

2,4-Dinitrophenol

51-28-5

Hazard Summary

2,4-Dinitrophenol is used in the manufacture of dyes, wood preservatives, and as a pesticide. The acute (short-term) effects of 2,4-dinitrophenol in humans through oral exposure are nausea, vomiting, sweating, dizziness, headaches, and loss of weight. Chronic (long-term) oral exposure to 2,4-dinitrophenol in humans has resulted in the formation of cataracts and skin lesions, weight loss, and has caused effects on the bone marrow, central nervous system (CNS), and cardiovascular system. Limited or no information is available on the developmental, reproductive, or carcinogenic effects of 2,4-dinitrophenol in humans. EPA has not classified 2,4-dinitrophenol for carcinogenicity.

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 oral chronic toxicity of 2,4-dinitrophenol and the [RfD](#), and the Agency for Toxic Substances and Disease Registry's (ATSDR's) Toxicological Profile for Dinitrophenols.(1)

Uses

- 2,4-Dinitrophenol is used in the manufacture of dyes and wood preservatives, as a pesticide, and as an indicator for the detection of potassium and ammonium ions. (1,6)
- During the 1930s, 2,4-dinitrophenol was used as a diet pill, but this use was stopped in 1938. (1)

Sources and Potential Exposure

- Exposure to 2,4-dinitrophenol occurs from pesticide runoff to water and from releases to the air from manufacturing plants. (1)

Assessing Personal Exposure

- 2,4-Dinitrophenol can be measured in the blood, urine, and tissues of exposed persons. (1)

Health Hazard Information

Acute Effects:

- Acute oral exposure to high levels of 2,4-dinitrophenol in humans has resulted in increased basal metabolic rate, nausea, vomiting, sweating, dizziness, headache, loss of weight, and other symptoms. (1,2)
- 2,4-Dinitrophenol is considered to have [high](#) acute toxicity, based on short-term animal tests in rats and mice. (3)

Chronic Effects (Noncancer):

- Chronic oral exposure to 2,4-dinitrophenol in humans and animals has resulted in the formation of cataracts and skin lesions and has caused effects on the bone marrow, CNS, and cardiovascular system. (1,2)
- The Reference Dose ([RfD](#)) for 2,4-dinitrophenol is 0.002 milligrams per kilogram body weight per day (mg/kg/d) based on cataract formation in humans. The [RfD](#) is an estimate (with uncertainty spanning perhaps an order of magnitude) of a daily oral exposure to the human population (including sensitive

subgroups), that is likely to be without appreciable risk of deleterious noncancer effects during a lifetime. It is not a direct estimator of risk but rather a reference point to gauge the potential effects. At exposures increasingly greater than the RfD, the potential for adverse health effects increases. Lifetime exposure above the RfD does not imply that an adverse health effect would necessarily occur. (4)

- EPA has low confidence in the study on which the RfD was based since this study only describes anecdotal data; low confidence in the database since the supporting database is meager; and, consequently, low confidence in the RfD. (4)
- EPA has not established a Reference Concentration (RfC) for 2,4-dinitrophenol. (4)

Reproductive/Developmental Effects:

- Case reports of women taking 2,4-dinitrophenol orally for weight loss suggest that it may affect the female reproductive system, but the limited information is inconclusive. (1)
- One study reported an increased incidence of stillborn animals and increased pup mortality in the offspring of animals exposed to 2,4-dinitrophenol by gavage. (1)

Cancer Risk:

- No information is available on the carcinogenic effects of 2,4-dinitrophenol in humans. (1)
- One study reported that 2,4-dinitrophenol did not promote tumor development in mice. (1,5)
- EPA has not classified 2,4-dinitrophenol for potential carcinogenicity. (4)

