

OCCUPATIONAL SAFETY AND HEALTH GUIDELINE FOR AMITROLE

INTRODUCTION

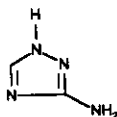
This guideline summarizes pertinent information about amitrole for workers and employers as well as for physicians, industrial hygienists, and other occupational safety and health professionals who may need such information to conduct effective occupational safety and health programs. Recommendations may be superseded by new developments; readers are therefore advised to regard these recommendations as general guidelines and to determine periodically whether new information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



• Structure



• Synonyms

3-Amino-s-triazole; 2-amino-1,3,4-triazole; 3AT; ATA; aminotriazole; 3-amino-1H-1,2,4-triazole; Amitril; Amizol; Cytrol; Weedazol; Azaplant; Azolan; Diurol; Domatol; Elmasil; Emisol; Fenamine; Kleer-Lot; Orga-414; Radoxone TL; X-All Liquid; Fenavar; Ramizol; Vorox

• Identifiers

1. CAS No.: 61-82-5
2. RTECS No.: XZ3850000
3. DOT UN: None
4. DOT label: None

• Appearance and odor

Amitrole is a nonflammable, colorless-to-white, crystalline solid that is odorless when pure. The use of amitrole on food crops is now banned in the United States; however, this

substance is still imported for use as a specialty herbicide (e.g., brush killer) and as a preharvest and postharvest herbicide on selected crops.

CHEMICAL AND PHYSICAL PROPERTIES

• Physical data

1. Molecular weight: 84.1
2. Boiling point (760 mm Hg): Data not available
3. Specific gravity (water = 1): 1.14 at 20°C (68°F)
4. Vapor density: Not applicable
5. Melting point: 159°C (318.2°F)
6. Vapor pressure at 20°C (68°F): Not applicable
7. Solubility: Soluble in water, alcohol, and chloroform; sparingly soluble in ethyl acetate; insoluble in acetone, diesel oil, ether, and kerosene
8. Evaporation rate: Not applicable

• Reactivity

1. Conditions contributing to instability: Heat and light
2. Incompatibilities: Amitrole in aqueous solution is neutral, but the compound acts as a weak base to form salts in contact with acids. This substance is also mildly corrosive to iron, aluminum, copper, and copper alloys.
3. Hazardous decomposition products: Toxic gases (such as oxides of nitrogen) may be released in a fire involving amitrole.
4. Special precautions: None

• Flammability

The National Fire Protection Association has not assigned a flammability rating to amitrole; this substance is not flammable.

1. Flash point: Not applicable

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

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.

Firefighters should wear a full set of protective clothing, including a self-contained breathing apparatus, when fighting fires involving amitrole.

EXPOSURE LIMITS

• OSHA PEL

The current Occupational Safety and Health Administration (OSHA) permissible exposure limit (PEL) for amitrole is 0.2 mg/m³ of air 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 0.2 mg/m³ as an 8-hr TWA. NIOSH has also recommended that amitrole be considered a potential occupational carcinogen and that exposure be limited to the lowest feasible concentration [NIOSH 1992].

• ACGIH TLV®

The American Conference of Governmental Industrial Hygienists (ACGIH) has assigned amitrole a threshold limit value (TLV) of 0.2 mg/m³ as a TWA for a normal 8-hr workday and a 40-hr workweek [ACGIH 1991b].

• Rationale for limits

The OSHA and NIOSH limits are based on the risk of cancer associated with exposure to amitrole, and the ACGIH limit is based on the risk of systemic and reproductive (fetotoxicity) effects associated with exposure to amitrole.

HEALTH HAZARD INFORMATION

• Routes of exposure

Exposure to amitrole can occur through inhalation, ingestion, and eye or skin contact.

