

Hydrazine

302-01-2

Hazard Summary

Individuals may be exposed to hydrazine in the workplace or to small amounts in tobacco smoke. Symptoms of acute (short-term) exposure to high levels of hydrazine may include irritation of the eyes, nose, and throat, dizziness, headache, nausea, pulmonary edema, seizures, and coma in humans. Acute exposure can also damage the liver, kidneys, and central nervous system in humans. The liquid is corrosive and may produce dermatitis from skin contact in humans and animals. Effects to the lungs, liver, spleen, and thyroid have been reported in animals chronically (long-term) exposed to hydrazine via inhalation. Increased incidences of lung, nasal cavity, and liver tumors have been observed in rodents exposed to hydrazine. EPA has classified hydrazine as a Group B2, probable human carcinogen.

Please Note: The main sources of information for this fact sheet are EPA's Integrated Risk Information System (IRIS) (4), which contains information on the carcinogenic effects of hydrazine including the unit cancer risk for inhalation exposure, EPA's Health and Environmental Effects Profile for Hydrazine (6), and the Agency for Toxic Substances and Disease Registry's (ATSDR's) Toxicological Profile for Hydrazines. (10)

Uses

- Hydrazine is used in agricultural chemicals (pesticides), chemical blowing agents, pharmaceutical intermediates, photography chemicals, boiler water treatment for corrosion protection, textile dyes, and as fuel for rockets and spacecraft. (4,6,8,10)

Sources and Potential Exposure

- Individuals may be occupationally exposed to hydrazine in the workplace. (1,2,10)
- Accidental discharge into water, air, and soil may occur during storage, handling, transport, and improper waste disposal. However, hydrazine rapidly degrades in the environment and is rarely encountered. (2,3)
- Small amounts of hydrazine have been detected in tobacco smoke. (2,10)

Assessing Personal Exposure

- Hydrazine may be detected in the blood of exposed individuals. (1,2)

Health Hazard Information

Acute Effects:

- Symptoms of acute exposure to high levels of hydrazine include irritation of the eyes, nose, and throat, temporary blindness, dizziness, headache, nausea, pulmonary edema, seizures, and coma in humans. Acute exposure can also damage the liver, kidneys, and the central nervous system (CNS) in humans. (2-4)
- The liquid is corrosive and may produce chemical burns and severe dermatitis from skin contact. (1,4)
- Acute animal tests in rats, mice, rabbits, and guinea pigs have demonstrated hydrazine to have **high** acute toxicity from inhalation and ingestion and **extreme** acute toxicity from dermal exposure. (5)

Chronic Effects (Noncancer):

- Information is not available on the chronic effects of hydrazine in humans.
- In animals chronically exposed to hydrazine by inhalation, effects on the respiratory system, liver, spleen, and thyroid have been observed. (10)
- EPA has not established a Reference Concentration (RfC) or a Reference Dose (RfD) for hydrazine. (4)
- The California Environmental Protection Agency (CalEPA) has calculated a chronic inhalation reference exposure level of 0.0002 milligrams per cubic meter (mg/m³) based on liver and thyroid effects in hamsters. The CalEPA reference exposure level is a concentration at or below which adverse health effects are not likely to occur. It is not a direct estimator of risk but rather a reference point to gauge the potential effects. At lifetime exposures increasingly greater than the reference exposure level, the potential for adverse health effects increases. (11)
- ATSDR has calculated an intermediate inhalation minimal risk level (MRL) of 0.005 mg/m³ (0.004 parts per million [ppm]) based on liver effects in mice. The MRL is an estimate of the daily human exposure to a hazardous substance that is likely to be without appreciable risk of adverse noncancer health effects over a specified duration of exposure. (10)

Reproductive/Developmental Effects:

