

# OCCUPATIONAL SAFETY AND HEALTH GUIDELINE FOR AMMONIUM SULFAMATE

## INTRODUCTION

This guideline summarizes pertinent information about ammonium sulfamate for workers and employers as well as for physicians, industrial hygienists, and other occupational safety and health professionals who may need such information to conduct effective occupational safety and health programs. Recommendations may be superseded by new developments; readers are therefore advised to regard these recommendations as general guidelines and to determine periodically whether new information is available.

## SUBSTANCE IDENTIFICATION

### • Formula



### • Synonyms

Ammonium amidosulfonate, ammonium amidosulphate, monoammonium sulfamate, sulfamic acid, monoammonium salt, sulfamate, Ammate, Amcide, Ammat, Amicide

### • Identifiers

1. CAS No.: 7773-06-0
2. RTECS No.: WO6125000
3. DOT UN: None
4. DOT label: None

### • Appearance and odor

Ammonium sulfamate is a white, brown-gray, or colorless crystalline noncombustible solid that is odorless.

## CHEMICAL AND PHYSICAL PROPERTIES

### • Physical data

1. Molecular weight: 114.1

2. Boiling point (at 760 mm Hg): Decomposes at 160°C (320°F)

3. Specific gravity (water = 1): 1.77

4. Vapor density: Not applicable

5. Melting point: 131°C (268°F)

6. Vapor pressure at 20°C (68°F): Zero

7. Solubility: Highly soluble in water and liquid ammonia; moderately soluble in glycerol, glycol, and formamide; slightly soluble in ethanol

8. Evaporation rate: Not applicable

### • Reactivity

1. Conditions contributing to instability: Heat

2. Incompatibilities: Fires and explosions may result from contact of ammonium sulfamate with strong oxidizers, hot water, potassium, sodium, sodium nitrite, metal chlorates, or hot acid solutions.

3. Hazardous decomposition products: Toxic gases (such as nitrogen or sulfur oxides and carbon monoxide) may be released when ammonium sulfamate decomposes.

4. Special precautions: Ammonium sulfamate is corrosive to mild steel.

### • Flammability

The National Fire Protection Association has not assigned a flammability rating to ammonium sulfamate; this substance is not combustible.

1. Flash point: Not applicable

2. Autoignition temperature: Not applicable

3. Flammable limits in air: Not applicable

4. Extinguishant: Use an extinguishant that is suitable for the materials involved in the surrounding fire.

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U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES  
Public Health Service Centers for Disease Control  
National Institute for Occupational Safety and Health  
Division of Standards Development and Technology Transfer

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

Firefighters should wear a full set of protective clothing (including a self-contained breathing apparatus) when fighting fires involving ammonium sulfamate.

## EXPOSURE LIMITS

### • OSHA PEL

The current Occupational Safety and Health Administration (OSHA) permissible exposure limits (PELs) for ammonium sulfamate are 10 mg/m<sup>3</sup> (total dust) and 5 mg/m<sup>3</sup> (respirable fraction) as an 8-hr time-weighted average (TWA) concentration [29 CFR 1910.1000, Table Z-1-A].

### • NIOSH REL

The National Institute for Occupational Safety and Health (NIOSH) has established a recommended exposure limit (REL) of 10 mg/m<sup>3</sup> (total dust) and 5 mg/m<sup>3</sup> (respirable fraction) as 8-hr TWAs [NIOSH 1992].

### • ACGIH TLV<sup>®</sup>

The American Conference of Governmental Industrial Hygienists (ACGIH) has assigned ammonium sulfamate a threshold limit value (TLV) of 10 mg/m<sup>3</sup> as a TWA for a normal 8-hr workday and a 40-hr workweek [ACGIH 1991b].

### • Rationale for limits

The limits are based on the risk of physical irritation associated with exposure to ammonium sulfamate.

## HEALTH HAZARD INFORMATION

### • Routes of exposure

Exposure to ammonium sulfamate can occur through inhalation and eye or skin contact.

### • Summary of toxicology

1. *Effects on Animals:* Ammonium sulfamate has a low order of toxicity in animals. When instilled into the eyes of rabbits, a 4% solution caused no irritation [Grant 1986]. The application of 20% to 50% solutions of ammonium sulfamate to the shaved skin of rats failed to produce irritation or systemic toxicity [ACGIH 1991a]. However, rabbits dermally exposed to 15% to 30% solutions for 20 days developed slight skin reactions [NLM 1991]. The oral LD<sub>50</sub> is 2,000 mg/kg for rats and 3,100 mg/kg for mice [NIOSH 1991]. Continuous feeding studies in rats have shown that chronic ingestion of high doses of ammonium sulfamate impairs growth but produces no other adverse effects [ACGIH 1991a]. Intraperitoneal injection of 0.8 g/kg ammonium sulfamate in rats produced respiratory stimulation and prostration before death occurred [Proctor et al. 1988].