Physical Properties

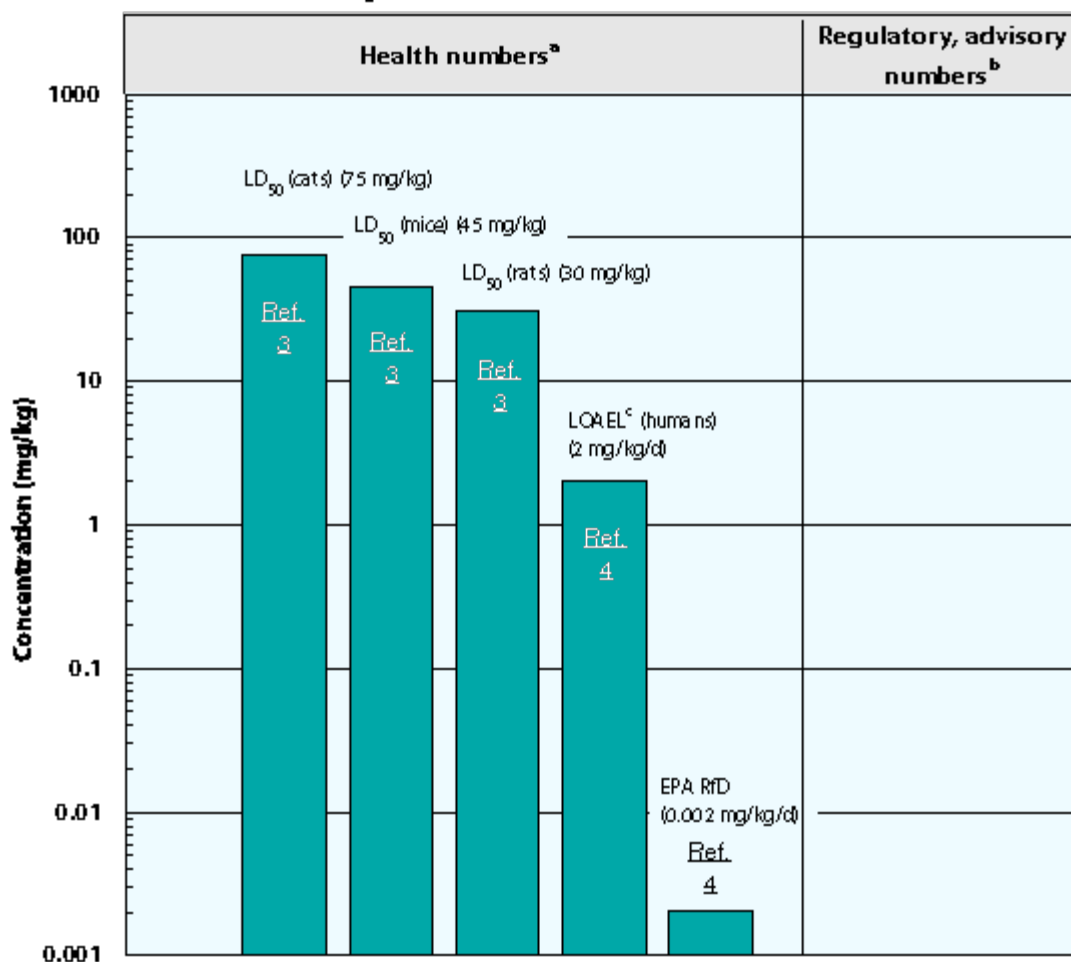
- The chemical formula for 2,4-dinitrophenol is $C_6H_4N_2O_5$ and the molecular weight is 184.11 g/mol. (6)
 - The vapor pressure for 2,4-dinitrophenol is 1.42×10^{-5} mm Hg at 25 °C, and its log octanol/water partition coefficient ($\log K_{ow}$) is 1.91. (7)
 - 2,4-Dinitrophenol exists as yellowish crystals, is slightly soluble in water, and is volatile with steam. (6)
 - The odor threshold for 2,4-dinitrophenol is not available.
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Conversion Factors:

To convert concentrations in air (at 25 °C) from ppm to mg/m^3 : $mg/m^3 = (ppm) \times (\text{molecular weight of the compound}) / (24.45)$. For 2,4-dinitrophenol: 1 ppm = 7.53 mg/m^3 .

Health Data from Oral Exposure

2,4-Dinitrophenol



LD₅₀ (Lethal Dose₅₀)--A calculated dose of a chemical in water 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.

The health 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.

^c The LOAEL is from the critical study used as the basis for the EPA RfD.

Summary created in April 1992, updated January 2000

References

1. Agency for Toxic Substances and Disease Registry (ATSDR). Toxicological Profile for Dinitrophenols. Public Health Service, U.S. Department of Health and Human Services, Atlanta, GA. 1995.
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3. U.S. Department of Health and Human Services. Registry of Toxic Effects of Chemical Substances (RTECS, online database). National Toxicology Information Program, National Library of Medicine, Bethesda, MD. 1993.
4. U.S. Environmental Protection Agency. Integrated Risk Information System (IRIS) on 2,4-Dinitrophenol. National Center for Environmental Assessment, Office of Research and Development, Washington, DC. 1999.
5. U.S. Department of Health and Human Services. Hazardous Substances Databank (HSDB, online database).

National Toxicology Information Program, National Library of Medicine, Bethesda, MD. 1993.

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7. U.S. Environmental Protection Agency. Assessment Tools for the Evaluation of Risk (ASTER, online database). Environmental Research Laboratory, Duluth, MN. 1993.