

Occupational Health Guideline for Magnesium Oxide Fume

INTRODUCTION

This guideline is intended as a source of information for employees, employers, physicians, industrial hygienists, and other occupational health professionals who may have a need for such information. It does not attempt to present all data; rather, it presents pertinent information and data in summary form.

SUBSTANCE IDENTIFICATION

- Formula: MgO
- Synonyms: Magnesia fume
- Appearance: White fume.

PERMISSIBLE EXPOSURE LIMIT (PEL)

The current OSHA standard for magnesium oxide fume is 15 milligrams of magnesium oxide fume per cubic meter of air (mg/m^3) averaged over an eight-hour work shift. The American Conference of Governmental Industrial Hygienists has recommended for magnesium oxide fume a Threshold Limit Value of $10 \text{ mg}/\text{m}^3$.

HEALTH HAZARD INFORMATION

• Routes of exposure

Magnesium oxide fume can affect the body if it is inhaled or if it comes in contact with the eyes.

• Effects of overexposure

1. Short-term Exposure: Magnesium oxide fume may cause irritation of the eyes and nose. It may also cause a metal fume fever. Symptoms of metal fume fever include chills, fever, headache, tightness of chest, cough, weakness, tiredness, dryness of the nose and mouth, muscular pain, nausea, and vomiting.

2. Long-term Exposure: None known.

3. Reporting Signs and Symptoms: A physician should be contacted if anyone develops any signs or symptoms and suspects that they are caused by exposure to magnesium oxide fume.

• Recommended medical surveillance

The following medical procedures should be made available to each employee who is exposed to magnesium oxide fume at potentially hazardous levels:

1. Initial Medical Screening: Employees should be screened for history of certain medical conditions (listed below) which might place the employee at increased risk from magnesium oxide fume exposure.

—Chronic respiratory disease: In persons with impaired pulmonary function, especially those with obstructive airway diseases, the breathing of magnesium oxide fume might cause exacerbation of symptoms due to its irritant properties.

2. Periodic Medical Examination: Any employee developing the above-listed conditions should be referred for further medical examination.

• Summary of toxicology

Magnesium oxide fume mildly irritates the eyes and nose. Examination of 95 workers exposed to an unspecified concentration of magnesium oxide dust revealed slight irritation of the eyes and nose; the magnesium level in the serum of 60% of those examined was above the normal upper limit of 3.5 mg%. Experimental subjects exposed to fresh magnesium oxide fume developed metal fume fever, an illness similar to influenza; their symptoms included fever, cough, oppression in the chest, and a leukocytosis. There are no reports of metal fume fever resulting from industrial exposure. Metal magnesium slivers produce a gaseous reaction and cause a slow-healing burn with ulceration, but this has not been reported for magnesium oxide.

CHEMICAL AND PHYSICAL PROPERTIES

• Physical data

1. Molecular weight: 40.3
2. Boiling point (760 mm Hg): 3582 C (6480 F) (solid)
3. Specific gravity (water = 1): Solid = 3.58
4. Vapor density (air = 1 at boiling point of magnesium oxide fume): Not applicable
5. Melting point: 2800 C (5072 F) (solid)

These recommendations reflect good industrial hygiene and medical surveillance practices and their implementation will assist in achieving an effective occupational health program. However, they may not be sufficient to achieve compliance with all requirements of OSHA regulations.

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service Centers for Disease Control
National Institute for Occupational Safety and Health

U.S. DEPARTMENT OF LABOR
Occupational Safety and Health Administration

- 6. Vapor pressure at 20 C (68 F): Essentially zero
- 7. Solubility in water, g/100 g water at 20 C (68 F): Insoluble
- 8. Evaporation rate (butyl acetate = 1): Not applicable

- **Reactivity**

- 1. Conditions contributing to instability: None
- 2. Incompatibilities: Magnesium oxide fume reacts violently with chlorine trifluoride.
- 3. Hazardous decomposition products: None
- 4. Special precautions: None

- **Flammability**

- 1. Not combustible

- **Warning properties**

Magnesium oxide fume may cause mild eye irritation.

MONITORING AND MEASUREMENT PROCEDURES

- **General**

Measurements to determine employee exposure are best taken so that the average eight-hour exposure is based on a single eight-hour sample or on two four-hour samples. Several short-time interval samples (up to 30 minutes) may also be used to determine the average exposure level. Air samples should be taken in the employee's breathing zone (air that would most nearly represent that inhaled by the employee).

