

OCCUPATIONAL SAFETY AND HEALTH GUIDELINE FOR ALDRIN POTENTIAL HUMAN CARCINOGEN

INTRODUCTION

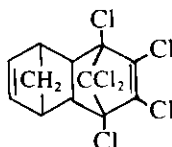
This guideline summarizes pertinent information about aldrin for workers, employers, and occupational safety and health professionals who may need such information to conduct effective occupational safety and health programs. Recommendations may be superseded by new developments in these fields; therefore, readers are advised to regard these recommendations as general guidelines.

NOTE: Most uses of aldrin were suspended by the U.S. Environmental Protection Agency, effective October 18, 1974. The only uses allowed are direct soil application, seed treatment if labeled "not for food use," dipping of plant roots and tops, subsurface termite control, and hot-caps.

SUBSTANCE IDENTIFICATION

• **Formula:** C₁₂H₈Cl₆

• **Structure:**



• **Synonyms:** Aldrex; aldrine; aldrosol; octalene; 1,2,3,4,10,10-hexachloro-1,4,4a,5,8,8a-hexahydro-exo-1,4-endo-5,8-dimethanonaphthalene

• **Identifiers:** CAS 309-00-2; RTECS 102100000; DOT 2761, label required: "Poison"

• **Appearance and odor:** Light to dark brown crystals with a mild chemical odor

CHEMICAL AND PHYSICAL PROPERTIES

• **Physical data**

1. Molecular weight: 364.90
2. Boiling point (at 760 mmHg): Decomposes
3. Specific gravity (water = 1): 1.6
4. Melting point: 104°C (219°F)

5. Vapor pressure at 20°C (68°F): 6.0 x 10⁻⁶ mmHg

6. Solubility in water: 0.027 mg/l at 27°C (80.6°F)

• **Reactivity**

1. **Incompatibilities:** Aldrin may react with concentrated mineral acids, acid catalysts, acid oxidizing agents, phenols, or reactive metals.

2. **Hazardous decomposition products:** Hydrochloric acid fumes and other chlorinated decomposition products may be released in a fire involving aldrin.

3. **Caution:** Aldrin should be stored in tightly closed containers in a well-ventilated area.

• **Flammability**

Aldrin is nonflammable.

• **Warning properties**

Evaluation of warning properties for respirator selection: Warning properties are not considered in recommending respirators for use with carcinogens.

EXPOSURE LIMITS

The current Occupational Safety and Health Administration (OSHA) permissible exposure limit (PEL) for aldrin is 0.25 milligrams of aldrin per cubic meter of air (mg/m³) as a time-weighted average (TWA) concentration over an 8-hour workshift (Skin). The notation "Skin" refers to the potential contribution to overall exposure by the cutaneous route including the mucous membranes and eyes. The National Institute for Occupational Safety and Health (NIOSH) recommends that aldrin be controlled and handled as a potential human carcinogen in the workplace and that exposure be minimized to the lowest feasible limit. The NIOSH recommended exposure limit (REL) is 0.15 mg/m³ as a TWA for up to a 10-hour workshift, 40-hour workweek. The NIOSH REL is the lowest concentration detectable by current NIOSH-validated sampling and analytical methods. The American Conference of Governmental Industrial Hygienists (ACGIH) threshold limit value (TLV[®]) is 0.25 mg/m³ (Skin) as a TWA for a normal 8-hour workday and a 40-hour workweek (Table 1).

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

Table 1.—Occupational exposure limits for aldrin

	Exposure limits mg/m ³
OSHA PEL TWA (Skin)*	0.25
NIOSH REL TWA (Ca)†	§0.15
ACGIH TLV® TWA (Skin)	0.25

* (Skin): Potential contribution to overall exposure by the cutaneous route including mucous membranes and eyes.

† (Ca): NIOSH recommends treating as a potential human carcinogen.

§ Lowest reliably detectable level.

