8. REGULATIONS AND ADVISORIES

The international, national, and state regulations and guidelines regarding synthetic vitreous fibers in air, water, and other media are summarized in Table 8-1.

The U.S. Department of Health and Human Services, National Toxicology Program (NTP 1998, 2000, 2002) classified glass wool (respirable size) as *reasonably anticipated to be a human carcinogen*, based on sufficient evidence of carcinogenicity in experimental animals. This assessment was originally prepared in 1993–1994 for the *7th Report on Carcinogens* (NTP 1994), but has not been updated since then in the *8th, 9th, or 10th Reports on Carcinogens* (NTP 1998, 2000, 2002). Continuous filament glass, rock wool, slag wool, or refractory ceramic fibers were not listed or assessed for carcinogenicity in the *7th, 8th, 9th, or 10th Report on Carcinogens* (NTP 1994, 1998, 2000, 2002).

The International Agency for Research on Cancer (IARC 2002) concluded that epidemiologic studies published since the previous IARC (1988) assessment provided no evidence of increased risks of lung cancer or of mesothelioma from occupational exposure during the manufacture of man-made vitreous fibers and inadequate evidence overall of any excess cancer risk. IARC (2002) concluded that there was (1) sufficient evidence in experimental animals for the carcinogenicity of certain special purpose glass fibers and of refractory ceramic fibers; (2) limited evidence in experimental animals for the carcinogenicity of insulation glass wool, rock (stone) wool, and slag wool; and (3) inadequate evidence in experimental animals for the carcinogenicity of continuous glass filament and certain newly developed, less biopersistent fibers such as X-607 and MMVF34. Insulation glass wool, rock (stone) wool, slag wool, and continuous filament glass were classified in Group 3, not classifiable as to carcinogenicity to humans because of the inadequate evidence of carcinogenicity in humans and the relatively low biopersistence of these materials. In contrast, refractory ceramic fibers and certain special-purpose glass fibers (104 E-glass and 475 glass fibers) not used as insulating materials were classified in Group 2B, possibly carcinogenic to humans, because of their relatively high biopersistence.

The U.S. EPA Integrated Risk Information System (IRIS) (2004) has not classified the potential carcinogenicity of glass wool, continuous filament glass, rock wool, or slag wool, but assigned refractory ceramic fibers to Group B2, probable human carcinogen, based on no data on carcinogenicity in humans and sufficient evidence of carcinogenicity in animal studies. Currently, EPA is developing a cancer

Table 8-1. Regulations and Guidelines Applicable to Synthetic Vitreous Fibers

Agency	Description	Information	References
INTERNATIONAL			
Guidelines:			
IARC	Carcinogenicity classification		
	Insulation glass wool, rock (stone) wool, slag wool, and continuous filament glass	Group 3[a]	IARC 2002
	Refractory ceramic fibers and certain special-purpose glass wools not used as insulating materials	Group 2B[b]	IARC 2002
NATIONAL			
Regulations and Guidelines:			
a. Air			
ACGIH	TLV (8-hour TWA)		
	Synthetic vitreous fibers		ACGIH 2001
	Continuous filament glass fibers, glass wool fibers, rock wool fibers, slag wool fibers, special purpose glass fibers	1.0 fibers/cc[c]	
	Continuous filament glass (inhalable fraction)	5 mg/m^3	
	Refractory ceramic fibers	0.2 fibers/cc[c]	
NIOSH	REL (10-hour TWA)		
	Fibrous glass dust (fiber glas®, fiberglass, glass fibers, and glass wool); fibers ≤3.5 µm in diameter and ≥10 µm in length)	3 fibers/cc	NIOSH 1992
	Total fibrous glass dust	5 mg/m^3	
	Refractory ceramic fibers	No data	NIOSH 1992
OSHA	PEL (8-hour TWA)		
	Fiberglass and mineral wool (glass wool, rock wool, and slag wool)	1.0 fiber/cc *voluntary*	OSHA 1999
	Synthetic vitreous fibers as an inert or nuisance dust		OSHA 2001b
	Respirable fraction	5 mg/m^3	
	Total dust	15 mg/m^3	
b. Water	No data		
c. Food	No data		
d. Other			
ACGIH	Carcinogenicity classification		
	Synthetic vitreous fibers		ACGIH 2001
	Continuous filament glass fibers (respirable fibers and inhalable fraction)	Group A4[d]	

