quency and pattern as to represent with reasonable accuracy the levels of exposure of the employees. In no case shall sampling be at intervals greater than 6 months for employees whose exposures to asbestos may reasonably be foreseen to exceed the exposure limits prescribed in paragraph (b) of this section.

(4) *Employee observation of monitoring.* Affected employees, or their representatives, shall be given a reasonable opportunity to observe any monitoring required by this paragraph and shall have access to the records thereof.

(g) *Caution signs and labels.* (1) *Caution signs.* (i) *Posting.* Caution signs shall be provided and displayed at each location where airborne concentrations of asbestos fibers may be in excess of the exposure limits prescribed in paragraph (b) of this section. Signs shall be posted at such a distance from such a location so that an employee may read the signs and take necessary protective steps before entering the area marked by the signs. Signs shall be posted at all approaches to areas containing excessive concentrations of airborne asbestos fibers.

(ii) *Sign specifications.* The warning signs required by paragraph (g)(1)(i) of this section shall conform to the requirements of 20" × 14" vertical format signs specified in § 1910.145(d)(4), and to this subdivision. The signs shall display the following legend in the lower panel, with letter sizes and styles of a visibility at least equal to that specified in this subdivision.

Legend	*Notation*
Asbestos	1" Sans Serif, Gothic or Block.
Dust Hazard	3/4" Sans Serif, Gothic or Block.
Avoid Breathing Dust	1/4" Gothic.
Wear Assigned Protective Equipment.	1/4" Gothic.
Do Not Remain In Area Unless Your Work Requires It	1/4" Gothic.
Breathing Asbestos Dust May Be Hazardous To Your Health	14 point Gothic.

Spacing between lines shall be at least equal to the height of the upper of any two lines.

(2) *Caution labels*—(i) *Labeling.* Caution labels shall be affixed to all raw materials, mixtures, scrap, waste, debris, and other products containing asbestos fibers, or to their containers, except that no label is required where asbestos fibers have been modified by a bonding agent, coating, binder, or other material so that during any reasonably foreseeable use, handling, storage, disposal, processing, or transportation, no airborne concentrations of asbestos fibers in excess of the exposure limits prescribed in paragraph (b) of this section will be released.

(ii) *Label specifications.* The caution labels required by paragraph (g)(2)(i) of this section shall be printed in letters of sufficient size and contrast as to be readily visible and legible. The label shall state:

CAUTION

Contains Asbestos Fibers

Avoid Creating Dust

Breathing Asbestos Dust May Cause Serious Bodily Harm

(h) *Housekeeping*—(1) *Cleaning.* All external surfaces in any place of employment shall be maintained free of accumulations of asbestos fibers if, with their dispersion, there would be an excessive concentration.

(2) *Waste disposal.* Asbestos waste, scrap, debris, bags, containers, equipment, and asbestos-contaminated clothing, consigned for disposal, which may produce in any reasonably foreseeable use, handling, storage, processing, disposal, or transportation airborne concentrations of asbestos fibers in excess of the exposure limits prescribed in paragraph (b) of this section shall be collected and disposed of in sealed impermeable bags, or other closed, impermeable containers.

(i) *Recordkeeping*—(1) *Exposure records.* Every employer shall maintain records of any personal or environmental monitoring required by this section. Records shall be maintained for a period of at least 20 years and shall be made available upon request to the Assistant Secretary of Labor for Occupational Safety and Health, the Director of the National Institute for Occupational Safety and Health, and to authorized representatives of either.

(2) *Access.* Employee exposure records required by this paragraph shall be provided upon request to employees, designated representatives, and the Assistant Secretary in accordance with 29 CFR 1910.20 (a)-(e) and (g)-(i).

(3) *Employee notification.* Any employee found to have been exposed at any time to airborne concentrations of asbestos fibers in excess of the limits prescribed in paragraph (b) of this section shall be notified in writing of the exposure as soon as practicable but not later than 5 days of the finding. The employee shall also be timely notified of the corrective action being taken.

(j) *Medical examinations*—(1) *General.* The employer shall provide or make available at his cost, medical examinations relative to exposure to asbestos required by this paragraph.

(2) *Preplacement.* The employer shall provide or make available to each of his employees, within 30 calendar days following his first employment in an occupation exposed to airborne concentrations of asbestos fibers, a comprehensive medical examination, which shall include, as a minimum, a chest roentgenogram (posterior-anterior 14 × 17 inches), a history to elicit symptomatology of respiratory disease, and pulmonary function tests to include forced vital capacity (FVC) and forced expiratory volume at 1 second ($FEV_{1.0}$).