HEALTH HAZARD INFORMATION

• Routes of exposure

Aldrin may cause adverse health effects following exposure via inhalation, ingestion, or dermal or eye contact. Dermal absorption is substantially increased when aldrin is dissolved in organic solvents.

• Summary of toxicology

1. *Effects on animals*: Acute or chronic oral administration of aldrin to dogs and rats produced liver and kidney degeneration; chronic oral administration produced liver cancer in mice and thyroid cancer in rats. Aldrin fed to pregnant hamsters and mice caused increased fetal deaths, as well as congenital anomalies and growth retardation in the offspring.

2. *Effects on humans*: Aldrin is a neurotoxin and has caused electroencephalogram abnormalities following short-term or long-term oral, dermal, or inhalation exposure.

• Signs and symptoms of exposure

1. *Short-term (acute)*: Exposure to aldrin can cause hyperirritability, headache, dizziness, nausea, vomiting, blood in the urine, tremors, convulsions, and coma.

2. *Long-term (chronic)*: Exposure to aldrin can cause redness of the skin and dermatitis, weight loss, muscular twitching, and convulsions.

RECOMMENDED MEDICAL PRACTICES

• Medical surveillance program

Workers with potential exposures to chemical hazards should be monitored in a systematic program of medical surveillance intended to prevent or control 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 and health, earliest possible detection of adverse health effects, and referral of workers for diagnostic confirmation and treatment. The occurrence of disease (a "sentinel health event," SHE) 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 surveillance program is intended to supplement, not replace, such measures.

A medical surveillance program should include systematic collection and epidemiologic analysis of relevant environmental and biologic monitoring, medical screening, morbidity, and mortality data. This analysis may provide information about the relatedness of adverse health effects and occupational exposure that cannot be discerned from results in individual workers. Sensitivity, specificity, and predictive values of biologic monitoring and medical screening tests should be evaluated on an industry-wide basis prior to application in any given worker group. Intrinsic to a surveillance program is the dissemination of summary data to those who need to know, including employers, occupational health professionals, potentially exposed workers, and regulatory and public health agencies.

• Preplacement medical evaluation

Prior to placing a worker in a job with a potential for exposure to aldrin, the physician 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, liver, kidneys, endocrine glands, and hematopoietic (blood-cell-forming), reproductive, and nervous systems.

A preplacement medical evaluation is recommended in order to detect and assess preexisting or concurrent conditions which may be aggravated or result in increased risk when a worker is exposed to aldrin at or below the NIOSH REL.

The examining physician should consider the probable frequency, intensity, and duration of exposure, as well as the nature and degree of the condition, in placing such a worker. Such conditions, which should not be regarded as absolute contraindications to job placement, include: preexisting chronic diseases of the skin, liver, kidneys, endocrine glands, and hematopoietic, reproductive, and nervous systems. Workers should inform their physicians of their potential for exposures to aldrin because internal absorption of this chemical pathologically increases the liver's ability to metabolize and eliminate medications which may be prescribed or taken "over the counter." The physician should obtain baseline values for liver function tests and a complete blood count with reticulocyte count.

• Periodic medical screening and/or biologic monitoring

Occupational health interviews and physical examinations should be performed at regular intervals. Additional examinations may be necessary should a worker develop symptoms that may be attributed to exposure to aldrin. The interviews, examinations, and appropriate medical screening and/or biologic monitoring tests should be directed at identifying an excessive decrease or adverse trend in the integrity and physiologic function of the skin, eyes, liver, kidney, and hematopoietic, reproductive, and nervous systems as compared to the baseline status of the individual worker or to expected values for a suitable reference population.

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

The medical, environmental, and occupational history interviews, the physical examination, and selected physiologic and laboratory tests which were conducted at the time of placement should be repeated at the time of job transfer or termination. Any changes in the worker's health status should be compared to those expected for a suitable reference population. Because occupational exposure to aldrin may cause diseases of prolonged induction-latency, the need for medical surveillance may extend well beyond termination of employment.