2. *Effects on Humans:* Ammonium sulfamate dust can cause irritation of the eyes, skin, and mucous membranes.

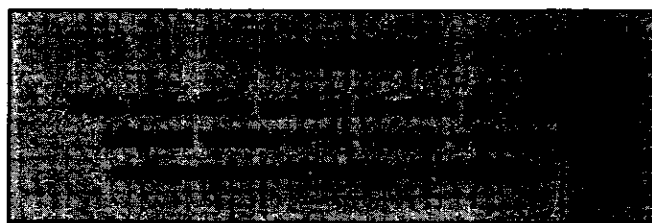
Few data are available on the effects of ammonium sulfamate exposure in humans. Repeated application of a 4% solution to the forearms of five volunteers did not produce irritation [Proctor et al. 1988]. Ingestion has caused gastrointestinal disturbances.

### • Signs and symptoms of exposure

1. *Acute exposure:* The signs and symptoms of acute over-exposure to ammonium sulfamate include possible irritation of the eyes and nose, cough, gastrointestinal disturbances, respiratory stimulation, prostration, and death.

2. *Chronic exposure:* No signs or symptoms of chronic ammonium sulfamate exposure have been reported.

### • Emergency procedures



Keep unconscious victims warm and on their sides to avoid choking if vomiting occurs. Initiate the following emergency procedures:

1. *Eye exposure:* Irritation may result! *Immediately and thoroughly* flush the eyes with large amounts of water, occasionally lifting the upper and lower eyelids.

2. *Skin exposure:* Irritation may result. *Immediately and thoroughly* wash contaminated skin with soap and water.

3. *Inhalation exposure:* Move the victim to fresh air *immediately*.

If the victim is not breathing, clean any chemical contamination from the victim's lips and perform cardiopulmonary resuscitation (CPR); if breathing is difficult, give oxygen.

4. *Ingestion exposure:* Take the following steps if ammonium sulfamate is ingested:

—Have the victim rinse the contaminated mouth cavity several times with a fluid such as water.

—Have the victim drink a glass (8 oz) of fluid such as water.

—Induce vomiting by giving syrup of ipecac as directed on the package. If ipecac is unavailable, have the victim touch the back of the throat with a finger until productive vomiting ceases.

—Do *not* force an unconscious or convulsing person to drink fluid or to vomit.

5. *Rescue:* Remove an incapacitated worker from further exposure and implement appropriate emergency procedures

(e.g., those listed on the material safety data sheet required by OSHA's hazard communication standard [29 CFR 1910.1200]). All workers should be familiar with emergency procedures and the location and proper use of emergency equipment.

## EXPOSURE SOURCES AND CONTROL METHODS

The following operations may involve ammonium sulfamate and result in worker exposures to this substance:

- Application of ammonium sulfamate as a herbicide for control of woody plants
- Manufacture of fire-retardant compositions for flame-proofing textiles and paper products
- Generation of nitrous oxide gas
- Manufacture of electroplating solutions

The following methods are effective in controlling worker exposures to ammonium sulfamate, depending on the feasibility of implementation:

- Process enclosure
- Local exhaust ventilation
- General dilution ventilation
- Personal protective equipment

Good sources of information about control methods are as follows:

1. ACGIH [1992]. *Industrial ventilation—a manual of recommended practice*. 21st ed. Cincinnati, OH: American Conference of Governmental Industrial Hygienists.
2. Burton DJ [1986]. *Industrial ventilation—a self study companion*. Cincinnati, OH: American Conference of Governmental Industrial Hygienists.
3. Alden JL, Kane JM [1982]. *Design of industrial ventilation systems*. New York, NY: Industrial Press, Inc.
4. Wadden RA, Scheff PA [1987]. *Engineering design for control of workplace hazards*. New York, NY: McGraw-Hill.
5. Plog BA [1988]. *Fundamentals of industrial hygiene*. Chicago, IL: National Safety Council.

## MEDICAL MONITORING

Workers who may be exposed to chemical hazards should be monitored in a systematic program of medical surveillance that is intended to prevent occupational injury and disease. The program should include education of employers and workers about work-related hazards, placement of workers in jobs that do not jeopardize their safety or health, early

detection of adverse health effects, and referral of workers for diagnosis and treatment. The occurrence of disease or other work-related adverse health effects should prompt immediate evaluation of primary preventive measures (e.g., industrial hygiene monitoring, engineering controls, and personal protective equipment). A medical monitoring program is intended to supplement, not replace, such measures. To place workers effectively and to detect and control work-related health effects, medical evaluations should be performed (1) before job placement, (2) periodically during the term of employment, and (3) at the time of job transfer or termination.

