

# Fine Mineral Fibers

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## Hazard Summary

As defined in the Clean Air Act, the term fine mineral fibers includes “mineral fiber emissions from facilities manufacturing or processing glass, rock, or slag fibers (or other mineral derived fibers) of average diameter 1 micrometer or less.” Included in this description are synthetic vitreous fibers, which include glasswool, rockwool, slagwool, glass filaments, and refractory ceramic fibers. Acute (short-term) effects of fine mineral fibers in humans consisted of upper respiratory tract irritation, with symptoms such as coughing, sore throat, and nasal itching and congestion; however, these symptoms did not continue after exposure ceased. Acute inhalation exposure to refractory ceramic fibers in animals resulted in pulmonary and pleural inflammation. Most studies in humans have not shown an increase in cancer from exposure to glasswool, glass filaments, rockwool, and slagwool. Animal studies have reported an increase in lung tumors in animals exposed to ceramic fibers by inhalation, while no increase in tumors was reported from exposure to glasswool, rockwool, or slagwool. The EPA has classified refractory ceramic fibers as probable human carcinogens. The International Agency for Research on Cancer (IARC) has determined glass filaments, glass wool, rock wool, and slag wool to not be classifiable as to their carcinogenicity to humans (Group 3). The National Toxicology Program (NTP) has classified certain glasswool fibers (inhalable fibers that are biopersistent in the respiratory system) as reasonably anticipated to be human carcinogens.

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Please Note: The main sources of information for this fact sheet are EPA's Integrated Risk Information System (IRIS) (2), which contains information on the carcinogenicity of refractory ceramic fibers, the Agency for Toxic Substances and Disease Registry's (ATSDR's) Toxicological Profile for Synthetic Vitreous Fibers (1), and the NTP's Report on Carcinogens, 13<sup>th</sup> Edition. (3)

## Uses

- Synthetic vitreous fibers, particularly glasswool, rockwool, and slagwool, are used for thermal and acoustical insulation for homes, other buildings and appliances. (1)
- Glass filaments are used mainly in textiles and as reinforcement materials in plastics, and currently are used mostly for electrical purposes. (1)
- Refractory ceramic fibers are mainly used for high-temperature insulation, such as for furnaces. (1)

## Sources and Potential Exposure

- Workers in facilities that manufacture or process fine mineral fibers, and workers installing insulation in a home or building may be exposed. (1)
- Fine mineral fibers may be released to the environment from industries manufacturing or processing such fibers, and from the demolition of homes in which insulation materials contain fine mineral fibers. (1)
- The exposure of the general population to fine mineral fibers in indoor and outdoor air is generally low. (1)
- The primary route of human exposure to fine mineral fibers is by inhalation and dermal contact from occupational exposure. (1)

## Assessing Personal Exposure

- No information is available on assessing personal exposure to fine mineral fibers.

## Health Hazard Information

### Acute Effects:

- Reversible irritation of the skin, eyes, nose and throat is associated with direct dermal and inhalation exposure to refractory ceramic fibers, fibrous glass, rockwool, and slagwool in construction and manufacturing workplaces. Symptoms include coughing, sore throat, and nasal itching and congestion; these symptoms did not continue after the exposure ceased. (1)
- Short-term inhalation exposure of laboratory animals to refractory ceramic fibers resulted in pulmonary and pleural inflammation. (1)

### Chronic Effects (Noncancer):

- Chronic exposure of humans to continuous glass fibers, glasswool, rockwool, and slagwool resulted in upper respiratory effects. (1)
- Chronic inhalation exposure of laboratory animals to glasswool, slagwool and refractory ceramic fibers resulted in pulmonary and pleural inflammation. (1)
- EPA has not established a Reference Concentration (RfC) or a Reference Dose (RfD) for fine mineral fibers.
- ATSDR has established a chronic inhalation minimal risk level (MRL) of 0.03 World Health Organization (WHO) fibers/cc for refractory ceramic fibers based on pulmonary inflammation in rats. WHO fibers are fibers with lengths greater than 5  $\mu\text{m}$ , diameters less than 3  $\mu\text{m}$ , and aspect ratios  $\geq 3:1$ . The ATSDR chronic MRL is a daily human exposure concentration at or below which adverse health effects are not likely to occur given exposures of 365 days or longer (1).

### Reproductive/Developmental Effects:

- No studies are available regarding the reproductive or developmental effects of fine mineral fibers in humans or animals.

