

MASS  
MP 13.2:  
R245/24  
mang.



# Commonwealth of Massachusetts

## RECOMMENDED SAFE PRACTICES BULLETIN

# MANGANESE

Synonyms: N/A  
CAS Number: 7439-96-5

Chemical Formula: Mn  
Date Completed: 6/88

### HAZARD SUMMARY

- Manganese can cause medical problems when inhaled.
- Manganese fumes can cause a flu-like illness.
- Long-term exposure to manganese can cause brain damage. In the late stages this illness resembles Parkinson's disease and is permanent.
- Manganese can cause liver damage.

### GENERAL DESCRIPTION

Manganese is a whitish-gray, brittle and reactive metal.

### HEALTH HAZARD INFORMATION

Exposure to manganese may occur by inhalation of dust, fumes or mists and by ingestion. Inhalation is the main source of absorption of manganese into the body. However, because ingestion may occur due to contaminated cigarettes, food or beverages, hands should be washed before eating or smoking.

#### ACUTE (short-term) HEALTH EFFECTS

Manganese dioxide fumes can cause "metal fume fever", a flu-like illness, with symptoms of thirst, dry cough, throat dryness, nausea, headache, chills, sweating, fatigue, chest discomfort, aching, and fever. These symptoms begin a few hours after exposure, and usually disappear within 24 hours.

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Department of Labor and Industries - Division of Occupational Hygiene  
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Alloys and compounds of manganese are minor irritants of the eye, skin and mucous membrane (the moist skin of the eyes, nose, mouth and throat).

#### CHRONIC (long-term) HEALTH EFFECTS

Long-term exposure to manganese can cause damage to the nervous system, lungs and liver.

Nervous system: The damage caused to the nervous system can be divided into three stages:

1. The earliest symptoms are vague, including muscle spasms, weakness, and joint pain.
2. In the second stage, there are speech disturbances, difficulty walking, and excessive salivation.
3. The third stage, which is not reversible, resembles Parkinson's disease. This may occur after at least six months of exposure. This stage is manifested by a "mask-like" facial expression, muscle weakness, muscle rigidity, tremors, and increased difficulty walking.

Lungs: Exposure to manganese may increase the likelihood of pneumonia.

Liver: Exposure to manganese may cause liver damage (cholestasis).

Cancer Hazard: Information is not currently available as to whether manganese may cause cancer.

Reproductive Hazard: Experimental female rodents given manganese compounds before and during pregnancy have had offspring with changes in growth, including retardation. The offspring have also been affected through the mother's milk. Exposure to manganese compounds has injured the reproductive system in male rodents.

In one study in humans, male workers exposed to manganese compounds had fewer children than those not exposed.

Manganese has been shown to cause mutations in living cells.

#### CONDITIONS THAT MAY BE AGGRAVATED BY EXPOSURE

Some lung, liver, psychiatric, and nervous system disorders may be made worse by manganese exposure. Smokers who are exposed to manganese may be more likely to develop bronchitis than are smokers without manganese exposure.

## OCCUPATIONAL EXPOSURE LIMITS

Most OSHA exposure limits are based on recommendations made by the ACGIH. Other recommendations by NIOSH may be more protective of human health. Many chemicals have not been studied for long-term effects. Because of individual susceptibility, a small percentage of workers exposed to this substance at or below any of the recommended limits may experience some ill effects.

### Manganese Dust

OSHA: The legal airborne exposure limit, not to be exceeded at any time, is 5 mg/m<sup>3</sup>.

ACGIH: The recommended airborne exposure limit is 5 mg/m<sup>3</sup>, not to be exceeded at any time.

### Manganese Fumes

OSHA: The legal airborne exposure limit is 1 mg/m<sup>3</sup>, averaged over an 8-hour workshift. The short-term exposure limit, not to be exceeded in any 15-minute period, is 3 mg/m<sup>3</sup>.

ACGIH: The recommended airborne exposure limit is 1 mg/m<sup>3</sup>, averaged over an 8-hour workshift. The recommended short-term exposure limit, not to be exceeded in any 15-minute period, is 3 mg/m<sup>3</sup>.

