

Occupational Health Guideline for Sodium Fluoroacetate

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_2FCOONa
- Synonyms: 1080; sodium monofluoroacetate; SFA
- Appearance and odor: Fluffy, white, odorless hygroscopic solid (sometimes dyed black).

PERMISSIBLE EXPOSURE LIMIT (PEL)

The current OSHA standard for sodium fluoroacetate is 0.05 milligram of sodium fluoroacetate per cubic meter of air (mg/m^3) averaged over an eight-hour work shift.

HEALTH HAZARD INFORMATION

• Routes of exposure

Sodium fluoroacetate 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

Sodium fluoroacetate may cause vomiting, apprehension, hallucinations, tingling of the nose and face, numbness of the face and facial twitching. It may also cause excitation and convulsions. Depression may occur after and between convulsive episodes. The heart may beat irregularly or stop. Symptoms are often delayed 30 minutes to two hours after swallowing this chemical.

• 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 sodium fluoroacetate.

• Recommended medical surveillance

The following medical procedures should be made available to each employee who is exposed to sodium fluoroacetate 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. Persons with a history of convulsive disorders or cardiovascular disease would be expected to be at increased risk from exposures. Examination of the nervous system, heart, lungs, and kidneys should be stressed.

—Urinalysis: Since kidney damage has been observed in humans exposed to sodium fluoroacetate, a urinalysis should be obtained to include at a minimum specific gravity, albumin, glucose, and a microscopic on centrifuged sediment.

—An electrocardiogram: Sodium fluoroacetate causes cardiac arrhythmias. Periodic surveillance of the heart is indicated.

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

• Summary of toxicology

Sodium fluoroacetate as the dust or in solution is highly toxic and causes convulsions and ventricular fibrillation. Fluoroacetate is metabolized to fluorocitrate, which blocks the tricarboxylic acid cycle, an essential element of energy production in mammalian cells. Estimates of the lethal oral dose in humans range from 2 to 10 mg/kg . Onset of symptoms after ingestion is frequently delayed for 30 minutes to 2 hours; effects are vomiting, apprehension, auditory hallucinations, nystagmus, tingling sensation of nose, numbness of face, facial twitching, and epileptiform convulsions. After a period of several hours there may be pulsus alternans, long sequences of ectopic heartbeats (often multifocal), tachycardia, ventricular fibrillation, and death. In a fatal

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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case of ingestion, autopsy findings included hemorrhagic pulmonary edema and degeneration of renal tubules.

CHEMICAL AND PHYSICAL PROPERTIES

• Physical data

1. Molecular weight: 100
2. Boiling point (760 mm Hg): Decomposes
3. Specific gravity (water = 1): Greater than 1
4. Vapor density (air = 1 at boiling point of sodium fluoroacetate): Not applicable
5. Melting point: 200 C (392 F)
6. Vapor pressure at 20 C (68 F): Essentially zero
7. Solubility in water, g/100 g water at 20 C (68 F): 111
8. Evaporation rate (butyl acetate = 1): Not applicable

• Reactivity

1. Conditions contributing to instability: None.
2. Incompatibilities: None.
3. Hazardous decomposition products: Toxic gases and vapors (such as hydrogen fluoride and carbon monoxide) may be released when sodium fluoroacetate decomposes.

4. Special precautions: None.

• Flammability

1. Not combustible

• Warning properties

Sodium fluoroacetate is not known to be an eye irritant. Grant describes some effects on the eye caused by this compound, but these are systemic effects.

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

An analytical method for sodium fluoroacetate 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.

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 sodium fluoroacetate or solutions containing sodium fluoroacetate.

• If employees' clothing has had any possibility of being contaminated with sodium fluoroacetate or solutions containing sodium fluoroacetate, employees should change into uncontaminated clothing before leaving the work premises.

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

• Where there is any possibility of exposure of an employee's body to sodium fluoroacetate or solutions containing sodium fluoroacetate, 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 sodium fluoroacetate should be removed immediately and not reworn until the sodium fluoroacetate is removed from the clothing.

• Employees should be provided with and required to use dust- and splash-proof safety goggles where sodium fluoroacetate or solutions containing sodium fluoroacetate may contact the eyes.

SANITATION

• Skin that becomes contaminated with sodium fluoroacetate should be immediately washed or showered to remove any sodium fluoroacetate.

• Workers subject to skin contact with sodium fluoroacetate or solutions containing sodium fluoroacetate should wash any areas of the body which may have contacted sodium fluoroacetate at the end of each work

day.

