDR RMEG child=Reference Media Evaluation Guide for a child								
EPA MCL = EPA Maximum Contaminant Level								
EPA RBC=Region III EPA Risk Based Concentrations for Residential soils								
ATSDR Action Level (TCDD) (*Dioxin and Dioxin-Like Compounds in Soil, Part 1: ATSDR Interim Policy Guideline Aug 21, 1997*)								
TCDD equivalents= Toxicity equivalents for dioxins and dioxin-like compounts								
* data are below the comparison values)								

Table 2: Estimated Exposure Doses & Cancer Risk for Water - Chauncey PCB Site							
DRINKING WATER INGESTION							
		Estimated Exposure Doses					
Contaminant	Maximum level	Young Child	Adult	Health based Guideline		Excess Cancer Risk	
	mg/L	mg/kg/day	mg/kg/day	mg/kg/day	Source	CSF	
HAND DUG WELL							
Arsenic	0.0037	0.0003	0.0001	0.0003	ATSDR Chron Oral MRL	1.5	38 in a million
LOGAN PSD							
Dibromochloromethane	0.0031	0.0003	0.0001	0.03	ATSDR Chron Oral MRL	0.084	2 in a million
ASSUMPTIONS FOR DRINKING WATER INGESTION							
Ingestion Rate - Drinking Water	*liters/day*	*1*	*2*				
Exposure Frequency	*days/year*	*365*	*365*				
	years	*6*	*70*				
Body Weight	*kilograms*	*10*	*70*				
INCIDENTAL INGESTION OF SURFACE WATER							
		Estimated Exposure Doses					
Contaminant	Max level	Young Child	Adult	Health based Guideline		Cancer Risk	
	mg/L	mg/kg/day	mg/kg/day	mg/kg/day	Source	CSF	
SURFACE WATER - MILLER BRANCH							
4-Chloro-3-methylphenol	0.0009	0.0000009	0.0000001		none		
N-Nitroso-di-n-propylamine	0.0007	0.0000007	0.0000001	0.095	ATSDR acute oral RfD	7	*
Pentachlorophenol	0.001	0.0000010	0.0000001	0.001	ATSDR chron oral MRL	0.12	*
SURFACE WATER - MIDDLE FORK							
delta-Benzene hexachloride (BHC)	0.000018	<0.0000001	<0.0000001		none		
1,2-Dibromo-3-chloropropane	0.001	0.0000010	0.0000001	0.002	ATSDR Int Oral MRL		
Heptachlor	0.000046	<0.0000001	<0.0000001	0.0005	EPA chron oral RfD	4.5	*
SURFACE WATER - ISLAND CREEK							
4,6-Dinitro-2-methylphenol	0.0008	0.0000008	0.0000001		none		
Pentachlorophenol	0.001	0.0000010	0.0000001	0.001	ATSDR chron oral MRL	0.12	*
ASSUMPTIONS FOR SURFACE WATER INGESTION							
Ingestion Rate - surface water	*liter/day*	*0.01*	*0.01*				
Exposure frequency	*days/year*	*350*	*350*				
	years	*6*	*30*				
Body Weight	*kg*	*10*	*70*				

Table 2: Estimated Exposure Doses & Cancer Risk for Water - Chauncey PCB Site							
INCIDENTAL INGESTION OF WATER - SUB-BASEMENT OF FORMER POWER PLANT							
		Estimated Exposure Doses					
Contaminant	Max level	Older Child	Adult	Health based Guideline		Cancer Risk	
	mg/L	mg/kg/day	mg/kg/day	mg/kg/day	Source	CSF	
Arsenic	0.0176	0.0000006	0.0000003	0.0003	ATSDR Chron Oral MRL	1.5	*
Cadmium	0.0048	0.0000002	0.0000001	0.0002	ATSDR chron oral MRL		
Lead	0.206	0.0000094	0.0000048				
Manganese	1.54	0.0000703	0.0000362	0.14	EPA RfD		
Arochlor - 1260 (PCB)	0.0068	0.0000003	0.0000002				
gamma-Chlordane	0.00012	<0.0000001	<0.0000001	0.0006	ATSDR chron oral MRL	0.35	*
delta-Benzene hexachloride (BHC)	0.000017	<0.0000001	<0.0000001		none		
Dieldrin	0.000083	<0.0000001	<0.0000001	0.00005	ATSDR chron oral MRL	16	*
Endrin aldehyde	0.00016	<0.0000001	<0.0000001		none		
Heptachlor epoxide	0.000064	<0.0000001	<0.0000001	0.000013	EPA chron oral RfD	9.1	*
TCDD equivalents for dioxin	0.000137	0.000000006	0.000000003	0.000000001	ATSDR chron oral MRL	150000	80 in a million

