Health Consultation

El Paso Schools

EL PASO COUNTY METAL SURVEY

EL PASO, EL PASO COUNTY, TEXAS

EPA FACILITY ID: TX0000605388

OCTOBER 12, 2001

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

Health Consultation: A Note of Explanation

An ATSDR health consultation is a verbal or written response from ATSDR to a specific request for information about health risks related to a specific site, a chemical release, or the presence of hazardous material. In order to prevent or mitigate exposures, a consultation may lead to specific actions, such as restricting use of or replacing water supplies; intensifying environmental sampling; restricting site access; or removing the contaminated material.

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:

Texas Department of Health
Under a Cooperative Agreement with the
Agency for Toxic Substances and Disease Registry

BACKGROUND AND STATEMENT OF ISSUES

Previously, at the request of the U.S. Environmental Protection Agency (EPA), the Texas Department of Health (TDH) and the Agency for Toxic Substances and Disease Registry (ATSDR) reviewed historical data collected in the El Paso area [1]. Recommendations were made that additional samples be collected to confirm the results of the historical data [1]. EPA collected samples from various locations in the El Paso, Texas and Sunland Park, New Mexico area. Based on the results of this sampling effort, TDH and ATSDR identified specific areas where the concentrations of lead and arsenic in the soil should be better characterized [2]. These areas included several El Paso schools. Between July 30, 2001 and August 1, 2001, EPA collected soil samples from five schools in the El Paso area. The purpose of this health consultation is to determine the public health significance of the lead and arsenic found in soil from these schools.

DISCUSSION

Between July 30 and August 1, 2001, soil samples were collected from four elementary schools (Alamo, Roosevelt, Mesita, and Vilas) and one high school (El Paso High). Samples, collected at depths of 0 to 1 inch and 0 to 6 inches, were analyzed for lead and arsenic content. A description of the samples and the sample results are presented in Tables 1 and 2. The average concentration of lead in the 0 to 1 inch samples ranged from 21 milligrams per kilogram (mg/kg) at Roosevelt Elementary to 137 mg/kg at Alamo Elementary (Table 1). The average concentration of arsenic in the 0 to 1 inch samples ranged from less than 3.0 mg/kg at three schools to 4.9 mg/kg at Vilas Elementary (Table 2). The average concentration of lead in the 0 to 6 inch samples ranged from 31 mg/kg to 313 mg/kg. Average arsenic concentrations in the 0 to 6 inch samples ranged from less than 3.0 mg/kg to 3.4 mg/kg.

Public Health Implications

Lead

We evaluate the public health significance of lead in soil by estimating the potential impact that it may have on the blood lead levels of potentially exposed populations. For this consultation we considered potential exposure of adults, children, and the developing fetus (of adult females that frequent the school grounds). In general, lead in soil has the greatest impact on preschool-age children as they are more likely to play in dirt and place their hands and other contaminated objects in their mouths. They also are better at absorbing lead through the gastrointestinal tract than adults and are more likely to exhibit the types of nutritional deficiencies that facilitate the absorption of lead. While lead in soil also can have an impact on adults and the developing fetus (through maternal exposure), the potential impact on these populations is low compared to the potential impact on young preschool age children.

The Centers for Disease Control and Prevention (CDC) has determined that a blood lead level ≥10 µg/dL in children indicates excessive lead absorption and constitutes the grounds for intervention [3, 4]. While there is no clear relationship between soil lead and blood lead applicable to all sites, a number of models have been developed to estimate the potential impact that lead in soil could have on different populations [5–7]. For children, the predicted 95th percentile blood lead level associated with a soil lead concentration of 500 mg/kg is approximately 10 µg/dL. This means that except in the most extreme cases (i.e., frequent contact by children exhibiting pica behavior, or desire for unnatural foods such as dirt or ashes) children regularly exposed to soil lead levels of 500 mg/kg should have no more than a 5% probability of having blood lead levels greater than 10 µg/dL. Based on the goal of limiting the probability of exceeding a blood lead level of 10 µg/dL to no more than 5%, depending on individual exposure situations, the concentrations of lead in soil where children might have regular contact should be less than 500 mg/kg. Exceeding this value should not be taken to imply that the contaminant will cause harm but does suggest that it warrants further consideration.

