Public Health Assessment

ASARCO, Incorporated

Taylor Springs, Montgomery County, Illinois

EPA Facility ID # ILD 062436704

Public Comment Period Ends March 18, 2005.

Prepared by

The Illinois Department of Public Health
Under a cooperative agreement with the
Agency for Toxic Substances and Disease Registry

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Summary

The Illinois Department of Public Health (IDPH) has evaluated the available site information and environmental data for the American Smelting and Refining Company (ASARCO), Inc. site in Taylor Springs, Illinois. Historical zinc smelting operations at the site have led to contamination of on-site and off-site environmental media.

IDPH concludes that the site poses a public health hazard because of the potential for residents, workers, and trespassers to be exposed to elevated levels of arsenic, cadmium, lead, and zinc in surface material on and near the site. IDPH has recommended ways for area residents to reduce their potential exposures and to evaluate where current exposures are elevated. IDPH recommends that environmental regulatory agencies take steps to further evaluate and reduce the potential for exposure to environmental hazards.

Purpose

The Illinois Department of Public Health (IDPH) has evaluated the American Smelting and Refining Company (ASARCO), Incorporated site in Taylor Springs at the request of the Illinois Environmental Protection Agency (Illinois EPA). Illinois EPA plans to propose the site to the U.S. Environmental Protection Agency (USEPA) for review by the Superfund Prioritization Panel. IDPH reviewed the available site information and environmental data for this public health assessment.

Background and Statement of Issues

The ASARCO, Inc. site is a 673-acre property west of Illinois Route 127 in Taylor Springs, Montgomery County, Illinois. Taylor Springs is a small community (population 670) just south of Hillsboro (Figure 1). The site is bordered by a railroad to the east and the middle fork of Shoal Creek to the west. A residential area is north of the site. A lake, some ponds, and surface water impoundments are on the site.

The site was used for smelting operations beginning about 1911. Coal, obtained in part from the Taylor Springs Coal Mine beneath part of Taylor Springs and the site property, fueled furnaces on the property. Today, Midwest Zinc, which continues to produce zinc oxide, leases 5.7 acres of the property. Midwest Zinc reportedly is in compliance with current environmental regulations (Illinois EPA 2000).

Most of the site outside the 100-acre operations area is wooded or cultivated farm fields and presents no environmental hazards. Soil, surface water, and groundwater near the current and historical operational areas are the most affected areas, containing slag, clinkers, demolition debris, and black fines. Process residues are spread over an area of about 50 acres, some near surface drainage and ponds. Most solid wastes were stockpiled on the unprotected ground surface. Shoal Creek, formed by branches that drain to the south, is a tributary of the Kaskaskia River. Shoal Creek's middle branch winds through the property. Over the years, the solid smelting waste was transported off the site to be used as fill and surface material (Illinois EPA 2000).

Site History

Construction of the zinc plant began about 1911. Eight coal-gas producers were constructed on the site. Zinc ore and locally produced coal were used to generate slab zinc and sulfuric acid. The frothy, reddish-brown waste from this operation, called slag, was generated until 1924. Several surface water impoundments have been constructed using the solid wastes from the plants. Some impoundments were constructed to hold process water and others were used to store coal. Coal was stockpiled under water to prevent spontaneous combustion.

Around 1916, the plant also began to produce zinc oxide. By the 1930s, the plant ended the production of primary zinc slab. The plant began to collect scrap metals to produce secondary zinc slab and secondary zinc oxide in the 1940s. The scrap metal feedstock generated by-products, including scrap iron and alloys of copper, aluminum, and lead. Waste products, gray to black granules generated from the "American Process" of primary zinc oxide production, are called "calcine" or "sinter clinkers" and were produced until about 1975. Through the years, various grades of paint pigments were blended using lead and zinc oxide.

In 1981, a cleanup was conducted after a transformer leaked fluid containing polychlorinated biphenyls (PCBs). Two underground storage tanks in the oxide plant facility were removed in the late 1980s.

