

Biphenyl

92-52-4

Hazard Summary

Biphenyl is used in organic syntheses, heat transfer fluids, dye carriers, food preservatives, as an intermediate for polychlorinated biphenyls, and as a fungistat in the packaging of citrus fruits. In workers, acute (short-term) exposure to high levels of biphenyl has been observed to cause eye and skin irritation and toxic effects on the liver, kidneys, and central and peripheral nervous systems. Kidney effects have been observed in chronically (long-term) exposed animals. EPA has classified biphenyl as a Group D, not classifiable as to human 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 oral chronic toxicity of biphenyl and the RfD, and EPA's Health and Environmental Effects Profile for 1,1-Biphenyl (2).

Uses

- Biphenyl is used in organic syntheses, heat transfer fluids, dye carriers, food preservatives, as an intermediate for polychlorinated biphenyls, and as a fungistat in the packaging of citrus fruits. (1,2,5,7)

Sources and Potential Exposure

- Individuals may be exposed to biphenyl in the workplace. (1)
- Paper impregnated with biphenyl is used in citrus packing to reduce fruit damage by fungus during shipment and storage. Biphenyl residue on citrus fruits has been detected and individuals may be exposed by ingestion of contaminated fruit. (2)
- Biphenyl has been detected in drinking water. Individuals may be exposed by the consumption of contaminated water. (2)
- Biphenyl has been reported in diesel exhaust. (2)

Assessing Personal Exposure

- No information was located regarding the measurement of personal exposure to biphenyl.

Health Hazard Information

Acute Effects:

- In workers, acute exposure to high levels of biphenyl has been observed to cause eye and skin irritation and toxic effects on the liver, kidneys, and central and peripheral nervous systems. Symptoms include headache, gastrointestinal pain, nausea, indigestion, numbness and aching of limbs, and general fatigue. (1,2)
- Tests involving acute exposure of rats, mice, and rabbits have demonstrated biphenyl to have moderate acute toxicity by ingestion and low to moderate acute toxicity by dermal exposure. (3)

Chronic Effects (Noncancer):

- In humans, chronic exposure is characterized mostly by central nervous system symptoms, such as fatigue, headache, tremor, insomnia, sensory impairment, and mood changes; however, such symptoms are rare. (1)
- The primary effect seen in animal studies has been kidney effects, which have been observed in rats chronically exposed to biphenyl by ingestion. (2,4)
- EPA has not established a Reference Concentration (RfC) for biphenyl. (4)
- The Reference Dose (RfD) for biphenyl is 0.05 milligrams per kilogram body weight per day (mg/kg/d) based on kidney damage in rats. 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 high confidence in the principal study on which the RfD was based because it was a well-conducted chronic bioassay covering a wide dose range with an adequate number of both animal and toxicity parameters assessed; low confidence in the database because the only supporting data are unpublished; and, consequently, medium confidence in the RfD. (4)

Reproductive/Developmental Effects:

- No information is available on the reproductive or developmental effects of biphenyl in humans.
- Limited data indicate that biphenyl does not cause teratogenic effects (birth defects) in animals. (4)
- Some evidence (not significant) of fetotoxicity has been observed in rats exposed to high levels of biphenyl via gavage (experimentally placing the chemical in the stomach). (2,4)

Cancer Risk:

- No data on the carcinogenic effects of biphenyl in humans are available. (4)
- EPA considers available studies on carcinogenicity in mice and rats to be inadequate. One study of mice orally exposed to biphenyl did not result in any increased incidence of tumors. A second study found tumors in treated and control rats, but their occurrence was not thought to be related to biphenyl administration. (2,4)
- EPA has classified biphenyl as a Group D, not classifiable as to human carcinogenicity. (4)

