

Lead Information Packet

Content

- Activity instructions
- Discussion starters
- Overview of set-up and lead basics (presentation slides)
- Basic Information: Lead in Paint, Dust, and Soil (EPA Fact Sheet)
- Lead Compounds: Technology Transfer Network Air Toxics Web Site (EPA Fact Sheet)

Activity Instructions

- Take 30 minutes to do the following:
 - Review the information in your packet.
 - Select a team spokesperson.
 - Establish where your stakeholder group stands on the issue of lead contamination from the Durite Facility.
 - Determine what new tests you have conducted and what new information has come to light.
 - Create a 3-slide presentation defending your stakeholder position and proposing next steps for addressing the issue (3 minutes for presentation, 2 minutes for questions).
 - At the end of the exercise, the local environmental agency will pass a resolution on next steps to address the issue.

Discussion Starters

Put yourselves in the shoes of the parents, environmentalists, educators, and other community members that are concerned about the health of the community.

1. How would you respond to the local news articles?
2. Where would you focus your efforts for the next 6 months (i.e., what kinds of follow-up studies or inquiries are most important for you to conduct)?
3. What is the most important information for you to convey to the rest of the public and to the local government agencies?

Basic Information: Lead in Paint, Dust, and Soil

Facts about lead

FACT: Lead exposure can harm young children and babies even before they are born.

FACT: Even children who seem healthy can have high levels of lead in their bodies.

FACT: You can get lead in your body by breathing or swallowing lead dust, or by eating soil or paint chips containing lead.

FACT: You have many options for reducing lead hazards. In most cases, lead-based paint that is in good condition is not a hazard.

FACT: Removing lead-based paint improperly can increase the danger to your family.

If you think your home might have lead hazards, read on to learn about lead and some simple steps to protect your family.

Health effects of lead

Childhood lead poisoning remains a major environmental health problem in the United States.

- People can get lead in their body if they:
 - Put their hands or other objects covered with lead dust in their mouths.
 - Eat paint chips or soil that contains lead.
 - Breathe in lead dust, especially during renovations that disturb painted surfaces.
- Lead is more dangerous to children because:
 - Babies and young children often put their hands and other objects in their mouths. These objects can have lead dust on them.
 - Children's growing bodies absorb more lead.
 - Children's brains and nervous systems are more sensitive to the damaging effects of lead.
- If not detected early, children with high levels of lead in their bodies can suffer from:
 - Damage to the brain and nervous system
 - Behavior and learning problems, such as hyperactivity
 - Slowed growth
 - Hearing problems
 - Headaches
- Lead is also harmful to adults. Adults can suffer from:
 - Reproductive problems (in both men and women)
 - High blood pressure and hypertension
 - Nerve disorders
 - Memory and concentration problems
 - Muscle and joint pain

Are you renovating, repairing or painting a home, child care facility or school built before 1978?

Beginning April 22, 2010, federal law requires that contractors performing renovation, repair and painting projects that disturb more than six square feet of paint in homes, child care facilities, and schools built before 1978 must be certified and trained to follow specific work practices to prevent lead contamination. Protect your family and make sure you only hire a contractor who is in a Lead-Safe Certified Firm. [Find a Lead-Safe Certified Firm near you.](#)

Read about EPA's requirements for [renovation, repair and painting](#). Read EPA's pamphlet on renovation, repair and painting:

Are you planning to buy or rent a home built before 1978?

Many houses and apartments built before 1978 have paint that contains lead (called lead-based paint). Lead from paint, chips, and dust can pose serious health hazards if not taken care of properly.

Federal law requires that individuals receive certain information before renting or buying a pre-1978 housing:

- LANDLORDS must disclose known information on lead-based paint and lead-based paint hazards before leases take effect. Leases must include a disclosure form about lead-based paint.
- SELLERS must disclose known information on lead-based paint and lead-based paint hazards before selling a house. Sales contracts must include a disclosure form about lead-based paint. Buyers have up to ten days to check for lead hazards.

Where lead is found

In general, the older your home, the more likely it has lead-based paint.

- Paint. Many homes built before 1978 have lead-based paint. The federal government banned lead-based paint from housing in 1978. Some states stopped its use even earlier. Lead can be found:
 - In homes in the city, country, or suburbs.
 - In apartments, single-family homes, and both private and public housing.
 - Inside and outside of the house.
- In soil around a home. Soil can pick up lead from exterior paint, or other sources such as past use of leaded gas in cars, and children playing in yards can ingest or inhale lead dust.
- Household dust. Dust can pick up lead from deteriorating lead-based paint or from soil tracked into a home.
- [Drinking water](#). Your home might have plumbing with lead or lead solder. Call your local health department or water supplier to find out about testing your water. You cannot see, smell or taste lead, and boiling your water will not get rid of lead. If you think your plumbing might have lead in it:
 - Use only cold water for drinking and cooking.
 - Run water for 15 to 30 seconds before drinking it, especially if you have not used your water for a few hours.
- The job. If you work with lead, you could bring it home on your hands or clothes. Shower and change clothes before coming home. Launder your work clothes separately from the rest of your family's clothes.
- Old painted toys and furniture.
- Food and liquids stored in lead crystal or lead-glazed pottery or porcelain. Food can become contaminated because lead can leach in from these containers.
- Lead smelters or other industries that release lead into the air.
- Hobbies that use lead, such as making pottery or stained glass, or refinishing furniture.
- Folk remedies that contain lead, such as "greta" and "azarcon" used to treat an upset stomach.