In 1994, building rubble from the demolition of some zinc oxide furnaces was placed in a low-lying area northwest of the current plant. Reports refer to this area as "Trench 1" (JMZ Geology 1998). Another area identified as receiving rubble in the former metals plant area is designated as "Trench 4."

Environmental Sampling

On-site groundwater wells were sampled in 1994 in the area within the operating zinc oxide plant. Cadmium, manganese, and zinc reportedly exceeded the Illinois EPA groundwater standards at that time. Eight additional wells were installed. In 1997, samples from 14 monitoring wells were analyzed (using two methods) for 13 metals, total metals, and dissolved metals (JMZ Geology 1998). Although some metals exceeded environmental standards in some wells, the investigators concluded that the contamination did not extend beyond the site boundary. The discharge point for area groundwater is believed to be the fork of Shoal Creek.

On-site surface water samples also were collected in 1997. In late 1997, testing of soils for PCBs did not find elevated levels. In May 2000, Illinois EPA inspected the site using a field instrument to test for levels of metals in soil and sediment. A tributary of Shoal Creek and other streams were tested. The field screening included the lake, a nearby smaller pond, and the pond used to store coal (Illinois EPA 2001).

In April and June 2001, Illinois EPA collected samples from several media at the site. Illinois EPA personnel collected six solid waste samples from the former plant area and sediment samples from 10 locations of various depths near a branch of Shoal Creek, a main drainage ditch, a pond, and the lake. Illinois EPA personnel also collected groundwater samples from three monitoring wells and two surface water samples. Off-site soil samples, collected from seven residential yards and four public properties at depths ranging from 0 to 5 inches, were analyzed for 23 metals and cyanide (USEPA 2004). IDPH mailed letters to the owners and residents of these residential properties to provide a health-based interpretation of the results. When levels were elevated, IDPH recommended ways to reduce exposure to contaminants in soil. IDPH also recommended that children who live on properties with elevated levels of lead or who play on the site have their blood tested for lead.

Site Visit

In June 2001, IDPH and Illinois EPA staff visited the site and discovered evidence of human activity and recreation at the lake. A rope hanging from a tree at the water's edge suggested the area had been used for swimming. Candy wrappers and other trash observed in the woods along the banks of the lake suggested trespassing. Fish, about 6 inches in length, were observed in the lake. Some shallow sediments were yellow and orange. Illegal dumping in wooded areas has been a problem through the years because of the secluded nature of the area.

Illinois EPA sampled some of the yards of residences next to the plant property in 2001. Reportedly, these homes are connected to municipal water. A day care center and a senior citizens' center are located along Illinois Route 127, about 0.75 miles from the site. The nearest school is about 1 mile east of the site on the east side of Illinois Route 127 at the corner of Hamilton and Spring Streets. Taylor Springs has a small business section and fire department.

IDPH staff most recently visited the site on February 23, 2004. Signs indicating "No Trespassing" were posted, but no gates or fencing restrict access.

Discussion

Chemicals of Interest

IDPH compared the results of the 1997 JMZ Geology groundwater investigation, and Illinois EPA 2001 and 2003 environmental sampling data with the appropriate comparison values to select chemicals for further evaluation (Attachment 1). Organic chemicals, including PCBs and pesticides, did not exceed comparison values in any media on or off the site. The chemicals of interest for the ASARCO site, including off-site residential soil, are antimony, arsenic, cadmium, lead, and zinc. The levels of these chemicals of interest in various environmental media can be found in Tables 1 through 5.

Metals in the environment can be present as elements or as compounds with another substance (for example, lead sulfate). Different forms have different abilities to enter the human body and differing toxicities. At one time, acids were produced at the site, and metals are more mobile in acidic environments than in more neutral, natural environments.

Exposure Assessment

An exposure pathway consists of a source of contamination, an environmental media and transport mechanism, a point of exposure, and a receptor population. Exposure to a chemical may have occurred in the past, may be occurring now, or may occur in the future. When all these elements linking the chemical source to an exposed population are known, a completed exposure pathway exists. When one or more of these elements is missing but could be present, a potential exposure pathway exists. Given current conditions, persons could be exposed to on-site wastes, sediments, and surface water and off-site surface soil. Persons would not be exposed to on-site groundwater.