• Summary of toxicology

1. *Effects on Animals:* Amitrole is a potent antithyroid agent and an animal carcinogen. Amitrole is slightly irritating to the eyes and skin of exposed rabbits [ACGIH 1991a]. Acute dermal exposure of rats and rabbits to 10,000 mg/kg did not induce toxicity. Exposure of rats to 439 mg/m³ for 4 hr did not induce eye or respiratory tract irritation or toxicity [ACGIH 1991a]. The oral LD₅₀ for mice and rats ranges from 11,000 to 14,000 mg/kg [ACGIH 1991a; Clayton and Clayton 1982]; however, a 25,000-mg/kg LD₅₀ has also been

cited for rats [ACGIH 1991a; NIOSH 1991]. When administered to young rabbits (dose and route not specified), amitrole produced cataracts and reduced the catalase activity within the lens [Grant 1986]. A number of subchronic studies via oral routes of administration have established the thyroid as the primary target organ of amitrole toxicity. In rats, the no observable effect level (NOEL) based on normal iodine 131 uptake was 0.5 ppm amitrole in the diet consumed during 13 weeks of exposure. Decreased thyroid function required 1.0 ppm in the diet for 29 days. Induction of increased thyroid weights required a minimum of 10 ppm in the diet for 13 weeks [ACGIH 1991a]. In addition, rats fed amitrole in drinking water (12 to 14 mg/day) developed goiter and showed histologic evidence of thyroid pathology at autopsy [Clayton and Clayton 1981]. Dietary exposure of breeding pairs of rats to amitrole caused reduced growth and viability of offspring [IARC 1986], and oral administration to pregnant mice caused fetotoxicity [NLM 1991]. In vitro mammalian test systems indicate that amitrole is also mutagenic [NIOSH 1991]. Amitrole has been tested for carcinogenicity in mice (by oral administration, skin application, and transplacental exposure), in rats (by oral and subcutaneous administration), and in hamsters (by oral administration). Orally, this substance produced thyroid tumors, liver carcinomas, and benign and malignant liver tumors in mice of both sexes; it also caused benign and malignant (adenocarcinomas) thyroid tumors in rats of both sexes, and benign pituitary tumors in female rats [IARC 1987]. On the basis of these studies, the International Agency for Research on Cancer (IARC) has concluded that the evidence for the carcinogenicity of amitrole in animals is sufficient [IARC 1987].

2. *Effects on Humans:* Amitrole is a thyroid toxin in humans. On the basis of effects seen in animals, this substance is also a potential occupational carcinogen. There have been no reports of signs or symptoms in exposed individuals, but extrapolations from animal data suggest that dyspnea, muscle spasms, fasciculations, ataxia, anorexia, salivation, and increased body temperature could occur [NLM 1991]. A single oral dose of 100 mg of amitrole given to volunteers inhibited thyroid iodine uptake for 24 hr after administration; the volunteers included healthy persons as well as individuals with hyperthyroidism [ACGIH 1991a]. Ingestion of 20 mg/kg of a commercial preparation (30% amitrole) by a 39-year-old woman did not induce signs or symptoms of toxicity [NLM 1991]. A small cohort study of Swedish railroad workers exposed for 45 days or more to amitrole, other pesticides, and organic and inorganic chemicals revealed an excess number of deaths from cancer. A subgroup of these workers exposed both to amitrole and chlorophenoxy herbicides had an increase in cancer mortality that was statistically significant; however, in the subgroup exposed primarily to amitrole alone, no

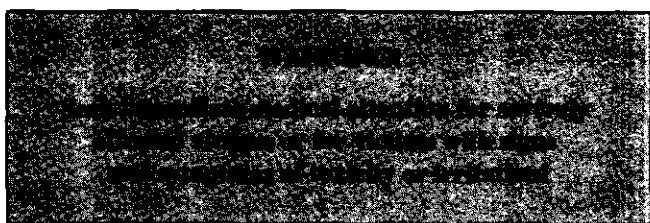
significant excess was seen [IARC 1987]. On the basis of this study, IARC has concluded that the evidence for the carcinogenicity of amitrole in humans is inadequate [IARC 1987].

- **Signs and symptoms of exposure**

1. *Acute exposure:* Other than mild irritation, no signs or symptoms of acute exposure to amitrole have been reported.

2. *Chronic exposure:* On the basis of effects seen in animals, the signs and symptoms of chronic exposure to amitrole could include dyspnea, muscle spasms, ataxia, anorexia, salivation, and increased body temperature; or lassitude, skin dryness, depression, and other effects indicative of thyroid function suppression.

