3M Science. Applied to Life.™

Personal Safety Division

Hazard awareness bulletin.

Lead

Helping to reduce your exposure to Lead during metal production and fabrication.

What is Lead?

Elemental lead is a soft and yet dense, silver-grey metal that is highly malleable with a melting point of 327°C and a boiling point of 1740°C.

Lead is relatively easy to extract from its naturally occuring ores and combined with its abundance and physical property has proved useful to humans throughout history. In modern society, due to its known toxicity, uses and applications are limited.

Although relatively stable and unreactive, inorganic lead and lead compounds are used extensively throughout industry. Industrial processes may generate lead dust, fumes or vapours which are hazardous to health.

Lead alkyls (organic lead) – used predominantly in the petrochemical industry – are not covered in this bulletin.

How can Lead affect me?

Workplace exposures to lead can cause a range of detrimental health effects – some can result from short-term acute exposures, others from long-term, repetitive, chronic exposures.

Acute health effects from production or fabrication

- Non-specific with lassitude (weariness)
- Abdominal cramps and constipation
- Myalgia (muscle pain)
- Anorexia

Chronic health effects from metal production or fabrication

- Peripheral motor neuropathy (especially wrist drop)
- Anaemia
- High blood pressure
- Kidney, liver and lung diseases
- Gastrointestinal problems
- Male fertility issues
- Encephalopathy (altered mental state)
- Central Nervous System (CNS) damage
- Impaired neurological development, particularly in the very early stages of foetal development

Did you know?

Metal workers, and particularly welders, are prone to developing pneumonia infections. These can normally be treated by antibiotics, but there is a clear correlation between welders and increased risk of developing serious or fatal pneumonia infections.

Medical Information

- Lead and inorganic lead compounds are classified as probably carcinogenic to humans (Group 2A) by the International Agency for Reseach on Cancer (IARC).

- Inhalation is the main method of workplace exposure. Larger particles may be captured in the upper respiratory tract, where they are transported by ciliation to the oesophagus and swallowed.

  Unlike many other particulate hazards, lead can readily pass into the blood stream in both the respiratory system (lungs) and the stomach. Once in the blood, it will be transported around the body finally being deposited mainly in bones, where it will steadily accumulate. Lead and lead compounds are slowly metabolised over time and excreted in the urine, with long latencies between exposure and excretion.

When do workplace exposures occur?

Inhalation

Often the primary route of lead exposure is through inhaling dust and fumes from the production and working of elemental lead and alloys. In metal fabrication the welding, grinding, cutting, drilling and polishing of alloys that contain lead can result in significant exposure.

What is welding fume?

The majority of welding fume is filler wire material that is vapourised by the welding arc. The gaseous metal will react with oxygen in the air to form a metal oxide and will solidify to form tiny metal oxide particles, of fume. Some welding fume will orginate from the metals being welded.

Many filler wires will contain metals that are known to be toxic and that can have detrimental health effects if inhaled. The contents of the filler wire and the amount of welding fume generated will vary by welding process.

Hot work

Other high energy or 'hot work' processes, including cutting, grinding and even polishing metals can create particles of metal and metal oxides that can be readily inhaled.

Other industrial applications may create dusts, mists or fumes of lead, for example the handling or application of powered or liquid chemicals which contain lead.

Dermal

The secondary route of exposure is through contact with the skin and eyes, particularly if lead is in a liquid form that can readily pass through or damage the skin.

Ingestion

Workers can be exposed by the accidental ingestion of lead, for example workers eating, drinking, smoking or biting their nails when their hands are contaminated.

Industries / Applications where workplace exposures may occur.

Examples of metal production and fabrication applications, as well as other industries and processes in which individuals may be exposed to lead compounds:

Metal production, metal fabrication and related

- Lead and other metal smelting, refining, alloying and casting
- Working with metallic lead and alloys containing lead
- Recovering and recycling lead from scrap and waste

Note: high temperature lead work (temp. >500°C) will give rise to higher levels of lead fume, compared to other processes which are more likely to generate lead dusts.