A summary of all estimated doses that exceeded health guidelines can be found in Table 6 and is discussed below.

Residents

Residents may be exposed to elevated levels of metals in their household dust and residential soil. In the past, nearby residents may have experienced exposures through air emissions. Particles emitted into the air from the smelting process eventually settle onto soil and household surfaces. Although no air data have been reviewed for this site, in the past, before engineered air controls were installed in these operations, fumes and particles likely existed. Properties where smelting wastes were used as fill or for driveways or roads, for example, may have higher metal concentrations than those that only received air deposition.

For residents, IDPH assumed that adults and children would be exposed to the maximum level of contaminants in residential soil for 10 months per year. Adults weighing 70 kilograms (kg) would incidentally ingest 100 milligrams of soil daily, and children weighing 25 kg would incidentally ingest 200 milligrams of soil daily. Metals in soil are poorly absorbed dermally.

On the basis of the above exposure scenario, adults could be exposed to lead in residential soil at levels that could cause adverse health effects. For children, adverse health effects could be possible from exposure to arsenic, cadmium, lead, and zinc in residential soil (Table 6). Adults and children also would have a low increased risk for cancer from exposure to arsenic (Attachment 2).

Trespassers

Trespassers, including hikers, all-terrain vehicle (ATV) operators, swimmers, and fishers, may be exposed to contaminants in on-site soil and sediment and have access to unauthorized swimming in the lake and ponds. If dust is stirred up, particles could be inhaled or ingested. Unsupervised swimming presents a drowning hazard.

For trespassers, IDPH assumed that middle school aged children (40 kg) to adults (70 kg) would come onto the site 100 days per year. IDPH assumed that trespassers would incidentally ingest 200 milligrams of soil daily from hiking and ATV riding activities, and would be exposed to the maximum level of contaminants in soil. Metals in soil are poorly absorbed dermally. The most recent surface water sampling did not detect any chemicals at levels greater than comparison values. No adverse health effects would be expected from exposure to surface water. No one uses on-site surface water as a drinking water source.

On the basis of the above exposure scenarios, trespassers could be exposed to lead and arsenic at levels that could cause noncancer adverse health effects (Table 6). Exposure to arsenic would also pose a moderate increased risk for cancer for trespassers (Attachment 2).

Although one on-site soil sample had a high level of antimony (507 mg/kg), the average levels of antimony were much lower. Therefore, no adverse health effects would be expected from exposure to antimony in soil.

Workers

Workers may be exposed to on-site soil and sediment. Former and current workers likely have greater exposures than the population at large because they handled these materials and were close to the operations. Many years of operation occurred prior to workplace and environmental regulations. Today, modern workplace practices likely have reduced worker exposures.

For workers, IDPH assumed that adults would be exposed to the maximum level of chemicals detected and would incidentally ingest 100 milligrams of soil a day for 250 days per year.

On the basis of that exposure scenario, workers may be exposed to levels of arsenic and lead that could cause adverse health effects (Table 6). A moderate increased risk for cancer would be expected for workers exposed to arsenic for 30 years of their lifetime (Attachment 2).

Although one on-site soil sample had a high level of antimony (507 mg/kg), the average levels of antimony were much lower. Therefore, no adverse health effects would be expected from exposure to antimony in soil.

Toxicological Evaluation

The likelihood that a person would experience adverse health effects depends upon the frequency and length of exposure, the age, body weight, and health status of the individual; the levels of the metals encountered; and the toxicity of individual metals. Exposure varies from person to person. Even persons working side-by-side can have different personal habits (e.g., smoking, nail biting) that could result in large differences in exposure.

Much information regarding adverse health effects from exposure to hazards is based on exposure to a single substance. Whether interactions among mixtures of metals increase or diminish adverse effects is uncertain. For example, some studies suggest that zinc has the ability to reduce the absorption of cadmium and other metals. Some of the metals of interest are known to accumulate in the human body and are known to interrupt normal physiological processes.