### • Preplacement medical evaluation

Before a worker is placed in a job with a potential for exposure to ammonium sulfamate, a licensed health care professional should evaluate and document the worker's baseline health status with thorough medical, environmental, and occupational histories, a physical examination, and physiologic and laboratory tests appropriate for the anticipated occupational risks. These should concentrate on the function and integrity of the eyes, skin, and upper respiratory tract. Medical monitoring for respiratory disease should be conducted using the principles and methods recommended by the American Thoracic Society [ATS 1987].

A preplacement medical evaluation is recommended to assess an individual's suitability for employment at a specific job and to detect and assess medical conditions that may be aggravated or may result in increased risk when a worker is exposed to ammonium sulfamate at or below the prescribed exposure limit. The licensed health care professional should consider the probable frequency, intensity, and duration of exposure as well as the nature and degree of any applicable medical condition. Such conditions (which should not be regarded as absolute contraindications to job placement) include a history and other findings consistent with drug allergies, aspirin intolerance, or eye, skin, or upper respiratory tract diseases; individuals using anticoagulant medications also may be at increased risk.

### • Periodic medical examinations and biological monitoring

Occupational health interviews and physical examinations should be performed at regular intervals during the employment period, as mandated by any applicable Federal, State, or local standard. Where no standard exists and the hazard is minimal, evaluations should be conducted every 3 to 5 years or as frequently as recommended by an experienced occupational health physician. Additional examinations may be necessary if a worker develops symptoms attributable to ammonium sulfamate exposure. The interviews, examinations, and medical screening tests should focus on identifying the adverse effects of ammonium sul-

famate on the eyes, skin, or upper respiratory tract or on blood clotting time. Current health status should be compared with the baseline health status of the individual worker or with expected values for a suitable reference population.

Biological monitoring involves sampling and analyzing body tissues or fluids to provide an index of exposure to a toxic substance or metabolite. No biological monitoring test acceptable for routine use has yet been developed for ammonium sulfamate.

- **Medical examinations recommended at the time of job transfer or termination**

The medical, environmental, and occupational history interviews, the physical examination, and selected physiologic or laboratory tests that were conducted at the time of job placement should be repeated at the time of job transfer or termination. Any changes in the worker's health status should be compared with those expected for a suitable reference population.

## **WORKPLACE MONITORING AND MEASUREMENT**

A worker's exposure to airborne ammonium sulfamate is determined by using tared, low-ash polyvinyl chloride filters (5 microns). Samples are collected at a maximum flow rate of 2 liters/min until a maximum air volume of 960 liters is collected. This is a gravimetric field test method based on the total weight collected; therefore, the sample does not need to be submitted to the laboratory for analysis. This method is described under "Filter Weighting Procedure" in the *OSHA Industrial Hygiene Technical Manual* [OSHA 1985]. Additional information can be found in Method 348 of the *Occupational Exposure Sampling Strategy Manual* [NIOSH 1977].

## **PERSONAL HYGIENE**

If ammonium sulfamate contacts the skin, workers should wash the affected areas with soap and water.

Clothing and shoes that are grossly contaminated with ammonium sulfamate should be removed and provisions should be made for safely removing this chemical from these articles.

A worker who handles ammonium sulfamate should thoroughly wash hands, forearms, and face with soap and water before eating, using tobacco products, or using toilet facilities.

Workers should not eat, drink, or use tobacco products in areas where ammonium sulfamate is handled, processed, or stored.

## **STORAGE**

Ammonium sulfamate should be stored in a cool, dry, well-ventilated area in tightly sealed containers that are labeled in accordance with OSHA's hazard communication standard [29 CFR 1910.1200]. Containers of ammonium sulfamate should be protected from physical damage and should be separated from strong oxidizers, water, potassium, sodium, sodium nitrite, metal chlorates, hot acid solutions, heat, sparks, and open flame. Because containers that formerly contained ammonium sulfamate may still hold product residues, they should be handled appropriately.

## **SPILLS**

In the event of a spill involving ammonium sulfamate, persons not wearing protective equipment and clothing should be restricted from contaminated areas until cleanup is complete. The following steps should be undertaken following a spill:

1. Do not touch the spilled material.
2. Notify safety personnel.
3. Remove all sources of heat and ignition.
4. Ventilate atmosphere to reduce the dust concentration.
5. Cover spills with a plastic sheet or tarp to minimize spreading; use a clean shovel to place the material into a clean, dry container; cover and remove the container from the spill area.

## **SPECIAL REQUIREMENTS**

U.S. Environmental Protection Agency (EPA) requirements for emergency planning, reportable quantities of hazardous releases, community right-to-know, and hazardous waste management may change over time. Users are therefore advised to determine periodically whether new information is available.

