Table 1. Nonmining and mining industries with the largest numbers of U.S. workers potentially exposed to respirable crystalline silica, 1986

SIC*	Industry	Estimated number of workers potentially exposed (1986)†	% total workers exposed (NOES)
Nonmining industries:			
174	Masonry, stonework, tile setting, and plastering	131,986	32.7
734	Services to dwellings and other buildings	65,812	10.3
327	Concrete, gypsum, and plaster products	63,456	33.3
176	Roofing and sheet metal work	51,153	25.3
356	General industrial machinery and equipment	44,991	16.2
807	Medical and dental laboratories	37,063	30.0
493	Combination of gas and electric and other utilities	35,074	21.2
179	Miscellaneous special trade contractors	32,615	7.8
753	Automotive repair shops	30,826	7.1
326	Pottery and related products	29,772	81.7
Mining industries:			
13	Oil and gas extraction	408,175	100‡
12	Bituminous coal and lignite mining	174,131	100
14	Mining and quarrying of nonmetallic minerals, except fuels	100,546	100
10	Metal mining	39,856	100

Source: NIOSH [1991].

*Standard industrial classification.

†Estimated number of workers potentially exposed to the hazards of flint, quartz, sand, or silica powder; based on data from the *County Business Patterns 1986* [Bureau of the Census 1986] and the National Occupational Exposure Survey (NOES) [NIOSH 1983b]. For SICs in which the estimates differed for individual hazards, the highest percentage was used for that SIC.

‡Exposure is assumed to be 100% in the mining industries.

Table 2. Main industries and activities around the world in which silica exposure has been reported

Industry or activity	Operations and tasks	Source materials
Agriculture	Plowing, harvesting, using machinery, burning agricultural waste, processing agricultural products	Soil
Mining and related milling operations	Most occupations (underground, surface, mill) and mines (metal and nonmetal, coal), rock drilling, dredging	Ores, associated rock
Quarrying and related milling operations	Crushing stone, sand and gravel processing, stone monument cutting and abrasive blasting, slate work (e.g., pencil manufacturing), diatomite calcination	Sandstone, granite, flint, sand, gravel, slate, diatomaceous earth
Construction	Abrasive blasting of structures and buildings, highway and tunnel construction, excavation and earth moving and digging, masonry, concrete work, demolition, dry sweeping and brushing, pressurized air blowing, jack hammering, laying railroad track, removing rust or paint, sanding and scaling, replacement of asphalt roofing, and hauling, pouring, mixing, or dumping silica-containing materials	Sand, concrete, rock, soil, mortar, plaster, shingles
Glass, including fiberglass	Raw material processing, refractory installation and repair	Sand, crushed quartz, refractory materials
Cement	Raw material processing	Clay, sand, limestone, diatomaceous earth
Abrasives	Silicon carbide production, abrasive products fabrication	Sand, tripoli, sandstone
Ceramics, including bricks, tiles, sanitary ware, porcelain, pottery, refractories, vitreous enamels	Mixing, molding, glaze or enamel spraying, finishing, sculpting, firing	Clay, shale, flint, sand, quartzite, diatomaceous earth
Iron and steel mills	Refractory preparation and furnace repair	Refractory material

(Continued)

Sources: IARC [1987; 1997], NIOSH [1979a; 1983a,b; 1996b], DOL, NIOSH [1997], Fulekar and Alam Khan [1995], Jain et al. [1977], Corn [1980], Webster [1982], Froines et al. [1986], Davis [1996], Weill et al. [1994], Lucas and Salisbury [1992], Pike [1992], McCunney et al. [1987], Fairfax [1998].