(3) *Annual examinations.* On or before January 31, 1973, and at least annually thereafter, every employer shall provide, or make available, comprehensive medical examinations to each of his employees engaged in occupations exposed to airborne concentrations of asbestos fibers. Such annual examination shall include, as a minimum, a chest roentgenogram (posterior-anterior 14 × 17 inches), a history to elicit symptomatology of respiratory disease, and pulmonary function tests to include forced vital capacity (FVC) and forced expiratory volume at 1 second ($FEV_{1.0}$).

(4) *Termination of employment.* The employer shall provide, or make available, within 30 calendar days before or after the termination of employment of any employee engaged in an occupation exposed to airborne concentrations of asbestos fibers, a comprehensive medical examination which shall include, as a minimum, a chest roen genogram (posterior-anterior 14 × 1 inches), a history to elicit symptom tology of respiratory disease, and pu monary function tests to inclu forced vital capacity (FVC) and force expiratory volume at 1 secon ($FEV_{1.0}$).

(5) *Recent examinations.* No medic examination is required of any em ployee, if adequate records show tha the employee has been examined i accordance with this paragraph withi the past 1-year period.

(6) *Medical records*—(i) *Maint nance.* Employers of employees exan ined pursuant to this paragraph sha cause to be maintained complete an accurate records of all such medic examinations. Records shall be re tained by employers for at least 2 years.

(ii) *Access.* Records of the medic examinations required by this para graph shall be provided upon reque to employees, designated represent tives, and the Assistant Secretary i accordance with 29 CFR 1910.20 (a) (e) and (g)-(i). These records shall als be provided upon the request to th Director of NIOSH. Any physicia who conducts a medical examinatio required by this paragraph shall fur nish to the employer of the examine employee all the information specifi cally required by this paragraph, an any other medical information relate to occupational exposure to asbesto fibers.

(Secs. 6(b), 8(c) and 8(g) (84 Stat. 1593, 159 1600; 29 U.S.C. 655, 657), the Secretary o Labor's Order 8-76 (41 FR 25059) and 2 CFR Part 1911, Ch. XVII of Title 29)

[39 FR 23502, June 27, 1974. Redesignate at 40 FR 27073, May 28, 1975, and amende at 41 FR 11505, Mar. 19, 1976; 45 FR 35281 May 23, 1980]

EFFECTIVE DATE NOTE: At 45 FR 35281 May 23, 1980, paragraphs (i)(2) and (j)(6)(i) of § 1910.1001 were revised, effective Augus 21, 1980. For the convenience of the user the superseded text appears below.

§ 1910.1001 Asbestos.

* * * * *

(i) * * *

(2) *Employee access.* Every employee and former employee shall have reasonable

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PLAINTIFF'S EXHIBIT
MON-230

ontainers in which they are shipped, vithout being either wetted, or enlosed, or ventilated so as to prevent ffectively the release of airborne asestos fibers in excess of the limits rescribed in paragraph (b) of this section.

(iii) *Spraying, demolition, or removal.* Employees engaged in the spraying f asbestos, the removal, or demolition f pipes, structures, or equipment covred or insulated with asbestos, and in he removal or demolition of asbestos nsulation or coverings shall be proided with respiratory equipment in ccordance with paragraph (d)(2)(iii) f this section and with special clothng in accordance with paragraph d)(3) of this section.

(d) *Personal protective equipment*—1) Compliance with the exposure imits prescribed by paragraph (b) of his section may not be achieved by he use of respirators or shift rotation f employees, except:

(i) During the time period necessary o install the engineering controls and o institute the work practices reuired by paragraph (c) of this section;

(ii) In work situations in which the ethods prescribed in paragraph (c) f this section are either technically ot feasible or feasible to an extent inufficient to reduce the airborne conentrations of asbestos fibers below he limits prescribed by paragraph (b) f this section; or

(iii) In emergencies.

(iv) Where both respirators and peronnel rotation are allowed by paraphs (d)(1) (i), (ii), or (iii) of this secion, and both are practicable, personel rotation shall be preferred and sed.

(2) Where a respirator is permitted y paragraph (d)(1) of this section, it hall be selected from among those aproved by the Bureau of Mines, Deartment of the Interior, or the Naional Institute for Occupational afety and Health, Department of lealth, Education, and Welfare, under he provisions of 30 CFR Part 11 (37 .R. 6244, Mar. 25, 1972), and shall be sed in accordance with subdivisions i), (ii), (iii), and (iv) of this subpararaph.

