Antimony Compounds

7440-36-0

Hazard Summary

Everyone is exposed to low levels of antimony in the environment. Acute (short-term) exposure to antimony by inhalation in humans results in effects on the skin and eyes. Respiratory effects, such as inflammation of the lungs, chronic bronchitis, and chronic emphysema, are the primary effects noted from chronic (long-term) exposure to antimony in humans via inhalation. Human studies are inconclusive regarding antimony exposure and cancer, while animal studies have reported lung tumors in rats exposed to antimony trioxide via inhalation. EPA has not classified antimony 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 inhalation and oral chronic toxicity and the RfC and RfD, and the Agency for Toxic Substances and Disease Registry's (ATSDR's) Toxicological Profile for Antimony (1).

Uses

- Antimony is alloyed with other metals such as lead to increase its hardness and strength; its primary use is in antimonial lead, which is used in grid metal for lead acid storage batteries. (1)
- Other uses of antimony alloys are for solder, sheet and pipe, bearing metals, castings, and type metal. (1)
- Antimony oxides (primarily antimony trioxide) are used as fire retardants for plastics, textiles, rubber, adhesives, pigments, and paper. (1)

Sources and Potential Exposure

- Antimony is found at very low levels throughout the environment. (1)
- The concentration of antimony in ambient air ranges from less than 1 nanogram per cubic meter (ng/m^3) (0.000001 milligram per cubic meter [mg/m^3]) to about 170 ng/m^3 (0.000170 mg/m^3). However, near factories that convert antimony ores into metal, or make antimony oxide, concentrations may be greater than 1,000 ng/m^3 (0.01 mg/m^3). (1)
- Soil usually contains very low concentrations of antimony (less than 1 part per million [ppm]). However, higher concentrations have been detected at hazardous waste sites and at antimony-processing sites. (1)
- Food contains small amounts of antimony: the average concentration of antimony in meats, vegetables, and seafood is 0.2 to 1.1 parts per billion (ppb). (1)
- People who work in industries that process antimony ore and metal, or make antimony oxide, may be exposed to antimony by breathing dust or by skin contact. (1)

Assessing Personal Exposure

- Antimony can be measured in the urine, feces, and blood. (1)

Health Hazard Information

Acute Effects:

- The only effects reported from acute exposure to antimony by inhalation in humans are effects on the skin

and eyes. Skin effects consist of a condition known as antimony spots, which is a rash consisting of pustules around sweat and sebaceous glands, while effects on the eye include ocular conjunctivitis. Oral exposure to antimony in humans has resulted in gastrointestinal effects. (1,2)
- Animal studies have reported effects on the lungs, cardiovascular system, and liver from acute exposure to high levels of antimony by inhalation. (1)
- Antimony is considered to have high acute toxicity based on short-term oral tests in rats, mice, and guinea pigs. (3)

Chronic Effects (Noncancer):
- The primary effects from chronic exposure to antimony in humans are respiratory effects that include antimony pneumoconiosis (inflammation of the lungs due to irritation caused by the inhalation of dust), alterations in pulmonary function, chronic bronchitis, chronic emphysema, inactive tuberculosis, pleural adhesions, and irritation. (1,2)
- Other effects noted in humans chronically exposed to antimony by inhalation are cardiovascular effects (increased blood pressure, altered EKG readings and heart muscle damage) and gastrointestinal disorders. (1,2)
- Animal studies have reported effects on the respiratory and cardiovascular systems and kidney from chronic inhalation exposure. Oral animal studies have reported effects on the blood, liver, central nervous system (CNS), and gastrointestinal effects. (1)
- A National Toxicology Program (NTP) 14-day drinking water study of potassium antimony tartrate reported an increase in relative liver and kidney weights in the high dose group (females only). A 13-week intraperitoneal injection study, also by the NTP, reported inflammation and/or fibrosis of the liver in mice dosed with potassium antimony tartrate. (6)
- EPA has not established a Reference Concentration (RfC) for antimony. However, EPA has established an RfC of 0.0002 milligrams per cubic meter (mg/m^3) for antimony trioxide based on respiratory effects in rats. The RfC is an estimate (with uncertainty spanning perhaps an order of magnitude) of a continuous inhalation 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 RfC, the potential for adverse health effects increases. Lifetime exposure above the RfC does not imply that an adverse health effect would necessarily occur. (4)
- EPA has medium confidence in the study on which the RfC was based because it uses an adequate number of animals but it is not a chronic, lifetime study; medium confidence in the database because no adequate developmental or reproductive studies are available; and, consequently, low confidence in the RfC. (4)
- The Reference Dose (RfD) for antimony is 0.0004 milligrams per kilogram body weight per day (mg/kg/d) based on longevity, blood glucose, and cholesterol in rats. (5)
- EPA has low confidence in the study on which the RfD was based because only one species was used, only one dose level was used, no no-observed-adverse-effect level (NOAEL) was determined, and gross pathology and histopathology were not well described; low confidence in the database due to lack of adequate oral exposure investigations; and, consequently, low confidence in the RfD. (5)

Reproductive/Developmental Effects:
- An increased incidence of spontaneous abortions, as compared with a control group, was reported in women working at an antimony plant. Disturbances in the menstrual cycle were reported in women exposed to various antimony compounds in a metallurgical plant. However, the study that reported these findings was unclear about concurrent exposure to other chemicals, nor did it provide the characteristics of the controls used. (1,2)
- Animal studies have reported a decrease in the number of offspring born to rats exposed to antimony prior to conception and throughout gestation. Reproductive effects, including metaplasia in the uterus and disturbances in the ovum-maturing process, were reported in a rat study, following inhalation exposure. (1)

Cancer Risk:

- In one human study, inhalation exposure to antimony did not affect the incidence of cancer in workers employed for 9 to 31 years. (1)
- Lung tumors have been observed in rats exposed to antimony trioxide by inhalation. (1,2,4)
- EPA has not classified antimony for carcinogenicity.