## MEDICAL MONITORING

Pre-employment and periodic medical histories and physical exams should be obtained for workers exposed to manganese. Attention should be paid to lung, liver, psychiatric and nervous system disorders. Urine levels of manganese can be used to assess the amount of exposure to manganese in groups of workers, but in individual workers the levels are not very meaningful. The normal level of manganese in urine is less than 3 ug/L. At levels greater than 40 to 50 ug/L neurological symptoms may eventually occur.

## EMERGENCY INFORMATION

### FIRST AID

Inhalation: Move the patient to fresh air. If breathing has stopped, begin artificial respiration. Seek immediate medical attention.

Ingestion: If the patient is conscious, he/she should first drink large amounts of water, and then be induced to vomit. Seek immediate medical attention.

Skin contact: Remove contaminated clothing, and wash skin with soap and water.

Eve Contact: Immediately rinse eyes with running water for at least 15 minutes, occasionally lifting upper and lower lids. Seek medical attention if irritation persists.

Antidotes: There are several agents which can be used to lessen the symptoms of manganese toxicity. These must be administered by trained medical personnel. L-dopa and 5-hydroxytryptophan can be used to improve the Parkinson-like symptoms due to chronic manganese exposure. Calcium EDTA can be used to decrease the amount of manganese in the body.

#### FIRE AND EXPLOSION

NFPA Rating: Flash Point: NA  
Extinguishing Media: dry sand, dry graphite,  
sodium chloride, or dry  
dolomite. Do not use water.  
Flammability: 3  
Reactivity: 0  
Health: 3 Flammable Limits: NA

Respiratory Protection: Self-contained breathing apparatus with full facepiece operated in pressure-demand or other positive-pressure mode.

Special Precautions: Move containers from the fire area if you can do so without risk. Cool containers that are exposed to flames with water from the side until well after fire is out.

#### SPILL, LEAK AND DISPOSAL PROCEDURES

Shut off ignition sources; do not permit flares, smoking or flames in hazard area.

Respiratory Protection: Self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode.

Protective Equipment: Wear protective gloves and clothing and dust-proof goggles.

Small Spills: With a clean shovel place material into clean, dry container and cover; move containers from spill area.

Large Spills: Reclaim or dissolve in a flammable solvent and atomize in a suitable combustion chamber equipped with an appropriate effluent gas cleaning device.

Disposal: See "Large Spills" above.

#### EMERGENCY INFORMATION SOURCES

CHEMTREC: (800) 424-9300  
Poison Information Center: (800) 682-9211; 232-2120 (Boston area only)

## PROTECTIVE MEASURES

### ENGINEERING CONTROLS

Engineering controls are almost always the best way to control employee exposure to hazardous chemicals. Engineering controls may include local exhaust ventilation, enclosure of the process, general dilution ventilation and others. However, for some jobs (such as outside work, confined space entry, non-routine maintenance, emergencies, and jobs done while workplace controls are being installed), personal protective equipment may be appropriate.

### RESPIRATORY PROTECTION

Improper use of respirators can be dangerous. Only respirators that have been approved by NIOSH or MSHA for exposures to manganese should be used. Such equipment should only be used if the employer has a written program that takes into account air concentrations of the contaminant, and includes respirator fit testing, regular training, maintenance, inspection, cleaning, and evaluation.

For most purposes the full facepiece for metallic fumes or dust is acceptable (for air levels up to 10 times the recommended standard).

### PROTECTIVE EQUIPMENT

Eye Protection: Dust-proof goggles.

Clothing: Protective gloves and clothing (suits, headgear, footwear).

## STORAGE AND REACTIVITY INFORMATION

### REACTIVITY

Manganese dust reacts with water or steam to produce highly flammable hydrogen.

### INCOMPATIBILITIES

Manganese reacts violently with carbon dioxide, fluorine, chlorine, hydrogen peroxide, nitric acid, phosphorus, sulfur dioxide.