(i) *Air purifying respirators.* A reusable or single use air purifying respirator, or a respirator described in paragraphs (d)(2) (ii) or (iii) of this section, shall be used to reduce the concentrations of airborne asbestos fibers in the respirator below the exposure limits prescribed in paragraph (b) of this section, when the ceiling or the 8-hour time-weighted average airborne concentrations of asbestos fibers are reasonably expected to exceed no more than 10 times those limits.

(ii) *Powered air purifying respirators.* A full facepiece powered air purifying respirator, or a powered air purifying respirator, or a respirator described in paragraph (d)(2)(iii) of this section, shall be used to reduce the concentrations of airborne asbestos fibers in the respirator below the exposure limits prescribed in paragraph (b) of this section, when the ceiling or the 8-hour time-weighted average concentrations of asbestos fibers are reasonably expected to exceed 10 times, but not 100 times, those limits.

(iii) *Type "C" supplied-air respirators, continuous flow or pressure-demand class.* A type "C" continuous flow or pressure-demand, supplied-air respirator shall be used to reduce the concentrations of airborne asbestos fibers in the respirator below the exposure limits prescribed in paragraph (b) of this section, when the ceiling or the 8-hour time-weighted average airborne concentrations of asbestos fibers are reasonably expected to exceed 100 times those limits.

(iv) *Establishment of a respirator program.* (*a*) The employer shall establish a respirator program in accordance with the requirements of the American National Standards Practices for Respiratory Protection, ANSI Z88.2-1969, which is incorporated by reference herein.

(*b*) See § 1910.6 concerning the availability of ANSI Z88.2-1969 and the maintenance of a historic file in connection therewith. The address of the American National Standards Institute is given in § 1910.100.

(*c*) No employee shall be assigned to tasks requiring the use of respirators if, based upon his most recent examination, an examining physician determines that the employee will be unable to function normally wearing a respirator, or that the safety or health of the employee or other employees will be impaired by his use of a respirator. Such employee shall be rotated to another job or given the opportunity to transfer to a different position whose duties he is able to perform with the same employer, in the same geographical area and with the same seniority, status, and rate of pay he had just prior to such transfer, if such a different position is available.

(3) Special clothing: The employer shall provide, and require the use of, special clothing, such as coveralls or similar whole body clothing, head coverings, gloves, and foot coverings for any employee exposed to airborne concentrations of asbestos fibers, which exceed the ceiling level prescribed in paragraph (b) of this section.

(4) Change rooms: (i) At any fixed place of employment exposed to airborne concentrations of asbestos fibers in excess of the exposure limits prescribed in paragraph (b) of this section, the employer shall provide change rooms for employees working regularly at the place.

(ii) Clothes lockers: The employer shall provide two separate lockers or containers for each employee, so separated or isolated as to prevent contamination of the employee's street clothes from his work clothes.

(iii) Laundering: (*a*) Laundering of asbestos contaminated clothing shall be done so as to prevent the release of air-borne asbestos fibers in excess of the exposure limits prescribed in paragraph (b) of this section.

(*b*) Any employer who gives asbestos-contaminated clothing to another person for laundering shall inform such person of the requirement in paragraph (d)(4)(iii)(*a*) of this section to effectively prevent the release of airborne asbestos fibers in excess of the exposure limits prescribed in paragraph (b) of this section.

(*c*) Contaminated clothing shall be transported in sealed impermeable bags, or other closed, impermeable containers, and labeled in accordance with paragraph (g) of this section.

(e) *Method of measurement.* All determinations of airborne concentrations of asbestos fibers shall be made by the membrane filter method at 400-450 × (magnification) (4 millimeter objective) with phase contrast illumination.

(f) *Monitoring*—(1) *Initial determinations.* Within 6 months of the publication of this section, every employer shall cause every place of employment where asbestos fibers are released to be monitored in such a way as to determine whether every employee's exposure to asbestos fibers is below the limits prescribed in paragraph (b) of this section. If the limits are exceeded the employer shall immediately undertake a compliance program in accordance with paragraph (c) of this section.

(2) *Personal monitoring*—(i) Samples shall be collected from within the breathing zone of the employees, on membrane filters of 0.8 micrometer porosity mounted in an open-face filter holder. Samples shall be taken for the determination of the 8-hour time-weighted average airborne concentrations and of the ceiling concentrations of asbestos fibers.