ASSUMPTIONS FOR SUB-BASEMENT WATER INGESTION			
Ingestion Rate - surface water	*liter/day*	*0.01*	*0.01*
Exposure frequency	*days/year*	*60*	*60*
	years	*6*	*30*
Age	*years*	*10*	
Body Weight	*kg*	*36*	*70*

mg/L=milligram per liter (equivalent to parts per million or ppm)

mg/kg/day=milligram per kilogram per day

CSF=EPA Cancer Slope Factor

ATSDR Chron Oral MRL=ATSDR Chronic Oral Minimal Risk Level for exposures over 365 days

ATSDR Acute Oral MRL = ATSDR Acute Oral Minimal Risk Level for exposures less than 15 days

ATSDR Int Oral MRL=ATSDR Intermediate Oral Minimal Risk Level for exposures between 15 and 365 days

EPA Chron Oral RfD=EPA Chronic Oral Reference Dose for exposures over 365 days

EPA RfD=Reference Dose from EPA 2002 Edt of the Drinking Water Standards and Health Advisories

* less than 1 in a million excess cancer risk

Table 3: Estimated Exposure Doses and Cancer Risk for Incidental Ingestion of Soil and Sediment - Chauncey PCB Site							
Contaminant	Max level	Estimated Exposure Doses		Health based Guideline		Excess Cancer Risk	
	ppm	Child	Adult	mg/kg/day	Source	CSF	calculation
	mg/kg	mg/kg/day	mg/kg/day				
SEDIMENT - MILLER BRANCH							
Lead	136	0.00261	0.00019		none		
Benzo(g,h)perylene	0.11	<0.00001	<0.00001		none		
Di-n-butylphthalate	0.11	<0.00001	<0.00001	0.1	EPA Chron Oral RfD		
Phenanthrene	0.16	<0.00001	<0.00001		none		
SEDIMENT - MIDDLE FORK							
Arsenic	16.7	0.00026	0.00002	0.0003	ATSDR Chron Oral MRL	1.5	33 in a million
Manganese	11,500	0.22055	0.01575	0.05	EPA RfD - environmental		
Lead	20	0.00038	0.00003		none		
Thallium	20.1	0.00039	0.00003		none		
Phenanthrene (PAH)	0.76	0.00001	<0.00001		none		
SEDIMENT - ISLAND CREEK							
Arsenic	268	0.00411	0.00029	0.0003	ATSDR Chron Oral MRL	1.5	529 in a million
Lead	29.7	0.00057	0.00004		none		
Thallium	34.1	0.00065	0.00005		none		
Di-n-butylphthalate	0.031	<0.00001	<0.00001	0.1	EPA Chron Oral RfD		
Benzo(a)pyrene (PAH)	0.43	0.00001	<0.00001			7.3	5 in a million
Phenanthrene (PAH)	2	0.00004	<0.00001		none		
TCDD equivalents for dioxin	0.000001736	<0.0000000001	<0.0000000001	0.0000000010	ATSDR chron oral MRL	150000	*
SURFACE SOIL - ISLAND CREEK (ADJACENT TO THE FORMER POWER PLANT)							
Arsenic	14.5	0.00022	0.00002	0.0003	ATSDR Chron Oral MRL	1.5	29 in a million
Cadmium	26.7	0.00051	0.00004	0.0002	ATSDR chron oral MRL		
Lead	438	0.00840	0.00060		none		
Arochlor - 1260 (PCB)	4.3	0.00008	0.00001		none		
Benzo(a)pyrene (PAH)	0.16	<0.00001	<0.00001			7.3	2 in a million
Benzo(g,h,i)perylene (PAH)	0.17	<0.00001	<0.00001		none		
Phenanthrene (PAH)	1.5	0.00003	<0.00001		none		

