

# Occupational Health Guideline for Methyl Iodide\*

## 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: CH<sub>3</sub>I
- Synonyms: Iodomethane
- Appearance: Colorless liquid which turns yellow, red, and brown on exposure to light and moisture.

## PERMISSIBLE EXPOSURE LIMIT (PEL)

The current OSHA standard for methyl iodide is 5 parts of methyl iodide per million parts of air (ppm) averaged over an eight-hour work shift. This may also be expressed as 28 milligrams of methyl iodide per cubic meter of air (mg/m<sup>3</sup>). The American Conference of Governmental Industrial Hygienists has issued a Notice of Intended Changes of its recommended Threshold Limit Value for methyl iodide from 5 ppm to 2 ppm and has classified it as having a carcinogenic potential for man.

## HEALTH HAZARD INFORMATION

### • Routes of exposure

Methyl iodide can affect the body if it is inhaled or if it comes in contact with the eyes or skin. It can also affect the body if it is swallowed.

### • Effects of overexposure

**1. Short-term Exposure:** Methyl iodide may cause nausea and vomiting, diarrhea, dizziness, slurred speech, visual disturbances, staggering, shaking, irritability, drowsiness, coma, and death. It may irritate the eyes and lungs. Contact with the liquid may cause irritation and blistering of the skin.

**2. Long-term Exposure:** Prolonged overexposure to methyl iodide may cause skin irritation.

**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 methyl iodide.

### • Recommended medical surveillance

The following medical procedures should be made available to each employee who is exposed to methyl iodide 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 central nervous system should be stressed. The skin should be examined for evidence of chronic disorders.

**2. Periodic Medical Examination:** The aforementioned medical examinations should be repeated on an annual basis.

### • Summary of toxicology

Methyl iodide vapor is an acute neurotoxin and possible pulmonary irritant. In mice, the LC<sub>50</sub> for 57 minutes' exposure was 900 ppm; the minimum fatal dose with 24-hour exposure was 75 ppm. A chemical worker accidentally exposed to the vapor developed giddiness, diarrhea, sleepiness, and irritability, with recovery in a week; when re-exposed 3 months later, he experienced drowsiness, vomiting, pallor, incoordination, slurred speech, muscular twitching, oliguria, coma, and death. At autopsy there was bronchopneumonia and pulmonary hemorrhages, with accumulation of combined iodine in the brain. Experimental application of the liquid to human skin produced a stinging sensation and slight reddening in 10 minutes; after 6 hours' contact there was spreading erythema with later formation of vesicles. One report mentions the production of sarcomas in 15 of 24 rats of BD strain arising from the subcutaneous injection of methyl iodide in an oil solution, but the report is fragmentary.

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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

## CHEMICAL AND PHYSICAL PROPERTIES

### • Physical data

1. Molecular weight: 142
2. Boiling point (760 mm Hg): 42.5 C (108 F)
3. Specific gravity (water = 1): 2.3
4. Vapor density (air = 1 at boiling point of methyl iodide): 4.9
5. Melting point: -66 C (-87 F)
6. Vapor pressure at 20 C (68 F): 375 mm Hg
7. Solubility in water, g/100 g water at 20 C (68 F): 2
8. Evaporation rate (butyl acetate = 1): Data not available

### • Reactivity

1. Conditions contributing to instability: Heat, light, and moisture
2. Incompatibilities: Methyl iodide reacts with strong oxidizing agents.
3. Hazardous decomposition products: Toxic gases and vapors (such as iodine and hydrogen iodide) may be released when methyl iodide decomposes.
4. Special precautions: None

### • Flammability

1. Not combustible

### • Warning properties

Although methyl iodide is known to have a sweet, ethereal odor, no quantitative data are available on the odor threshold. Methyl iodide is treated as a material with poor warning properties.

According to Grant, concentrations of methyl iodide of 4300 to 14,620 ppm caused immediate irritation of the eyes and lacrimation in mice, but 860 ppm for 10 minutes caused no 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 methyl iodide vapors using an adsorption tube with subsequent desorption with toluene and gas chromatographic analysis. Also, detector tubes certified by NIOSH under 42 CFR Part 84 or other direct-reading devices calibrated to measure methyl iodide may be used. An analytical method for methyl iodide is in the *NIOSH Manual of Analytical Methods*, 2nd Ed., Vol. 2, 1977, available from the Government Printing Office, Washington, D.C. 20402 (GPO No. 017-033-00260-6).

