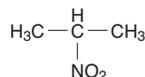


## 2-Nitropropane

### CAS No. 79-46-9

Reasonably anticipated to be a human carcinogen

First listed in the *Fourth Annual Report on Carcinogens* (1985)



### Carcinogenicity

2-Nitropropane is *reasonably anticipated to be a human carcinogen* based on sufficient evidence of carcinogenicity from studies in experimental animals.

#### Cancer Studies in Experimental Animals

Inhalation exposure to 2-nitropropane caused liver tumors (hepatocellular carcinoma) in male rats in two different studies (IARC 1982). Since 2-nitropropane was listed in the *Fourth Annual Report on Carcinogens*, an additional study in rats has been identified. In male rats administered 2-nitropropane by stomach tube for 16 weeks and held for an additional 61 weeks, the incidence of liver cancer was significantly increased (IARC 1999).

#### Cancer Studies in Humans

The data available from epidemiological studies are inadequate to evaluate the relationship between human cancer and exposure specifically to 2-nitropropane.

### Properties

2-Nitropropane is a nitroalkane compound which at room temperature is a colorless liquid with a pleasant fruity odor. It is soluble in water and chloroform and miscible with most aromatic hydrocarbons, esters, ethers, ketones, and low-molecular-weight carboxylic acids (HSDB 2009). It is stable under normal temperatures and pressures, but moderately flammable (Akron 2009). Physical and chemical properties of 2-nitropropane are listed in the following table.

Property	Information
Molecular weight	89.1 <sup>a</sup>
Specific gravity	0.9821 at 25°C/4°C <sup>a</sup>
Melting point	-93°C <sup>a</sup>
Boiling point	120.3°C <sup>a</sup>
Log $K_{ow}$	0.93 <sup>b</sup>
Water solubility	17 g/L at 25°C <sup>a</sup>
Vapor pressure	17.2 mm Hg at 25°C <sup>a</sup>
Vapor density relative to air	3.06 <sup>a</sup>
Dissociation constant (pK <sub>a</sub> )	7.68 at 25°C <sup>b</sup>

Sources: <sup>a</sup>HSDB 2009, <sup>b</sup>ChemIDplus 2009.

### Use

2-Nitropropane is used principally as a solvent and chemical intermediate (IARC 1982, 1999, HSDB 2009). As a solvent, it is used in inks, paints, adhesives, varnishes, polymers, and synthetic materials. It is used as a solvent or cosolvent with many resins, and these solvent-resin mixtures are used as coatings, including coatings for beverage cans. 2-Nitropropane is a feedstock for the manufacture of 2-nitro-2-methyl-1-propanol and 2-amino-2-methyl-1-propanol. It is also used as a component of explosives and rocket propellants and as an additive in fuels for internal combustion engines for hobbyists and for racing cars.

### Production

U.S. production of 2-nitropropane was estimated at 30 million pounds in 1977 and over 5,000 lb in 1982 (HSDB 2009). One U.S. producer was identified in 1982, and two producers in 1999, but production volumes were not reported (IARC 1982, 1999). In 2009, 2-nitropropane was produced commercially by one manufacturer each in the United States and Europe (SRI 2009) and was available from 16 suppliers, including 8 U.S. suppliers (ChemSources 2009). Reports filed under the U.S. Environmental Protection Agency's Toxic Substances Control Act Inventory Update Rule between 1986 and 2002 indicated that U.S. production plus imports of 2-nitropropane total 10 million to 50 million pounds (EPA 2004).

### Exposure

The routes of potential human exposure to 2-nitropropane are inhalation, ingestion, and dermal contact (IPCS 1992). For the general population, daily intake of 2-nitropropane has been estimated at 50 to 100 mg, which includes exposure due to its use as a solvent for beverage-can coatings, film-laminating adhesives, and printing inks for food packaging (3 ng) and from vegetable oils (30 ng). Cigarette smokers receive an additional exposure of 1.2 µg per cigarette. 2-Nitropropane was measured in mainstream smoke at concentrations ranging from 19.1 ng per untreated cigarette to 7.4 ng per cigarette for cigarettes with high levels of potassium sorbate (added as a mold inhibitor) (Gaworski *et al.* 2008). 2-Nitropropane was measured in the exhaled breath of healthy nonsmoking urban dwellers at an average concentration of 0.406 ng/L among individuals who had avoided known sources of 2-nitropropane (e.g., medication, perfume, paint, glue, aerosols, dust, tobacco smoke, and areas with polluted air from industrial wastes) for the week prior to sampling and for the duration of sampling (IPCS 1992).