Where lead is likely to be a hazard

Lead from paint chips, which you can see, and lead dust, which you can't always see, can be serious hazards.

- Peeling, chipping, chalking, or cracking lead-based paint is a hazard and needs immediate attention.
- Lead-based paint may also be a hazard when found on surfaces that children can chew or that get a lot of wear-and-tear. These areas include:
 - Windows and window sills.
 - Doors and door frames.
 - Stairs, railings, and banisters.
 - Porches and fences.

Note: Lead-based paint that is in good condition is usually not a hazard.

- Lead dust can form when lead-based paint is dry scraped, dry sanded, or heated. Dust also forms when painted surfaces bump or rub together. Lead chips and dust can get on surfaces and objects that people touch. Settled lead dust can re-enter the air when people vacuum, sweep or walk through it.
- Lead in soil can be a hazard when children play in bare soil or when people bring soil into the house on their shoes. Contact the [National Lead Information Center \(NLIC\)](#) to find out about testing soil for lead.

How to check your family and home for lead

Just knowing that a home has lead-based paint may not tell you if there is a hazard.

To reduce your child's exposure to lead, get your child checked, have your home tested (especially if your home has paint in poor condition and was built before 1978), and fix any hazards you may have.

- Your family

Children's blood lead levels tend to increase rapidly from 6 to 12 months of age, and tend to peak at 18 to 24 months of age.

Consult your doctor for advice on testing your children. A simple blood test can detect high levels of lead. Blood tests are important for:

- Children at ages one and two.
- Children and other family members who have been exposed to high levels of lead.
- Children who should be tested under your state or local health screening plan.

Your doctor can explain what the test results mean and if more testing will be needed.

- Your home

You can get your home checked in one of two ways, or both

- A paint inspection tells you the lead content of every different type of painted surface in your home. It won't tell you whether the paint is a hazard or how you should deal with it.
- A risk assessment tells you if there are any sources of serious lead exposure (such as peeling paint and lead dust). It also tells you what actions to take to address these hazards.

Have qualified professionals do the work. There are standards in place for certifying lead-based paint professionals to ensure the work is done safely, reliably, and effectively. Contact the [National Lead Information Center](#) (NLIC) for a list of contacts in your area.

Trained professionals use a range of methods when checking your home, including:

- Visual inspection of paint condition and location.
- A portable x-ray fluorescence (XRF) machine.
- Lab tests of paint samples.
- Surface dust tests.

Note: Home test kits for lead are available, but studies suggest that they are not always accurate. Consumers should not rely on these tests before doing renovations or to assure safety.

What you can do to protect your family

- If you suspect that your house has lead hazards, you can take some immediate steps to reduce your family's risk:

If you rent, notify your landlord of peeling or chipping paint.

Clean up paint chips immediately.

Clean floors, window frames, window sills, and other surfaces weekly. Use a mop, sponge, or paper towel with warm water and a general all-purpose cleaner or a cleaner made specifically for lead.

REMEMBER: NEVER MIX AMMONIA AND BLEACH PRODUCTS TOGETHER SINCE THEY CAN FORM A DANGEROUS GAS.

Thoroughly rinse sponges and mop heads after cleaning dirty or dusty areas.

Wash children's hands often, especially before they eat and before nap time and bed time.

Keep play areas clean. Wash bottles, pacifiers, toys, and stuffed animals regularly.

Keep children from chewing window sills or other painted surfaces.

Clean or remove shoes before entering your home to avoid tracking in lead from soil.

Make sure children eat healthy and nutritious meals as recommended by the [National Dietary Guidelines](#). Children with good diets absorb less lead.

- Additional steps:

You can temporarily reduce lead hazards by taking actions such as repairing damaged painted surfaces and planting grass to cover soil with high lead levels. These actions are not permanent solutions and will need ongoing attention.

To permanently remove lead hazards, you must hire a certified lead "abatement" contractor.

Abatement (or permanent hazard elimination) methods include removing, sealing, or enclosing lead-based paint with special materials. Just painting over the hazard with regular paint is not enough.

Always hire a person with special training for correcting lead problems -- someone who knows how to do this work safely and has the proper equipment to clean up thoroughly. Certified contractors will employ qualified workers and follow strict safety rules set by their state or the federal government.

