

# Occupational Health Guideline for Dimethyl Acetamide

## 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:  $\text{CH}_3\text{CON}(\text{CH}_3)_2$
- Synonyms: N,N-dimethyl acetamide; DMAC
- Appearance and odor: Colorless liquid with a faint, ammonia-like odor.

## PERMISSIBLE EXPOSURE LIMIT (PEL)

The current OSHA standard for dimethyl acetamide is 10 parts of dimethyl acetamide per million parts of air (ppm) averaged over an eight-hour work shift. This may also be expressed as 35 milligrams of dimethyl acetamide per cubic meter of air ( $\text{mg}/\text{m}^3$ ).

## HEALTH HAZARD INFORMATION

### • Routes of exposure

Dimethyl acetamide can affect the body if it is inhaled, if it comes in contact with the eyes or skin, or if it is swallowed. It may enter the body through the skin.

### • Effects of overexposure

Repeated or prolonged exposure to dimethyl acetamide may cause liver damage with yellow jaundice. Repeated exposure at high concentrations may cause depression, drowsiness, confusion, and hallucinations.

### • 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 dimethyl acetamide.

### • Recommended medical surveillance

The following medical procedures should be made available to each employee who is exposed to dimethyl acetamide 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 liver should be stressed.

—Liver function tests: Since liver damage has been observed in humans exposed to dimethyl acetamide, a profile of liver function should be obtained by using a medically acceptable array of biochemical tests.

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

### • Summary of toxicology

Inhalation of the vapor or skin absorption of the liquid causes liver damage. Repeated dermal application of the liquid to dogs at a dosage level of 4.0 ml/kg for 6 weeks caused severe fatty infiltration of the liver. Repeated exposure of rats to a concentration of 195 ppm for 6 months resulted in focal necrosis of the liver; exposure to 40 ppm for the same period of time caused no adverse effects. Workers repeatedly exposed to 20 to 25 ppm developed jaundice; appreciable skin absorption was thought to have occurred. Dimethyl acetamide has a significant antitumor effect in animals. Nine patients with neoplastic disease were given daily doses of 400 mg/kg by an unspecified route for 3 or more days as a therapeutic trial; they experienced depression, lethargy, confusion, and disorientation; on the last (4th or 5th) day of therapy or within 24 hours thereafter, the patients had visual and auditory hallucinations, perceptual distortions, and at times delusions; after 24 hours these gradually subsided.

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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: 87.1
2. Boiling point (760 mm Hg): 166 C (331 F)
3. Specific gravity (water = 1): 0.94
4. Vapor density (air = 1 at boiling point of dimethyl acetamide): 3.0
5. Melting point: -20 C (-4 F)
6. Vapor pressure at 20 C (68 F): 1.5 mm Hg
7. Solubility in water, g/100 g water at 20 C (68 F): Miscible in all proportions
8. Evaporation rate (butyl acetate = 1): Less than 0.17

### • Reactivity

1. Conditions contributing to instability: Temperatures above 350 C (662 F) cause decomposition and development of pressure in closed containers.

2. Incompatibilities: Contact with carbon tetrachloride and other halogenated compounds, particularly when in contact with iron, may cause fires and explosions.

3. Hazardous decomposition products: Toxic gases and vapors (such as dimethylamine and carbon monoxide) may be released in a fire involving dimethyl acetamide.

4. Special precautions: Dimethyl acetamide will attack some forms of plastics, rubber, and coatings.

### • Flammability

1. Flash point: 70 C (158 F) (open cup)
2. Autoignition temperature: 490 C (914 F)
3. Flammable limits in air, % by volume: Lower: 1.8 (at 212 F); Upper: 11.5 (at 320 F)
4. Extinguishant: Alcohol foam, dry chemical, carbon dioxide. Do not use halogenated extinguishing media.

### • Warning properties

1. Odor Threshold: No quantitative information is available.

2. Eye Irritation Level: Grant states that "on decomposition, it is said to emit fumes which are highly irritating to the eyes and mucous membranes." He reports that it causes mild, reversible injury graded 3 on a scale of 10 when tested on rabbit eyes.

3. Evaluation of Warning Properties: Since no quantitative information is available relating its warning properties to air concentrations, this substance is treated as a material with poor warning properties.