## 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.

## PERSONAL PROTECTIVE EQUIPMENT

- Employees should be provided with and required to use impervious clothing, gloves, face shields (eight-inch minimum), and other appropriate protective clothing necessary to prevent repeated or prolonged skin contact with liquid methyl iodide.
- Non-impervious clothing which becomes contaminated with liquid methyl iodide should be removed immediately and not reworn until the methyl iodide is removed from the clothing.
- Employees should be provided with and required to use splash-proof safety goggles where liquid methyl iodide may contact the eyes.

## SANITATION

- Skin that becomes wet with liquid methyl iodide should be immediately washed or showered with soap or mild detergent and water to remove any methyl iodide.
- Employees who handle liquid methyl iodide should wash their hands thoroughly with soap or mild detergent and water before eating, smoking, or using toilet facilities.
- Eating and smoking should not be permitted in areas where liquid methyl iodide is handled, processed, or stored.

## COMMON OPERATIONS AND CONTROLS

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

## Operation

Use as a methylating agent in organic synthesis; use as a laboratory reagent; use in academic laboratory courses in organic chemistry

Use as an insecticidal fumigant on scale insects and beetles

Use in analytical chemistry laboratories (test for pyridine, evaluating type of sulfur linkage in vulcanized rubber)

## Controls

Process enclosure; local exhaust ventilation; general dilution ventilation; personal protective equipment

Process enclosure; general dilution ventilation; personal protective equipment

Local exhaust ventilation; general dilution ventilation; personal protective equipment

stand the facility's emergency rescue procedures and know the locations of rescue equipment before the need arises.

## SPILL AND LEAK PROCEDURES

- Persons not wearing protective equipment and clothing should be restricted from areas of spills or leaks until cleanup has been completed.
- If methyl iodide is spilled or leaked, the following steps should be taken:
  1. Ventilate area of spill or leak.
  2. Collect for reclamation or absorb in vermiculite, dry sand, earth, or a similar material.

## REFERENCES

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## 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 methyl iodide gets into the eyes, wash eyes promptly with large amounts of water, lifting the lower and upper lids occasionally. Get medical attention immediately. Contact lenses should not be worn when working with this chemical.

### • Skin Exposure

If methyl iodide gets on the skin, immediately flush the contaminated skin using soap or mild detergent and water. If methyl iodide soaks through the clothing, remove the clothing immediately and flush the skin using soap or mild detergent and water. If irritation persists after washing, get medical attention.

### • Breathing

If a person breathes in large amounts of methyl iodide, 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.

### • Swallowing

When methyl iodide has been swallowed, get medical attention immediately. If medical attention is not immediately available, get the afflicted person to vomit by having him touch the back of his throat with his finger or by giving him syrup of ipecac as directed on the package. This non-prescription drug is available at most drug stores and drug counters and should be kept with emergency medical supplies in the workplace. Do not make an unconscious person vomit.

### • 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. Under-

## \* SPECIAL NOTE

Methyl iodide appears on the OSHA "Candidate List" of chemicals being considered for further scientific review regarding its carcinogenicity (*Federal Register*, Vol. 45, No. 157, pp. 5372-5379, 12 August 1980).

The International Agency for Research on Cancer (IARC) has evaluated the data on this chemical and has concluded that it causes cancer. See *IARC Monographs on the Evaluation of Carcinogenic Risk of Chemicals to Man*, Volume 15, 1977.

### RESPIRATORY PROTECTION FOR METHYL IODIDE

| Condition  | Minimum Respiratory Protection*<br>Required Above 5 ppm   |
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| Vapor Concentration  |   |
| 50 ppm or less   | Any supplied-air respirator.<br>Any self-contained breathing apparatus.   |
| 250 ppm or less  | Any supplied-air respirator with a full facepiece, helmet, or hood.<br>Any self-contained breathing apparatus with a full facepiece.  |
| 800 ppm or less  | A Type C supplied-air respirator operated in pressure-demand or other positive pressure or continuous-flow mode.  |
| Greater than 800 ppm or entry and escape from unknown concentrations | Self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode.<br><br>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.   |
| Escape   | Any gas mask providing protection against organic vapors.<br>Any escape self-contained breathing apparatus.   |

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