Contact the [National Lead Information Center \(NLIC\)](#) for help with locating certified contractors in your area and to see if financial

Source: <http://www.epa.gov/lead/pubs/leadinfo.htm>

Lead Compounds [\(a\)](#): Technology Transfer Network Air Toxics Web Site

Hazard Summary-Created in April 1992; Revised in January 2000

Lead is used in the manufacture of batteries, metal products, paints, and ceramic glazes. Exposure to lead can occur from breathing contaminated workplace air or house dust or eating lead-based paint chips or contaminated dirt. Lead is a very toxic element, causing a variety of effects at low dose levels. Brain damage, kidney damage, and gastrointestinal distress are seen from acute (short-term) exposure to high levels of lead in humans. Chronic (long-term) exposure to lead in humans results in effects on the blood, central nervous system (CNS), blood pressure, kidneys, and Vitamin D metabolism. Children are particularly sensitive to the chronic effects of lead, with slowed cognitive development, reduced growth and other effects reported. Reproductive effects, such as decreased sperm count in men and spontaneous abortions in women, have been associated with high lead exposure. The developing fetus is at particular risk from maternal lead exposure, with low birth weight and slowed postnatal neurobehavioral development noted. Human studies are inconclusive regarding lead exposure and cancer.

Please Note: The main sources of information for this fact sheet are EPA's [Integrated Risk Information System \(IRIS\)](#), which contains information on the carcinogenic effects of lead, and the Agency for Toxic Substances and Disease Registry's (ATSDR's) [Toxicological Profile for Lead](#).

Uses

- The primary use of lead is in the manufacture of batteries. [\(1\)](#)
- Lead is also used in the production of metal products, such as sheet lead, solder (but no longer in food cans), and pipes, and in ceramic glazes, paint, ammunition, cable covering, and other products. [\(1\)](#)
- Tetraethyl lead was used in gasoline to increase the octane rating until lead additives were phased out and eventually banned from use in gasoline in the U.S. by the EPA by 1996. [\(1\)](#)

Sources and Potential Exposure

- The largest source of lead in the atmosphere has been from leaded gasoline combustion, but with the phasedown of lead in gasoline, air lead levels have decreased considerably. Other airborne sources include combustion of solid waste, coal, and oils, emissions from iron and steel production and lead smelters, and tobacco smoke. [\(1,2\)](#)
- Exposure to lead can also occur from food and soil. Children are at particular risk to lead exposure since they commonly put hands, toys, and other items in their mouths, which may come in contact with lead-containing dust and dirt. [\(1,2\)](#)
- Lead-based paints were commonly used until 1978 and flaking paint, paint chips, and weathered paint powder may be a major source of lead exposure, particularly for children. [\(1,2\)](#)
- Lead in drinking water is due primarily to the presence of lead in certain pipes, solder, and fixtures. [\(1,2\)](#)
- Exposure to lead may also occur in the workplace, such as lead smelting and refining industries, steel and iron factories, gasoline stations, and battery manufacturing plants. [\(1,2\)](#)
- Lead has been listed as a pollutant of concern to EPA's [Great Waters Program](#) due to its persistence in the environment, potential to bioaccumulate, and toxicity to humans and the environment. [\(3\)](#)

Assessing Personal Exposure

- The amount of lead in the blood can be measured to determine if exposure to lead has occurred. [\(1,2\)](#)
- The level of lead in the blood is measured in micrograms per deciliter ($\mu\text{g}/\text{dL}$).
- Exposure to lead can also be evaluated by measuring erythrocyte protoporphyrin (EP), a component of red blood cells known to increase when the amount of lead in the blood is high. This method was commonly used to screen children for potential lead poisoning. [\(1,2\)](#)
- Methods to measure lead in teeth or bones by X-ray fluorescence techniques are not widely available. [\(1\)](#)

Health Hazard Information

Acute Effects:

- Death from [lead poisoning](#) may occur in children who have blood lead levels greater than 125 $\mu\text{g}/\text{dL}$ and brain and kidney damage have been reported at blood lead levels of approximately 100 $\mu\text{g}/\text{dL}$ in adults and 80 $\mu\text{g}/\text{dL}$ in children. [\(1,2\)](#)
- Gastrointestinal symptoms, such as colic, have also been noted in acute exposures at blood lead levels of approximately 60 $\mu\text{g}/\text{dL}$ in adults and children. [\(1,2\)](#)
- Short-term (acute) animal tests in rats have shown lead to have [moderate](#) to [high](#) acute toxicity. [\(4\)](#)

Chronic Effects (Noncancer):