- **Sentinel health events**

1. Acute SHE's include: Non-autoimmune hemolytic anemia.
2. Delayed-onset SHE's include: Cataract, toxic hepatitis, and non-autoimmune hemolytic anemia.

MONITORING AND MEASUREMENT PROCEDURES

- **TWA exposure evaluation**

Measurements to determine worker exposure to aldrin should be taken so that the TWA exposure is based on a single entire workshift sample or an appropriate number of consecutive samples collected during the entire workshift. Under certain conditions, it may be appropriate to collect several short-term interval samples (up to 30 minutes each) to determine the average exposure level. Air samples should be taken in the worker's breathing zone (air that most nearly represents that inhaled by the worker).

- **Method**

Sampling and analysis may be performed by collecting aldrin with a glass-fiber filter and a midjet impinger containing isooctane. The filter is extracted using isooctane, and analysis is performed using a gas chromatograph with an electrolytic conductivity detector. A detailed sampling and analytical method for aldrin may be found in the *NIOSH Manual of Analytical Methods* (method number 5502).

PERSONAL PROTECTIVE EQUIPMENT

Chemical protective clothing (CPC) should be selected after utilizing available performance data, consulting with the manufacturer, and then evaluating the clothing under actual use conditions.

Workers should be provided with and required to use CPC, gloves, and other appropriate protective clothing necessary to prevent skin contact with aldrin.

SANITATION

Clothing which is contaminated with aldrin should be removed immediately and placed in sealed containers for storage until it can be discarded or until provision is made for the removal of aldrin from the clothing. If the clothing is to be laundered or cleaned, the person performing the operation should be informed of aldrin's hazardous properties. Reusable clothing and equipment should be checked for residual contamination before reuse or storage.

A change room with showers, washing facilities, and lockers that permit separation of street and work clothes should be provided.

Workers should be required to shower following a workshift and prior to putting on street clothes. Clean work clothes should be provided daily.

Skin that becomes contaminated with aldrin should be promptly washed with soap and water.

The storage, preparation, dispensing, or consumption of food or beverages, the storage or application of cosmetics, the storage or smoking of tobacco or other materials, or the storage or use of products for chewing should be prohibited in work areas.

Workers who handle aldrin should wash their faces, hands, and forearms thoroughly with soap and water before eating, smoking, or using toilet facilities.

COMMON OPERATIONS AND CONTROLS

Common operations in which exposure to aldrin may occur and control methods which may be effective in each case are listed in Table 2.

Table 2.—Operations and methods of control for aldrin

Operations	Controls
During formulation and handling of insecticide	Personal protective equipment, local exhaust ventilation
During maintenance of equipment and storage containers	Personal protective equipment

EMERGENCY FIRST AID PROCEDURES

In the event of an emergency, remove the victim from further exposure, send for medical assistance, and initiate emergency procedures.

- **Eye exposure**

Where there is any possibility of a worker's eyes being exposed to aldrin, an eye-wash fountain should be provided within the immediate work area for emergency use.

If aldrin gets into the eyes, flush them immediately with large amounts of water for 15 minutes, lifting the lower and upper lids occasionally. Get medical attention as soon as possible. Contact lenses should not be worn when working with this chemical.

- **Skin exposure**

Where there is any possibility of a worker's body being exposed to aldrin, facilities for quick drenching of the body should be provided within the immediate work area for emergency use.

If aldrin gets on the skin, wash it immediately with soap and water. If aldrin penetrates the clothing, remove the clothing immediately and wash the skin with soap and water. Get medical attention promptly.

• Rescue

If a worker has been incapacitated, move the affected worker from the hazardous exposure. 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.

SPILLS AND LEAKS

Workers not wearing protective equipment and clothing should be restricted from areas of spills or leaks until cleanup has been completed.