Physical Properties

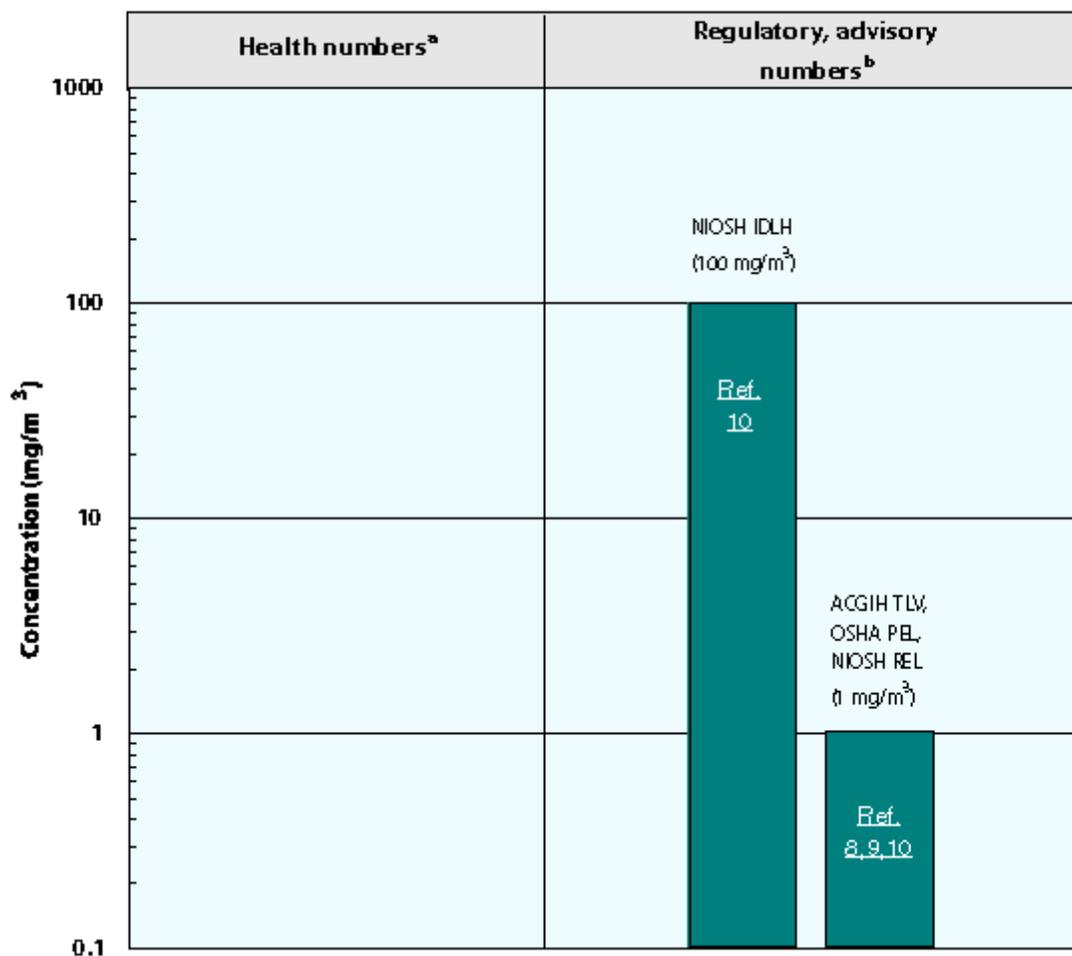
- The chemical formula for biphenyl is $(C_6H_5)_2$, and it has a molecular weight of 154.20 g/mol. (5)
- Biphenyl occurs as colorless leaflets that are insoluble in water. (5)
- Biphenyl has a pleasant, peculiar odor, with an odor threshold of 0.00083 parts per million (ppm) (0.005 milligrams per cubic meter (mg/m^3)). (6,7)
- The vapor pressure of biphenyl is 0.01 mm Hg at 25 °C, and it has a log octanol/water partition coefficient ($\log K_{ow}$) of 3.16 to 4.16. (2)

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 biphenyl: $1 \text{ ppm} = 6.3 \text{ mg}/m^3$. To convert from $\mu g/m^3$ to mg/m^3 : $mg/m^3 = (\mu g/m^3) \times (1 \text{ mg}/1,000 \mu g)$.

Health Data from Inhalation Exposure

Biphenyl



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.

NIOSH IDLH-- National Institute of Occupational Safety and Health's immediately dangerous to life or health concentration; 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.

NIOSH REL--NIOSH's recommended exposure limit; NIOSH-recommended exposure limit for an 8- or 10-h time-weighted-average exposure and/or ceiling.

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.

References

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