- Chronic exposure to lead in humans can affect the blood. Anemia has been reported in adults at blood lead levels of 50 to 80 µg/dL, and in children at blood lead levels of 40 to 70 µg/dL. (1,2)
- Lead also affects the nervous system. Neurological symptoms have been reported in workers with blood lead levels of 40 to 60 µg/dL, and slowed nerve conduction in peripheral nerves in adults occurs at blood lead levels of 30 to 40 µg/dL. (1,2)
- Children are particularly sensitive to the neurotoxic effects of lead. There is evidence that blood lead levels of 10 to 30 µg/dL, or lower, may affect the hearing threshold and growth in children. (1,2)
- Other effects from chronic lead exposure in humans include effects on blood pressure and kidney function, and interference with vitamin D metabolism. (1,2,5)
- Animal studies have reported effects similar to those found in humans, with effects on the blood, kidneys, and nervous, immune, and cardiovascular systems noted. (1,2,5)
- EPA has not established a Reference Concentration (RfC) or a Reference Dose (RfD) for elemental lead or inorganic lead compounds. (6)
- EPA has established a Reference Dose (RfD) for tetraethyl lead (an organometallic form of lead) of 1×10^{-7} milligrams per kilogram body weight per day (mg/kg/d) based on effects in the liver and thymus of rats. The RfD is an estimate (with uncertainty spanning perhaps an order of magnitude) of a daily oral exposure to the human population (including sensitive subgroups) that is likely to be without appreciable risk of deleterious noncancer effects during a lifetime. It is not a direct estimator of risk, but rather a reference point to gauge the potential effects. At exposures increasingly greater than the RfD, the potential for adverse health effects increases. Lifetime exposure above the RfD does not imply that an adverse health effect would necessarily occur. (7)
- EPA has medium to low confidence in the RfD due to (1) medium to low confidence in the study on which the RfD for tetraethyl lead was based because, although only a few animals per sex per dose level were tested, a good histopathologic exam was conducted and a dose-severity was observed; and (2) medium to low confidence in the data base because some supporting information was available. (7)

Reproductive / Developmental Effects:

- Studies on male lead workers have reported severe depression of sperm count and decreased function of the prostate and/or seminal vesicles at blood lead levels of 40 to 50 µg/dL. These effects may be seen from acute as well as chronic exposures. (1,5)
- Occupational exposure to high levels of lead has been associated with a high likelihood of spontaneous abortion in pregnant women. However, the lowest blood lead levels at which this occurs has not been established. These effects may be seen from acute as well as chronic exposures. (1,5)
- Exposure to lead during pregnancy produces toxic effects on the human fetus, including increased risk of preterm delivery, low birthweight, and impaired mental development. These effects have been noted at maternal blood lead levels of 10 to 15 µg/dL, and possibly lower. Decreased IQ scores have been noted in children at blood lead levels of approximately 10 to 50 µg/dL. (1,2)
- Human studies are inconclusive regarding the association between lead exposure and other birth defects, while animal studies have shown a relationship between high lead exposure and birth defects. (1,5)

Cancer Risk:

- Human studies are inconclusive regarding lead exposure and an increased cancer risk. Four major human studies of workers exposed to lead have been carried out; two studies did not find an association between lead exposure and cancer, one study found an increased incidence of respiratory tract and kidney cancers, and the fourth study found excesses for lung and stomach cancers. However, all of these studies are limited in usefulness because the route(s) of exposure and levels of lead to which the workers were exposed were not reported. In addition, exposure to other chemicals probably occurred. (1,2,6)
- Animal studies have reported kidney tumors in rats and mice exposed to lead via the oral route. (1,2,5,6)
- EPA considers lead to be a Group B2, probable human carcinogen. (6)