- Information is not available on the reproductive or developmental effects of hydrazine in humans.
- Data regarding developmental effects in animals are limited to a study in which hydrazine injected into pregnant rats resulted in fetotoxicity including increased fetal and neonatal mortality. (6,10)
- Inhalation of hydrazine for a year resulted in effects to the ovaries, endometrium, and uterus in female rats and to the testes in male hamsters. (10)

Cancer Risk:

- Adequate information is not available on the carcinogenic effects of hydrazine in humans. (4)
- Increased incidences of lung and liver tumors have been observed in mice exposed to hydrazine by inhalation, in their drinking water, via gavage and injection. Tumors in the nasal cavity were observed in rats and hamsters exposed by inhalation. (4,6,7)
- EPA has classified hydrazine as a Group B2, probable human carcinogen. (4)
- EPA uses mathematical models, based on human and animal studies, to estimate the probability of a person developing cancer from breathing air containing a specified concentration of a chemical. EPA calculated an inhalation unit risk estimate of $4.9 \times 10^{-3} \text{ (}\mu\text{g/m}^3\text{)}^{-1}$. EPA estimates that, if an individual were to continuously breathe air containing hydrazine at an average of 0.0002 $\mu\text{g/m}^3$ ($2.0 \times 10^{-7} \text{ mg/m}^3$) over his or her entire lifetime, that person would theoretically have no more than a one-in-a-million increased chance of developing cancer as a direct result of breathing air containing this chemical. Similarly, EPA estimates that breathing air containing 0.002 $\mu\text{g/m}^3$ ($2.0 \times 10^{-6} \text{ mg/m}^3$) would result in not greater than a one-in-a-hundred thousand increased chance of developing cancer, and air containing 0.02 $\mu\text{g/m}^3$ ($2.0 \times 10^{-5} \text{ mg/m}^3$) would result in not greater than a one-in-ten thousand increased chance of developing cancer. For a detailed discussion of confidence in the potency estimates, please see IRIS. (4)
- EPA has calculated an oral cancer slope factor of $3.0 \text{ (mg/kg/d)}^{-1}$. (4)

