# CAUT Health and Safety Fact Sheet

## Lead

ISSUE 19

Lead, according to the Workers Health and Safety Centre's fact sheet "Lead: A lasting legacy", is "…found naturally in the ore galena and transformed into the metallic form by roasting or smelting." It is prized because it resists corrosion and has sound absorption properties. Used in its pure form or combined chemically with other elements, it is used industrially as metallic, organic and/or inorganic lead.

Workers can be exposed to lead through mining, production or object use at the workplace, but one of the biggest exposures happened when lead was introduced as an additive to gasoline in the 1920's, until eliminated from use in the 1970's.

Lead has recently been found to be contaminating drinking water through old, deteriorating lead piping, particularly in urban areas. Although lead paints are seldom used anywhere now except industrially, children are still exposed to lead paint in older buildings, and through lead-based or painted objects they may put in their mouths.

This fact sheet will alert staff in post-secondary institutions to workplace exposure and environmental exposure latency that may precipitate systemic poisoning and possible cancers.

### Workplace Exposure

Lead is typically found in the production of lead-based batteries and sheathing for electric cable, used in radiation shields around x-ray equipment and nuclear reactors, and as part of an alloy for welding, ammunition and plumbing materials[1]. It has been used for roofing, restoration of old buildings, chemically resistant linings, noise control materials, electrical and electronic equipment, motor vehicles and other transportation equipment, and as a bearing metal; pipes, traps and bends; fuel and storage tanks, and wheel weights.[2]

Although some of the previously-mentioned uses will almost certainly be found in academic workspaces, the most significant use of lead that is a cause for alarm is casting metals, glass, making ceramic glazes, paints, ornamental items and stained glass,[3] particularly in fine arts departments.

> The prevention of second-hand exposure is critical ... not only is training important for worker safety, but that it should be extended to include family members and health care professionals

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It is the employer's and user's responsibility to ensure that Material Safety Data Sheets are available for chemical, biological, designated substances, and other workplace hazards.

## Keep It at Work

A key way to limit lead contamination is to "keep it at work". NIOSH's 2002 report[4] on take-home exposures from workers to their families indicated that worker families, children, pregnant women, the elderly, immune compromised and the disabled are particularly vulnerable to second-hand exposure, physically and because the lack of hazard and safety awareness.

The prevention of second-hand exposure is critical – appropriate and effective engineering and administrative controls, coupled with hygienic work practices will protect workers, and their families and communities. Clothes, bodies and tools are recognized carriers of take-home contamination.

The report notes that not only is training important for worker safety, but that it should be extended to include family members and health care professionals.

## Environmental Exposure

Previous exposure to decades of lead-based gasoline is believed to be the predominant cause of lead-based illnesses.

Other causes are:
- drinking water passing through lead pipes, or PVC pipes that use lead salts as a stabilizer, is a problem both at home and at work

- food contaminated from being processed in lead-soldered cans or cooked in glazed pottery
- lead-based paints residue in older buildings and children's toys
- red lead oxide used in protective paint for structural iron and steel, and commonly found on barns
- lead oxide used in fine crystal glassware and flint glass for specialized magnifying lenses
- toys with lead paint or plastic

*The Latin name plumbum is the source for the atomic symbol Pb for lead*

## How lead enters and affects the body

The Canadian Centre for Occupational Health and Safety identifies lead as "Very Toxic" (Possible cancer hazard, reproductive hazard, teratogen, mutagen)[5], with the routes of entry being through ingestion, inhalation or absorption. Fetuses can be exposed through the placenta. Lead accumulates in the body, with long-term toxicity, known as "plumbism", occurring from either long-term or acute exposure. Blood lead levels have been used to determine toxicity levels, but more recent methodology is sampling from shin bones with more accurate analysis. Occupational exposure happens most commonly through inhalation from dust particles, and ingestion of food, drink, cosmetics, tobacco products and clothing coming in contact with lead-contaminated hands.