Physical Properties

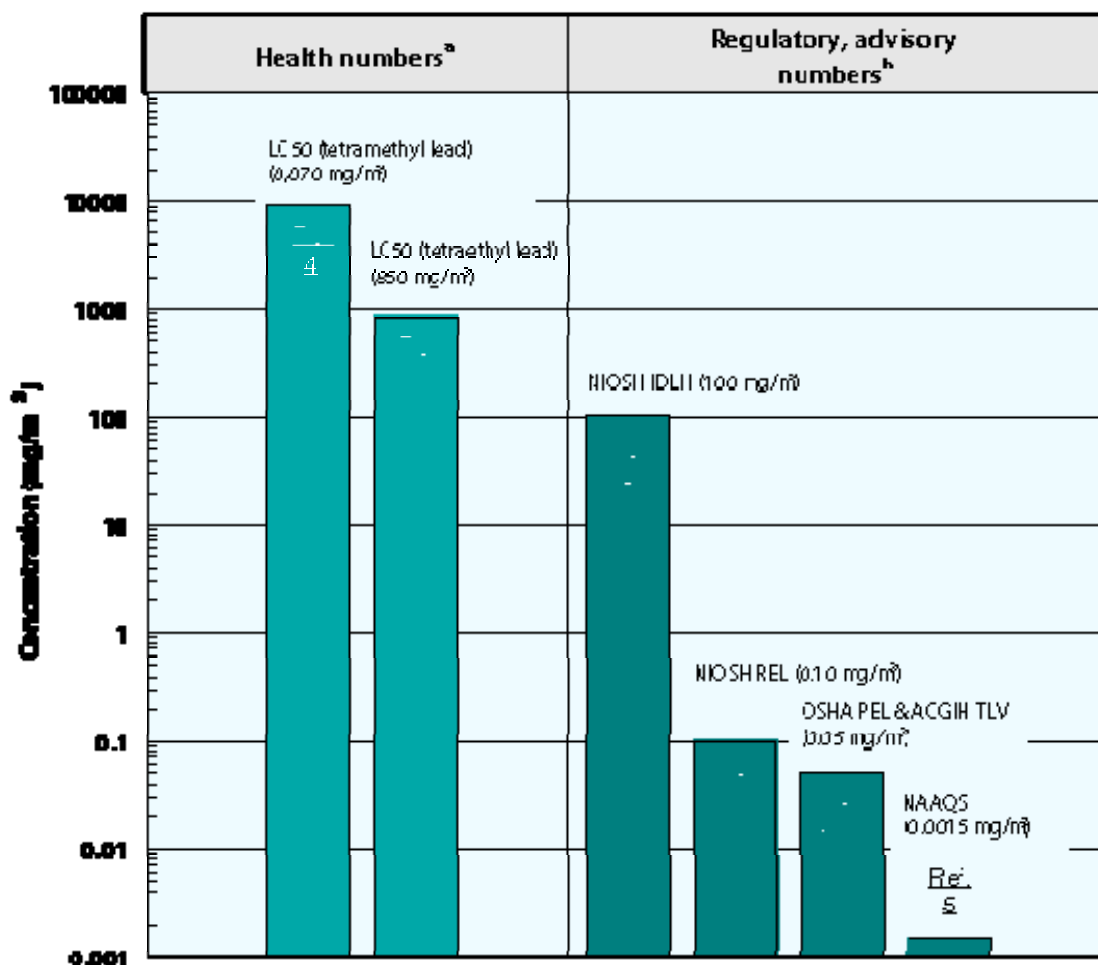
- Lead is a naturally occurring, bluish-gray metal that is found in small quantities in the earth's crust. (1,2)
- Lead is present in a variety of compounds such as lead acetate, lead chloride, lead chromate, lead nitrate, and lead oxide. (1,2)
- Pure lead is insoluble in water; however, the lead compounds vary in solubility from insoluble to water soluble. (1,2)
- The chemical symbol for lead is Pb and the atomic weight is 207.2 g/mol. (1)
- The vapor pressure for lead is 1.0 mm Hg at 980 °C. (1)

Conversion Factors (only for the gaseous form):

To convert concentrations in air (at 25°C) from ppm to mg/m³: $\text{mg/m}^3 = (\text{ppm}) \times (\text{molecular weight of the compound}) / (24.45)$. For lead: $1 \text{ ppm} = 8.5 \text{ mg/m}^3$.

Health Data from Inhalation Exposure

Lead



ACGIH TLV--American Conference of Governmental and Industrial Hygienists' threshold limit value expressed as a time-weighted average; the concentration of a substance to which most workers can be exposed without adverse effects.

LC₅₀ (Lethal Concentration₅₀)--A calculated concentration of a chemical in air to which exposure for a specific length of time is expected to cause death in 50% of a defined experimental animal population.

NIOSH REL--National Institute of Occupational Safety and Health's recommended exposure limit; NIOSH-recommended exposure limit for an 8- or 10-h time-weighted-average exposure and/or ceiling.

NIOSH IDLH -- NIOSH's immediately dangerous to life or health concentration; NIOSH recommended exposure limit to ensure that a worker can escape from an exposure condition that is likely to cause death or immediate or delayed permanent adverse health effects or prevent escape from the environment.

NAAQSNational Ambient Air Quality Standard. EPA sets NAAQS that protect public health and the environment for six commonly found pollutants: ozone, particle pollution, nitrogen oxides, sulfur dioxide, carbon monoxide and lead. The NAAQS for lead is 0.15 µg/m³. The rolling 3-month average of lead in total suspended particles may not exceed this level.

OSHA PEL--Occupational Safety and Health Administration's permissible exposure limit expressed as a time-weighted average; the concentration of a substance to which most workers can be exposed without adverse effect averaged over a normal 8-h workday or a 40-h workweek.

The health and regulatory values cited in this factsheet were obtained in December 1999.

^aHealth numbers are toxicological numbers from animal testing or risk assessment values developed by EPA.

^bRegulatory numbers are values that have been incorporated in Government regulations, while advisory numbers are nonregulatory values provided by the Government or other groups as advice. OSHA and NAAQS numbers are regulatory, whereas NIOSH and ACGIH numbers are advisory.

^a Human exposure to lead occurs through a combination of inhalation and oral exposure, with inhalation generally contributing a greater proportion of the dose for occupationally exposed groups, and the oral route generally contributing a greater proportion of the dose for the general population. The effects of lead are the same regardless of the route of exposure (inhalation or oral) and are correlated with internal exposure, as blood lead levels. For this reason, this fact sheet will not discuss the exposure in terms of route but will present it in terms of blood lead levels.

Source: <http://www.epa.gov/ttn/atw/hlthef/lead.html>

Blood Pb levels (µg/dL) by age and sex, 2009-2010 NHANES.

