U.S. Environmental Protection Agency
Mid-Atlantic Region
1650 Arch Street
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EXIDE TECHNOLOGIES SITE

Risk Assessment for Lead in Residential Soil Background and Investigation Results

BACKGROUND

Each EPA or State cleanup is unique in terms of the contaminants present, their potential health effects and the exposure pathway. Therefore, EPA normally conducts risk assessments on a site-by-site basis. A risk assessment estimates the current and possible future risks, if no action were taken to cleanup the site. EPA's goal is to manage risks at acceptable levels, and risk managers incorporate risk assessment information with a variety of site factors to select the best cleanup strategies.

Lead is a unique contaminant and one to which EPA has devoted much research and analysis. The primary tool used by EPA to estimate risk from soil contaminated with lead is called the Integrated Exposure Uptake Biokinetic (IEUBK) model. This model is used to estimate blood lead concentrations for children within a study area that are exposed to lead from multiple sources. In the Exide investigation, this exposure would include the lead in the soil due to smelter emissions.

THE IEUBK MODEL

Given a number of input variables, the IEUBK model estimates the blood lead level expected in exposed children aged 6 to 84 months. Since this age group is most vulnerable to health problems from lead exposure, EPA cleanup levels are designed to be protective of this group in a residential setting.

The IEUBK model incorporates lead concentrations from various media including tap water, air, lead paint, household dust, and food. These lead concentrations can either be measured in the community or estimated (called default values). Soil lead concentrations are also used in the model, and are always based on measurements in the community (site-specific). The IEUBK model also considers factors such as the bioavailability of lead in soil, a soil-to-dust transfer factor, and soil ingestion rate. In addition, the model uses a statistical parameter called the geometric standard deviation, which describes the relative variability in the blood lead levels of children exposed to the same levels of lead.

Default media lead concentration values for the IEUBK model come from averages derived from multiple sites. Site-specific information comes from actual environmental and blood samples within the Exide study area. For this risk assessment, EPA used both default values and site-specific values to the IEUBK model.

BLOOD LEAD STUDY

A blood lead study, an important part of the risk assessment, was conducted to measure current blood lead levels among children living in the Exide study area. The study was delayed one year until 2002 in order to perform the study at the optimum time recommended by EPA guidance (late summer is considered the best time). The blood lead study indicated that 34 out of 36 children tested exhibited blood lead levels between 0.5 ug/dL and 7 ug/dL. Only two children exhibited blood lead levels above the Centers for Disease Control (CDC) standard of 10 ug/dL. One child had a blood lead level of 14 ug/dL and the other had a blood lead level of 17 ug/dL. EPA determined that one of the children did not live in the area, and was only an occasional visitor. Since the permanent resident at the same property did not exhibit elevated blood lead levels, EPA concluded that the visiting child was being exposed to lead elsewhere. The parents were advised to follow-up with their family physician. The second child with elevated blood lead levels had recently moved into the area. The parents informed the investigators that the child has had a history of elevated blood lead associated with lead paint exposures at their former home. This child's blood lead level has decreased since the family moved into the area.

The blood lead study concluded that the overall blood lead levels for children in the area are safely below the CDC standard. In fact, the average blood lead levels in the Exide study area were nearly identical to the national average of 2.0 ug/dL.

RISK ASSESSMENT AND SOIL CLEANUP LEVEL

The Exide Child Lead Risk Assessment applied two site-specific inputs from the environmental sampling and the designated default parameter inputs to the IEUBK model.

Initially, Exide also recommended modifying the soil ingestion rate from the default value. Exide suggested that the low blood lead levels found within the tested children may mean that the soil ingestion rate default value in the model was too high (the model overestimated the amount of soil ingested). After further analysis and discussion, EPA rejected this change.