Critical blood lead levels for adults are less well established. The Occupational Safety and Health Administration (OSHA) recommends that workers whose blood lead levels exceed 40 µg/dL should have medical evaluations and workers whose blood lead levels exceed 60 µg/dL be removed from the exposure. In Texas workers, blood lead levels greater than 25 µg/dL must be reported to TDH. For adults who work at or frequent the school areas, we based our assessment on the same goal of limiting the probability of exceeding a blood lead level of 10 µg/dL to no more than 5 percent.

At each of the schools, the average concentration of lead in soil was considerably less than the 500 mg/kg screening value for children. Only one 0 to 6 inch sample from Alamo Elementary and one 0 to 1 inch sample from El Paso High exceeded the screening value for children (Table 1).

Although schools are areas where both children and adults could contact soil, the average concentrations of lead to which people might be exposed are considerably less than 500 mg/kg and would not pose a risk either to children or adults [5 – 7]. Any potential risks are further reduced by the fact that the exposure assumptions that we used to derive the screening values assume that people contact the soil every day and that the soil at the school is the only soil to which they are exposed. Based on these data, we would not anticipate the lead in the soil to present a public health hazard to any of the potentially exposed populations.

<u>Arsenic</u>

To assess the potential health risks associated with the arsenic in the soil, we compared the soil concentrations to a health-based screening value specific to arsenic. This screening value represents a level in the soil that is considered safe for human contact. While exceeding this screening value does not imply that the contaminant will cause harm, it does suggest that potential exposure to the contaminant warrants further consideration.

The screening value that we used for arsenic in soil (20 mg/kg) is based on a child exposure scenario and EPA's reference dose (RfD) for arsenic of 0.3 µg/kg/day [8]. RfDs are based on the assumption that there is an identifiable exposure threshold (both for the individual and for populations) below which there are no observable adverse effects. Thus, the RfD is an estimate of a daily exposure to arsenic that is unlikely to cause adverse non-cancer health effects even if exposure were to occur every day for a lifetime. For arsenic, the RfD was derived by dividing the identified no observable adverse effects level (NOAEL[1]) of 0.8 µg/kg/day, obtained from human epidemiologic studies, by an uncertainty factor of three. The lowest observable adverse effects level (LOAEL[2]) associated with these epidemiologic studies was 14 µg/kg/day, where exposure to arsenic above this level resulted in hyperpigmentation of the skin, keratosis (patches of hardened skin), and possible vascular complications [8–10]. We used standard assumptions for body weight (15 kg; child) and soil ingestion (200 mg per day; child) to calculate the screening value. Screening values calculated using child exposure scenarios also are conservative (health protective) with respect to protecting adults.

The average concentrations of arsenic in soil from the schools were considerably less than the 20 mg/kg screening value, and no individual sample exceeded the screening value (Table 2). Any potential risks are further reduced by the fact that the exposure assumptions that we used to derive the screening value assume that people contact the soil every day and that the soil at the school is the only soil to which they are exposed. Based on these conservative assumptions it is not likely that children or adults who regularly eat soil from any of the schools would experience adverse non-cancer health effects.

EPA also classifies arsenic as a known human carcinogen based on sufficient evidence from human data. An increase in lung cancer mortality was observed in multiple human populations exposed primarily through inhalation. Also, increased mortality from multiple internal organ cancers (liver, kidney, lung, and bladder) and an increased incidence of skin cancer (non-malignant) were observed in populations consuming water high in inorganic arsenic [8]. We used EPA's cancer slope factor (CSF) for arsenic to estimate the potential increased lifetime cancer risks associated with exposure to arsenic in soil from these schools. For people exposed to the soil from any of the schools every day for 9 years, we estimate there to be no increase in the lifetime risk for cancer. Based on these data, we would not anticipate the arsenic in the soil from any of the schools to present a public health hazard to any of the potentially exposed populations.

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[1]The highest dose at which adverse effects were not observed.

[2]The lowest dose at which adverse effects were observed.