(ii) Sampling frequency and patterns. After the initial determinations required by paragraph (f)(1) of this section, samples shall be of such frequency and pattern as to represent with reasonable accuracy the levels of exposure of employees. In no case shall the sampling be done at intervals greater than 6 months for employees whose exposure to asbestos may reasonably be foreseen to exceed the limits prescribed by paragraph (b) of this section.

(3) *Environmental monitoring*—(i) Samples shall be collected from areas of a work environment which are representative of the airborne concentrations of asbestos fibers which may reach the breathing zone of employees. Samples shall be collected on a membrane filter of 0.8 micrometer porosity mounted in an open-face filter holder. Samples shall be taken for the determination of the 8-hour time-weighted average airborne concentrations and of the ceiling concentrations of asbestos fibers.

(ii) *Sampling frequency and patterns.* After the initial determinations required by paragraph (f)(1) of this section, samples shall be of such fre-

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23543

TABLE Z-2

Material	8-hour time weighted average	Acceptable ceiling concentration	Acceptable maximum peak above the acceptable ceiling concentration for an 8-hour shift. Concentration	Maximum duration
ene (Z37.40-1969)[1]	10 p.p.m	25 p.p.m	50 p.p.m	10 minutes.
ium and beryllium npounds (Z37.29-1970).	2 μg/M³	5 μg/M³	25 μg/M³	30 minutes.
ium fume (Z37.5-1970)	0.1 mg/M³	0.3 mg/M³		
ium dust (Z37.5-1970)	0.2 mg/M³	0.6 mg/M³		
on disulfide (Z37.3-1968)	20 p.p.m	30 p.p.m	100 p.p.m	30 minutes.
on tetrachloride (Z37.17-67)	10 p.p.m	25 p.p.m	200 p.p.m	5 minutes in any 4 hours.
mic acid and chromates 7 7-1971)		1 mg/10M³		
ne dibromide (Z37.31-0)	20 p.p.m	30 p.p.m	50 p.p.m	5 minutes.
ne dichloride (Z37.21-9)	50 p.p.m	100 p.p.m	200 p.p.m	5 minutes in any 3 hours.
aldehyde (Z37.16-1967)	3 p.p.m	5 p.p.m	10 p.p.m	30 minutes.
gen fluoride (Z37.28-9)	3 p.p.m			
gen sulfide (Z37.2-1966)		20 p.p.m	50 p.p.m	10 minutes once only if no other measurable exposure occurs.
de as dust (Z37.28-1969)	2.5 mg./M³			
ury (Z37 8-1971)		1 mg./10M³		
l chloride (Z37.18-1969)	100 p.p.m	200 p.p.m	300 p.p.m	5 minutes in any 3 hours.
ylene chloride (Z37.23-9)	500 p.p.m	1,000 p.p.m	2,000 p.p.m	5 minutes in any 2 hours.
o (alkyl) mercury 7 30-1969)	0.01 mg./M³	0.04 mg./M³		
e (Z37.15-1969)	100 p.p.m	200 p.p.m	600 p.p.m	5 minutes in any 3 hours.
chloroethylene (Z37.22-7)	do	do	300 p.p.m	5 minutes in any 3 hours.
ne (Z37.12-1967)	200 p.p.m	300 p.p.m	500 p.p.m	10 minutes.
roethylene (Z37.19-7)	100 p.p.m	200 p.p.m	300 p.p.m	5 minutes in any 2 hours.

Occupational exposures to benzene are subject to the requirements of § 1910.1028 except as specifically exempted by 1.1028(a)(2). Exposures exempted by § 1910.1028(a)(2) are covered by this § 1910.1000

TABLE Z-3—MINERAL DUSTS

Substance	Mppcf[2]	Mg/M³
stalline:		
uartz (respirable)	250[3]	10mg/M³[4]
	%SiO₂+5	%SiO₂+2
uartz (total dust)		30mg/M³
		%SiO₂+2
obalite: Use ½ the value lculated from the count or ass formula for quartz. mite: Use ½ the value lculated from the formulae r quartz. ho, including natural omaceous earth	20	80mg/M³
		%SiO₂

TABLE Z-3—MINERAL DUSTS—Continued

Substance	Mppcf[2]	Mg/M³
Silicates (less than 1% crystalline silica):		
Mica	20	
Soapstone	20	
Talc (non-asbestos-form)	20[5]	
Talc (fibrous). Use asbestos limit		
Tremolite (see talc, fibrous)		
Portland cement	50	
Graphite (natural)	15	
Coal dust (respirable fraction less than 5% SiO₂)		2.4mg/M³ or 10mg/M³
For more than 5% SiO₂		%SiO₂+2
Inert or Nuisance Dust:		
Respirable fraction	15	5mg/M³
Total dust	50	15mg/M³

NOTE: Conversion factors—
mppcf × 35.3 = million particles per cubic meter
= particles per c.c.