- **Emergency planning requirements**

Ammonium sulfamate is not subject to EPA's emergency planning requirements under the Superfund Amendments and Reauthorization Act (SARA) [42 USC 11022].

- **Reportable quantity requirements for hazardous releases**

A hazardous substance release is defined by EPA as any spilling, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, or disposing of hazardous substances into the environment (including the abandonment or discarding of contaminated containers). In the event of a release that is above the reportable quantity for that chemical, employers are required by the Comprehensive Environmental Response, Compensation, and Liability Act

(CERCLA) [40 CFR 355.40] to notify the proper Federal, State, and local authorities.

The reportable quantity for ammonium sulfamate is 5,000 lb. If an amount equal to or greater than this quantity is released within a 24-hr period in a manner that will expose persons outside the facility, employers are required to do the following:

- Notify the National Response Center *immediately* at (800) 424-8802 or at (202) 426-2675 in Washington, D.C. [40 CFR 302.6].
- Notify the emergency response commission of the State likely to be affected by the release [40 CFR 355.40].
- Notify the community emergency coordinator of the local emergency planning committee (or relevant local emergency response personnel) of any area likely to be affected by the release [40 CFR 355.40].

#### • Community right-to-know requirements

Employers are not required by SARA [42 USC 11022] to submit a Toxic Chemical Release Inventory Form (Form R) to EPA reporting the amount of ammonium sulfamate emitted or released from their facility annually.

#### • Hazardous waste management requirements

EPA considers a waste to be hazardous if it exhibits any of the following characteristics: ignitability, corrosivity, reactivity, or toxicity as defined in 40 CFR 261.21-261.24. Although ammonium sulfamate is not specifically listed as a hazardous waste under the Resource Conservation and Recovery Act (RCRA) [40 USC 6901 et seq.], EPA requires employers to treat waste as hazardous if it exhibits any of the characteristics discussed above.

Providing detailed information about the removal and disposal of specific chemicals is beyond the scope of this guideline. The U.S. Department of Transportation, EPA, and State and local regulations should be followed to ensure that removal, transport, and disposal of this substance are conducted in accordance with existing regulations. To be certain that chemical waste disposal meets EPA regulatory requirements, employers should address any questions to the RCRA hotline at (800) 424-9346 or at (202) 382-3000 in Washington, D.C. In addition, relevant State and local authorities should be contacted for information about their requirements for waste removal and disposal.

## RESPIRATORY PROTECTION

#### • Conditions for respirator use

Good industrial hygiene practice requires that engineering controls be used where feasible to reduce workplace concentrations of hazardous materials to the prescribed exposure limit. However, some situations may require the use of

respirators to control exposure. Respirators must be worn if the ambient concentration of ammonium sulfamate exceeds prescribed exposure limits. Respirators may be used (1) before engineering controls have been installed, (2) during work operations such as maintenance or repair activities that involve unknown exposures, (3) during operations that require entry into tanks or closed vessels, and (4) during emergencies. Workers should use only respirators that have been approved by NIOSH and the Mine Safety and Health Administration (MSHA).

#### • Respiratory protection program

Employers should institute a complete respiratory protection program that, at a minimum, complies with the requirements of OSHA's respiratory protection standard [29 CFR 1910.134]. Such a program must include respirator selection, an evaluation of the worker's ability to perform the work while wearing a respirator, the regular training of personnel, fit testing, periodic workplace monitoring, and regular respirator maintenance, inspection, and cleaning. The implementation of an adequate respiratory protection program (including selection of the correct respirator) requires that a knowledgeable person be in charge of the program and that the program be evaluated regularly. For additional information on the selection and use of respirators and on the medical screening of respirator users, consult the *NIOSH Respirator Decision Logic* [NIOSH 1987b] and the *NIOSH Guide to Industrial Respiratory Protection* [NIOSH 1987a].

## PERSONAL PROTECTIVE EQUIPMENT

Protective gloves and clothing should be worn to prevent skin contact with ammonium sulfamate. Chemical protective clothing should be selected on the basis of available performance data, manufacturers' recommendations, and evaluation of the clothing under actual conditions of use. No reports have been published on the resistance of various protective clothing materials to ammonium sulfamate permeation. If permeability data are not readily available, protective clothing manufacturers should be requested to provide information on the best chemical protective clothing for workers to wear when they are exposed to ammonium sulfamate.

If ammonium sulfamate is dissolved in water or an organic solvent, the permeation properties of both the solvent and the mixture must be considered when selecting personal protective equipment and clothing.

Safety glasses, goggles, or face shields should be worn during operations in which ammonium sulfamate might contact the eyes (e.g., through dust particles). Eyewash fountains and emergency showers should be available within the immediate work area whenever the potential exists for eye or skin contact with ammonium sulfamate. Contact lenses

should not be worn if the potential exists for ammonium sulfamate exposure.

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