

Chromium

Hazard Awareness Bulletin
July 2022

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

What is Chromium?

Elemental chromium metal (chrome) is steel-grey color metal that can be readily polished and is highly resistant to corrosion. Elemental chromium metal and hexavalent chromium are rarely found in nature; trivalent chromium exists in various ores, making up approximately 13% of the earth's crust.

Chromium metal has been used through the ages as a decorative metal, for example in jewelry, ornamental works through to car body trim and metal plating due to its corrosion resistant properties,

Chromium is frequently used to electroplate other metals, particularly steel. Chromium is also used extensively in alloys – for example with steel to make stainless steel and non-ferrous metal alloys.

In other industries, inorganic chromium (chromates) compounds often have vibrant colors and have been used extensively as pigments, dyes, preservatives and ceramics as well as being potentially hazardous components in Portland Cement.

How can Chromium affect me?

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

Did you know?

Asthma is a debilitating and potentially fatal disease which causes difficulty with breathing, wheezing, coughing or a tight feeling in the chest. Occupational asthma is where the condition is specifically linked to workplace exposure to asthmagens (chemicals that cause an allergic asthmatic reaction). There are two types of occupational asthma: workplace exposure to asthmagens causing asthma in a worker, or workplace exposure aggravating existing asthma.

Pneumoconiosis is the accumulation of dust in the lungs and the subsequent reaction to its presence. The term covers a wide range of different diseases and is derived from the Greek, meaning “dusty lungs”. Pneumoconiosis are generally long-term and irreversible diseases characterized by inflammation (pneumonitis) and scarring (pulmonary fibrosis) of the lung tissue. However, in some cases, particularly silicosis, rapidly progressive forms can occur after only short periods of intense exposure.

Canadian Centre for Occupational Health & Safety. OSH Answers Fact Sheets - What are the Effects of Dust on the Lungs?. www.ccohs.ca/oshanswers/chemicals/lungs_dust.html

Potential acute health effects associated with metal production or fabrication

- Irritation of the nose and upper respiratory tract
- Irritation, inflammation, and ulceration of the skin (particularly from chromic acid exposure)
- Eye irritation and damage from liquid splashes

Potential chronic health effects associated with metal production or fabrication

- Damage to the membranes of the nose and upper respiratory tract leading to ulcers and holes in the nasal septum
- Hypersensitivity pneumonitis
- Allergic dermatitis
- Hearing impairment
- Kidney damage
- Lung cancer
- Male fertility issues
- Fetal development issues
- Occupational asthma
- Pneumoconiosis

Additional Information

- Hexavalent chromium compounds are classified as a Group 1 - Carcinogenic to humans by the International Agency for Research on Cancer (IARC), and as an A1 - Confirmed human carcinogen by the American Conference of Governmental Industrial Hygienists (ACGIH).
- Chronic Obstructive Pulmonary Disease (COPD) is a serious long-term lung disease which results in irreversible narrowing of the airways over time, reducing the flow of air into the lungs due to inflammation of the air passages and damage to lung tissue. In extreme cases the reduced air flow to the lungs is highly debilitating and can be fatal. Other symptoms include a persistent cough (>3 months of the year), wheezing, and increased phlegm production. COPD includes the conditions bronchitis and emphysema.

When do workplace exposures occur?

Inhalation

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

What is welding fume?

The majority of welding fume is filler material that is vaporized 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, or fume. Some welding fume will originate from the metals being welded. Many filler materials will contain metals that are known to be toxic and that can have detrimental health effects if inhaled. The contents of the filler material 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 inhaled.

Workers can also be exposed when working with metals that have a plating or surface coating that contains chromium or chromium compounds.

Other industrial applications may create dusts, mists, or fumes of chromium compounds. For example, the handling or application of powdered or liquid chemicals which contain chromium compounds.

Dermal

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

Ingestion

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

Did you know?

Metal workers, and particularly welders, are prone to developing pneumonia infections. Welders can be at risk for developing serious or fatal pneumonia infections.

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 chromium compounds:

Metal production, metal fabrication and related applications

- Welding, cutting, grinding, and casting of stainless steels and other alloys containing chromium
- Electroplating of chromium onto other metals (chromic acid)
- Smelting of copper, zinc, and ferrochromium ores

Other applications

- Pigments, dyes, inks, leather tanning
- Wood preservatives
- Pesticides
- Specialty paints, particularly aircraft and marine
- Automotive body repair industry – repair/spray application of paints containing chromium
- Chemical industries
- Plastics industries
- Portland cement (as an impurity)

Medical surveillance

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

National, state, or provincial regulations typically define a “suspension level,” a concentration of chromium 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, state, or provincial regulations may also set an “action level,” a concentration of chromium in the blood or urine which, if exceeded, may trigger the implementation of additional monitoring and control measures.

What can I do to help protect my workers?

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.

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 used to reduce exposures and risks to workers.

Respiratory Protective Equipment (RPE) – air-purifying respirators

3M has a range of RPE that can help reduce your exposure to dusts, mists, metal fume, as well as gases and vapors commonly encountered in metal production and fabrication. These include disposable particulate respirators, reusable half- and full-facepiece respirators, all the way to heavy-duty battery powered air-purifying respirators combined with a range of robust facepieces, headtops, and helmets.