Table 8-1. Regulations and Guidelines Applicable to Synthetic Vitreous Fibers

Agency	Description	Information	References
NATIONAL *(cont.)*			
ACGIH	Glass wool fibers, rock wool fibers, slag wool fibers, and special purpose glass fibers	Group A3[e]	
	Refractory ceramic fibers	Group A2[f]	
EPA	Carcinogenicity classification		
	Glass wool, continuous filament glass, rock wool, and slag wool	No data	IRIS 2002
	Refractory ceramic fibers	Group B2[g]	IRIS 2002
	Inhalation unit risk	No data	
	Oral slope factor	No data	
NTP	Carcinogenicity classification		
	Glass wool (respirable size)	Reasonably anticipated to be a human carcinogen	NTP 2002
	Continuous filament glass, rock wool, slag wool, and refractory ceramic fibers	No data[h]	NTP 2002
STATE			
Regulations and Guidelines:			
a. Air		No data	
b. Water		No data	
c. Food		No data	
d. Other		No data	

[a]Group 3: not classifiable as to carcinogenicity to humans, based on inadequate evidence of carcinogenicity in humans and inadequate or limited evidence in experimental animals
[b]Group 2B: possibly carcinogenic to humans, based on limited evidence of carcinogenicity in humans and less than sufficient evidence of carcinogenicity in experimental animals
[c]Respirable fibers: length >5 µm; aspect ratio ≥3:1, as determined by the membrane filter method at 400–450X magnification (4-mm objective), using phase-contrast illumination.
[d]Group A4: not classifiable as a human carcinogen
[e]Group A3: confirmed animal carcinogen with unknown relevance to humans
[f]Group A2: suspected human carcinogen, based on limited evidence of carcinogenicity in humans and sufficient evidence of carcinogenicity in experimental animals with relevance to humans
[g]Group B2: probable human carcinogen, based on sufficient evidence of carcinogenicity in animals
[h]Not listed or assessed in the 9th Report on Carcinogens (NTP 2001)

ACGIH = American Conference of Governmental Industrial Hygienists; EPA = Environmental Protection Agency; IARC = International Agency for Research on Cancer; IRIS = Integrated Risk Information System; NIOSH = National Institute of Occupational Safety and Health; NTP = National Toxicology Program; OSHA = Occupational Safety and Health Administration; PEL = permissible exposure limit; REL = recommended exposure limit; TLV = threshold limit value; TWA = time-weighted average

assessment for refractory ceramic fibers based on recent multiple-exposure chronic inhalation animal bioassays. The assessment is considering the development of quantitative inhalation unit risk estimates for refractory ceramic fibers based on the animal tumorigenic responses, but, as of February 2004, the assessment was not completed.

In 1999, a Health and Safety Partnership Program was established as a voluntary workplace safety program for workers involved in the manufacture, fabrication, installation, and removal of glass wool, rock wool, and slag wool products (Marchant et al. 2002; OSHA 1999). The program was established as a result of negotiations between OSHA, the North American Insulation Manufacturers Association, the National Insulation Association, and the Insulation Contractors Association of America. The program established a voluntary eight-hour time-weighted average (TWA) permissible exposure limit (PEL) of 1 respirable fiber/cc. Respirable fibers are counted as particles with length >5 μm, diameter <3 μm, and aspect ratio ≥3:1. The agreement specifies that when the PEL is exceeded in a workplace (such as when insulation is blown into attics or removed), workers will wear NIOSH certified dust respirators.