

Occupational Health Guideline for Azinphos-Methyl

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: $C_{10}H_{12}N_3O_3PS_2$
- Synonyms: Guthion; O,O-dimethyl-S-(4-oxo-1,2,3-benzotriazin-3-(4H)-yl-methyl)phosphorodithioate
- Appearance: Brown waxy solid.

PERMISSIBLE EXPOSURE LIMIT (PEL)

The current OSHA standard for azinphos-methyl is 0.2 milligram of azinphos-methyl per cubic meter of air (mg/m^3) averaged over an eight-hour work shift.

HEALTH HAZARD INFORMATION

• Routes of exposure

Azinphos-methyl 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

1. Short-term Exposure: The sequence of the development of effects varies with the route of entry. After inhalation of azinphos-methyl, breathing and eye effects are the first to appear. These include tightness of the chest, wheezing, a bluish discoloration of the skin, small pupils, aching in and behind the eyes, blurring of vision, tearing, runny nose, headache, and watering of the mouth. After swallowing azinphos-methyl, loss of appetite, nausea, vomiting, abdominal cramps, and diarrhea may appear within two hours. After skin absorption, sweating and twitching in the area of absorption may occur usually within 15 minutes to four hours. With severe intoxication by all routes, in addition to all the

above symptoms, weakness, generalized twitching and paralysis may occur and breathing may stop. In addition, dizziness, confusion, staggering, slurred speech, generalized sweating, irregular or slow heart beat, convulsions, and coma may occur.

2. Long-term Exposure: Repeated exposure to levels of azinphos-methyl may make a person more susceptible to the effects of this and related chemicals. Repeated exposure to concentrations which are too small to produce symptoms after a single exposure may result in the onset of symptoms.

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 azinphos-methyl.

• Recommended medical surveillance

The following medical procedures should be made available to each employee who is exposed to azinphos-methyl 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 reduced pulmonary function, convulsive disorders, or recent exposure to anticholinesterase agents would be expected to be at increased risk from exposure. Examination of the respiratory system, nervous system, cardiovascular system, and attention to the cholinesterase levels in the blood should be stressed. The skin should be examined for evidence of chronic disorders.

—Cholinesterase determination: Azinphos-methyl causes depressed levels of activity of cholinesterase in the serum and erythrocytes. The cholinesterase activity in the serum and erythrocytes should be determined by using medically acceptable biochemical tests prior to any new period of exposure.

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

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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basis, with the exception of the cholinesterase determination which should be performed quarterly or at any time overexposure is suspected or signs and symptoms of toxicity occur.

• Summary of toxicology

Azinphos-methyl (Guthion) is an anticholinesterase agent; absorption may occur from inhalation of the dust or mist; from skin absorption of solutions, or from ingestion. Signs and symptoms of overexposure are caused by the inactivation of the enzyme cholinesterase, which results in the accumulation of acetylcholine at synapses in the nervous system, skeletal and smooth muscles, and secretory glands. The sequence of the development of systemic effects varies with the route of entry. The onset of signs and symptoms occurs promptly and almost always within 12 hours. After inhalation respiratory and ocular effects are the first to appear, often within a few minutes after exposure. Respiratory effects include tightness in the chest and wheezing due to bronchoconstriction and excessive bronchial secretion; laryngeal spasms and excessive salivation may add to the respiratory distress; cyanosis may also occur. Ocular effects include miosis, aching in and behind the eyes (attributed to ciliary spasm), blurring of distant vision, tearing, rhinorrhea, and frontal headache. After ingestion, gastrointestinal effects, such as anorexia, nausea, vomiting, abdominal cramps, and diarrhea appear within 15 minutes to 2 hours. After skin absorption, localized sweating and muscular fasciculations in the immediate area occur, usually within 15 minutes to 4 hours; skin absorption is somewhat greater at higher ambient temperatures, and is increased by the presence of dermatitis. With severe intoxication by all routes, an excess of acetylcholine at the neuromuscular junctions of skeletal muscle causes weakness aggravated by exertion, involuntary twitchings, fasciculations, and eventually paralysis; the most serious consequence is paralysis of the respiratory muscles. Effects on the central nervous system include giddiness, confusion, ataxia, slurred speech, Cheyne-Stokes respiration, convulsions, coma, and loss of reflexes. The blood pressure may fall to low levels, and cardiac irregularities including complete heart block may occur; these effects may sometimes be reversed by establishing adequate pulmonary ventilation. Complete symptomatic recovery usually occurs within 1 week; increased susceptibility to the effects of anticholinesterase agents persists for weeks after exposure. Daily exposure to concentrations which are insufficient to produce symptoms following a single exposure may result in the onset of symptoms. Continued daily exposure may be followed by increasingly severe effects. In a study of eight workers engaged in the formulation of a Guthion wettable powder and exposed to concentrations up to 9.6 mg/m³, the lowest activity of cholinesterase in blood serum was 78% of the value before exposure, and there were no signs or symptoms of illness.

