Occupational Health Guideline for Strychnine

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: $C_{21}H_{22}N_2O_2$
- Synonyms: None
- Appearance and odor: Colorless, odorless solid.

PERMISSIBLE EXPOSURE LIMIT (PEL)

The current OSHA standard for strychnine is 0.15 milligram of strychnine per cubic meter of air (mg/m^3) averaged over an eight-hour work shift.

HEALTH HAZARD INFORMATION

- **Routes of exposure**

Strychnine affects the body after it is swallowed. There are no literature sources to indicate that strychnine presents a significant hazard from skin or eye exposure.

- **Effects of overexposure**

After swallowing strychnine, effects usually occur within 10 to 30 minutes and include stiffness of the face and neck muscles, increased excitability, restlessness, and apprehension. These symptoms may progress to repeated convulsions and death.

- **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 strychnine.

- **Recommended medical surveillance**

The following medical procedures should be made available to each employee who is exposed to strychnine 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 strychnine exposure.

—Convulsive disorders: Strychnine causes convulsions. Persons with a history of convulsive disorders may be more susceptible to the effects of this agent.

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

- **Summary of toxicology**

Strychnine is a potent convulsant. In humans the mean lethal oral dose is approximately 100 to 120 mg. After ingestion, effects usually occur within 10 to 30 minutes and include stiffness of the face and neck muscles, increased reflex excitability, restlessness, apprehension, and heightened acuity of perception. Any sensory stimulus may produce a violent motor response which in the early stages of intoxication tends to be a coordinated extensor thrust and in later stages it may be a tetanic convulsion with opisthotonos; anoxia and cyanosis develop rapidly. Between convulsions, muscular relaxation is complete, breathing is resumed, and cyanosis lessens. Because sensation is unaffected, the convulsions are painful and lead to overwhelming fear; as many as 10 convulsions separated by intervals of 10 to 15 minutes may be experienced, but death often occurs after the second to fifth convulsion and even the first convulsion may be fatal if sustained; death is commonly due to asphyxia.

CHEMICAL AND PHYSICAL PROPERTIES

- **Physical data**

1. Molecular weight: 334.4
2. Boiling point (760 mm Hg): Decomposes
3. Specific gravity (water = 1): 1.36
4. Vapor density (air = 1 at boiling point of strychnine): Not applicable
5. Melting point: 268 C (547 F)
6. Vapor pressure at 20 C (68 F): Essentially zero

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7. Solubility in water, g/100 g water at 20 C (68 F): 0.02

8. Evaporation rate (butyl acetate = 1): Not applicable

• **Reactivity**

1. Conditions contributing to instability: None.

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 when strychnine decomposes.

4. Special precautions: None.

• **Flammability**

1. Not combustible

• **Warning properties**

Strychnine 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**

An analytical method for strychnine 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

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

• 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 strychnine where skin contact may occur.

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

SANITATION

• Eating and smoking should not be permitted in areas where strychnine or liquids containing strychnine are handled, processed, or stored.

• Skin that becomes contaminated with strychnine or liquids containing strychnine should be promptly washed or showered to remove any strychnine.

• Employees who handle strychnine or liquids containing strychnine 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 strychnine may occur and control methods which may be effective in each case:

Operation	Controls
Application and formulation of medicinals and pesticides	Personal protective equipment
Manufacture of strychnine	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 strychnine or liquids containing strychnine get into the eyes, wash eyes immediately with large amounts of water, lifting the lower and upper lids occasionally. Get medical attention. Contact lenses should not be worn

when working with this chemical.

• **Skin Exposure**

If strychnine or liquids containing strychnine get on the skin, promptly wash the contaminated skin using soap or mild detergent and water. If strychnine or liquids containing strychnine penetrate through the clothing, remove the clothing promptly and wash the skin using soap or mild detergent and water. If irritation is present after washing, get medical attention.

• **Breathing**

If a person breathes in large amounts of strychnine, 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 strychnine or liquids containing strychnine 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 strychnine 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 strychnine should be absorbed in vermiculite, dry sand, earth, or a similar material.

• Waste disposal method:

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

REFERENCES

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RESPIRATORY PROTECTION FOR STRYCHNINE

Condition	Minimum Respiratory Protection* Required Above 0.15 mg/m³
Particulate Concentration	
0.75 mg/m³ or less	Any dust respirator, except single-use.
1.5 mg/m³ or less	Any dust 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.
3 mg/m³ or less	A high efficiency particulate filter respirator with a full facepiece. A powered air-purifying respirator with a high efficiency particulate filter. Any supplied-air respirator with a full facepiece, helmet, or hood. Any self-contained breathing apparatus with a full facepiece. A Type C supplied-air respirator operated in pressure-demand or other positive pressure or continuous-flow mode.
Greater than 3 mg/m³ 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 respirator, except single-use. Any escape self-contained breathing apparatus.

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