

Propylenimine

Safety Data Sheet

Division of Occupational Health and Safety
National Institutes of Health



WARNING!

This compound is absorbed through the skin and the respiratory and intestinal tracts. It is toxic and carcinogenic and causes severe irritation of skin and eyes. Avoid formation and breathing of aerosols or vapors.

Laboratory operations should be conducted in a fume hood, glove box, or ventilated cabinet.

PI is flammable and explosive. Keep away from sparks and open flames. In case of fire, use carbon dioxide or dry chemical extinguisher.

Avoid skin contact: if exposed, wash with soap and water.

For eye exposure, irrigate immediately with large amounts of water. For ingestion, drink water or milk. For inhalation, remove victim promptly to clean air. Administer rescue breathing if necessary. Refer to physician at once.

In case of laboratory spill, wear protective clothing during cleanup. Avoid skin contact or breathing of aerosols or vapors. Wash down area with water. Dispose of waste solutions and materials appropriately.

A. Background

1. Propylenimine (PI) is a highly toxic, flammable, reactive liquid. It is readily absorbed by the skin and may cause blistering and eye damage. Sensitization may occur. It is a strong carcinogen in rats and a mutagen in bacteria.
2. PI is volatile, and the vapors can explode when exposed to a spark or open flame. A risk of inhalation may exist, even when handling dilute solutions, as the door does not provide adequate warning.

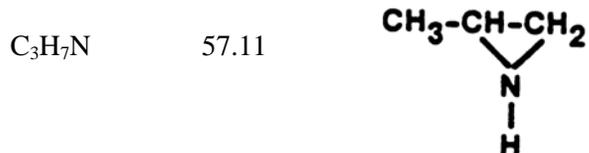
B. Chemical and Physical Data

1. Chemical Abstract No.: 75-55-8
2. Synonyms: PI; 1,2-Propyleneimine; Methylethylenimine; 1,2-Propyleneimine; Propylenimine; 2-Methylaziridine (9Cl); 2-Methylazacyclopropane;

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3. Molecular formula, weight and structure:



- Density: 0.802 g/cm³ at 25° C relative to water at 4° C.
- Absorption spectroscopy: Data compiled by Dermer and Ham (1969).
- Volatility: 112 mm Hg at 20° C. Concentration of saturated vapor is 15% or 150,000 ppm.
- Solubility: Miscible with water; soluble in most organic solvents.
- Description, appearance, and odor: Colorless oily liquid with strong amine odor; fumes in air.
- Boiling Point: 63-64° C.
- Stability: Thermally stable. Polymerizes rapidly in presence of traces of acid (store over NaOH pellets). Hydrolyzes slowly in aqueous solution. Flammable. Decomposed by UV light.
- Chemical reactivity: Highly reactive. Acid-catalyzed ring-opening reactions are highly exothermic.
- Flash point: Unknown, but PI is classed as a flammable liquid by the Department of Transportation.
- Auto ignition temperature: Unknown.
- Flammable limits: Unknown.

C. Fire, Explosion, and Reactivity Hazard Data

- Use carbon dioxide or dry chemical fire extinguisher. Fire-fighting personnel should wear air-supplied respirators with full-face masks.
- The vapors can explode when sparked.
- Acids, some metals, and chloride ion can catalyze an exothermic polymerization reaction.
- Incompatible with water. In the presence of acids, copper alloys, and silver alloys, decomposition may be explosive.
- Nitrogen oxides may be produced on incineration.
- Do not expose to spark or open flame.

D. Operational Procedures

The *NIH Guidelines for the Laboratory Use of Chemical Carcinogens* describe operational practices to be followed when potentially carcinogenic chemicals are used in NIH laboratories. The Guidelines should be consulted to identify the proper use conditions required and specific controls to be implemented during normal and complex operations or manipulations involving PI.

Chemical inactivation: No validated method reported.

Decontamination: Turn off equipment that could be affected by PI or the materials used for cleanup. If more than 100 ml has been spilled or if there is any uncertainty regarding the procedures to be followed for decontamination, call the NIH Fire Department (dial 116) for assistance. Wash surfaces with copious

quantities of water. Glassware should be rinsed (in a hood) with an organic solvent, followed by soap and water. Animal cages should be washed with water.