Physical Properties

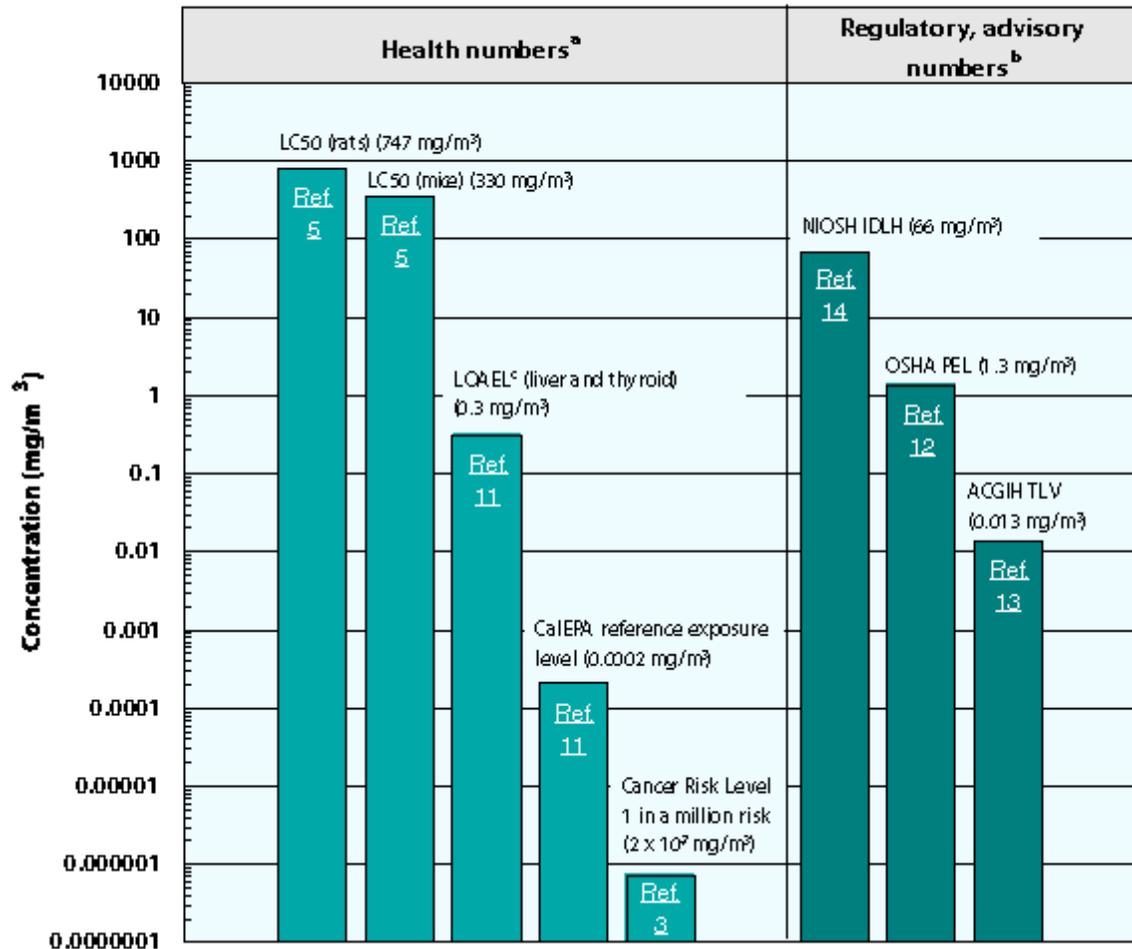
- The chemical formula for hydrazine is H₄N₂, and its molecular weight is 32.05 g/mol. (6)
- Hydrazine occurs as a colorless, oily, flammable liquid that is miscible with water. (6,8)
- Hydrazine has a penetrating odor, resembling that of ammonia, with an odor threshold of 3.7 ppm. (8,9)
- The vapor pressure for hydrazine is 14.4 mm Hg at 25 °C, and its log octanol/water partition coefficient (log K_{ow}) is 0.08. (6)

Conversion Factors:

To convert concentrations in air (at 25 °C) from ppm to mg/m^3 : $\text{mg}/\text{m}^3 = (\text{ppm}) \times (\text{molecular weight of the compound}) / (24.45)$. For hydrazine: $1 \text{ ppm} = 1.31 \text{ mg}/\text{m}^3$.

Health Data from Inhalation Exposure

Hydrazine



ACGIH TLV--American Conference of Governmental and Industrial Hygienists' threshold limit value expressed as a time-weighted average; the concentration of a substance to which most workers can be exposed without adverse effects.

LC₅₀ (Lethal Concentration₅₀)--A calculated concentration of a chemical in air to which exposure for a specific length of time is expected to cause death in 50% of a defined experimental animal population.

LOAEL--Lowest-observed-adverse-effect level

NIOSH IDLH--National Institute of Occupational Safety and Health's immediately dangerous to life or health limit; NIOSH recommended exposure limit to ensure that a worker can escape from an exposure condition that is likely to cause death or immediate or delayed permanent adverse health effects or prevent escape from the environment.

OSHA PEL--Occupational Safety and Health Administration's permissible exposure limit expressed as a time-weighted average; the concentration of a substance to which most workers can be exposed without adverse effect averaged over a normal 8-h workday or a 40-h workweek.

The health and regulatory values cited in this factsheet were obtained in December 1999.

^a Health numbers are toxicological numbers from animal testing or risk assessment values developed by EPA.

^b Regulatory numbers are values that have been incorporated in Government regulations, while advisory numbers are nonregulatory values provided by the Government or other groups as advice. OSHA numbers are regulatory, whereas NIOSH and ACGIH numbers are advisory.

^c The LOAEL is from the critical study used as the basis for the CalEPA chronic reference exposure level.

References

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