The following sections will discuss chemicals to which persons may be exposed at sufficient levels to cause adverse health effects.

Arsenic

Residents and workers may be exposed to low levels of arsenic for prolonged periods. Long-term exposure to low levels of inorganic arsenic may lead to an increase risk for a darkening of the skin and the appearance of small “corns” or “warts” on the palm, soles, and torso. In addition, trespassers and workers exposed to low levels of arsenic may have a moderate increased risk for cancer over their lifetimes. For residents, a low increased risk for cancer may be expected from exposure to arsenic.

The estimated dose for a child exposed to arsenic in residential soil (0.001 mg/kg-day), a child trespassing onto the site (0.002 mg/kg-day), an adult trespasser (0.001 mg/kg-day) and an adult worker (0.002 mg/kg-day) all are greater than the chronic minimal risk level (MRL) of 0.0003 mg/kg-day. The MRL is based on epidemiologic studies that found a no-observed-adverse-effect level (NOAEL) of 0.0008 mg/kg-day and a lowest-observed-adverse-effect level (LOAEL) of 0.014 mg/kg-day for skin changes [ATSDR 2000]. The estimated doses are greater than the NOAEL, but 7 to 14 times less than the LOAEL.

USEPA, the National Toxicology Program, the U.S. Department of Health and Human Services and the International Agency for Research on Cancer consider inorganic arsenic to be a known human carcinogen. Studies have associated the ingestion of arsenic mainly with skin cancer. Studies also have shown that ingestion of arsenic can cause cancers of the bladder, kidneys, liver, lungs, and prostate (ATSDR 2000). Cancers caused by chemical exposure often do not appear until 10 or more years after exposure. Also, cancers caused by chemicals cannot be distinguished from cancers that occur spontaneously.

Cadmium

Residents may be exposed to low levels of cadmium for prolonged periods; however, adverse health effects would not be expected.

The estimated dose for a child exposed to cadmium in residential soil (0.00076 mg/kg-day) is greater than the chronic MRL of 0.0002 mg/kg-day. This is less than the NOAEL of 0.0021 mg/kg-day and the LOAEL for serious kidney problems of 0.0078 mg/kg-day found in human studies. Therefore exposure to cadmium in residential soil would not be expected to cause adverse health effects. Animal data suggest that cadmium is a probable human carcinogen (ATSDR 1999). However, because cadmium has no oral cancer slope factor, estimating the carcinogenic risk is not possible.

Cadmium, which has no beneficial role in the human body, can accumulate, primarily in the kidneys. Cadmium exposures should be avoided and minimized to avoid excessive body burdens of this metal.

Lead

Elevated levels of lead have the potential to affect residents, workers and trespassers. Lead has no known essential role in the human body. Exposure to lead at elevated levels can affect almost every organ and system in the body. The most sensitive is the central nervous system, particularly in children. Lead exposure is especially a problem for pregnant women and young children because lead is known to interrupt the normal development of the brain. Lead also can damage the kidneys and the reproductive system. In adults, exposure to lead can result in increased blood pressure. Lead and cadmium affect the same organs in the body, so exposure to both metals at the same time can increase the risk for adverse health effects.

Even at doses that do not result in noticeable symptoms, lead can interrupt normal enzymatic functions in our bodies (ATSDR 1999). Good nutrition, hygiene, and housecleaning practices are even more important in homes near known environmental sources of lead. Because of lead's widespread use in many products, including paint, before 1978, lead contamination is a problem in many older homes. A blood test is the only way to determine if a person is being exposed to elevated levels of lead (IDPH 1995).

Zinc

Because zinc slab and zinc oxide have been the primary products made at this site, zinc has been widely distributed in the area and residents may be exposed to elevated levels of zinc. Zinc is an essential element in the human diet. Too little or too much zinc can cause health problems (ATSDR 1994).