### HAZARDOUS DECOMPOSITION PRODUCTS

Reacts with water or steam to produce hydrogen.

### STORAGE

Manganese should be stored in tightly closed containers in a cool, well-ventilated area away from water, steam or oxidizers (see INCOMPATIBILITIES section).

## PHYSICAL AND CHEMICAL DATA

Boiling Point: 2097°C (3806°F)  
Melting Point: 1245°C (2273°F)  
Vapor Pressure: 1 mmHg at 1227°C  
Specific Gravity (water=1): 7.2

Molecular Weight: 54.94  
Solubility in Water: insoluble  
Evaporation Rate: NA  
Vapor Density: NA

## ADDITIONAL INFORMATION

Manganese's four principal uses are in: 1) the production of steel (and as an alloying agent for special steels, aluminum and copper); 2) the manufacture of dry cell batteries; 3) the production of potassium permanganate; and 4) electrode coating in welding rods.

## DEFINITIONS

ACGIH is the American Conference of Governmental Industrial Hygienists. It recommends upper limits for exposure to workplace chemicals.

Action level is the amount of a chemical in the air above which OSHA-specified medical and air monitoring must be done.

A carcinogen is a substance that causes cancer.

The C.A.S. number is assigned by the Chemical Abstracts Service to identify a specific chemical.

The flash point is the temperature at which a liquid or solid gives off enough vapor to form a flammable mixture with air.

mg/m<sup>3</sup> means milligrams of a chemical in a cubic meter of air. It is a measure of how much of a chemical is in the air.

MSHA is the Mine Safety and Health Administration, the federal agency that regulates mining. It also evaluates and approves respirators.

A mutagen is a substance that causes a change in the genetic material in a body cell. Mutations can lead to birth defects, miscarriages, or cancer.

NFPA is the National Fire Protection Association. It classifies substances according to their fire and explosion hazard.

NIOSH is the National Institute for occupational Safety and Health. It tests equipment, evaluates and approves respirators, conducts studies of workplace hazards, and proposes standards to OSHA.

OSHA is the Occupational Safety and Health Administration, which adopts and enforces health and safety standards.

ppm means parts of a substance per million parts of air. It is a measure of how much gas or vapor is in the air.

A teratogen is a substance that causes birth defects by damaging the fetus.

The vapor pressure is a measure of how easily a liquid or a solid gives off vapors. A higher vapor pressure indicates a higher concentration of the substance in the air, and therefore increases the amount of it breathed in.

## WHERE TO GO FOR ADDITIONAL INFORMATION

The following information is available from the Massachusetts Department of Labor and Industries.

### RIGHT TO KNOW INFORMATION

The Right to Know Program can answer questions about particular chemicals, training, labeling, and other Right to Know matters. Violations of the Right to Know Law should be reported to the nearest office of the Department of Labor and Industries.

### PUBLIC PRESENTATIONS

Presentations and educational programs on occupational health or the Right to Know Law can be given for labor unions, trade associations and other groups.

### OCCUPATIONAL HEALTH AND SAFETY SERVICES

Upon receipt of a complaint, an inspection may be conducted at your workplace. An inspection may include a walk-through, air monitoring, and evaluation of existing conditions and controls. Complaints about workplace health and safety conditions may be reported to any office of the Department of Labor and Industries. Such complaints are maintained strictly confidential. In addition, employers may obtain free technical assistance in complying with OSHA standards and the Massachusetts Right to Know Law.

### MEDICAL EVALUATION

The Division of Occupational Hygiene has the names of various occupational health services and occupational physicians who are board-certified. This information is available upon request.

## MASSACHUSETTS DEPARTMENT OF LABOR AND INDUSTRIES

### Division of Occupational Hygiene

West Newton (617) 969-7177

### Division of Industrial Safety

Boston (617) 727-3460  
Lawrence (617) 681-7798

New Bedford (617) 997-8263  
Springfield (413) 734-1421

Worcester (617) 752-6504  
Pittsfield (413) 445-4214