Age	Sex	N	Avg.	Std. Dev.	5%	25%	50%	75%	95%	99%
1-5 yr	Total	836	1.61	1.49	0.53	0.85	1.21	1.81	4.00	8.03
	Male	429	1.59	1.32	0.51	0.83	1.22	1.84	4.09	7.49
	Female	407	1.64	1.65	0.54	0.90	1.20	1.77	3.69	9.59
6-11 yr	Total	1009	1.05	0.74	0.42	0.61	0.83	1.22	2.36	4.29
	Male	521	1.10	0.73	0.45	0.66	0.88	1.30	2.37	4.18
	Female	488	0.99	0.75	0.38	0.58	0.79	1.12	2.35	3.98
12-19 yr	Total	1183	0.84	0.68	0.33	0.50	0.69	0.96	1.82	3.10
	Male	632	0.98	0.69	0.40	0.58	0.80	1.11	2.09	3.91
	Female	551	0.69	0.62	0.30	0.44	0.57	0.79	1.31	2.25
20-59 yr	Total	3856	1.50	1.83	0.44	0.72	1.08	1.70	3.53	7.27
	Male	1843	1.88	2.33	0.56	0.92	1.37	2.12	4.49	9.68
	Female	2013	1.15	1.10	0.40	0.61	0.89	1.35	2.63	4.41
60+ yr	Total	1909	2.09	1.51	0.72	1.16	1.69	2.53	4.79	8.28
	Male	941	2.46	1.78	0.87	1.39	1.99	2.90	5.56	9.89
	Female	968	1.73	1.07	0.65	1.01	1.43	2.14	3.75	5.42
Overall	Total	8793	1.50	1.57	0.43	0.72	1.10	1.76	3.66	7.21
	Male	4366	1.75	1.88	0.50	0.84	1.29	2.05	4.31	8.62
	Female	4427	1.25	1.13	0.39	0.63	0.96	1.48	2.97	5.17

Source: (CDC, 2013)

Case Study: Lead Contamination and Local Exposure



RISK ASSESSMENT TRAINING AND EXPERIENCE
Exposure Assessment Course Series – EXA 409

Office of Research and Development
National Center for Environmental Assessment

What You Can Expect to Learn from This Course

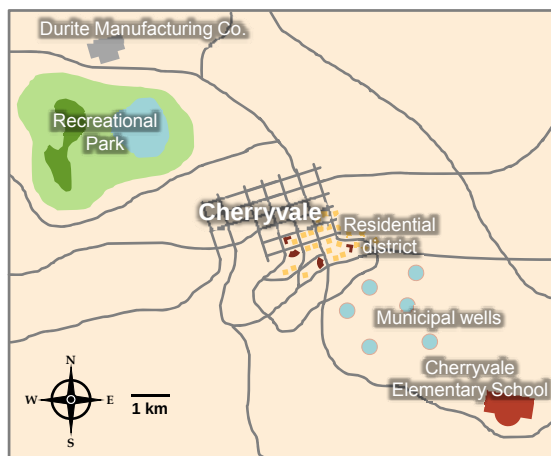
- How to apply exposure assessment concepts in the analysis of a “real-world” chemical exposure scenario
- Background information on factors affecting lead exposures and health effects due to these exposures
- Stakeholder perspectives on application of exposure assessment to risk management decisions

PROBLEM OVERVIEW: LEAD-CONTAMINATED COMMUNITY NEAR MANUFACTURING FACILITY

EXA 409

2

Durite Manufacturing and Surrounding Community



- Cherryvale population: 2,386
- Durite Manufacturing located:
 - 5 km NW of Cherryvale
 - 7 km NW of residential district
 - consists of individual dwellings and high-rise apartments
 - 9 km NW of municipal wells
 - public water source for Cherryvale
 - 14 km NW of Cherryvale Elementary
 - Attended by children of Cherryvale
- Largest elementary school in the area

EXA 409

3

THE DAILY NEWS

www.dailynews.com

CHERRYVALE'S FAVORITE NEWSPAPER

- Since 1879

DURITE MANUFACTURING ACCUSED OF POISONING CHILDREN



Local environmental activist finds levels of lead in soil at factor exceed allowable standards.

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EXA 409

4

THE DAILY NEWS

www.dailynews.com

CHERRYVALE'S FAVORITE NEWSPAPER

- Since 1879

HOSPITAL FINDS ELEVATED BLOOD- LEAD LEVELS IN LOCAL CHILDREN



Three children show high levels of lead; others show symptoms of exposure.

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EXA 409

5

- Since 1879

LEAD FOUND IN GROUNDWATER

Routine tests show contamination of town drinking water.

- Since 1879

PARENTS MARCH ON TOWN HALL

THE DAILY NEWS

www.dailynews.com

CHERRYVALE'S FAVORITE NEWSPAPER

- Since 1879

DURITE MANUFACTURING CLAIMS FACILITY IS SAFE

CEO of facility claims factory
uses best available control
technologies



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EXA 4098



United States
Environmental Protection
Agency

Problem Overview

- Soil surrounding facility contaminated with lead levels at levels of concern
- Three children with measured elevated blood-lead levels and others show symptoms of lead exposure
- Groundwater contaminated with lead
- Community is concerned
- Durite Manufacturing uses best available control technology

EXA 4099

LEAD BACKGROUND INFORMATION AND DATA

EXA 409

10

Lead Characterization and Use

- What is lead?