- Eating and smoking should not be permitted in areas where sodium fluoroacetate or solutions containing sodium fluoroacetate are handled, processed, or stored.
- Employees who handle sodium fluoroacetate or solutions containing sodium fluoroacetate should wash their hands thoroughly with soap or mild detergent and water before eating, smoking, or using toilet facilities.

COMMON OPERATIONS AND CONTROLS

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

Operation	Controls
Formulation of pesticides	Local exhaust ventilation; personal protective equipment
Use in hand or aircraft application for pest control	Personal protective equipment; material substitution (product replacement)
Manufacture of sodium fluoroacetate	Process enclosure; 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 sodium fluoroacetate or solutions containing sodium fluoroacetate get 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 sodium fluoroacetate or solutions containing sodium fluoroacetate get on the skin, immediately flush the contaminated skin with water. If sodium fluoroacetate or solutions containing sodium fluoroacetate penetrate through the clothing, remove the clothing promptly and flush the skin with water. If irritation is present after washing, get medical attention promptly.

• Breathing

If a person breathes in large amounts of sodium fluoroacetate, 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 sodium fluoroacetate or solutions containing sodium fluoroacetate have been swallowed and the person is conscious, give the person large quantities of water immediately. After the water has been swal-

lowed, 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.

• 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 spills until cleanup has been completed.

- If sodium fluoroacetate is spilled, the following steps should be taken:

1. Ventilate area of spill.
2. Collect spilled material in the most convenient and safe manner and deposit in sealed containers for reclamation or for disposal in a secured sanitary landfill. Liquid containing sodium fluoroacetate should be absorbed in vermiculite, dry sand, earth, or a similar material.

- Waste disposal method:

Sodium fluoroacetate may be disposed of in sealed containers in a secured sanitary landfill.

REFERENCES

- American Conference of Governmental Industrial Hygienists: "Sodium Fluoroacetate," *Documentation of the Threshold Limit Values for Substances in Workroom Air* (3rd ed., 2nd printing), Cincinnati, 1974.
- Deichmann, W. B., and Gerarde, H. W.: *Toxicology of Drugs and Chemicals*, Academic Press, New York, 1969.
- Gleason, M. N., Gosselin, R. E., Hodge, H. C., and Smith, R. P.: *Clinical Toxicology of Commercial Products* (3rd ed.), Williams and Wilkins, Baltimore, 1969.
- Grant, W. M.: *Toxicology of the Eye* (2nd ed.), C. C. Thomas, Springfield, Illinois, 1974.
- Harrison, J. W. E., et al.: "Acute Poisoning with Sodium Fluoroacetate (Compound 1080)," *Journal of the American Medical Association*, 149:1520-1522, 1952.
- Harrison, J. W. E., et al.: "Fluoroacetate (1080) Poisoning," *Industrial Medicine and Surgery*, 21:440-442, 1952.
- Hayes, W. J., Jr.: *Clinical Handbook on Economic Poisons, Emergency Information for Treating Poisoning*, U.S. Public Health Service Publication No. 476, U.S. Government Printing Office, Washington, D.C., 1963.
- International Labour Office: *Encyclopedia of Occupational Health and Safety*, McGraw-Hill, New York, 1971.

- Patty, F. A. (ed.): *Toxicology*, Vol. II of *Industrial Hygiene and Toxicology* (2nd ed. rev.), Interscience, New York, 1963.
- Sax, N. I.: *Dangerous Properties of Industrial Materials* (3rd ed.), Van Nostrand Reinhold, New York, 1968.
- Spector, W. S. (Vols. I, II), Negherbon, W. O. (Vol. III), Grebe, R. M. (Vol. IV), and Dittmer, D. S. (Vol.

- V) (eds.): *Handbook of Toxicology*, Saunders, Philadelphia, 1956-1959.
- Spencer, E. Y.: *Guide to the Chemicals Used in Crop Protection* (6th ed.), Publication 1093, Research Branch Agriculture, Canada, 1973.
- Stolman, A. (ed.): *Progress in Chemical Toxicology*, Academic Press, New York, 1965-1969.

RESPIRATORY PROTECTION FOR SODIUM FLUOROACETATE

Condition	Minimum Respiratory Protection* Required Above 0.05 mg/m ³
Particulate Concentration	
0.25 mg/m ³ or less	Any dust and mist respirator, except single-use.
0.5 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.
2.5 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.
5 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 5 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.
Escape	Any dust and mist respirator, except single-use. Any escape self-contained breathing apparatus.

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