

Occupational Health Guideline for 2-Aminopyridine

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: $\text{NH}_2\text{C}_6\text{H}_4\text{N}$
- Synonyms: Alpha-aminopyridine
- Appearance and odor: Colorless solid with a characteristic odor.

PERMISSIBLE EXPOSURE LIMIT (PEL)

The current OSHA standard for 2-aminopyridine is 0.5 part of 2-aminopyridine per million parts of air (ppm) averaged over an eight-hour work shift. This may also be expressed as 2 milligrams of 2-aminopyridine per cubic meter of air (mg/m^3).

HEALTH HAZARD INFORMATION

• Routes of exposure

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

• Effects of overexposure

1. *Short-term Exposure:* 2-Aminopyridine may cause headache, dizziness, nausea, and weakness. It may also cause flushing of the arms and legs, convulsions, and death.

2. *Long-term Exposure:* None known.

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 2-aminopyridine.

• Recommended medical surveillance

The following medical procedures should be made available to each employee who is exposed to 2-aminopyridine at potentially hazardous levels:

1. *Initial Medical Screening:* Employees should be screened for history of certain medical conditions (listed below) which might place the employee at increased risk from 2-aminopyridine exposure.

—Convulsive disorders: 2-Aminopyridine causes convulsion. Persons with a history of convulsive disorders may be more susceptible to the effects of this agent.

—Liver disease: Although 2-aminopyridine is not known as a liver toxin in humans, the importance of this organ in the biotransformation and detoxification of foreign substances should be considered before exposing persons with impaired liver function.

—Kidney disease: Although 2-aminopyridine is not known as a kidney toxin in humans, the importance of this organ in the elimination of toxic substances justifies special consideration in those with impaired renal function.

—Chronic respiratory disease: In persons with impaired pulmonary function, especially those with obstructive airway diseases, the breathing of 2-aminopyridine might cause exacerbation of symptoms due to its irritant properties.

2. *Periodic Medical Examination:* Any employee developing the above-listed conditions should be referred for further medical examination.

• Summary of toxicology

2-Aminopyridine in aqueous solution is a central nervous system excitant and convulsant. The LD50 in mice by intraperitoneal injection was 35 mg/kg; lethal doses in animals produced excitement, tremors, convulsions, tetany, and death. Fatal doses were readily absorbed through the skin. In industrial experience, intoxication has occurred from inhalation of the dust or vapor, or by skin absorption following direct contact. Fatal intoxication occurred in a chemical worker who spilled a solution of 2-aminopyridine on his clothing during a

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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distillation; he continued to work in contaminated clothing for 1-½ hours. Two hours later, he developed dizziness, headache, respiratory distress, and convulsions that progressed to respiratory failure and death; it is probable that skin absorption was a contributing factor in this case. A non-fatal intoxication from exposure to an undetermined concentration of 2-aminopyridine in air resulted in severe headache, weakness, convulsions, and a stuporous state that lasted several days. A chemical worker exposed to an estimated air concentration of 20 mg/m³ (5.2 ppm) developed severe pounding headache, nausea, flushing of the extremities, and elevated blood pressure, but he recovered fully within 24 hours. An aqueous solution dropped in a rabbit's eye was only mildly irritating.

CHEMICAL AND PHYSICAL PROPERTIES

• Physical data

1. Molecular weight: 94.1
2. Boiling point (760 mm Hg): 210 C (410 F)
3. Specific gravity (water = 1): Greater than 1
4. Vapor density (air = 1 at boiling point of 2-aminopyridine): 3.2
5. Melting point: 56 C (133 F)
6. Vapor pressure at 20 C (68 F): Low
7. Solubility in water, g/100 g water at 20 C (68 F): Greater than 100
8. Evaporation rate (butyl acetate = 1): Data not available

• Reactivity

1. Conditions contributing to instability: Heat
2. Incompatibilities: Contact with strong oxidizers may cause fires and explosions.
3. Hazardous decomposition products: Toxic gases and vapors (such as oxides of nitrogen and carbon monoxide) may be released in a fire involving 2-aminopyridine.
4. Special precautions: None

• Flammability

1. Flash point: 68 C (154 F) (closed cup)
2. Autoignition temperature: Data not available
3. Flammable limits in air, % by volume: Data not available
4. Extinguishant: Carbon dioxide, dry chemical, alcohol foam

• Warning properties

1. Odor threshold: No information is available concerning the odor threshold of 2-aminopyridine.
2. Eye Irritation Level: Grant reports that "2-aminopyridine tested in 0.02M aqueous solution at pH 9.4 by dropping on a rabbit's cornea from which the epithelium had been removed caused only transient corneal haze and slight delay in return to normal." The vapor of 2-aminopyridine is not specifically stated as being an eye irritant, but since Patty reports that this compound is a strong base and that it is soluble in water, it is treated as an eye irritant for the purposes of this guideline. In addition, Patty points out that most of the amino

pyridines "cause rather intense skin and eye irritation."