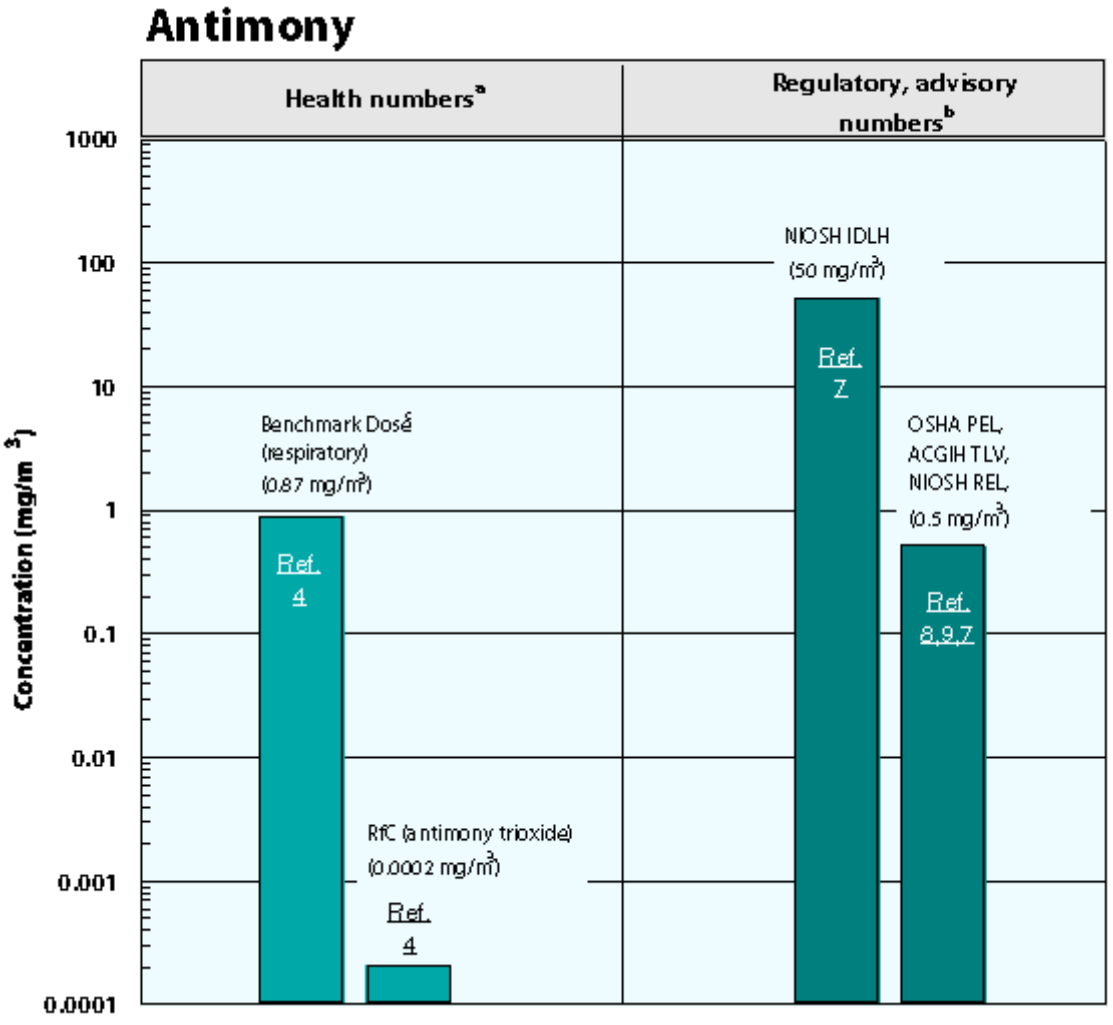
Physical Properties

- Antimony is a silvery-white metal that is found in the earth's crust. Antimony ores are mined and then either changed to antimony metal or combined with oxygen to form antimony oxide. (1)
- Antimony trioxide is a white powder that is very slightly soluble in water. (1)
- Antimony metal is a very brittle, moderately hard metal. (1)
- The chemical symbol for antimony is Sb, and it has an atomic weight of 121.75 g/mol. (1)
- The chemical formula for antimony trioxide is O_3Sb_2, and its molecular weight is 291.50 g/mol. (1)

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 antimony: 1 ppm = 4.97 mg/m^3. To convert from $\mu g/m^3$ to mg/m^3: $mg/m^3 = (\mu g/m^3) \times (1\ mg/1{,}000\ \mu g)$.

Health Data from Inhalation Exposure



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 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.
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.
[c] This benchmark dose is from the critical study used as the basis for the EPA RfC for antimony trioxide.

Summary created in April 1992, updated in January 2000.

References

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4. U.S. Environmental Protection Agency. Integrated Risk Information System (IRIS) on Antimony Trioxide. Environmental Criteria and Assessment Office, Office of Health and Environmental Assessment, Office of Research and Development, Cincinnati, OH. 1999.
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8. Occupational Safety and Health Administration (OSHA). Occupational Safety and Health Standards, Toxic and Hazardous Substances. Code of Federal Regulations. 29 CFR 1910.1000. 1998.
9. American Conference of Governmental Industrial Hygienists (ACGIH). 1999 TLVs and BEIs. Threshold Limit Values for Chemical Substances and Physical Agents, Biological Exposure Indices. Cincinnati, OH. 1999.