Other aplications

- Removal, stripping and burning of lead paint
- Hot cutting in demolition and dismantling operations
- Lead-acid battery manufacture, breaking and recycling
- Some painting of buildings and spray-painting of vehicles
- Manufacturing and processing lead compounds and chemicals
- Manufacturing leaded glass
- Manufacturing and using pigments, colours and ceramic glazes

Note: high temperature lead work (temp. >500°C) will give rise to higher levels of lead fume, compared to other processes which are more likely to generate lead dusts.

Medical surveillance

Those who are, or are likely to be significantly exposed to lead, may be required by national regulations to undergo regular health checks and medical surveillance, including periodic monitoring of lead levels within their blood or urine.

National regulations typically define a 'suspension level', a concentration of lead in the blood or urine that must not be exceeded. If the 'suspension level' is exceeded then the worker will need to be removed from work tasks that may result in further exposures, and an investigation leading to corrective actions implemented.

National regulations may also set an 'action level', a concentration of (metal) in the blood or urine which if exceeded may trigger the implementation of additional monitoring and control measures.

What can I do to protect myself?

Use appropriate controls

Employers need to conduct a risk assessment, including a determination of exposure levels compared to exposure limits to understand what control measures may be needed.

If required, controls from the hierarchy of controls should be implemented and their effectiveness measured. For example local exhaust ventilation (LEV) can be a highly effective engineering control used in welding, grinding and many other applications.

An important component of controlling lead exposures is to minimise ingestion by implementing good hygiene practises, for example washing, changing and showering facilities.

Get the equipment that you need.

In addition to implementing other control measures, Personal Protective Equipment (PPE) such as Respiratory Protective Equipment (RPE) is commonly required to reduce exposures and risks to workers.

Respiratory Protective Equipment (RPE) – filtering respirators

From disposable particulate respirators, to reusable half- and full-face masks, through to heavy-duty battery powered air purifying respirators combined with a range of robust face masks, headtops and helmets; 3M has a range of RPE that can help reduce your exposure to dusts, mists, metal fume, ozone as well as other gases and vapours, commonly encountered in metal production and fabrication.

Respiratory Protective Equipment (RPE) – supplied air respirators

3M also have a wide range of continuous and demand valve supplied air respirators, suitable for use in some of the most demanding working environments.

Welding shields with respiratory protection

3M also have a wide range of 3M™ Speedglas™ Welding shields that provide eye and face protection from harmful light, sparks and splatter. All of these welding shields can be used with 3M disposable or reusable half-masks. Alternatively, 3M have welding shields and helmets that are designed to work with 3M powered or supplied air systems, to give you multiple types of protection in one product.

Eye and Face Protective Equipment

Whether it be a 3M™ Spedglas™ welding visor with an auto-darkening filter or a light-weight full face shield, 3M has a full range of PPE to help protect you from the many hazards encountered in welding and metal working.

Other PPE

3M also can provide a wide range of other safety solutions you need to work safely, comfortably and effectively, including:

- Head, eye and face protection
- Disposable and reusable ear plugs, ear muffs
- Communication solutions
- Disposable and reusable protective coveralls
- Appropriate gloves for hand and skin protection
- Fall protection
- Confined space solutions
- Fixed and personal gas detection
- Fixed flame detection solutions

Training

A key component of an effective PPE programme is a training concept for workers, those responsible for health and safety and employers in their roles and responsibilities.

For example, workers wearing PPE should be trained in and understand:

- the nature of all hazardous substances present and the potential effects upon their health
- how PPE works, what it does and its limitations
- proper fitting and use of the PPE
- inspection, maintainance and cleaning of the PPE as well as identifying defective PPE and knowing how to deal with it

Stay informed

When selecting the appropriate protective equipment, local or national regulations, laws and guidelines need to be complied with.

One of the tasks of the occupational safety and health department is to keep an eye on constantly changing legal regulations, occupational exposure limits, etc.

Technical help

At any time, you can get in touch with one of our PPE experts for personalised help on the selection and use of 3M products. Their job is to help you through the process of selecting adequate and suitable products based on your risk assessment, as well as helping you understand how to fit, use and look after your PPE – helping you to stay healthy and safe so you can focus on what matters: doing your job properly and staying healthy for your loved ones and family.

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