The estimated dose for a child exposed to zinc in residential soil (1.5 mg/kg-day) is greater than the intermediate and chronic MRL of 0.3 mg/kg-day. Chronic and intermediate MRLs are based on changes in blood chemistry seen in women given zinc supplements for 10 weeks. The changes were observed at a LOAEL of 1 mg/kg-day (ATSDR 1994). Children who receive the recommended daily allowance of zinc in their diet each day (approximately 0.2 mg/kg-day) could receive up to 7 times this amount by playing in contaminated soil. This could cause changes in the blood chemistry of exposed children and lead to adverse health effects.

Community Health Concerns

In 1981, Illinois EPA received a complaint about a leaking transformer at the site. The investigators found that the main power transformer had leaked fluid within a building with a concrete floor and that the cleanup appeared to be appropriate.

Also in 1981, county workers investigated complaints of random dumping in secluded parts of the site. They found rusted appliances, cans, tires and other debris. Because site access is not restricted and some parts of the site are secluded and wooded, dumping has been an ongoing issue.

Illinois EPA sponsored a public availability session on May 3, 2004, at the Taylor Springs Community Center. Representatives from Illinois EPA, IDPH, and the Montgomery County Health Department were present to answer questions. Community concerns included whether residential soil contained elevated levels of metals and whether vegetables grown in contaminated soil would contain elevated levels of metals. Fact sheets from ATSDR and IDPH explained to the residents the possible health effects from exposure to soil contaminated with metals. The residents were also given information on ways to reduce their exposure to metals in surface soil.

Child Health Considerations

Children live in homes near the facility and many residential soil samples had elevated levels of metals. In several yards, lead levels exceeded the IDPH Lead Poisoning Prevention Code guideline of 1,000 parts per million. Lead exposure is especially a problem for pregnant women and young children because lead is known to interrupt the normal development of the brain. In addition, exposure to arsenic in soil may pose a low increased cancer risk over a lifetime of exposure. IDPH mailed letters to the owners and residents of the affected residential properties to recommend ways to reduce exposure to contaminants in soil. IDPH also recommended that children who live on properties with elevated levels of lead or who play on the site have their blood tested for lead.

IDPH reviewed the most recent blood lead data available. Montgomery County had 24 cases of elevated blood lead levels in 441 children (less that 6 years old) tested in 2001 and 18 cases of elevated blood lead levels in 448 children tested in 2002. These rates, 5% and 4%, respectively, are less than the statewide rate of 7% in 2001 and 6% in 2002 (IDPH 2004). For the years 1999–2002, 25 children in the Taylor Springs zip code (61089) had their blood tested for lead. No elevated levels were found.

Surface water on the site has been used for swimming and recreation for the community for years and remains accessible. Future cleanup plans include filling the on-site lakes with solid material, which would reduce the risk of drowning for trespassers on the site.

Conclusions

IDPH concludes that the ASARCO site is a public health hazard because of the potential for residents, workers, and trespassers to be exposed to elevated levels of metals in the surface material and soil on and near the site. Of the metals present, exposure to lead and arsenic is most likely to cause adverse health effects.

No barriers or fencing restrict access to the site. In addition to the elevated levels of metals, unsupervised surface water presents a drowning hazard to trespassers. Former workers and nearby residents likely were exposed to higher levels of contaminants than exist today; however, IDPH cannot reconstruct these past exposures.

Recommendations

IDPH recommends that –

- People living near areas known to contain smelting wastes or elevated levels of metals in soil should take steps to reduce the potential for exposure to these metals.
- Illinois EPA should consider implementing additional restrictions for the site, including gates, fencing, and warning signs on the perimeter of the site.
- Families with young children (less than 6 years of age) who live on properties with elevated levels of lead or whose children play on the site should have their children's blood tested for lead.
- Current workers and future cleanup workers should use proper personal protection to reduce exposure to metals in on-site wastes and contaminated residues.

Public Health Actions

IDPH has mailed letters to the owners and residents of the affected residential properties to provide recommendations about ways to reduce exposure to contaminants in soil. IDPH also recommended that children who live on properties with elevated levels of lead or who play on the site have their blood tested for lead. A state law requires that children enrolled in a licensed day care or in a public school must have had at least one blood lead test.