Respiratory Protective Equipment (RPE) – supplied air respirators

3M also has a wide range of supplied air respirators, suitable for use in some of the most demanding work environments.

Welding shields with respiratory protections

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

Eye and Face Protective Equipment

Whether it be a 3M™ Speedglas™ welding visor with an auto-darkening filter or a lightweight 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 can also provide a wide range of other safety solutions including:

- Head, eye, and face protection
- Disposable and reusable ear plugs and ear muffs
- Protective Communication solutions
- Disposable protective coveralls
- Fall protection
- Confined space solutions



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Use our interactive disposable respirator selector to help you find a respirator that meets your protection needs.



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[Find your respirator](#)

Use our interactive powered & supplied air respirator selector to help you find a respirator that meets your protection needs.

[View all 3M PPE Solutions](#)

Oxidation States

Chromium rarely exists in its elemental metal form in nature as its relatively chemically reactive. When heated, for example during welding, chromium will react with oxygen in the air to form chromium oxides. But the properties of chromium mean that it can exist in different chemical forms, or oxidation states:

+3 oxidation state – trivalent chromium: Cr_2O_3 (chromium (III) oxide)

+6 oxidation state – hexavalent chromium: CrO_3 (chromium (VI) oxide)

Hexavalent chromium is the most hazardous form of chromium – it is known to cause skin and respiratory tract inflammation as well as being a known human carcinogen.

Training

A key component of an effective PPE program is training for both workers and those responsible for health and safety in the workplace.

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

- How PPE works, what it does, and its limitations
- Inspection, maintenance, and cleaning of the PPE as well as identifying defective PPE and knowing proper disposal
- Proper fitting and use of the PPE
- The nature of all hazardous substances present and the potential effects upon their health

Stay Informed

When selecting the appropriate protective equipment, local, state, provincial, or national regulations, laws, and guidelines need to be followed.

One of the tasks of the occupational safety and health specialist is to monitor constantly changing legal regulations, occupational exposure limits, etc.

Technical Help

At any time, you can get in touch with one of our PPE professionals for personalized help on the selection and use of 3M products. They can help you through the process of selecting suitable products based on your risk assessment, as well as helping you understand how to fit, use, and maintain your PPE – helping you to stay protected.

References and Resources

Webelements: Webelements. Chromium: the basics. [Online] [Cited: 22 November 2018.] <https://www.webelements.com/chromium/>.

Smedlehy, et al: Smedley, J, Dick, F and Sadhra, S. Oxford Handbook of Occupational Health (second edition). 2013

HSE - [metal] and you: Health and Safety Executive (HSE). INDG346 - Chromium and you. Working with Chromium - are you at risk? [Online] [Cited: 1 October 2018.] <http://www.hse.gov.uk/pubns/indg346.pdf>.

ACGIH TLVs: American Conference of Governmental Industrial Hygienists (ACGIH(R)). Threshold Limit Values for Chemical Substances and Physical Agents & Biological Exposure Indices (TLVs(R) and BEIs(R)). 2018

OSHA SLTC: Occupational Safety and Health Administration (OSHA). Safety and Health Topics - Hexavalent Chromium. [Online] [Cited: 1 October 2018.] <https://www.osha.gov/SLTC/hexavalentchromium/>.

ASTDR: Agency for Toxic Substances and Disease Registry (ASTDR). Toxic Substances Portal - Chromium. [Online] [Cited: 1 October 2018.] <https://www.atsdr.cdc.gov/substances/toxsubstance.asp?toxid=17>.

NIOSH Pocket Guide: The National Institute for Occupational Safety and health (NIOSH). NIOSH Pocket Guide to Chemical Hazards. [Online] [Cited: 22 November 2018.] <https://www.cdc.gov/niosh/npg/default.html>.

IARC: International Agency for Research on Cancer (IARC). IARC Monograph - Chromium (VI) Compounds. [Online] [Cited: 1 October 2018.] <https://monographs.iarc.fr/wp-content/uploads/2018/06/mono100C-9.pdf>.

Antonini: Health Effects of Welding. Antonini, J M. 1, 2003, Critical Reviews in Toxicology, Vol. 33, pp. 61-103.

Nemery: Metal toxicity and respiratory tract. Nemery, B. 1990, Eu Respir J, Vol. 3. pp. 202-219.

Palmer: Palmer et al (2009). Mortality from infectious pneumonia in metal workers: a comparison with deaths from asthma in occupations exposed to respiratory sensitizers. THORAX Online first, published on August 23, 2009.

HSE Burden of cancer: Health and Safety Executive (HSE). RR858 - The burden of occupational cancer in Great Britain - Lung Cancer. 2012. [Online] [Cited: 22 November 2018.] <http://www.hse.gov.uk/research/rrpdf/rr858.pdf>

Canadian Centre for Occupational Health & Safety. OSH Answers Fact Sheets – Asthma, Work-related. <https://www.ccohs.ca/oshanswers/diseases/asthma.html>

Canadian Centre for Occupational Health & Safety. OSH Answers Fact Sheets - Chronic Obstructive Pulmonary Diseases. www.ccohs.ca/oshanswers/diseases/chronic_obstructive.html

Health and Safety Executive (HSE). Health risks from welding. <https://www.hse.gov.uk/welding/health-risks-welding.htm>

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