Uncertainties

General Uncertainties

The conclusions in this consultation are based on data developed by EPA contractors. Although a description of the quality assurance and quality control (QA/QC) measures used to evaluate these data were not available for review, EPA Region 6 personnel indicated that the data were QA/QC'd to their satisfaction. We assumed the data to be accurate unless specifically qualified.

The most likely routes of exposure to the contaminants found in the soil are ingestion (eating the soil) and inhalation (breathing in the soil as windblown dust). Based on the information available for this consultation, we would not anticipate the inhalation of windblown dust to be a major contributor to exposure even though windblown dust may be common in El Paso. Overall, the concentrations of the contaminants in the soil are low and would not be likely to result in any significant loading of the air with contaminants.

In order for exposure to the contaminants to occur through ingestion, the soil must be physically available. The screening values that we used in this consultation assume that the soil is available and that physical barriers such as grass are not present. The presence of the grass would further reduce the likelihood for exposure. Individual behavior patterns also are important in assessing risk. The amount of soil that a person eats, how often they eat the soil, and the average concentration of the contaminant in the soil that they eat all are important factors in determining potential public health implications. For this consultation we assumed that people would eat soil from the schools every day and that their total daily consumption of soil and dust would come from the school. In most instances these types of assumptions overestimate the potential exposures.

Specific Uncertainties

There is considerable controversy with respect to assessing potential risks associated with exposure to arsenic. Both the RfD and the CSF are based on human ecological studies that have recognized uncertainties with respect to the assignation of exposure. Such studies find it difficult to avoid errors in assigning people to specific exposure groups. The studies upon which the RfD and the CSF are based also involved exposure to arsenic in drinking water. The ability of the body to absorb arsenic in water is likely higher than the ability of the body to absorb arsenic in soil. In our analysis we assumed that the arsenic in the soil was 100% absorbed. Assuming that the applied dose (the amount available for absorption) is the same as the internal dose (the amount that has been absorbed), is conservative and to some unknown extent overestimates the risk. We also did not consider the kinetics of arsenic in the body in our risk estimates. The RfD and the CSF are based on daily exposures over a lifetime. Since the half-life (the time it takes ½ of the absorbed arsenic to be excreted) is short (40-60 hours), the risk estimates for exposures that occur less frequently than every day also may result in an overestimate of the risks.

With specific respect to the cancer risk estimates, the mechanisms through which arsenic causes cancer are not known; however, arsenic is not believed to act directly with DNA. Since the studies used to derive the CSF are based on exposure doses much higher than those likely to be encountered at this site, it is questionable whether it is appropriate to assume linearity for the dose-response assessment for arsenic at low doses. The actual dose-response curve at low doses may be sublinear which would mean that the risk estimates in this consultation overestimate the actual risks.

ATSDR's Child Health Initiative

We recognize that the unique vulnerabilities of children demand special attention. Windows of vulnerability (critical periods) exist during development, particularly during early gestation, but also throughout pregnancy, infancy, childhood and adolescence ---- periods when toxicants may permanently impair or alter structure and function [8]. Unique childhood vulnerabilities may be present because, at birth, many organs and body systems (including the lungs and the immune, endocrine, reproductive, and nervous systems) have not achieved structural or functional maturity. These organ systems continue to develop throughout childhood and adolescence. Children may exhibit differences in absorption, metabolism, storage, and excretion of toxicants, resulting in higher biologically-effective doses to target tissues. Depending on the affected media, they also may be more exposed than adults because of behavior patterns specific to children. In an effort to account for children's unique vulnerabilities, and in accordance with ATSDR's Child Health Initiative [9] and EPA's National Agenda to Protect Children's Health from Environmental Threats [10], we used the potential exposure of children as a guide in assessing the potential public health implications of the contaminants.

CONCLUSIONS

1. The average concentrations of lead and arsenic in soil from the schools did not exceed their respective soil-based screening values. Thus, it is not likely that people frequenting the school grounds would experience adverse health effects associated with the contaminants found in the soil. Based on the available information we have concluded that the concentrations of lead and arsenic found in soil from the schools do not pose a public health hazard to any of the potentially exposed populations.