CHEMICAL AND PHYSICAL PROPERTIES

• Physical data

1. Molecular weight: 317.3
2. Boiling point (760 mm Hg): Decomposes
3. Specific gravity (water = 1): 1.4
4. Vapor density (air = 1 at boiling point of azinphos-methyl): Not applicable
5. Melting point: 73 C (163 F)
6. Vapor pressure at 20 C (68 F): Essentially zero
7. Solubility in water, g/100 g water at 20 C (68 F): 0.003
8. Evaporation rate (butyl acetate = 1): Not applicable

• Reactivity

1. Conditions contributing to instability: High temperatures cause gas evolution and may develop pressure in sealed containers.

2. Incompatibilities: Contact with strong oxidizers may cause fires and explosions.

3. Hazardous decomposition products: Toxic gases and vapors (such as sulfur dioxide, oxides of nitrogen, phosphoric acid mist, and carbon monoxide) may be released in a fire involving azinphos-methyl.

4. Special precautions: None

• Flammability

1. Flash point: Data not available

2. Autoignition temperature: Data not available

3. Flammable limits in air, % by volume: Not applicable

4. Extinguishant: Water

• Warning properties

Since azinphos-methyl has a negligible vapor pressure, warning properties are not considered. Azinphos-methyl is not known to be an eye irritant.

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

At the time of publication of this guideline, no measurement method for azinphos-methyl had been published by NIOSH.

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 azinphos-methyl or liquids containing azinphos-methyl, where skin contact may occur.

- If employees' clothing has had any possibility of being contaminated with azinphos-methyl or liquids containing azinphos-methyl, employees should change into uncontaminated clothing before leaving the work premises.

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

- Where exposure of an employee's body to azinphos-methyl or liquids containing azinphos-methyl 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 azinphos-methyl should be removed immediately and not reworn until the azinphos-methyl is removed from the clothing.

- Employees should be provided with and required to use dust- and splash-proof safety goggles where azinphos-methyl or liquids containing azinphos-methyl may contact the eyes.

SANITATION

- Skin that becomes contaminated with azinphos-methyl should be immediately washed or showered with soap or mild detergent and water to remove any azinphos-methyl.

- Workers subject to skin contact with azinphos-methyl or liquids containing azinphos-methyl should wash with soap or mild detergent and water any areas of the body which may have contacted azinphos-methyl at the end of each work day.

- Eating and smoking should not be permitted in areas where azinphos-methyl or liquids containing azinphos-methyl are handled, processed, or stored.

- Employees who handle azinphos-methyl or liquids containing azinphos-methyl 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 azinphos-methyl may occur and control methods which may be effective in each case:

Operation	Controls
Application as an insecticide and acaricide on field crops, fruit, vegetables, cotton, tobacco, and sugar cane	Personal protective equipment; product substitution
Formulation for use as an insecticide	Personal protective equipment; product substitution
Manufacture of azinphos-methyl	Product substitution; local exhaust ventilation; process enclosure; 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 azinphos-methyl, or liquids or mists containing azinphos-methyl get into the eyes, wash eyes immediately with large amounts of water, lifting the lower and upper lids occasionally. Get medical attention immediately. Contact lenses should not be worn when working with this chemical.

• Skin Exposure

If azinphos-methyl, or liquids or mists containing azinphos-methyl get on the skin, immediately wash the contaminated skin using soap or mild detergent and water. If azinphos-methyl, or liquids or mists containing azinphos-methyl penetrate through the clothing, remove the clothing immediately and wash the skin using soap or mild detergent and water. Get medical attention immediately.

• Breathing

If a person breathes in large amounts of azinphos-methyl, 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 azinphos-methyl or liquids containing azinphos-methyl have 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.

- **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 azinphos-methyl 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:

Azinphos-methyl may be disposed of:

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

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

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RESPIRATORY PROTECTION FOR AZINPHOS-METHYL

Condition	Minimum Respiratory Protection* Required Above 0.2 mg/m ³
Particulate Concentration	
2 mg/m ³ or less	<p>Any chemical cartridge respirator with an organic vapor cartridge(s) and dust and mist filter(s), including pesticide respirators which meet the requirements of this class.</p> <p>Any supplied-air respirator.</p> <p>Any self-contained breathing apparatus.</p>
5 mg/m ³ or less	<p>A chemical cartridge respirator with a full facepiece, organic vapor cartridge(s), and dust and mist filter(s), including pesticide respirators which meet the requirements of this class.</p> <p>A gas mask with a chin-style or a front- or back-mounted organic vapor canister and dust and mist filter, including pesticide respirators which meet the requirements of this class.</p> <p>Any supplied-air respirator with a full facepiece, helmet, or hood.</p> <p>Any self-contained breathing apparatus with a full facepiece.</p> <p>A Type C supplied-air respirator operated in pressure-demand or other positive pressure or continuous-flow mode.</p>
Greater than 5 mg/m ³ ** or entry and escape from unknown concentrations	<p>Self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode.</p> <p>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.</p>
Fire Fighting	<p>Self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode.</p>
Escape	<p>Any gas mask providing protection against organic vapors and particulates, including pesticide respirators which meet the requirements of this class.</p> <p>Any escape self-contained breathing apparatus.</p>

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

**Use of supplied-air suits may be necessary to prevent skin contact while providing respiratory protection from airborne concentrations of azinphos-methyl; 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 5 mg/m³, an auxiliary self-contained breathing apparatus operated in positive pressure mode should also be worn.