IDPH will assist Illinois EPA with the health interpretation of any future data that is generated as a result of additional sampling. Also, IDPH staff will participate in public meetings to help address the health concerns of interested parties.

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Tables

Table 1. Chemicals of Interest in ASARCO On-Site Solid Waste–Illinois EPA samples collected on 4/25/01 (in milligrams per kilogram)

Chemical	Concentration Ranges	Samples ≥ CV	Comparison Values (CV)		
			Type	Value	Source
Antimony	ND–507	3/6	Child	20	RMEG
		1/6	Adult	300	RMEG
Arsenic	1.8–1,880	6/6	All ages	0.5	CREG
		4/6	Child	20	CEMEG
		2/6	Adult	200	CEMEG
Cadmium	1.5J–43.5J	4/6	Child	10	CEMEG
Copper	183–5,750J	1/6	Child	2,000	IEMEG
Lead	19.9–37,700J	4/6	Child	1,000	IDPH
Zinc	3,900–70,800	4/6	Child	20,000	CEMEG

RMEG = reference dose media evaluation guide
CREG = cancer risk evaluation guide
CEMEG = chronic environmental media evaluation guide
IEMEG = intermediate environmental evaluation guide
IDPH = standard for lead in residential soil from the Illinois Lead Poisoning Prevention Code
J = estimated value
ND = not detected

Table 2. Chemicals of Interest in ASARCO On-Site sediment–Illinois EPA samples collected on 4/24/01 (in milligrams per kilogram)

Chemical	Concentration Ranges	Samples ≥CV	Comparison Values (CV)		
			Type	Value	Source
Arsenic	0.86–130J	10/10	All ages	0.5	CREG
		2/10	Child	20	CEMEG
Cadmium	4.4J–188J	6/10	Child	10	CEMEG
		1/10	Adult	100	CEMEG
Lead	6.3–3,160J	5/10	Child	1,000	IDPH
Zinc	245–77,500	4/10	Child	20,000	CEMEG

CREG = cancer risk evaluation guide
CEMEG = chronic environmental media evaluation guide
IDPH = standard for lead in residential soil from the Illinois Lead Poisoning Prevention Code
J = estimated value

Table 3. Chemicals of Interest in Off-Site Soil from Taylor Springs–Public and Private Properties Collected at Various Depths (in milligrams per kilogram)

Chemical	Concentrations Ranges and Number of Samples Exceeding Comparison Values (CV)				Comparison Values (CV)		
	6/13/01 Samples	Samples ≥ CVs	6/18/03 Samples	Samples ≥ CVs	Type	Value	Source
Arsenic	10.4–159	12/12	6.9–104	16/16	All	0.5	CREG
		6/12		6/16	Child	20	CEMEG
Cadmium	ND–114J	7/12	2.1–68.8	8/16	Child	10	CEMEG
		1/12		0/16	Adult	100	CEMEG
Lead	170–11,600J	8/12	80.7–9,360	8/16	Child	1,000	IDPH
Zinc	4,120J–222,000J	7/12	364–69,700	6/16	Child	20,000	IEMEG
		1/12		0/16	Adult	200,000	IEMEG

CREG = cancer risk evaluation guide
CEMEG = chronic environmental media evaluation guide
IDPH = standard for lead in residential soil from the Illinois Lead Poisoning Prevention Code
IEMEG = intermediate environmental evaluation guide
J = estimated value
ND = not detected

Table 4. Chemicals of Interest in ASARCO On-Site Surface Water–Illinois EPA samples collected 4/25/2001 and JMZ Geology samples collected 8/1/1997 (in micrograms per liter)

Chemical	Range 4/25/01 n=2	Samples ≥ CVs	Range 8/1/97 n=5	Samples ≥ CVs	Comparison Values (CV)	
					Value	Source
Cadmium	ND–ND	0/2	ND–230	2/5	5	MCL
Lead	ND–ND	0/2	ND–22	2/5	15	MCL
Zinc	23.7–24	0/2	ND–67,000	1/5	5,000	MCL