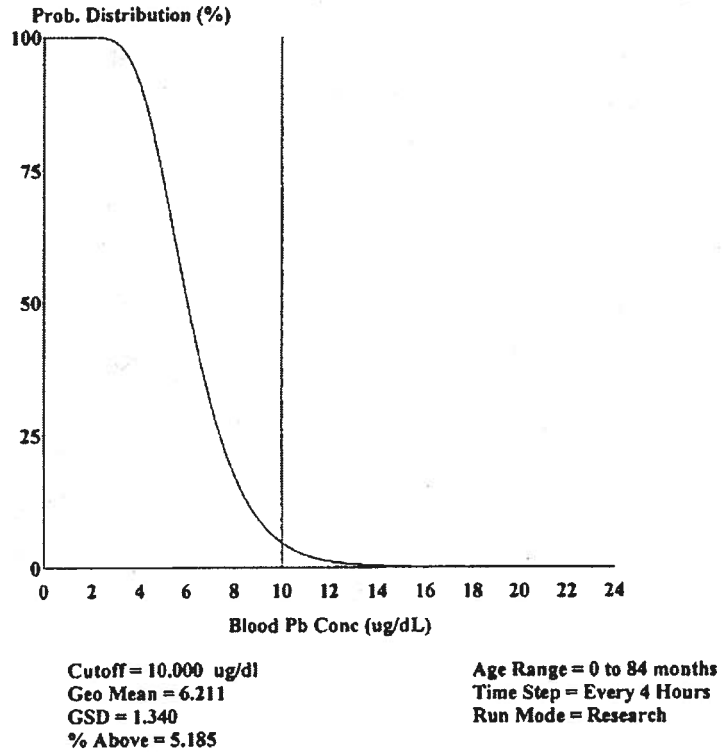
The 650 parts per million (ppm) soil cleanup level is derived by applying the site-specific inputs for the geometric standard deviation (from the blood lead study) and tap water lead concentration (from Study Area sampling). EPA used the model default values for the remaining inputs that include updated dietary lead intake values to the IEUBK model.

The following table lists the primary parameter inputs used in the IEUBK model to calculate the soil lead cleanup level:

Medium	Parameter	Age (years)						
		0-1	1-2	2-3	3-4	4-5	5-6	6-7
Air	Concentration (ug/m^3)	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Diet	Daily intake (ug/day)	2.26	1.96	2.13	2.04	1.95	2.05	2.22
Soil/Dust	Soil/dust transfer coefficient	0.70	0.70	0.70	0.70	0.70	0.70	0.70
Soil Ingestion Rate	Total daily intake (mg/day)	85	135	135	135	100	90	85
All	Bioavailability	30%	30%	30%	30%	30%	30%	30%
Tap water	**Concentration (ug/L)**	**1**	**1**	**1**	**1**	**1**	**1**	**1**
All	**GSD**	**1.32**	**1.32**	**1.32**	**1.32**	**1.32**	**1.32**	**1.32**

Bold: Site-specific inputs

Below is the graph of the model's output using the site-specific inputs for tap water and the GSD and applying the default values for the remaining parameters:



This graph of the IEUBK model output illustrates that a cleanup target of 650 ppm meets the standard that children below the age of 84 months have a 5% or less chance of exceeding 10 ug/dL blood lead.

As discussed in the final decision letter, EPA initially applied the Exide plant air monitoring data to the model. However, EPA determined that air data from within the plant boundary are not

representative of community wide levels. As a result, EPA selected the model default value which had the effect of increasing the soil lead cleanup level from 600 ppm to 650 ppm.

The 650 ppm soil lead level developed through the risk assessment is consistent with the Order and EPA policy and guidance. The IEUBK model has been used at several lead sites throughout the country. Site-specific conditions generally result in differences in the range of soil lead levels that are protective for the specific community. Below are some of the sites and their respective soil lead cleanup levels predicted by the model:

Site	**Location**	**Soil Clean up Level (ppm)**
NL Industries,	Granite City, IL	500
Price Battery	Hamburg, PA	570
East Helena	Helena, MT	620
Palmerton Zinc	Palmerton, PA	650
Bunker Hill	Coeur d'Alene, ID	700
Blackwell Zinc	Blackwell, OK	750
Sherwin Williams	Coffeyville, KS	750
National Zinc Site	Bartlesville, OK	925

EPA is very confident that the 650 ppm soil lead cleanup level established under the Consent Order is properly derived and will be protective for resident children. This cleanup level along with voluntary blood lead monitoring will assure long term protection of human health and the environment in Laureldale Borough and Muhlenberg Township.

NEXT STEPS

- EPA will review the Exide Residential Cleanup Workplan;
- EPA will schedule a meeting with the elected officials and stakeholders to discuss the cleanup workplan;
- EPA will schedule a public meeting to present the risk assessment and the residential cleanups;
- Residential soil cleanup will begin in spring 2008.

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