

Occupational Health Guideline for Ferrovanadium Dust

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:** Ferrovanadium contains varying amounts of iron and vanadium and several other minor constituents (e.g., silicon, manganese, chromium, and nickel). Ferrovanadium has been produced with as little as 35% vanadium and as much as 85% vanadium.
- **Synonyms:** None
- **Appearance:** Dark, odorless solid particles.

PERMISSIBLE EXPOSURE LIMIT (PEL)

The current OSHA standard for ferrovanadium dust is 1 milligram of ferrovanadium dust (as vanadium) per cubic meter of air (mg/m^3) averaged over an eight-hour work shift. NIOSH has recommended that the permissible exposure limit be changed to 1 mg/m^3 averaged over a work shift of up to 10 hours per day, 40 hours per week. The NIOSH Criteria Document for Vanadium should be consulted for more detailed information.

HEALTH HAZARD INFORMATION

• Routes of exposure

Ferrovanadium dust can affect the body if it is inhaled or if it comes in contact with the eyes.

• Effects of overexposure

Ferrovanadium dust causes irritation of the eyes, nose, and throat.

• 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 ferrovanadium dust.

• Recommended medical surveillance

The following medical procedures should be made available to each employee who is exposed to ferrovanadium dust at potentially hazardous levels:

1. Initial Medical Examination:

—A complete history and physical examination: The purpose is to detect pre-existing conditions that might place the exposed employee at increased risk, and to establish a baseline for future health monitoring. Examination of the respiratory system should be stressed. The skin and eyes should be examined for evidence of chronic disorders.

—14" x 17" chest roentgenogram: Ferrovanadium dust may cause respiratory impairment. Surveillance of the lungs is indicated.

—FVC and FEV (1 sec): Ferrovanadium dust is reported to cause asthmatic-like symptoms. Periodic surveillance is indicated.

2. Periodic Medical Examination: The aforementioned medical examinations should be repeated on an annual basis, except that an x-ray is considered necessary only when indicated by the results of pulmonary function testing.

• Summary of toxicology

Ferrovanadium dust is a mild irritant of the eyes and respiratory tract. Animals exposed for 1 hour on alternate days for 2 months to very high concentrations (1000 to 2000 mg/m^3) developed chronic bronchitis and pneumonitis. Workers exposed to unspecified concentrations developed a slight irritation of the eyes and respiratory tract. Systemic effects have not been reported from industrial exposure.

CHEMICAL AND PHYSICAL PROPERTIES

• Physical data

1. Molecular weight: Not applicable
2. Boiling point (760 mm Hg): Not applicable
3. Specific gravity (water = 1): Greater than 1
4. Vapor density (air = 1 at boiling point of ferrovanadium dust): Not applicable

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.

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5. Melting point: Not applicable
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: Heat
2. Incompatibilities: Contact with strong oxidizers may cause fires and explosions.
3. Hazardous decomposition products: None
4. Special precautions: None

• **Flammability**

1. Flash point: Not applicable
2. Minimum ignition temperature: 400 C (752 F) (layer); 440 C (824 F) (cloud)
3. Minimum explosive concentration: 1.3 grams per cubic meter
4. Extinguishant: Dry sand, dry dolomite, dry graphite powder

• **Warning properties**

Ferrovandium dust may cause 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 ferrovandium dust, followed by chemical treatment and atomic absorption spectrophotometry. An analytical method for ferrovandium dust is in the *NIOSH Manual of Analytical Methods*, 2nd Ed., Vol. 5, 1979, available from the Government Printing Office, Washington, D.C. 20402 (GPO No. 017-033-00349-1).

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.

SANITATION

- Eating and smoking should not be permitted in areas where ferrovandium dust is generated in handling, processing, or storing of ferrovandium.
- Employees who handle ferrovandium dust should wash their hands thoroughly with soap or mild detergent and water before eating or smoking.

COMMON OPERATIONS AND CONTROLS

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

Operation	Controls
Liberation during manufacture and processing of ferrovandium alloy	General dilution ventilation; personal protective equipment
Use in the production of steel as an additive to produce grain refinement and hardenability	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.

• **Eye Exposure**

If ferrovandium dust gets into the eyes, wash eyes immediately with large amounts of water, lifting the lower and upper lids occasionally. If irritation persists after washing, get medical attention. Contact lenses should not be worn when working with this chemical.

• **Breathing**

If a person breathes in large amounts of ferrovandium dust, 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 AND DISPOSAL PROCEDURES

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

- If potentially hazardous amounts of ferrovanadium dust are inadvertently released, the following steps should be taken:

1. Remove all ignition sources.
2. Ventilate area of release to disperse the dust.
3. Collect released material in the most convenient and safe manner and deposit in sealed containers for reclamation or for disposal in a secured sanitary landfill.

- Waste disposal method:

Ferrovanadium dust may be disposed of in a secured sanitary landfill.

REFERENCES

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RESPIRATORY PROTECTION FOR FERROVANADIUM DUST

Condition	Minimum Respiratory Protection* Required Above 1 mg/m³
*Particulate Concentration	
5 mg/m ³ or less	Any dust and mist respirator, except single-use respirator.
10 mg/m ³ or less	Any dust and mist respirator, except single-use or quarter-mask respirator. Any fume respirator or high efficiency particulate filter respirator. Any supplied-air respirator. Any self-contained breathing apparatus.
50 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.
500 mg/m ³ or less	A powered air-purifying respirator with a full facepiece and a high efficiency particulate filter. A Type C supplied-air respirator with a full facepiece operated in pressure-demand or other positive pressure mode or with a full facepiece, helmet, or hood operated in continuous-flow mode.
Greater than 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.