

USEPA Office of Air quality Planning and Standards

Asbestos: Health and Exposure

Hazard Summary

- No studies are available on the acute (short-term) effects of asbestos in animals or humans
- Lung effects are a major health concern from asbestos, as chronic (long-term) exposure to asbestos in humans via inhalation can result in a **lung disease termed asbestosis**. Asbestosis is characterized by shortness of breath and cough and may lead to severe impairment of respiratory function and ultimately death.
- Other effects from chronic inhalation exposure to asbestos include an accumulation of scar-like tissue in the membranes that surround the lung, pulmonary hypertension, and immunological effects.
- The U.S. Environmental Protection Agency (EPA) has not established a Reference Concentration (RfC) or a Reference Dose (RfD) for asbestos.
- No studies are available on the reproductive or developmental effects of asbestos via inhalation, and oral studies in animals have not reported any reproductive or developmental effects.
- Cancer is a major concern from asbestos exposure, as inhalation exposure can cause **lung cancer and mesothelioma** (a rare cancer of the thin membranes lining the abdominal cavity and surrounding internal organs), and possibly gastrointestinal cancers in humans. Oral exposure to asbestos may be associated with cancer of the esophagus, stomach, and intestines. However, the evidence on cancer from oral asbestos exposure is not conclusive. EPA has classified asbestos as a Group A, **human carcinogen**, based primarily on inhalation studies, and has calculated an inhalation unit risk estimate of 2.3×10^{-1} (fibers/mL)-1.

* Please Note: The main sources of information for this fact sheet are EPA's Integrated Risk Information System (IRIS), which contains information on the carcinogenic effects of asbestos including the unit cancer risk for inhalation exposure, and the Agency for Toxic Substances and Disease Registry's (ATSDR's) Toxicological Profile for Asbestos. Other secondary sources include the Hazardous Substances Data Bank (HSDB), a database of summaries of peer-reviewed literature, and the Registry of Toxic Effects of Chemical Substances (RTECS), a database of toxic effects that are not peer reviewed.

Environmental/Occupational Exposure

- Airborne exposure to asbestos may occur through the erosion of natural deposits in asbestos-bearing rocks, from a variety of asbestos-related industries, or from clutches and brakes on cars and trucks. The concentrations in outdoor air are highly variable. (1)
- Asbestos has been detected in indoor air, where it is released from a variety of building

materials such as insulation and ceiling and floor tiles. Typical concentrations in indoor range from 1 to 200 ng/m³.(1) (1)

- Asbestos may be released to water from a number of sources, including erosion of natural deposits, corrosion from asbestos-cement pipes, and disintegration of asbestos roofing materials with subsequent transport into sewers. (1)

Assessing Personal Exposure

- It is possible to test for the presence of asbestos fibers in urine, feces, or mucus. In addition, a chest X-ray, although it cannot detect the asbestos fibers themselves, can detect early signs of lung disease caused by asbestos. (1)

Health Hazard Information

Acute Effects:

- No studies were located on the acute (short-term) toxicity of asbestos in animals or humans. (1-4)

Chronic Effects (Noncancer):

- Chronic (long-term) inhalation exposure to asbestos in humans can lead to a lung disease termed asbestosis, which is a diffuse fibrous scarring of the lungs. Symptoms of asbestosis include shortness of breath, difficulty in breathing, and coughing. Asbestosis is a progressive disease, i.e., the severity of symptoms tends to increase with time, even after the exposure has stopped. In severe cases, this disease can lead to death, due to impairment of respiratory function. (1,2)
- Other effects from asbestos exposure via inhalation in humans include pulmonary hypertension and immunological effects. (1,2)
- Feeding studies in animals exposed to high doses of asbestos have not detected any evidence of adverse toxic effects. (1,2)
- EPA has not established an RfC or an RfD for asbestos. (5)

Reproductive/Developmental Effects:

- No studies were located on the developmental or reproductive effects of asbestos in animals or humans via inhalation. (1,2,3)
- Birth defects were not noted in the offspring of animals exposed to asbestos in the diet during pregnancy. (1)
- No effects on fertility were observed in animals exposed to asbestos in the diet during breeding, pregnancy, and lactation. (1)

Cancer Risk:

- A large number of occupational studies have reported that exposure to asbestos via inhalation can cause lung cancer and mesothelioma (a rare cancer of the membranes lining the abdominal cavity and surrounding internal organs). (1,2,3)
- Individuals who smoke and are also exposed to asbestos have a greater than additive increased risk of developing lung cancer. (1)
- Several occupational studies have reported an increase in gastrointestinal cancer from inhalation exposure to asbestos and subsequent oral ingestion. (1,2)
- Long- and intermediate-range asbestos fibers ($>5\mu\text{m}$) appear to be more carcinogenic than short fibers ($<5\mu\text{m}$). (1)
- Several epidemiological studies have found an association between asbestos in drinking water and cancer of the esophagus, stomach, and intestines; however confounding factors and the short follow up time relative to the long latent period for tumor formation make it difficult to interpret the results. (1,5)
- A series of large-scale lifetime feeding studies in animals reported that intermediate-range asbestos fibers increased the incidence of a benign tumor of the large intestine in male rats, while short-range asbestos fibers showed no significant increase in tumor incidence. (1,5)
- EPA considers asbestos to be a human carcinogen (cancer-causing agent) and has ranked it in EPA's Group A. (5)
- EPA uses mathematical models, based on human and animal studies, to estimate the probability of a person developing cancer from breathing air containing a specified concentration of a chemical. EPA calculated an inhalation unit risk estimate of 2.3×10^{-1} (fibers/mL)⁻¹. EPA estimates that, if an individual were to breathe air containing asbestos at 0.000004 fibers/mL⁽²⁾ over his or her entire lifetime, that person would theoretically have no more than a one-in-a-million increased chance of developing cancer as a direct result of breathing air containing this chemical. Similarly, EPA estimates that breathing air containing 0.00004 fibers/mL would result in not greater than a one-in-a-hundred thousand increased chance of developing cancer, and air containing 0.0004 fibers/mL would result in not greater than a one-in-ten-thousand increased chance of developing cancer. (5)

Physical Properties

- Asbestos is the name applied to a group of six different minerals that occur naturally in the environment. (1)
- The most common mineral type is white, but others may be blue, gray, or brown. (1)
- These minerals are made up of long, thin fibers that are somewhat similar to fiberglass. (1)
- Asbestos is neither volatile nor soluble; however, small fibers may occur in suspension in both air and water. (1)

Uses

- The main uses of asbestos are in building materials, paper products, asbestos-cement products, friction products, textiles, packings and gaskets, and asbestos-reinforced

- plastics. (1)
- Asbestos use in the United States is currently decreasing. (1)

Health Data from Inhalation Exposure

Concentration in fibers/m3)	Health numbers ^a	Regulatory, advisory numbers ^b	Reference
1,000.0			
-- -- -- -- 10.0	• EPA Cancer Risk Level ^c (1-in-a-million excess lifetime risk) = 4 fibers/mL	• ACGIH TLV (2 fibers >5µm/cm ³) (chrysotile and other forms of asbestos)	5 2
-- -- -- -- 1.0			
-- -- -- -- 0.1		• ACGIH TLV (0.5 fibers >5µm/cm ³) • OSHA PEL (0.2 fibers >5µm/cm ³) • NIOSH REL and ACGIH TLV (crocidolite) (0.1 fiber <5µm/cm ³)	2 2 2

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 REL--National Institute of Occupational Safety and Health'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.

^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.

References

1. Agency for Toxic Substances and Disease Registry (ATSDR). Toxicological Profile for Asbestos (Draft). U.S. Public Health Service, U.S. Department of Health and Human Services, Atlanta, GA. 1989.
2. E.J. Calabrese and E.M. Kenyon. Air Toxics and Risk Assessment. Lewis Publishers, Chelsea, MI. 1991.
3. U.S. Department of Health and Human Services. Hazardous Substances Data Bank (HSDB, online database). National Toxicology Information Program, National Library of Medicine, Bethesda, MD. 1993.
4. 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.
5. U.S. Environmental Protection Agency. Integrated Risk Information System (IRIS) on Asbestos. Environmental Criteria and Assessment Office, Office of Health and Environmental Assessment, Office of Research and Development, Cincinnati, OH. 1993.

1. *Nanograms per cubic meter is a way to measure for asbestos in air.
2. *Fibers per cubic meter is a way to measure for asbestos in air.