- **Method**

Sampling and analyses may be performed by collection of magnesium oxide fume on a cellulose membrane filter, followed by treatment with nitric acid, and atomic absorption spectrophotometric analysis. An analytical method for magnesium oxide fume is in the *NIOSH Manual of Analytical Methods*, 2nd Ed., Vol. 3, 1977, available from the Government Printing Office, Washington, D.C. 20402 (GPO No. 017-033-00261-4).

RESPIRATORS

- Good industrial hygiene practices recommend that engineering controls be used to reduce environmental concentrations to the permissible exposure level. However, there are some exceptions where respirators may be used to control exposure. Respirators may be used when engineering and work practice controls are not technically feasible, when such controls are in the process of being installed, or when they fail and need to be supplemented. Respirators may also be used for operations which require entry into tanks or closed vessels, and in emergency situations. If the use of respirators is necessary, the only respirators permitted are those that have been approved by the Mine Safety and Health Administration (formerly Mining Enforcement and Safety Administration) or by the National Institute for Occupational Safety and Health.

- In addition to respirator selection, a complete respiratory protection program should be instituted which includes regular training, maintenance, inspection, cleaning, and evaluation.

COMMON OPERATIONS AND CONTROLS

The following list includes some common operations in which exposure to magnesium oxide fume may occur and control methods which may be effective in each case:

Operation	Controls
Liberation from fabrication of alloys for aircraft, ships, automobiles, boats, tools, machinery, and military equipment	Local exhaust ventilation; general dilution ventilation; personal protective equipment
Liberation from casting of metal and alloys	Local exhaust ventilation; general dilution ventilation
Liberation from fabrication of metal	Local exhaust ventilation; general dilution ventilation; personal protective equipment

EMERGENCY FIRST AID PROCEDURES

In the event of an emergency, institute first aid procedures and send for first aid or medical assistance.

- **Breathing**

If a person breathes in large amounts of magnesium oxide fume, move the exposed person to fresh air at once. If breathing has stopped, perform artificial respiration. Keep the affected person warm and at rest. Get medical attention as soon as possible.

- **Rescue**

Move the affected person from the hazardous exposure. If the exposed person has been overcome, notify someone else and put into effect the established emergency rescue procedures. Do not become a casualty. Understand the facility's emergency rescue procedures and know the locations of rescue equipment before the need arises.

SPILL PROCEDURES

- Persons not wearing protective equipment and clothing should be restricted from areas of releases until cleanup has been completed.

- If potentially hazardous amounts of magnesium oxide fume are inadvertently released, ventilate the area of release to disperse the fume.

REFERENCES

• American Conference of Governmental Industrial Hygienists: "Magnesium Oxide Fume," *Documentation of the Threshold Limit Values for Substances in Workroom Air* (3rd ed., 2nd printing), Cincinnati, 1974.

- American Industrial Hygiene Association: "Magnesium," *Hygienic Guide Series*, Detroit, Michigan, 1960.
- Browning, E.: *Toxicity of Industrial Metals* (2nd ed.), Butterworths, London, 1969.
- Patty, F. A. (ed.): *Toxicology*, Vol. II of *Industrial Hygiene and Toxicology* (2nd ed. rev.), Interscience, New York, 1963.

RESPIRATORY PROTECTION FOR MAGNESIUM OXIDE FUME

Condition	Minimum Respiratory Protection* Required Above 15 mg/m ³
Particulate Concentration	
150 mg/m ³ or less	Any fume respirator or high efficiency particulate filter respirator. Any supplied-air respirator. Any self-contained breathing apparatus.
750 mg/m ³ or less	A high efficiency particulate filter respirator with a full facepiece. Any supplied-air respirator with a full facepiece, helmet, or hood. Any self-contained breathing apparatus with a full facepiece.
7,500 mg/m ³ or less	A powered air-purifying respirator with a high efficiency particulate filter. A Type C supplied-air respirator operated in pressure-demand or other positive pressure or continuous-flow mode.
Greater than 7,500 mg/m ³ or entry and escape from unknown concentrations	Self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode. A combination respirator which includes a Type C supplied-air respirator with a full facepiece operated in pressure-demand or other positive pressure or continuous-flow mode and an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive pressure mode.
Fire Fighting	Self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode.

*Only NIOSH-approved or MSHA-approved equipment should be used.