Lead is a heavy, corrosion-resistant metal that occurs naturally in the environment (primarily found as lead compounds) and can persist for a very long time.

- What has lead been used in?

- Batteries
- Ceramic glazes
- Cable covers
- Dyes
- Weights
- Paints – Banned in 1978*
- Gasoline – Phased out starting in 1973; banned entirely in 1996*
- Solder – Banned if >0.2% lead in 1986; banned in food cans entirely in 1995*
- Plumbing – Restricted lead content of faucets, pipes, and other plumbing materials to 8% in 1986*
- Ammunition – Banned for waterfowl hunting in 1991*



*U.S. regulations only

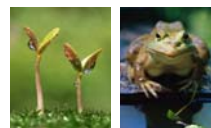
EXA 409

11

Lead Environmental Fate and Transport

- What happens to lead when it enters the environment?

- Can travel long distances in air before depositing onto soil or water
- Adsorbs strongly to soil particles. Remains in the upper levels of soil profile, but can also be transported to surface water via erosion and runoff.
- Unlikely to migrate to groundwater from soil
- Adsorbs strongly to sediment particles, where it can persist for many years. Can also re-suspend into water column. Fish are exposed via suspended and bottom sediment.
- Bioconcentrates in plants and animals



EXA 409

12

Lead Exposure

- What are the sources of lead exposure?
- **General population:** ingesting dusts, breathing air, drinking water, or eating foods that contain lead

Source	Exposure Media	Origin
Primary:	Lead-contaminated dust	Lead paint, lead emissions
Secondary:	Lead-contaminated drinking water	Lead pipes, erosion of natural deposits
	Food	Plant uptake, atmospheric deposition, formerly from lead-soldered food cans

- **Children:** swallowing paint chips or dust from deteriorated lead-based paints
 - Deteriorated lead paint is number-one cause of severe lead poisoning in U.S. children
 - Particularly vulnerable due to non-adult behavior (e.g., crawling, mouthing)
 - Correlation between lead in soil and lead in blood of children has been studied extensively

EXA 409

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Lead Health Effects

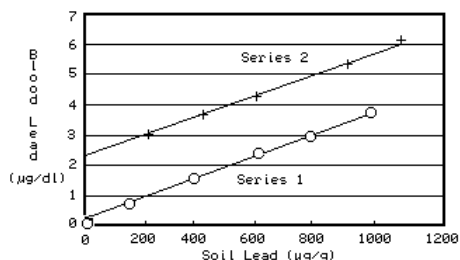
- What are the health effects of lead?
 - **General population:**
 - High blood pressure and hypertension
 - Coronary heart disease
 - Cognitive function decrements, depression and anxiety
 - Reduced kidney function, immune effects
 - **Children:**
 - Damage to brain and nervous system
 - Level of concern: ≥ 5 $\mu\text{g/dL}$ -blood
 - Possibly no threshold for effect
 - Behavior and learning problems: IQ, academic performance, learning and memory, inattention, impulsivity, hyperactivity
 - Impaired motor skills
 - Atopic and Inflammatory conditions (e.g., asthma and allergy)

EXA 409

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Correlation between Lead Levels in Soil and in Blood

Figure 3. EPA UPTAKE/BIOKINETIC MODEL FOR LEAD:
BLOOD AND SOIL LEAD CORRELATION



Legend:

	Series 1	Series 2
AIR CONCENTRATION:	0.000 $\mu\text{g Pb}/\text{m}^3$	0.200 $\mu\text{g Pb}/\text{m}^3$
DIET Intake:	0.00 $\mu\text{g}/\text{day}$	6.79 $\mu\text{g}/\text{day}$
DRINKING WATER:	0.000 L/day 0.0 $\mu\text{g}/\text{L}$	0.52 L/day 4 $\mu\text{g}/\text{L}$
SOIL:	0-1000 $\mu\text{g Pb}/\text{g}$	0-1000 $\mu\text{g Pb}/\text{g}$
HOUSE DUST:	0.0 $\mu\text{g Pb}/\text{g}$	200.0 $\mu\text{g Pb}/\text{g}$
PAINT Intake:	0.00 $\mu\text{g Pb}/\text{day}$	0.00 $\mu\text{g Pb}/\text{day}$
MATERNAL CONTRIBUTION:	Infant Model 0.00 $\mu\text{g Pb}/\text{dL}$	Infant Model 7.50 $\mu\text{g Pb}/\text{dL}$
AGE OF CHILDREN:	24-36 months	24-36 months

- Linear correlation between lead in soil and lead in blood
- Introducing exposures via other routes only marginally increases blood-lead levels
 - In this scenario, soil intake is the driving blood-lead levels
 - Note that paint intake is not modeled