Table 2 (Continued). Main industries and activities around the world in which silica exposure has been reported

Industry or activity	Operations and tasks	Source materials
Silicon and ferro-silicon foundries (ferrous and nonferrous)	Raw materials handling, casting, molding and shaking out, abrasive blasting, fettling, furnace installation and repair	Sand, refractory material
Metal products, including structural metal, machinery, transportation equipment	Abrasive blasting	Sand
Shipbuilding and repair	Abrasive blasting	Sand
Rubber and plastics	Raw materials handling	Fillers (tripoli, diatomaceous earth)
Paint	Raw materials handling, site preparation	Fillers (tripoli, diatomaceous earth, silica flour)
Soaps and cosmetics	Manufacturing or occupational use of abrasive soaps and scouring powders	Silica flour
Roofing asphalt felt	Filling and granule application	Sand and aggregate, diatomaceous earth
Agricultural chemicals	Raw material crushing, handling, bagging; or dumping products or raw materials	Phosphate ores and rock
Jewelry	Cutting, grinding, polishing, buffing, etching, engraving, casting, chipping, sharpening, sculpting	Semiprecious gems or stones, abrasives, glass
Arts, crafts, sculpture	Pottery firing, ceramics, clay mixing, kiln repairs, abrasive blasting, sand blasting, engraving, cutting, grinding, polishing, buffing, etching, engraving, casting, chipping, sharpening, sculpting	Clays, glazes, bricks, stones, rocks, minerals, sand, silica flour
Dental material	Sand blasting, polishing	Sand, abrasives
Boiler scaling	Coal-fired boilers	Ash and concretions
Automobile repair	Abrasive blasting, sanding, removing paint and rust	Sand, metals, priming putty

Table 3. Industrial silica sand and gravel sold or used by U.S. producers in 1994, by major end use

General use	End use
Sand:	
Glass-making	Containers, flat (plate and window), specialty, fiberglass (unground or ground)
Foundry work	Molding and core, molding and core facing (ground), refractory
Metallurgical work	Silicon carbide, flux for metal smelting
Abrasive work	Blasting, scouring cleansers (ground), sawing and sanding, chemicals (ground and unground)
Fillers	Rubber, paints, putty, whole grain fillers/building products
Ceramics	Pottery, brick, tile
Filtration	Water (municipal, county, local), swimming pool, others
Petroleum manufacturing	Hydraulic fracturing, well packing, and cementing
Recreation	Golf course, baseball, volleyball, play sands, beaches, traction (engine), roofing granules and fillers, other (ground silica or whole grain)
Gravel	Silicon, ferrosilicon, filtration, nonmetallurgical flux, other

Sources: IARC [1997]; BOM [1994].

Table 4. Most frequently recorded occupations of U.S. residents aged 15 or above whose death certificates list silicosis as an underlying or contributory cause of death—selected States, 1991–1992[*]

COC[†]	Occupation	Number	%
616	Mining machine operator	39	16.0
889	Laborer, except construction	29	11.9
019	Manager or administrator, not elsewhere classified	11	4.5
633	Supervisor or precision production occupations	11	4.5
453	Janitor, cleaner	8	3.3
719	Molding, casting machine operator	8	3.3
243	Supervisor or proprietor of sales occupations	6	2.5
844	Operating engineer	6	2.5
637	Machinist	5	2.1
787	Hand molding, casting, and forming occupations	5	2.1
—	All other occupations	109	44.9
—	Occupation not reported	6	2.5
	TOTAL	243	100.1[‡]

Source: NIOSH [1996a].
[*]Data for 1985–1990 are reported in Table 4–11 of NIOSH [1994d].
[†]COC: 1980 census occupation code.
[‡]Column does not add to 100.0 because of rounding.

Table 5. Other occupations* reporting cases of silicosis in workers

Industry or occupation	Reference
Agriculture industry or forestry worker	Fennerty et al. [1983]; Dynnik et al. [1981]; Beaumont et al. [1995]
Brewery worker	Nemery et al. [1993]
Confectioner	Canessa et al. [1990]
Crystal cutter	Suskovic et al. [1990]
Drycleaning worker	Seitz et al. [1982]
Filter candle production worker	Vigliani and Mottura [1948]
Grave digger and well digger	al-Kassimi et al. [1991]
Kaolin worker	Rodriguez et al. [1985]
Metal polisher	Malik et al. [1985]
Pit digger	de Barros Hatem and Cavalcanti [1990]
Souvenir casting worker	Carel et al. [1994]
Woodworker	Thoreux et al. [1990]

*Includes only occupations not listed in Tables 2 or 4.