If aldrin is spilled or leaked, the following steps should be taken:

1. Ventilate area of spill or leak.
2. Aldrin solid may be collected and placed in an appropriate container.
3. Aldrin solid or liquid may be collected by vacuuming with an appropriate high-efficiency filtration system.
4. For small quantities of liquids containing aldrin, absorb on paper towels and place in an appropriate container.
5. Large quantities of liquids containing aldrin may be absorbed in vermiculite, dry sand, earth, or a similar material and placed in an appropriate container.

WASTE REMOVAL AND DISPOSAL

U.S. Environmental Protection Agency, Department of Transportation, and/or state and local regulations shall be followed to assure that removal, transport, and disposal are in accordance with existing regulations.

RESPIRATORY PROTECTION

It must be stressed that the use of respirators is the least preferred method of controlling worker exposure and should not normally be used as the only means of preventing or minimizing exposure during routine operations. However, there are some exceptions for which respirators may be used to control exposure: when engineering and work practice controls are not technically feasible, when engineering controls are in the process of being installed, or during emergencies and certain maintenance operations including those requiring confined-space entry (Table 3).

In addition to respirator selection, a complete respiratory protection program should be instituted which as a minimum complies with the requirements found in the OSHA Safety and Health Standards 29 CFR 1910.134. A respiratory protection program should include as a minimum an evaluation of the worker's ability to perform the work while wearing a respirator, the regular training of personnel, fit testing, periodic environmental monitoring, maintenance, inspection, and cleaning. The implementation of an adequate respiratory protection program, including selection of the correct respirators,

requires that a knowledgeable person be in charge of the program and that the program be evaluated regularly.

Only respirators that have been approved by the Mine Safety and Health Administration (MSHA, formerly Mining Enforcement and Safety Administration) and by NIOSH should be used. **Remember! Air-purifying respirators will not protect from oxygen-deficient atmospheres.**

BIBLIOGRAPHY

- American Conference of Governmental Industrial Hygienists: *TLVs® Threshold Limit Values and Biological Exposure Indices for 1987-88*, Cincinnati, 1987.
- American Lung Association of San Diego and Imperial Counties: "Taking the Occupational History," *Annals of Internal Medicine*, 99:641-651, November 1983.
- Clayton, G.D., and Clayton, F.E. (eds.): *Toxicology*, Vol. II A of *Patty's Industrial Hygiene and Toxicology* (3rd rev. ed.), John Wiley & Sons, Inc., New York, 1981.
- *Code of Federal Regulations*, U.S. Department of Labor, Occupational Safety and Health Administration, 29 CFR 1910.134, 1910.1000, OSHA 2206, revised July 1, 1986.
- *Code of Federal Regulations*, U.S. Department of Transportation, 49 CFR 172.101, Transportation 49, revised October 1, 1982.
- *Federal Register*, Vol. 39, No. 203, pp. 37246-37272, October 18, 1974.
- Goldman, R.H., and Peters, J.M.: "The Occupational and Environmental Health History," *Journal of the American Medical Association*, 246:2831-2836, 1981.
- Halperin, W.E., Ratcliffe, J., Frazier, T.M., Wilson, L., Becker, S.P., and Shulte, P.A.: "Medical Screening in the Workplace: Proposed Principles," *Journal of Occupational Medicine*, 28(8): 547-552, 1986.
- Hankinson, J.L.: "Pulmonary Function Testing in the Screening of Workers: Guidelines for Instrumentation, Performance, and Interpretation," *Journal of Occupational Medicine*, 28(10):1081-1092, 1986.
- International Agency for Research on Cancer: *IARC Monographs on the Carcinogenic Risk of Chemicals to Man, Some Organochlorine Pesticides*, Vol. 5, Lyon, France, 1974.
- Levy, B.S., and Wegman, D.H. (eds.): *Occupational Health: Recognizing and Preventing Work-Related Disease*, Little, Brown and Company, Boston, 1983.
- Mark, H.F., Othmer, D.F., Overberger, C.G., Seaborg, G.T., Grayson, M., and Eckroth, D. (eds.): *Kirk-Othmer Encyclopedia of Chemical Technology* (3rd ed.), John Wiley & Sons, Inc., New York, 1981.
- National Institute for Occupational Safety and Health, U.S. Department of Health, Education, and Welfare, Public Health Service, Center for Disease Control: *Criteria for a Recommended Standard . . . Occupational Exposure During the Manufacture and Formulation of Pesticides*, DHEW (NIOSH) Publication No. 78-174, 1978.
- National Institute for Occupational Safety and Health, U.S. Department of Health, Education, and Welfare, Public Health Service, Center for Disease Control: "Special Occupational Hazard Review for Aldrin/Dieldrin," DHEW (NIOSH) Publication No. 78-201, Rockville, 1978.