Disposal: No waste streams containing PI shall be disposed of in sinks or general refuse. Surplus PI or chemical waste streams contaminated with PI shall be handled as hazardous chemical waste and disposed of in accordance with the NIH chemical waste disposal system. Non-chemical waste (*e.g.*, animal carcasses and bedding) containing PI shall be handled and packaged for incineration in accordance with the NIH medical-pathological waste disposal system. Potentially infectious waste (*e.g.*, tissue cultures) containing PI shall be disinfected by heat using a standard autoclave treatment and packaged for incineration, as above. Burnable waste (*e.g.*, absorbent bench top liners) minimally contaminated with PI shall be handled as potentially infectious waste and packed for incineration, as above. Absorbent materials (*e.g.*, associated with spill cleanup) grossly contaminated shall be handled in accordance with the chemical waste disposal system. Radioactive waste containing PI shall be handled in accordance with the NIH radioactive waste disposal system.

Storage: Store PI stock quantities in a flammable storage cabinet over pellets of NaOH, in screw-capped vials or bottles with Teflon or conical polyethylene liners, or in ampoules.

E. Monitoring and Measurement Procedures Including Direct Field Measurements and Sampling for Subsequent Laboratory Analysis

1. **Sampling:** For air sampling, the Drager multi-gas detector (using the hydrazine tube) and the Mine Safety Appliance universal testing kit with PI tube have been evaluated (Dow, 1976). The latter is more accurate but not as fast or as sensitive as the Drager device. Direct air sampling into Folin's reagent with subsequent extraction is an efficient method provided the author's directions are followed exactly (Crompton, 1965). For water sampling, extract with chloroform.
2. **Separation and analysis:** The most sensitive and rapid method is HPLC, with lower limits of 0.01 ppm in aqueous solution (Evans *et al.*, 1975). Other methods are GC and colorimeters (Crompton, 1965; Epstein *et al.*, 1955).

F. Biological Effects (Animal and Human)

Note: Except where specifically mentioned, there are no data in the literature concerning the biological effects of PI. The statements made below are based on the supposition that the effects of PI are qualitatively similar to those of ethylenimine, since PI is also a strong alkylating agent.

1. **Absorption:** PI is absorbed through animal skin, eyes, and the respiratory and gastrointestinal tracts.
2. **Distribution:** PI or its metabolic products are distributed to all tissues, with highest amounts in liver, gastrointestinal tract, spleen, kidney, and bone marrow. Significant amounts are also found in the auditory canal and mammary glands (Ulland *et al.*, 1971).
3. **Metabolism and excretion:** A major metabolite of PI is probably 1- or 2-methyl-2-aminoethanol. PI and its metabolites are rapidly excreted in the urine, with smaller amounts appearing in feces and expired air. A considerable quantity is bound to tissue macro-molecules (DNA, RNA, proteins).
4. **Toxic effects:** Acute LD₅₀s are 19 mg/kg (rat, oral) and 43 mg/kg (guinea pig, skin). Inhaled PI at a level of 500 ppm is lethal to rats in 4 hours and to guinea pigs in 1 hour (Carpenter *et al.*, 1949). Chief target organs are the kidney, skin (irritation, vesication), and respiratory tract (irritation, lung congestion, edema, hemorrhage).
5. **Carcinogenic effects:** Parenteral or oral administration of PI to female rats produced breast cancers with lung metastases and (in both sexes) ear duct tumors and leukemia (Ulland *et al.*, 1971).

6. Mutagenic and teratogenic effects: PI is mutagenic to *Salmonella* in the Ames test and probably to plants. There are no data on teratogenicity.

G. Emergency Treatment

1. Skin and eye exposure: For skin exposure, remove contaminated clothing and wash skin with soap and water for 15-30 minutes; burns may be delayed several hours. For eye exposure, irrigate immediately with copious quantities of running water for at least 15 minutes. Obtain ophthalmological evaluation.
2. Ingestion: Drink plenty of water or milk.
3. Inhalation: Remove victim promptly to clean air. Administer rescue breathing if necessary. Inhalation or ingestion may produce nausea, vomiting, cough, and lung irritation. Symptoms may be delayed. Exposure with or without symptoms requires hospitalization for observation and treatment. Difficulty in breathing requires oxygen on the way to the hospital.
4. Refer to a physician at once.

H. References

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