MCL = maximum contaminant level
ND = not detected

Table 5. Chemicals of Interest in ASARCO On-Site Groundwater–Illinois EPA samples collected 4/25/2001 and JMZ Geology samples collected 8/1/1997 (in micrograms per liter)

Chemical	Range 6/12/01 n=3	Samples ≥ CV	Range 7/17/97 10/5/97 n=14	Samples ≥ CV	Comparison Values (CV)	
					Value	Source
Antimony	ND–24	1/3	ND–7 all ND	1/14 0/14	6	MCL
Arsenic	3.5J–13.7J	1/3	2–96 ND–330	6/14 7/14	10	MCL
Cadmium	ND–4	0/3	ND–1,200 ND–1,200	8/14 8/14	5	MCL
Lead	12.2–60.5	2/3	ND–180 ND–540	7/14 10/14	15	MCL
Zinc	68.4J–334J	0/3	ND–43,000 100–48,000	5/14 6/14	3,000	CEMEG
		0/3	ND–43,000 100–48,000	5/14 5/14	10,000	CEMEG

ND = not detected
J = estimated value
MCL = maximum contaminant level
CEMEG = chronic environmental media evaluation guide

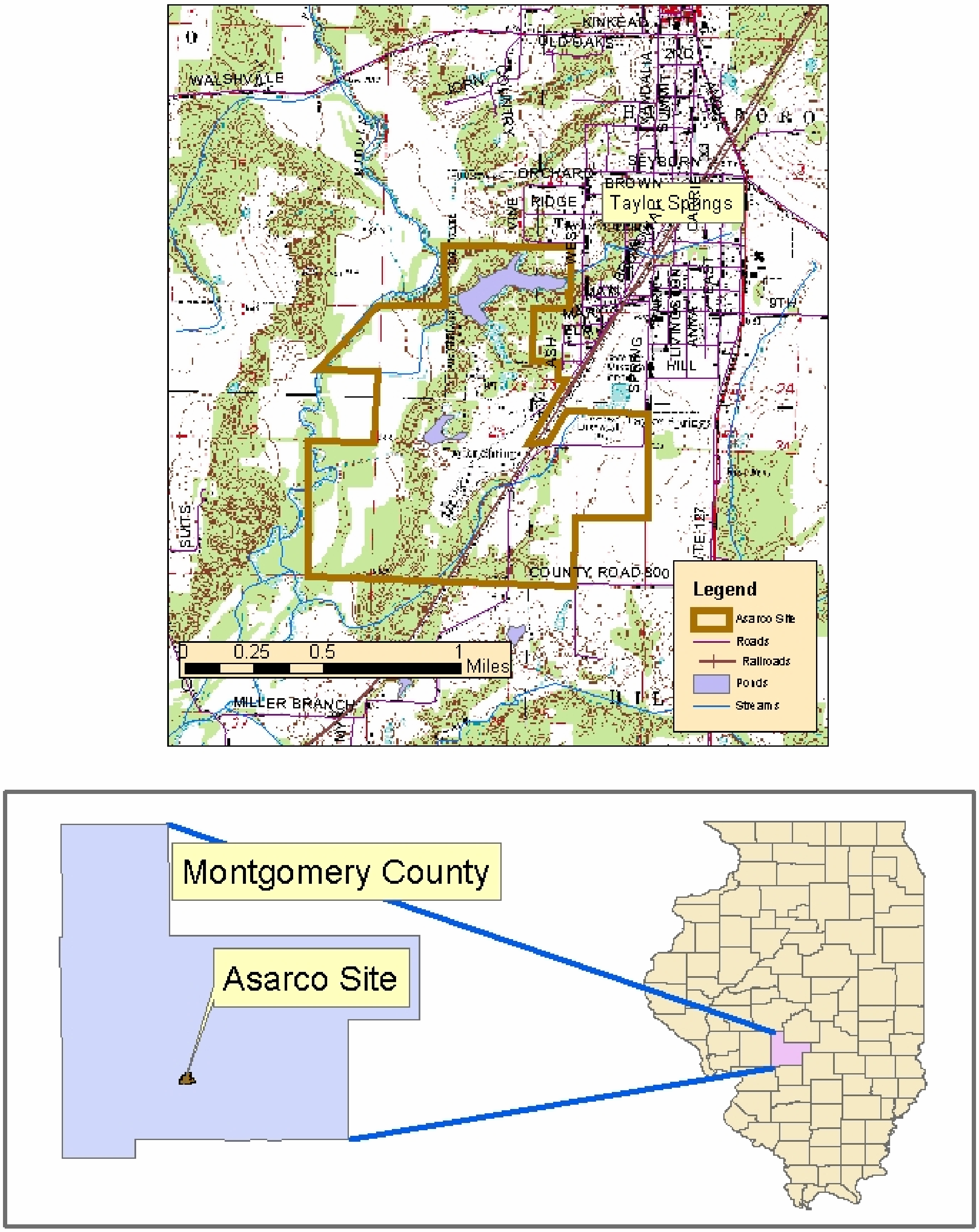
Table 6. Summary of Estimated Doses Greater than Health Guidelines