- National Institute for Occupational Safety and Health, U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control: *NIOSH Manual of Analytical Methods* (3rd ed., Vol. 1), Eller, P.M. (ed.), DHHS (NIOSH) Publication No. 84-100, Cincinnati, 1984.
- National Institute for Occupational Safety and Health, U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control: *Registry of Toxic Effects of Chemical Substances* (Microfiche Edition), Sweet, D. V., and Lewis, R.J. (eds.), Cincinnati, April 1985.
- Proctor, N.H., and Hughes, J.P.: *Chemical Hazards of the Workplace*, J.B. Lippincott Company, Philadelphia, 1978.
- Rom, W.N. (ed.): *Environmental and Occupational Medicine*, Little, Brown and Company, Boston, 1983.
- Rothstein, M.A.: *Medical Screening of Workers*, Bureau of National Affairs, Washington, DC, 1984.
- Rutstein, D.D., Mullan, R.J., Frazier, T.M., Halperin, W.E., Melius, J.M., and Sestito, J.P.: "Sentinel Health Events (Occupational): A Basis for Physician Recognition and Pub-

- lic Health Surveillance," *American Journal of Public Health*, 73:1054-1062, 1983.
- Sax, N.I. (ed.), *Dangerous Properties of Industrial Materials* (6th ed.), Van Nostrand Reinhold Company, New York, 1984.
- Scientific Assembly on Environmental and Occupational Health: "Evaluation of Impairment/Disability Secondary to Respiratory Disease," *American Review of Respiratory Diseases*, 126:945-951, 1982.
- Scientific Assembly on Environmental and Occupational Health: "Surveillance for Respiratory Hazards in the Occupational Setting," *American Review of Respiratory Diseases*, 126:952-956, 1982.
- *Toxic and Hazardous Industrial Chemicals Safety Manual*, The International Technical Information Institute, Tokyo, Japan, 1976.
- U.S. Department of Transportation, Coast Guard: *CHRIS Hazardous Chemical Data*, GPO Stock No. 050-012-00147-2, 1978.
- Windholz, M. (ed.): *The Merck Index* (10th ed.), Merck & Co., Inc., Rahway, New Jersey, 1983.

Table 3.—Respiratory protection for aldrin

Condition	Minimum respiratory protection*
Any detectable concentration	Any self-contained breathing apparatus with a full facepiece and operated in a pressure-demand or other positive pressure mode Any supplied-air respirator with a full facepiece and operated in a pressure-demand or other positive pressure mode in combination with an auxiliary self-contained breathing apparatus operated in a pressure-demand or other positive pressure mode
Planned or emergency entry into environments containing unknown or any detectable concentration	Any self-contained breathing apparatus with a full facepiece and operated in a pressure-demand or other positive pressure mode Any supplied-air respirator with a full facepiece and operated in a pressure-demand or other positive pressure mode in combination with an auxiliary self-contained breathing apparatus operated in a pressure-demand or other positive pressure mode
Firefighting	Any self-contained breathing apparatus with a full facepiece and operated in a pressure-demand or other positive pressure mode
Escape only	Any air-purifying full facepiece respirator (gas mask) with a chin-style or front- or back-mounted organic vapor canister having a high-efficiency particulate filter Any appropriate escape-type self-contained breathing apparatus

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