Symptoms of lead poisoning include:
- headache, fatigue, forgetfulness, irritability, dizziness, depression
- nausea, abdominal cramps
- joint pain, muscle tremors
- metallic taste, vomiting, constipation or bloody diarrhea
- peripheral neuropathy, also known as "lead palsy"
- increased rate of miscarriage and fetal death

The International Agency for Research on Cancer (IARC) classifies lead and its compounds as possibly carcinogenic to humans.[6] The American Conference of Governmental Industrial Hygienists (ACGIH) designates lead as an A3 carcinogen – confirmed animal carcinogen with unknown relevance to humans. The ACGIH recommended exposure limit for lead is currently TLV-TWA: 0.5 mg/m3, but recent studies suggest that lower or no exposure level is safer.

## Other Health Effects?

A growing body of evidence may point to lead as a cause of cognitive impairment in adults, as well as schizophrenia from prenatal exposure to lead.

In cognitive impairment studies, Drs. Brian Schwartz and colleagues at John Hopkins University[7] noted that cognitive dysfunction and decline in adults, especially as they age, may be a delayed response from environmental lead exposure from earlier life, particularly when leaded gasoline was in use. The recent findings also have relevance to occupational lead exposure standards. In a recent commentary "Adult Lead Exposure: Time for Change",

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Class D, Division 2A & 2B

Drs. Schwartz and Howard Hu advise that cumulative lead dose must be kept below a specified threshold and that OSHA should modify its lead standards to prevent both acute and chronic effects.

In the prenatal exposure effects from lead, Drs. Ezra Susser, Gelman Professor and Chair of epidemiology at Columbia University's Mailman School of Public Health, and Dr. Mark G.A. Opler, Assistant Professor of Psychiatry at New York University, an initial 2004 study[8] showed schizophrenia is twice the rate for adults who were exposed to lead while in the womb. Although currently they cannot conclusively rule out other factors, second phase results of the study have been consistent with earlier findings.

## PPE

Appropriate and effective engineering controls should be the first line of defense before using Personal Protective Equipment. If PPE must be used for work or emergency purposes, then the following should apply:

- wearing of a respirator: refer to CSA Standard Z94.4-93 "Selection, Care, and Use of Respirators"
- chemical safety goggles
- face shield, if necessary
- chemical protective gloves, coveralls, boots, and/or other protective clothing to prevent skin contact
- remove contaminated clothing immediately and bag; discard or wash before re-wearing; alert laundry department; DO NOT WEAR HOME
- shower in "double-locker" room – one for contaminated PPE and shower, and one "clean" room with "home" clothes

## First Aid

You should know what steps to take whenever you may be exposed to a workplace hazard. Familiarize yourself with them prior to a potential exposure. The following is recommended for lead:

- eye: irrigate immediately; do not rub; seek medical assistance
- skin: soap flush promptly
- breathing: seek medical attention immediately
- swallow: do not induce vomiting; drink 240 – 300 ml of water to dilute; medical attention immediately

## Toolkit Resources

CDC/NIOSH Pocket Guide to Chemical Hazards, Lead www.cdc.gov/niosh/npg/npgd0368.html

## Resources

CCOHS www.ccohs.ca

CDC/NIOSH www.cdc.gov

WHSC www.whsc.on.ca

## Notes

**1** Lead: A lasting legacy, Workers Health and Safety Centre, Resource Lines, Winter 2003

**2, 3** CCOHS, 1-Basic Information on Lead, OSH Answers

**4** Protecting Workers' Families, A Research Agenda Report of the Workers' Family Protection Task Force, CDC/NIOSH, February 2002

**5** CCOHS, 4-Working Safely with Lead, OSH Answers

**6** IARC Monographs on the Evaluation of Carcinogenic Risks to Humans, Recent Meetings, Volume 87: Inorganic and organic lead compounds, February 2004

**7** International Review of Psychiatry; Lead and cognitive function in adults: A questions and answers approach to a review of the evidence for cause, treatment, and prevention, Online Publication Date: 01 December 2001; Effects of Lead on the Adult Brain: A 15-Year Exploration

**8** Opler MG, Brown AS, Graziano J, Desai M, Zheng W, Schaefer C, Factor-Litvak P, Susser ES, Prenatal lead exposure, delta-aminolevulinic acid, and schizophrenia. Environ Health Perspect. 2004 Apr:112(5):548-52