- **Emergency procedures**



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

1. *Eye exposure:* Tissue irritation may result from exposure to particulates or concentrated solutions, vapors, mists, or aerosols of amitrole. **Immediately and thoroughly** flush eyes with large amounts of water, occasionally lifting the upper and lower eyelids.

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

3. *Inhalation exposure:* If particulates or vapors, mists, or aerosols of amitrole are inhaled, 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 amitrole or any material containing it 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 uses involve amitrole and may result in worker exposures to this substance:

- Use in the formulation of herbicides
- Use as a herbicide for hardwood nursery stock, aquatic weeds, and nonselective weed control along highways and railroads
- Use as a cotton defoliant and as a reagent in photography
- Use as a herbicide on poison ivy and poison oak
- Use as a herbicide on food crops (now banned in the United States)

The following methods are effective in controlling worker exposures to amitrole, 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 amitrole, 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 thyroid gland, and they should include measurement of the individual's pre-exposure level of thyroid activity.

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 amitrole 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 diseases of the thyroid gland.

• 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 amitrole exposure. The interviews, examinations, and medical screening tests should focus on identifying the adverse effects of amitrole on the thyroid gland. 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 amitrole.

• 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. Because occupational exposure to amitrole may cause diseases with prolonged latent periods, the need for medical monitoring may extend well beyond the termination of employment.

WORKPLACE MONITORING AND MEASUREMENT

A worker's exposure to airborne amitrole is determined by using a midget impinger containing 10 ml of distilled water. Samples are collected at a maximum flow rate of 1.0 liter/min until a maximum air volume of 60 liters is collected. Analysis is conducted by high performance liquid chromatography using ultraviolet detection. The limit of detection for this procedure is 0.004 mg/m³. This method is described in the OSHA Computerized Information System [OSHA 1988] and in the OSHA Laboratory In-House Methods File [OSHA 1991].

PERSONAL HYGIENE

If amitrole contacts the skin, workers should flush the affected areas immediately with plenty of water for 15 min and then wash with soap and water.

Clothing and shoes contaminated with amitrole should be removed immediately, and provisions should be made for safely removing this chemical from these articles. Persons laundering contaminated clothing should be informed of the hazardous properties of amitrole.

A worker who handles amitrole 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 amitrole or a solution containing amitrole is handled, processed, or stored.

STORAGE

Amitrole 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 amitrole should be protected from physical damage and should be stored separately from acids, heat, and light. Because containers that formerly contained amitrole may still hold product residues, they should be handled appropriately.

SPILLS AND LEAKS

In the event of a spill or leak involving amitrole, 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 or leak:

1. Do not touch the spilled material.
2. For small dry spills, use a clean shovel and place the material in a clean, dry container; cover and remove the container from the spill area.
3. Absorb small liquid spills with sand or other noncombustible absorbent material and place the material in a covered container for later disposal.
4. For large liquid spills, build dikes far ahead of the spill to contain the amitrole for later reclamation or disposal.

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

Amitrole is not subject to EPA 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 or local authorities.

The reportable quantity for amitrole is 1 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 Section 313 of SARA to submit a Toxic Chemical Release Inventory Form (Form R) to EPA reporting the amount of amitrole 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. Amitrole is listed as a hazardous waste under the Resource Conservation and Recovery Act (RCRA) [40 USC 6901 et seq.] and has been assigned EPA Hazardous Waste No. U011. This substance has been banned from land disposal and may be treated by incineration. Amitrole also may be disposed of in an organometallic or organic lab pack that meets the requirements of 40 CFR 264.316 or 265.316.

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 amitrole 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 any possibility of skin contact with amitrole. 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 amitrole 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 amitrole.

If amitrole 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 amitrole might contact the eyes (e.g., through dust particles or splashes of solution). Eyewash fountains and emergency showers should be available within the immediate work area whenever the potential exists for eye or skin contact with amitrole. Contact lenses should not be worn if the potential exists for amitrole exposure.

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