3. Evaluation of Warning Properties: Since there are no quantitative data relating warning properties to air concentrations of 2-aminopyridine, this substance is treated as a material with poor warning properties. Its concentration in saturated air could result in a significant exposure relative to the permissible exposure.

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 2-aminopyridine is in the *NIOSH Manual of Analytical Methods*, 2nd Ed., Vol. 4, 1978, available from the Government Printing Office, Washington, D.C. 20402 (GPO No. 017-033-00317-3).

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 skin contact with 2-aminopyridine or solutions containing 2-aminopyridine, where skin contact may occur.
- If employees' clothing may have become contaminated with 2-aminopyridine or solutions containing 2-aminopyridine, employees should change into uncontaminated clothing before leaving the work premises.

- Clothing contaminated with 2-aminopyridine should be placed in closed containers for storage until it can be discarded or until provision is made for the removal of 2-aminopyridine from the clothing. If the clothing is to be laundered or otherwise cleaned to remove the 2-aminopyridine, the person performing the operation should be informed of 2-aminopyridine's hazardous properties.

- Where exposure of an employee's body to 2-aminopyridine or solutions containing 2-aminopyridine 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 2-aminopyridine should be removed immediately and not worn until the 2-aminopyridine is removed from the clothing.

- Employees should be provided with and required to use dust- and splash-proof safety goggles where 2-aminopyridine or solutions containing 2-aminopyridine may contact the eyes.

SANITATION

- Skin that becomes contaminated with 2-aminopyridine should be immediately washed or showered to remove any 2-aminopyridine.

- Workers subject to skin contact with 2-aminopyridine or solutions containing 2-aminopyridine should wash any areas of the body which may have contacted 2-aminopyridine at the end of each work day.

- Eating and smoking should not be permitted in areas where 2-aminopyridine or solutions containing 2-aminopyridine are handled, processed, or stored.

- Employees who handle 2-aminopyridine or solutions containing 2-aminopyridine 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 2-aminopyridine may occur and control methods which may be effective in each case:

Operation	Controls
Use in production of chemical intermediates for manufacture of pharmaceuticals; use in manufacture of dyes, lubricant antioxidants, and herbicides	Local exhaust ventilation; general dilution 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 2-aminopyridine or solutions containing 2-aminopyridine 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 2-aminopyridine or solutions containing 2-aminopyridine get on the skin, immediately flush the contaminated skin with water. If 2-aminopyridine or solutions containing 2-aminopyridine penetrate through the clothing, remove the clothing immediately and wash the skin with water. If irritation persists after washing, get medical attention.

• Breathing

If a person breathes in large amounts of 2-aminopyridine, 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 2-aminopyridine has been swallowed, 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.

• 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 2-aminopyridine is spilled, the following steps should be taken:

1. Ventilate area of spill.

2. For small quantities, sweep onto paper or other suitable material, place in an appropriate container and burn in a safe place (such as a fume hood). Large quantities may be reclaimed; however, if this is not practical, dissolve in a flammable solvent (such as alcohol) and atomize in a suitable combustion chamber equipped with an appropriate effluent gas cleaning device.

- Waste disposal methods:

2-Aminopyridine may be disposed of:

1. By making packages of 2-aminopyridine in paper or other flammable material and burning in a suitable combustion chamber equipped with an appropriate effluent gas cleaning device.

2. By dissolving 2-aminopyridine in a flammable solvent (such as alcohol) and atomizing in a suitable combustion chamber equipped with an appropriate effluent gas cleaning device.

REFERENCES

• American Conference of Governmental Industrial Hygienists: "2-Aminopyridine," *Documentation of the Threshold Limit Values for Substances in Workroom Air* (3rd ed., 2nd printing), Cincinnati, 1974.

- Fairhall, L. T.: *Industrial Toxicology* (2nd ed.), Williams and Wilkins, Baltimore, 1957.
- Grant, W. M.: *Toxicology of the Eye* (2nd ed.), C. C. Thomas, Springfield, Illinois, 1974.
- 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.

RESPIRATORY PROTECTION FOR 2-AMINOPYRIDINE

Condition	Minimum Respiratory Protection* Required Above 0.5 ppm
Vapor Concentration 5 ppm (20 mg/m ³) or less	Any supplied-air respirator with a full facepiece, helmet, or hood. Any self-contained breathing apparatus with a full facepiece.
Greater than 5 ppm (20 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 gas mask providing protection against organic vapors and particulates. Any escape self-contained breathing apparatus.

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