EXA 409

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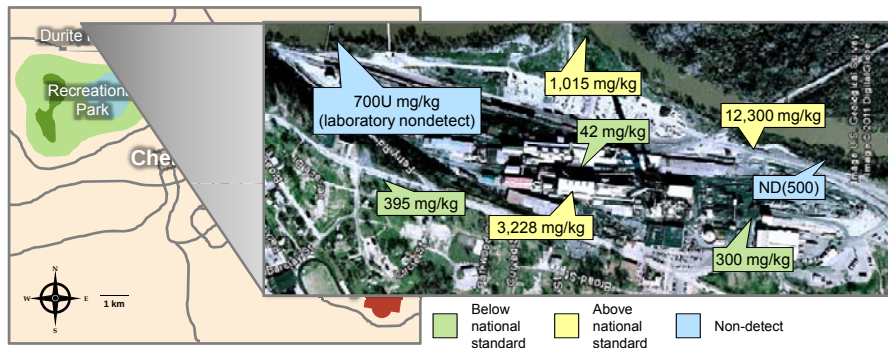
LOCAL MONITORING DATA

EXA 409

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Lead in Soil

• Soil lead standard, children's play areas	400 mg/kg (ppm)	* from TSCA Section 403
• Soil lead standard for other residential soils	1,200 mg/kg*(ppm)	* from TSCA Section 403
• Natural levels of lead in soils:	<50 mg/kg	* from CDC - ATSDR
• Concentrations found at Durite Manufacturing Site (see figure below)		



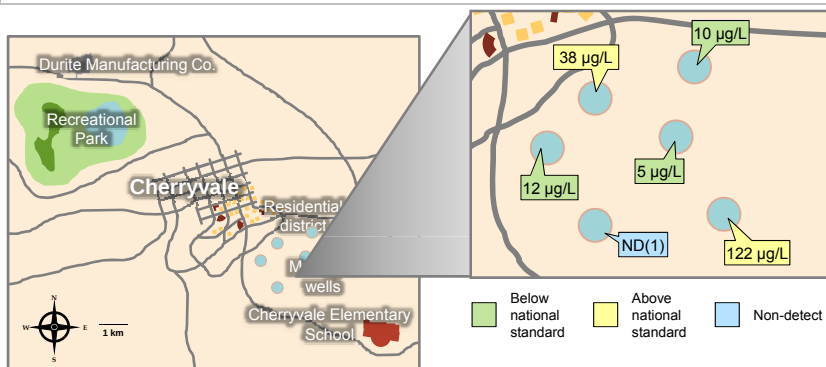
- No data collected on lead in soil in the nearby park or at residences in Cherryvale

EXA 409

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Lead in Ground Water

- EPA Drinking water standard for lead: 15 µg/L (ppb)* * from Safe Drinking Water Act of 1974
- Natural levels of lead in ground water: 1–100 µg/L (average ~3 µg/L)
- Concentrations found in Cherryvale municipal drinking water wells:



- No data collected for ground water wells recently installed at the Durite Manufacturing site.

EXA 409

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Lead Levels in Children's Blood

- CDC levels of concern:
 - ≥5 µg/dL - Community-wide lead poisoning prevention activities are advised
 - ≥20 µg/dL - Medical evaluation and environmental investigations and remediation is advised
 - ≥45 µg/dL - Medical treatment (i.e., chelation therapy) may be necessary
- NHANES levels of lead in blood of children, ranges 1-6, 6-11, and 12-19:
 - Average: 0.8 – 1.6 µg/dL
 - 95th Percentile: 1.8 – 4.0 µg/dL

Concentrations found in blood of children at Cherryvale municipal hospital:

<1 µg/dL	11 µg/dL
3 µg/dL	15 µg/dL
8 µg/dL	25 µg/dL

- Highest level found in 2 year-old child whose parents worked at Durite and who was rumored to have spent the last year at the on-site Durite Day Care Center.

EXA 409

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STAKEHOLDER PARTICIPATION

EXA 409

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Activity Instructions

- Separate into stakeholder groups representing these perspectives:
 - Manufacturers
 - Local Environmental Agency
 - Local Health Department
 - Citizens/Activists
- ⌚ 30 minutes: Preparation
 - Each group reviews the data in their packet, develops a position, and prepares a presentation.
- ⌚ 20 minutes (5 minutes each):
 - Each group presents its position in 3 minutes, leaving 2 minutes for questions.
- ⌚ 5 minutes: Resolution
 - The local Environmental Agency concludes the meeting with a final resolution.

EXA 409

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Activity Instructions, continued

- Assume you have an unlimited budget.
- Use the knowledge you've picked up from previous EXA courses to develop your presentation.
- Has new information come to light during the past 6 months?

DEVELOPING STAKEHOLDER PERSPECTIVES

(What did you learn in the last
six months?)

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**Danger:
Contaminated
Area**



Activity Wrap-Up



Were the original data problematic?



How did the municipal wells
become contaminated?



What is the responsibility of
industry in an arena of uncertainty?



How does problem formulation
affect risk management?