Chemical	Age	Estimated Dose (in milligrams per kilogram-day)	Chronic MRL (in milligrams per kilogram-day)
Residents			
Arsenic	Child	0.001	0.0003
Cadmium	Child	0.00076	0.0002
Zinc	Child	1.5	0.3
Trespassers			
Arsenic	Adult	0.001	0.0003
	Child	0.002	0.0003
Workers			
Arsenic	Adult	0.002	0.0003

MRL = Minimal Risk Level

Figures

Figure 1 - Asarco Site Location Map



IDPH, 2004

Attachments

Attachment 1

Comparison Values Used in Screening Contaminants for Further Evaluation

Environmental Media Evaluation Guides (EMEGs) are developed for chemicals based on their toxicity, frequency of occurrence at National Priorities List (NPL) sites, and potential for human exposure. They are not action levels but are comparison values. They are developed without consideration for carcinogenic effects, chemical interactions, multiple route exposure, or exposure through other environmental media. They are very conservative concentration values designed to protect sensitive members of the population.

Reference Dose Media Evaluation Guides (RMEGs) are another type of comparison value. They are developed without consideration for carcinogenic effects, chemical interactions, multiple route exposure, or exposure through other environmental media. They are very conservative concentration values designed to protect sensitive members of the population.

Cancer Risk Evaluation Guides (CREGs) are estimated contaminant concentrations based on a probability of one excess cancer in a million persons exposed to a chemical over a lifetime.

Maximum Contaminant Levels (MCLs) have been established by USEPA for public water supplies to reduce the chances of occurrence of adverse health effects from use of contaminated drinking water. These standards are well below levels for which health effects have been observed and take into account the financial feasibility of achieving specific contaminant levels. These are enforceable limits that public water supplies must meet.

Lifetime Health Advisories for drinking water (LTHAs) have been established by USEPA for drinking water. They represent the concentrations of chemicals in drinking water that are not expected to cause any adverse, non-carcinogenic effects over a lifetime of exposure. These are conservative values that incorporate a margin of safety.

Attachment 2

Cancer Slope Factors Used and Lifetime Cancer Risks Calculated for this Public Health Assessment

The only carcinogen detected at elevated levels at ASARCO is arsenic, which has a potency factor of 1.5 (milligrams per kilogram-day)$^{-1}$. The cancer risk estimations are based on the doses in Table 6 with the additional modifying factor of 20/70 years for child lifetime risk and 30/70 years for adult lifetime risk.

Age	Dose (milligrams per kilogram-day)	Potency Factor (milligrams per kilogram-day)$^{-1}$	Modifying Factor (years)	Cancer Risk
Residents				
Adults	0.0002	1.5	30/70	1.3×10^{-4}
Child	0.001	1.5	20/70	4.3×10^{-4}
Trespassers				
Adults	0.001	1.5	30/70	6.4×10^{-4}
Child	0.002	1.5	20/70	8.6×10^{-4}
Workers				
Adults	0.002	1.5	30/70	1.3×10^{-3}