EPA's Toxics Release Inventory reported environmental releases of 2-nitropropane totaling over 655,000 lb in 1988; releases then steadily declined to a low of 16,000 lb in 2003 and were variable through 2007. Half of the releases reported since 1988 have been to air, except in 1989, when a large quantity of 2-nitropropane was released to an underground injection well. In 2007, eight facilities released a total of 28,600 lb of 2-nitropropane (TRI 2009). When released to air, 2-nitropropane photodegrades, with a half-life of 9.8 days, or reacts with hydroxyl radicals, with a half-life of 44 days (HSDB 2009). When released to soil or water, it will volatilize and is not likely to bioaccumulate. However, the portion that does not volatilize from soil may leach into groundwater.

Potential occupational exposure to 2-nitropropane occurs during its manufacture, formulation, and use in industrial construction and maintenance, printing, highway maintenance, and food packaging (IARC 1982). The National Occupational Hazard Survey (conducted from 1972 to 1974) estimated that 29,842 workers potentially were exposed to 2-nitropropane (NIOSH 1976). Subsequent estimates published by the National Institute for Occupational Safety and Health were 100,000 workers in 1977 and 185,000 workers in 1980 (NIOSH 1977, 1980). The National Occupational Exposure Survey (conducted from 1981 to 1983) estimated that 9,818 workers, including 1,817 women, potentially were exposed to 2-nitropropane (NIOSH 1990). Air concentrations of up to 6,000 mg/m<sup>3</sup> have been measured in workplaces. In 1962, monitored concentrations in the air during drum-filling operations ranged from 580 to 1,640 ppm. Of samples taken at a production plant in 1977, 98% had concentrations below the American Conference of Governmental Industrial Hygienists time-weighted-average limit of 10 ppm (IPCS 1992). Average air concentrations were reported to be 0.05 ppm at a tire manufacturing plant and 1 ppm at a chemical plant (IARC 1982). Air concen-

trations measured in work areas from 1981 to 1983 ranged from 20 to 80 ppm under normal operating conditions. However, the concentrations in all but two personal monitoring samples were at or below 20 ppm; the two highest concentrations were 53 and 73 ppm (Crawford *et al.* 1985).

## Regulations

### **Coast Guard (Dept. of Homeland Security)**

Minimum requirements have been established for safe transport of 2-nitropropane on ships and barges.

### **Department of Transportation (DOT)**

Nitropropanes are considered hazardous materials, and special requirements have been set for marking, labeling, and transporting these materials.

### **Environmental Protection Agency (EPA)**

#### **Clean Air Act**

*National Emission Standards for Hazardous Air Pollutants:* 2-Nitropropane is listed as a hazardous air pollutant.

#### **Comprehensive Environmental Response, Compensation, and Liability Act**

Reportable quantity (RQ) = 10 lb.

#### **Emergency Planning and Community Right-To-Know Act**

*Toxics Release Inventory:* Listed substance subject to reporting requirements.

#### **Resource Conservation and Recovery Act**

*Listed Hazardous Waste:* Waste codes for which the listing is based wholly or partly on the presence of 2-nitropropane = U171, F005.

Listed as a hazardous constituent of waste.

### **Occupational Safety and Health Administration (OSHA, Dept. of Labor)**

While this section accurately identifies OSHA's legally enforceable PELs for this substance in 2018, specific PELs may not reflect the more current studies and may not adequately protect workers. Permissible exposure limit (PEL) = 25 ppm (90 mg/m<sup>3</sup>).

## Guidelines

### **American Conference of Governmental Industrial Hygienists (ACGIH)**

Threshold limit value – time-weighted average (TLV-TWA) = 10 ppm.

### **National Institute for Occupational Safety and Health (NIOSH, CDC, HHS)**

Immediately dangerous to life and health (IDLH) limit = 100 ppm.

Listed as a potential occupational carcinogen.

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