

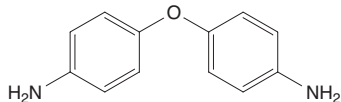
## 4,4'-Oxydianiline

### CAS No. 101-80-4

Reasonably anticipated to be a human carcinogen

First listed in the *Fifth Annual Report on Carcinogens* (1989)

Also known as 4,4'-diaminodiphenyl ether



### Carcinogenicity

4,4'-Oxydianiline is *reasonably anticipated to be a human carcinogen* based on sufficient evidence of carcinogenicity from studies in experimental animals.

#### Cancer Studies in Experimental Animals

4,4'-Oxydianiline caused tumors in two rodent species, at several different tissue sites, and by two different routes of exposure. Dietary administration of 4,4'-oxydianiline increased the combined incidence of benign and malignant liver tumors (hepatocellular adenoma and carcinoma) in mice and rats of both sexes. It also increased the combined incidence of benign and malignant thyroid-gland tumors (follicular-cell adenoma or carcinoma) in rats of both sexes and caused benign thyroid-gland tumors (follicular-cell adenoma) in female mice and benign Harderian-gland tumors (adenoma) in mice of both sexes (IARC 1978, 1982, NCI 1980). Subcutaneous injection of 4,4'-oxydianiline increased the combined incidence of benign and malignant liver tumors (hepatocellular neoplasia) in rats of both sexes (IARC 1978, 1982).

#### Cancer Studies in Humans

No epidemiological studies were identified that evaluated the relationship between human cancer and exposure specifically to 4,4'-oxydianiline.

### Properties

4,4'-Oxydianiline is an aromatic diamine ether that is a colorless crystal at room temperature (IARC 1982). It is insoluble in water, benzene, carbon tetrachloride, and ethanol, but it is soluble in acetone. 4,4'-Oxydianiline is stable under normal conditions. However, it is combustible, hygroscopic, and incompatible with strong oxidizing agents (Columbia 2009). Physical and chemical properties of 4,4'-oxydianiline are listed in the following table.

Property	Information
Molecular weight	200.3 <sup>a</sup>
Melting point	186°C to 187°C <sup>a</sup>
Boiling point	> 300°C <sup>a</sup>
Log $K_{ow}$	2.06 <sup>a</sup>
Water solubility	0.560 g/L at 25°C <sup>b</sup>
Vapor pressure	$4.36 \times 10^{-6}$ mm Hg at 25°C <sup>b</sup>
Dissociation constant ( $pK_a$ )	8.52 <sup>c</sup>

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

### Use

4,4'-Oxydianiline is used primarily in the production of polyimide and poly(ester)imide resins. These resins are used in the manufacture of temperature-resistant products such as wire enamels, electrical equipment, coated fabrics, flame-retardant fibers, oil sealants and retainers, binders in laminates for printed circuits and honeycomb structures, molding of grinding wheels, and polymers used as

adhesives in metal-to-metal bonding of airplane parts (NCI 1980, IARC 1982).

### Production

4,4'-Oxydianiline has been commercially produced in the United States since 1959 (IARC 1982). Production was estimated at 100,000 lb to 1 million pounds in 1974 (NCI 1980) and probably over 2,000 lb in 1976 and 1978 (HSDB 2009). The U.S. Environmental Protection Agency's Toxic Substances Control Act (TSCA) Chemical Substance Inventory listed four manufacturers producing a total of about 2,000 lb of 4,4'-oxydianiline in 1977 (EPA 1979). According to the U.S. International Trade Commission, 4,4'-oxydianiline was produced in undisclosed amounts by three U.S. companies in 1980 and one U.S. company from 1981 to 1988 (USITC 1981, 1989). In 2009, 4,4'-oxydianiline was produced by six manufacturers worldwide, including U.S. manufacturer (SRI 2009), and was available from 32 suppliers, including 18 U.S. suppliers (ChemSources 2009). Reports filed in 1986, 1990, 1998, and 2002 under EPA's TSCA Inventory Update Rule indicated that U.S. production plus imports of 4,4'-oxydianiline totaled 1 million to 10 million pounds; in 1994, inventories dipped to between 10,000 and 500,000 lb (EPA 2004). In 1980, U.S. imports of 4,4'-oxydianiline totaled 48,500 lb (IARC 1982).