Table 3: Estimated Exposure Doses and Cancer Risk for Incidental Ingestion of Soil and Sediment - Chauncey PCB Site							
Contaminant	Max level	Estimated Exposure Doses		Health based Guideline		Excess Cancer Risk	
	ppm	Child	Adult	mg/kg/day	Source	CSF	calculation
	mg/kg	mg/kg/day	mg/kg/day				
SURFACE SOIL - PIT (ADJACENT TO THE FORMER POWER PLANT)							
Arsenic	29.1	0.00045	0.00003	0.0003	ATSDR Chron Oral MRL	1.5	57 in a million
Lead	1270	0.02436	0.00174		none		
Manganese	4220	0.08093	0.00578	0.05	EPA RfD - environmental		
Thallium	6.4	0.00012	0.00001		none		
Arochlor - 1260 (PCB)	15	0.00029	0.00002		none		
Benzo(a)pyrene (PAH)	0.25	<0.00001	<0.00001			7.3	3 in a million
Benzo(g,h,i)perylene (PAH)	0.31	0.00001	<0.00001		none		
Dibenzo(a,h)anthracene (PAH)	0.12	<0.00001	<0.00001		none		
Phenanthrene (PAH)	1.5	0.00003	<0.00001		none		
TCDD equivalents for dioxin	0.000002440	<0.0000000001	<0.0000000001	0.0000000010	ATSDR chron oral MRL	150000	1 in a million
SURFACE SOIL - RESIDENTIAL YARD							
Benzo(a)pyrene (PAH)	0.54	0.00001	<0.00001			7.3	6 in a million
Dibenzo(a,h)anthracene (PAH)	0.16	<0.00001	<0.00001		none		
Benzo(g,h,i)perylene (PAH)	0.48	0.00001	<0.00001		none		
Endrin ketone	0.0093	<0.00001	<0.00001		none		
Phenanthrene (PAH)	0.97	0.00002	<0.00001		none		
SURFACE SOIL - SCHOOL YARD							
Lead	32.5	0.00062	0.00004		none		
Mercury	1.6	0.00003	<0.00001		none		
Aldrin	0.099	<0.00001	<0.00001	0.00003	ATSDR chron oral MRL	17	3 in a million
Benzo(a)pyrene (PAH)	0.081	<0.00001	<0.00001			7.3	1 in a million
Benzo(g,h,i)perylene (PAH)	0.11	<0.00001	<0.00001		none		
Endrin ketone	0.0068	<0.00001	<0.00001		none		
Phenanthrene (PAH)	0.46	0.00001	<0.00001		none		
TCDD equivalents for dioxin	0.000000815	<0.0000000001	<0.0000000001	0.0000000010	ATSDR chron oral MRL	150000	*

ASSUMPTIONS			
Ingestion Rate	*kg/day*	*0.0002*	*0.0001*
Exposure Frequency	*days/year*	*350*	*350*
	years	*6*	*30*
Body Weight	*kg*	*10*	*70*

Table 3: Estimated Exposure Doses and Cancer Risk for Incidental Ingestion of Soil and Sediment - Chauncey PCB Site							
Contaminant	Max level	Estimated Exposure Doses		Health based Guideline		Excess Cancer Risk	
	ppm	Child	Adult	mg/kg/day	Source	CSF	calculation
	mg/kg	mg/kg/day	mg/kg/day				
mg/kg = milligram per kilogram (equivalent to parts per million or ppm)							
mg/kg/day=milligram per kilogram per day							
kg/day = kilogram per day							
CSF=EPA Cancer Slope Factor							
ATSDR Chron Oral MRL=ATSDR Chronic Oral Minimal Risk Level for exposures over 365 days							
EPA Chron Oral RfD=EPA Chronic Oral Reference Dose for exposures over 365 days							
EPA RfD = EPA Reference Dose for environmental exposures							
* less than 1 in a million excess cancer risk							

