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Manganese

Hazard Awareness Bulletin
April 2023

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

What is Manganese?

Manganese is a grey-white metal that resembles iron but is harder and more brittle. Being highly chemically reactive, elemental manganese is not found in nature, but is found in a variety of minerals and ores.

Manganese metal is used in many metal alloys, mainly steel but also aluminum alloys. Manganese promotes hardness and durability in steel and helps resist galvanic corrosion in aluminum alloys.

Aluminum alloys contain up to 1.5% manganese, with steel alloys up to 2.5% manganese, with some special steel grades significantly higher proportions. Manganese also frequently makes up a significant proportions of welding rods and filler metals, as the manganese helps the flux flow freely due to its lower boiling point compared to that of iron.

Manganese compounds have other uses in a range of applications, particularly in the chemical and ceramics industries.

How can Manganese affect me?

Workplace exposures to manganese have been associated with a range of potential health effects – some can result from short-term acute exposures, others from long-term, repetitive, chronic exposures. Common symptoms can include irritation of the eyes, nose, and throat.

Potential acute health effects associated with metal production or fabrication

- Irritation of nose, throat, and respiratory tract

Potential chronic health effects associated with metal production or fabrication

- Male fertility issues
- Central nervous system damage, commonly known as “Manganism”
- Early symptoms – sleepiness. Weakness. Mood swings
- Late stage symptoms – slowed speech, tremors, moto-control issues
- Pneumonitis

Extra Fact

- Manganese oxide is used in many welding consumables. For example; a flux agent in the coatings of metal arc electrodes, in the flux-cored arc electrodes, and as an alloying element used in electrodes.

When do workplace exposures occur?

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

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

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

Ingestion
Workers can be exposed by the accidental ingestion of manganese, 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. There is a clear correlation between welders and increased risk of 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 manganese compounds:

Metal production, metal fabrication and related applications
- Manganese mining, smelting, and refining processes
- Production of alloys, melting and foundry operations as well as powder metallurgy, particularly alloys
- Steel – improves rolling and forging properties
- Aluminum and antimony (sometimes with copper) – creates ferromagnetic alloys
- Welding and grinding of manganese containing aluminum, steel, and alloys
- Polishing or other processes on steels and manganese alloys

Other applications
- Pigments, de-colorizer and additives for paint, pottery, glass and other ceramics
- Chemical industry, particularly the permanganates which are powerful oxidizing agents
- Manufacture, use of specialist dry cell batteries

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

Find your respirator

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

Find your respirator

Use our respirator selection guide to help you find a respirator that meets your protection needs.

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

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

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