### Exposure

The routes of potential human exposure to 4,4'-oxydianiline are inhalation and dermal contact. 4,4'-Oxydianiline may be released in waste streams from its production and its use in formulating polyimides (HSDB 2009). In air, it is expected to degrade rapidly (with an estimated half-life of 1.8 hours) by reacting with photochemically produced hydroxyl radicals. The particulate phase is removed via deposition. In soil, 4,4'-oxydianiline undergoes covalent chemical bonding with humic material; moderate leaching is expected in the absence of covalent binding. Since 1988, reported total environmental releases of 4,4'-oxydianiline have remained between 251 and 3,327 lb except in 2002, when 14,663 lb was released, including over 14,000 lb to on-site landfills (TRI 2009). In 2007, three facilities released 2,708 lb of 4,4'-oxydianiline, of which 2,149 lb was released to hazardous-waste landfills, 346 lb to air, and 214 lb to surface water.

Occupational exposure is most likely to occur during the manufacture of 4,4'-oxydianiline or its use in production of polyimide-type resins (HSDB 2009). Exposure may occur through inhalation of dust or through eye or skin contact. The National Occupational Hazard Survey (conducted from 1972 to 1974), estimated that 45 workers potentially were exposed to 4,4'-oxydianiline (NIOSH, 1976). No more recent estimates of occupational exposure were found.

### Regulations

#### Environmental Protection Agency (EPA)

*Emergency Planning and Community Right-To-Know Act*  
*Toxics Release Inventory*: Listed substance subject to reporting requirements.

### References

- Akron. 2009. *The Chemical Database*. The Department of Chemistry at the University of Akron. <http://ull.chemistry.uakron.edu/erd> and search on CAS number. Last accessed: 6/2/09.
- ChemIDplus. 2009. *ChemIDplus Advanced*. National Library of Medicine. <http://chem.sis.nlm.nih.gov/chemidplus/chemidheavy.jsp> and select Registry Number and search on CAS number. Last accessed: 6/2/09.
- ChemSources. 2009. *Chem Sources - Chemical Search*. Chemical Sources International. <http://www.chemsources.com/chemonline.html> and search on oxydianiline. Last accessed: 6/2/09.
- Columbia. 2009. *4,4'-Oxydianiline*. Columbia Analytical Services. [http://www.caslab.com/4\\_4-oxydianiline.php5](http://www.caslab.com/4_4-oxydianiline.php5). Last accessed: 9/16/09.
- EPA. 2004. *Non-confidential IUR Production Volume Information*. U.S. Environmental Protection Agency. <http://www.epa.gov/oppt/iur/tools/data/2002-vol.html> and search on CAS number.

HSDB. 2009. *Hazardous Substances Data Bank*. National Library of Medicine. <http://toxnet.nlm.nih.gov/cgi-bin/sis/htmlgen?HSDB> and search on CAS number. Last accessed: 6/2/09.

IARC. 1978. 4,4'-Diaminodiphenyl ether. In *Some Aromatic Amines and Related Nitro Compounds (Hair Dyes, Colouring Agents and Miscellaneous Industrial Chemicals)*. IARC Monographs on the Evaluation of Carcinogenic Risks to Humans, vol. 16. Lyon, France: International Agency for Research on Cancer. pp. 301-308.

IARC. 1982. 4,4'-Diaminodiphenyl ether. In *Some Industrial Chemicals and Dyestuffs*. IARC Monographs on the Evaluation of Carcinogenic Risk of Chemicals to Humans, vol. 29. Lyon, France: International Agency for Research on Cancer. pp. 203-212.

NCI. 1980. *Bioassay of 4,4'-Oxydianiline for Possible Carcinogenicity*. Technical Report Series No. 205. DHHS (NTP) Publication No. 80-14. Bethesda, MD: National Institutes of Health. 143 pp.

NIOSH. 1976. *National Occupational Hazard Survey (1972-74)*. DHEW (NIOSH) Publication No. 78-114. Cincinnati, OH: National Institute for Occupational Safety and Health.

SRI. 2009. *Directory of Chemical Producers*. Menlo Park, CA: SRI Consulting. Database edition. Last accessed: 6/2/09.

TRI. 2009. *TRI Explorer Chemical Report*. U.S. Environmental Protection Agency. Last updated: 3/19/09. <http://www.epa.gov/triexplorer> and select 4,4'-Diaminodiphenyl Ether.

USITC. 1981. *Synthetic Organic Chemicals, United States Production and Sales, 1980*. USITC Publication No. 1183. Washington, DC: United States International Trade Commission.

USITC. 1989. *Synthetic Organic Chemicals, United States Production and Sales, 1988*. USITC Publication No. 2219. Washington, DC: United States International Trade Commission.