Table 4. Comparison of Estimated Exposure Doses with NOAELs and LOAELS from Tables 2 & 3						
Chauncey PCB Site						
Contaminant	Estimated exposure dose [X]	Estimated exposure dose greater than or equal to health-based guideline? [Y]	NOEALs and LOAELs		Is further evaluation needed?	Reference
	mg/kg/day		mg/kg/day	Type		
DRINKING WATER - HAND DUG WELL						
Arsenic	0.0003	Y	0.0014	NOAEL	N	[3]
DRINKING WATER - LOGAN COUNTY PSD						
Dibromochloromethane	0.0003	N			N	
SURFACE WATER - MILLER BRANCH						
4-Chloro-3-methylphenol (p-chloro-m-cresol)*	0.0000009	Y	30	NOAEL	N	[7]
N-Nitroso-di-n-propylamine	0.0000007	N			N	
Pentachlorophenol	0.0000010	N			N	
SURFACE WATER - MIDDLE FORK						
delta-Benzene hexachloride (BHC)	<0.0000001	Y	0.3000000	LOAEL	N	[8]
1,2-Dibromo-3-chloropropane	0.0000010	N			N	
Heptachlor	<0.0000001	N			N	
SURFACE WATER - ISLAND CREEK						
4,6-Dinitro-2-methylphenol	0.0000008	Y				see pg 8 of text
Pentachlorophenol	0.0000010	N			N	
SUB-BASEMENT WATER FORMER POWER PLANT						
Arsenic	0.0000006	N			N	
Cadmium	0.0000002	N			N	
Lead	0.0000094	Y	0.0140000	LOAEL	N	[5]
Manganese	0.0000703	N			N	
Arochlor - 1260 (PCB)	0.0000003	Y	0.0050000	LOAEL	N	[6]
gamma-Chlordane	<0.0000001	N			N	
delta-Benzene hexachloride (BHC)	<0.0000001	Y	0.3000000	LOAEL	N	[8]
Dieldrin	<0.0000001	N			N	
Endrin aldehyde	<0.0000001	Y	0.0500000	LOAEL	N	[4]
Heptachlor epoxide	<0.0000001	N			N	
TCDD equivalents	0.000000006	Y	0.000000120	LOAEL	N	[9]
SEDIMENT - MILLER BRANCH						
Lead	0.00261	Y	0.01400	LOAEL	N	[5]
Benzo(g,h)perylene (PAH)	<0.00001	Y	125	NOAEL	N	[14]
Di-n-butylphthalate	<0.00001	N			N	
Phenanthrene (PAH)	<0.00001	Y	125	NOAEL	N	[14]
SEDIMENT - MIDDLE FORK						
Arsenic	0.00026	Y	0.00140	NOAEL	N	[3]
Manganese	0.22055	Y	0.59000	LOAEL	N	[11]
Lead	0.00038	Y	0.01400	LOAEL	N	[5]
Thallium	0.00039	Y	0.20000	NOAEL	N	[13]
Phenanthrene (PAH)	0.00001	Y	125	NOAEL	N	[14]
SEDIMENT - ISLAND CREEK						
Arsenic	0.00411	Y	0.00140	NOAEL	YES	[3]
Lead	0.00057	Y	0.01400	LOAEL	N	[5]
Thallium	0.00065	Y	0.20000	NOAEL	N	[13]
Di-n-butylphthalate	<0.00001	N			N	
Benzo(a)pyrene (PAH)	0.00001	Y	125	NOAEL	N	[14]
Phenanthrene (PAH)	0.00004	Y	125	NOAEL	N	[14]
TCDD equivalents	<0.000000001	N			N	