PUBLIC HEALTH ACTION PLAN

Actions Recommended

1. None at this time.

REFERENCES

1. Agency for Toxic Substances and Disease Registry. Health Consultation Review of historical soil sampling results El Paso County Metal Survey Site, El Paso, El Paso County, Texas. Texas Department of Health. July 20, 2001.

2. Agency for Toxic Substances and Disease Registry. Health Consultation Heavy metals confirmation sampling El Paso, El Paso County, Texas - Sunland Park, Dona Ana County, New Mexico. Texas Department of Health. August, 2001.

3. Centers for Disease Control. Preventing lead poisoning in young children. US Department of Health and Human Services; October 1991.

4. Agency for Toxic Substances and Disease Registry. The nature and extent of lead poisoning in children in the United States: a report to Congress. Atlanta: US Department of Health and Human Services; 1988.

5. US Environmental Protection Agency (USEPA). Memorandum from Mark Maddaloni, chair technical review workgroup adult lead subgroup to Pat Van Leeuwen, region 5 superfund program use of the technical review workgroup Interim Adult Lead Methodology in Risk Assessment, April 1999.

6. Agency for Toxic Substances and Disease Registry (ATSDR). Analysis paper: Impact of lead-contaminated soil on public health. US Department of Health and Human Services; May 1992.

7. Society for Environmental Geochemistry and Health. 1993. Lead in soil, recommended guidelines. Science Reviews.

8. US Environmental Protection Agency. 2000. Strategy for research on environmental risks to children. Washington, DC: US Environmental Protection Agency, Office of Research and Development. EPA/600/R-00/068, Section 1.2.

9. Agency for Toxic Substances and Disease Registry (ATSDR). Child health initiative. Atlanta: US Department of Health and Human Services; 1995.

10. US Environmental Protection Agency. The children's environmental health yearbook; 1998.

Table 1. El Paso Schools Soil Sampling Results - Lead

School	Soil Sample (0 to 1 inch depth)			Soil Samples (0 to 6 inch depth)		
	#pos/ #samples	Detection Limit (mg/kg)	Mean[1] (min-max) (mg/kg)	#pos/ #samples	Detection Limit (mg/kg)	Mean[1] (min-max) (mg/kg)
Alamo	6/6	3.0	137.4 (3.5 - 328)	4/6	3.0	312.7 (<3.0 t 1,800)
Roosevelt	1/1	3.0	21	1/1	3.0	31
Mesita	26/30	3.0	81.2 (<3.0 - 330)	23/30	3.0	60.5 (<3.0 - 330)
Vilas	11/12	3.0	119.5 (<3.0 - 480)	11/11	3.0	31.9 (<3.0 - 67)
El Paso High	68/74	3.0	71.3 (<3.0 - 1,500)	56/73	3.0	47.4 (<3.0 - 250)

[1] Values reported to be below the detection limit were taken as ½ the detection limit to calculate the mean.

Table 2. El Paso Schools Soil Sampling Results - Arsenic

School	Soil Sample (0 to 1 inch depth)			Soil Samples (0 to 6 inch depth)		
	#pos/ #samples	Detection Limit (mg/kg)	Mean[1] (min-max) (mg/kg)	#pos/ #samples	Detection Limit (mg/kg)	Mean[1] (min-max) (mg/kg)
Alamo	0/6	3.0	<3.0 '	0/6	3.0	<3.0
Roosevelt	0/1	3.0	<3.0	0/1	3.0	<3.0
Mesita	4/30	3.0	2.4 (<3.0 - 11)	4/30	3.0	2.2 (<3.0 - 10)
Vilas	5/12	3.0	4.9 (<3.0 - 14)	4/11	3.0	3.4 (<3.0 - 12)
El Paso High	0/74	3.0	<3.0	1/73	3.0	1.6 (<3.0 - 4.9

[1] Values reported to be below the detection limit were taken as ½ the detection limit to calculate the mean.

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CERTIFICATION

This health consultation was prepared by the Texas Department of Health under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with approved methodology and procedures existing at the time the health consultation was initiated.

Technical Project Officer, SPS, SSAB, DHAC, ATSDR

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

Chief, Superfund Site Assessment Branch, DHAC, ATSDR