[1] Millions of particles per cubic foot of air, based on impinger samples counted by light-field technics.
[2] The percentage of crystalline silica in the formula is the amount determined from air-borne samples, except in those instances in which other methods have been shown to be applicable.
[3] Both concentration and percent quartz for the application of this limit are to be determined from the fraction passing a size-selector with the following characteristics:
[4] Containing <1% quartz; if 1% quartz, use quartz limit.

Aerodynamic diameter (unit density sphere)	Percent passing selector
2	90
2.5	75
3.5	50
5.0	25
10	0

The measurements under this note refer to the use of an AEC instrument. The respirable fraction of coal dust is determined with a MRE; the figure corresponding to that of 2.4 Mg/M³ in the table for coal dust is 4.5 Mg/M³.

(Secretary of Labor's Order No. 8-76 (41 CFR Part 25059); 29 CFR Part 1911)

[39 FR 23502, June 27, 1974. Redesignated and amended at 40 FR 23073, May 28, 1975; 42 FR 22525, May 3, 1977; 43 FR 2600, Jan. 17, 1978; 43 FR 5963, Feb. 10, 1978; 43 FR 13503, Mar. 31, 1978; 43 FR 19624, May 5, 1978; 43 FR 27384, June 23, 1978; 43 FR 46809, Oct. 3, 1978; 43 FR 53007, Nov. 14, 1978; 43 FR 57602, Dec. 8, 1978]

§ 1910.1001 Asbestos.

(a) *Definitions.* For the purpose of this section, (1) "Asbestos" includes chrysotile, amosite, crocidolite, tremolite, anthophyllite, and actinolite.

(2) "Asbestos fibers" means asbestos fibers longer than 5 micrometers.

(b) *Permissible exposure to airborne concentrations of asbestos fibers*—(1) *Standard effective July 7, 1972.* The 8-hour time-weighted average airborne concentrations of asbestos fibers to which any employee may be exposed shall not exceed five fibers, longer than 5 micrometers, per cubic centimeter of air, as determined by the method prescribed in paragraph (e) of this section.

(2) *Standard effective July 1, 1976.* The 8-hour time-weighted average airborne concentrations of asbestos fibers to which any employee may be exposed shall not exceed two fibers, longer than 5 micrometers, per cubic centimeter of air, as determined by the method prescribed in paragraph (e) of this section.

(3) *Ceiling concentration.* No employee shall be exposed at any time to airborne concentrations of asbestos fibers in excess of 10 fibers, longer than 5 micrometers, per cubic centimeter of air, as determined by the method prescribed in paragraph (e) of this section.

(c) *Methods of compliance*—(1) *Engineering methods.* (i) *Engineering controls.* Engineering controls, such as, but not limited to, isolation, enclosure, exhaust ventilation, and dust collection, shall be used to meet the exposure limits prescribed in paragraph (b) of this section.

(ii) *Local exhaust ventilation.* (a) Local exhaust ventilation and dust collection systems shall be designed, constructed, installed, and maintained in accordance with the American National Standard Fundamentals Governing the Design and Operation of Local Exhaust Systems, ANSI Z9.2-1971, which is incorporated by reference herein.

(b) See § 1910.6 concerning the availability of ANSI Z9.2-1971, and the maintenance of a historic file in connection therewith. The address of the American National Standards Institute is given in § 1910.100.

(iii) *Particular tools.* All hand-operated and power-operated tools which may produce or release asbestos fibers in excess of the exposure limits prescribed in paragraph (b) of this section, such as, but not limited to, saws, scorers, abrasive wheels, and drills, shall be provided with local exhaust ventilation systems in accordance with subdivision (ii) of this subparagraph.

(2) *Work practices*—(i) *Wet methods.* Insofar as practicable, asbestos shall be handled, mixed, applied, removed, cut, scored, or otherwise worked in a wet state sufficient to prevent the emission of airborne fibers in excess of the exposure limits prescribed in paragraph (b) of this section, unless the usefulness of the product would be diminished thereby.

(ii) *Particular products and operations.* No asbestos cement, mortar, coating, grout, plaster, or similar material containing asbestos shall be removed from bags, cartons, or other