## 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 dimethyl acetamide vapors using a silica gel tube, followed by desorption with methanol, and gas chromatographic analysis. Also, detector tubes certified by NIOSH under 42 CFR Part 84 or other direct-reading devices calibrated to measure dimethyl acetamide may be used. An analytical method for dimethyl acetamide 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.

## 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 any possibility of skin contact with liquid dimethyl acetamide.

• Clothing contaminated with dimethyl acetamide should be placed in closed containers for storage until it can be discarded or until provision is made for the removal of dimethyl acetamide from the clothing. If the clothing is to be laundered or otherwise cleaned to remove the dimethyl acetamide, the person performing the operation should be informed of dimethyl acetamide's hazardous properties.

• Where exposure of an employee's body to dimethyl acetamide may occur, facilities for quick drenching of the body should be provided within the immediate work area for emergency use.

- Non-impervious clothing which becomes contaminated with dimethyl acetamide should be removed immediately and not reworn until the dimethyl acetamide is removed from the clothing.
- Employees should be provided with and required to use splash-proof safety goggles where liquid dimethyl acetamide may contact the eyes.

## SANITATION

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

## COMMON OPERATIONS AND CONTROLS

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

Operation	Controls
Use as a spinning solvent for synthetic fibers; as a solvent for film casting and top coating resins	Local exhaust ventilation; personal protective equipment
Use as a reaction medium and catalyst; as an extraction solvent for recovery and purification of butadiene; use as a crystallization and purification solvent; as a paint stripping solvent; during recovery and purification from top coating, film casting, spinning, and chemical processes	Local exhaust 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 dimethyl acetamide gets into the eyes, wash eyes immediately with large amounts of water, lifting the lower and upper lids occasionally. If irritation is present after washing, get medical attention. Contact lenses should not be worn when working with this chemical.

### • Skin Exposure

If liquid dimethyl acetamide gets on the skin, immediately flush the contaminated skin with water. If liquid dimethyl acetamide soaks through the clothing, remove the clothing immediately and flush the skin with water. If irritation persists after washing, get medical attention promptly.

### • Breathing

If a person breathes in large amounts of dimethyl acetamide, 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 liquid dimethyl acetamide has been swallowed and the person is conscious, give the person large quantities of water immediately. After the water has been swallowed, try to get the person to vomit by having him touch the back of his throat with his finger. Do not make an unconscious person vomit. Get medical attention immediately.

## SPILL, LEAK, AND DISPOSAL PROCEDURES

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

- If dimethyl acetamide is spilled or leaked, the following steps should be taken:

1. Ventilate area of spill or leak.
2. For small quantities, absorb on paper towels. Evaporate in a safe place (such as a fume hood). Allow sufficient time for evaporating vapors to completely clear the hood ductwork. Burn the paper in a suitable location away from combustible materials. Large quantities can be reclaimed or collected and atomized in a suitable combustion chamber equipped with an appropriate effluent gas cleaning device.

- Waste disposal methods:

Dimethyl acetamide may be disposed of:

1. By absorbing it in vermiculite, dry sand, earth or a similar material and disposing in sealed containers in a secured sanitary landfill.
2. By atomizing in a suitable combustion chamber equipped with an appropriate effluent gas cleaning device.

## REFERENCES

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## RESPIRATORY PROTECTION FOR DIMETHYL ACETAMIDE

Condition	Minimum Respiratory Protection* Required Above 10 ppm
Vapor Concentration	
100 ppm or less	Any supplied-air respirator.** Any self-contained breathing apparatus.**
400 ppm or less	Any supplied-air respirator with a full facepiece, helmet, or hood. Any self-contained breathing apparatus with a full facepiece. A Type C supplied-air respirator operated in pressure-demand or other positive pressure or continuous-flow mode.
Greater than 400 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.  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. Any escape self-contained breathing apparatus.

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

\*\*If eye irritation occurs, full-facepiece respiratory protective equipment should be used.

\*\*\*Use of supplied-air suits may be necessary to prevent skin contact while providing respiratory protection from airborne concentrations of dimethyl acetamide; however, this equipment should be selected, used, and maintained under the immediate supervision of trained personnel. Where supplied-air suits are used above a concentration of 400 ppm, an auxiliary self-contained breathing apparatus operated in positive pressure mode should also be worn.