Table 4. Comparison of Estimated Exposure Doses with NOAELs and LOAELS from Tables 2 & 3						
Chauncey PCB Site						
Contaminant	Estimated exposure dose [X]	Estimated exposure dose greater than or equal to health-based guideline? [Y]	NOEALs and LOAELs		Is further evaluation needed?	Reference
	mg/kg/day		mg/kg/day	Type		
SURFACE SOIL - ISLAND CREEK (ADJACENT TO THE FORMER POWER PLANT)						
Arsenic	0.00022	N			N	
Cadmium	0.00051	Y	0.00210	NOAEL	N	[10]
Lead	0.00840	Y	0.01400	LOAEL	N	[5]
Arochlor - 1260 (PCB)	0.00008	Y	0.00500	LOAEL	N	[6]
Benzo(a)pyrene (PAH)	<0.00001	Y	125	NOAEL	N	[14]
Benzo(g,h,i)perylene (PAH)	<0.00001	Y	125	NOAEL	N	[14]
Phenanthrene (PAH)	0.00003	Y	125	NOAEL	N	[14]
SURFACE SOIL - PIT (ADJACENT TO THE FORMER POWER PLANT)						
Arsenic	0.00045	Y	0.00140	NOAEL	N	[3]
Lead	0.02436	Y	0.01400	LOAEL	YES	[5]
Manganese	0.08093	Y	0.59000	LOAEL	N	[11]
Thallium	0.00012	Y	0.20000	NOAEL	N	[13]
Arochlor - 1260 (PCB)	0.00029	Y	0.00500	LOAEL	N	[6]
Benzo(a)pyrene (PAH)	<0.00001	Y	125	NOAEL	N	[14]
Benzo(g,h,i)perylene (PAH)	0.00001	Y	125	NOAEL	N	[14]
Dibenzo(a,h)anthracene (PAH)	<0.00001	Y	125	NOAEL	N	[14]
Phenanthrene (PAH)	0.00003	Y	125	NOAEL	N	[14]
TCDD equivalents	<0.000000001	N			N	
SURFACE SOIL - RESIDENTIAL YARD						
Benzo(a)pyrene (PAH)	0.00001	Y	125	NOAEL	N	[14]
Dibenzo(a,h)anthracene (PAH)	<0.00001	Y	125	NOAEL	N	[14]
Benzo(g,h,i)perylene (PAH)	0.00001	Y	125	NOAEL	N	[14]
Endrin ketone***	<0.00001	Y	0.45000	NOAEL	N	[4]
Phenanthrene (PAH)	0.00002	Y	125	NOAEL	N	[14]
SURFACE SOIL - SCHOOL YARD						
Lead	0.00062	Y	0.01400	LOAEL	N	[5]
Mercury**	0.00003	Y	0.00130	NOAEL	N	[12]
Aldrin	<0.00001	N			N	
Benzo(a)pyrene (PAH)	<0.00001	Y	125	NOAEL	N	[14]
Benzo(g,h,i)perylene (PAH)	<0.00001	Y	125	NOAEL	N	[14]
Endrin ketone***	<0.00001	Y	0.45000	NOAEL	N	[4]
Phenanthrene (PAH)	0.00001	Y	125	NOAEL	N	[14]
TCDD equivalents	<0.000000001	N			N	
mg/kg/day = milligrams per kilogram per day						
NOEAL = no-observed-adverse effect level						
LOAEL = lowest-observed-adverse effect level						
NOTE: Island Creek soil and sediment samples were from the area adjacent to the former power plant						
[X] The highest estimated exposure doses from Tables 2 and 3						
[Y] The health based guidelines are noted on Tables 2 and 3. If there is no health based guideline, the number is assumed to be greater than it.						
* The NOAEL for m-cresol was used						
** The NOAEL for organic mercury was used						
***The NOEAL for endrin was used						

GLOSSARY

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

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

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.

Cancer
Any one of a group of diseases that occur 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.

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.

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.

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.

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

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

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 "exposure dose" is how much of a substance is encountered in the environment. An "absorbed dose" is the amount of a substance that actually got into the body through the eyes, skin, stomach, intestines, or lungs.

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.

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 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.

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].

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.

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].

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.

mg/kg
Milligram per kilogram.

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].

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 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.

Public health hazard
A category used in ATSDR's public health assessment documents 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.

Risk
The probability that something will cause injury or harm.

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].

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.

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.

Substance
A chemical.

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.

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 that could result in harmful health effects that require rapid intervention.