## Cancer Risk:

### Glasswool:

- A large study of glasswool, rockwool, and slagwool workers in the U.S. analyzing mortality data from the 1940s to the 1980s showed no or small increases in the risk for respiratory system cancer, but no correlation between length of exposure and increased risk. (1)
- A study of respiratory cancer among glasswool, rockwool, and slagwool workers in the U.S. analyzing mortality data collected until 1992 reported a small, but statistically significant increase in respiratory cancer for workers employed less than 5 years. However, no increased cancer risk was reported with years of employment or cumulative exposure. (1)
- A large European study of glasswool, rockwool, or slagwool workers showed no increased cancer risk related to date of hire or employment length. (1)
- In inhalation studies in rats and hamsters, there was no significant increase in lung tumors from exposure to glasswool. (1)
- EPA has not classified glasswool for carcinogenicity.
- IARC has classified glasswool as Group 3, not classifiable as to their carcinogenicity to humans. (4)
- NTP has classified certain glasswool fibers (inhalable fibers that are biopersistent in the respiratory system) as reasonably anticipated to be human carcinogens. (3)

### Glass filaments:

- Studies of glass filament workers in the U.S., Europe, or Canada have not reported increased risk of respiratory cancer related to exposure or duration of employment. (1)
- No statistically significant increase in tumor incidence was seen in experiments in which glass filaments of relatively large diameter ( $>3 \mu\text{m}$ ) were administered intraperitoneally to rats. (4)
- EPA has not classified glass filaments for carcinogenicity.
- IARC has classified glass filaments as Group 3, not classifiable as to their carcinogenicity to humans. (4)

### Rockwool and Slagwool:

- A large study of glasswool, rockwool, and slagwool workers in the U.S. analyzing mortality data from the 1940s to the 1980s showed no or small increases in the risk for respiratory system cancer, but no correlation between length of exposure and increased risk. (1)
- A study of respiratory cancer among glasswool, rockwool, and slagwool workers in the U.S. analyzing mortality data collected until 1992 reported a small, but statistically significant increase in respiratory cancer for workers employed less than 5 years. However, no increased cancer risk was reported with years of employment or cumulative exposure. (1)
- A large European study of glasswool, rockwool, or slagwool workers showed no increased cancer risk related to date of hire or employment length. (1)
- In chronic inhalation studies in rats exposed to rockwool and slagwool, no increase in lung tumor incidence was seen. (1)
- EPA has not classified rockwool or slagwool for carcinogenicity.
- IARC has classified rockwool and slagwool as Group 3, not classifiable as to their carcinogenicity to humans. (4)

### Ceramic fibers:

- A statistically significant increase in lung tumors was reported in studies of laboratory animals

exposed to ceramic fibers by inhalation. (1)

- EPA has classified refractory ceramic fibers as Group B2, probable human carcinogens. (2)

## Physical Properties

- As defined in the Clean Air Act, section 112(b), the term fine mineral fibers includes “mineral fiber emissions from facilities manufacturing or processing glass, rock, or slag fibers (or other mineral derived fibers) of average diameter 1 micrometer or less.” (8)
- Fine mineral fibers are inclusive of synthetic vitreous fibers, which include glasswool, rockwool, slagwool, glass filaments, and refractory ceramic fibers. (1)
- In the past, synthetic vitreous fibers were classified into three categories: fibrous glass; rock and slag wool; and refractory ceramic fibers. A more recent classification proposed by IARC consists of only two categories: filaments (including continuous glass filaments) and wool (including glasswool, slagwool, refractory ceramic fibers and other newly engineered fibers). (4)
- Fine mineral fibers have high tensile strength, high heat resistance, resistance to chemical attack and flame resistance. (4)
- The size of mineral fibers is related to their toxicity, with airborne fibers with diameters <3 µm generally considered respirable in humans. (1)

## Health Data from Inhalation Exposure

Type of Fibers	Type of Value (reference)	Value
<b>Toxicity, Health, or Risk Value</b>		
Refractory Ceramic Fibers	ATSDR chronic inhalation MRL (1)	0.03 WHO <sup>a</sup> fibers/cc
<b>Regulatory or Advisory Value</b>		
Inert or nuisance dust, shipyard (fibrous glass, mineral wool): total dust	OSHA PEL (5)	15 mg/m <sup>3</sup>
Inert or nuisance dust, shipyard (fibrous glass, mineral wool): respirable fraction	OSHA PEL (5)	5 mg/m <sup>3</sup>
Fibrous glass dust: total dust	NIOSH REL (7)	5 mg/m <sup>3</sup>
Continuous filament glass fibers, inhalable fraction	ACGIH TLV (6)	5 mg/m <sup>3</sup>
Fibers ≤ 3.5 µm in diameter and ≥ 10 µm in length.	NIOSH REL (7)	3 fibers/cm <sup>3</sup>
Continuous filament glass fibers, glasswool, rockwool, and slagwool fibers, and special purpose glass fibers for respirable fibers > 5 µm in length and aspect ratio ≥ 3:1.	ACGIH TLV (6)	1 fiber/cc
Refractory ceramic fibers for respirable fibers > 5 µm in length and aspect ratio ≥ 3:1.	ACGIH TLV (6)	0.2 fibers/cc

<sup>a</sup> WHO fibers are fibers with lengths greater than 5 µm, diameters less than 3 µm, and aspect ratios ≥ 3:1

**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.

**ATSDR MRL**--Agency for Toxic Substances and Disease Registry's Minimum Risk Level, which is an estimate of the daily human exposure to a hazardous substance that is likely to be without appreciable risk of adverse non-cancer health effects over a specified duration of exposure.

**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.

Summary created in April 1992, updated in September 2016

## References

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