



2/8/74

Inter Office

Personnel and Organization Staff

February 8, 1974

Mrs. J. M. Thomas
Personnel Relations and Administrative Services
Ford Customer Services Division

Subject: Asbestos Fiber Emission from Rotunda Vacuum Cleaner Models F 20, F 26,
and F 27

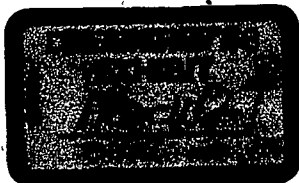
As requested, we evaluated asbestos fiber emissions from Rotunda vacuum cleaner Models F 20, F 26, and F 27. These vacuum cleaners are intended to be used to clean asbestos laden brake lining dust on brake linings and drums during brake rebuild at dealerships.

All three models use cloth filters, but the F-20 uses a bag type cloth filter. The F 26 and F 27 models are larger tank type models that deposit the contaminant directly into the tank beneath the cloth filter. The F 20 bag loads up rather quickly and the resulting disposal of the contaminant is rather messy. The F 26 and F 27 are more desirable from the standpoint of contaminant disposal.

The asbestos air sampling technique used was that prescribed under the provisions of the Occupational Safety and Health Act (OSHA) - See attachment. This technique calls for air sampling at two liters per minute using Type AA Millipore membrane filters, and subsequent analysis by 430X phase microscopy. It was impossible to conduct an isokinetic efficiency on the vacuum cleaners without deviating drastically from the prescribed OSHA technique. Therefore, the vacuums were tested in a small sealed room that had no air changes. The discharge from the vacuums provided the air movement in the room, and the room air was then sampled at three points equidistant from the discharges of the vacuums. The room air was changed between tests of the three models of vacuums by using mechanical exhaust ventilation. Ten pounds of asbestos fiber was vacuumed up during each model test over a period of ten minutes.

The current OSHA Threshold Limit Value (TLV) for airborne asbestos fiber is five fibers greater than five microns in length per milliliter of air with a downward revision to two fibers greater than five microns in length per milliliter of air scheduled for July 1, 1976. The results of the air samples are all within the five fiber TLV and only one sample exceeded the two fiber TLV. The sample that exceeded the two fiber TLV was one of the three samples taken during the test of model F 26. The other two samples were well below the two fiber TLV.

Because two out of three of the samples taken during the F 26 model testing were within the two fiber TLV, and considering the fact that test conditions were extremely severe, it can be expected that model F 26 will be acceptable under dealership conditions. Therefore, F 20, F 26, and F 27 vacuums are all acceptable from the fiber emission standpoint for use in the cleaning of dust from brake assemblies.



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GRE00101

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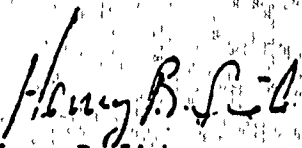
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Although emissions from the vacuums are acceptable, we feel special precautions will be required when emptying and cleaning the vacuums. A United States Bureau of Mines or National Institute for Occupational Safety and Health approved respirator for pneumoconiosis dust, such as the 3M No. 8710, should be worn when cleaning the vacuum. The contaminant from the vacuum should be disposed of in sealed containers and labeled for the asbestos hazard, per subparagraph g and h of the October 18, 1972 Federal Register 1910.93a, pages 22143 and 22144.

If there are any questions or if we can be of further assistance, please contact us.


Henry B. Lick
Senior Industrial Hygienist
Ford/Philco-Ford

Attachment

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GRE00102

January 10, 1977

Data Sheet

Rotunda Vacuum Cleaners (Doyle Vacuum)

Asbestos Emission

Concentration of Fibers
Greater than 5 Microns
in Length/Milliliter of Air

Remarks

8 Hour Occupational Safety and Health Act Threshold Limit Value

5

" " " " " " " " " "

Effective July 1, 1976

2

A. Model F-20, SN-RE02162 - Sample #1

0.4

" #2

0.9

" #3

0.5

B. " F-26, SN-RE04321 - Sample #4

0.8

" #5

0.9

" #6

2.6

C. " F-27, SN-RE03337 - Sample #7

1.2

" #8

1.3

" #9

1.9

Note: Room size 880 Ft.³ - Samples taken equidistant from vacuum cleaner

Instrumentation: MSA Model G Pumps and Millipore membrane Type AA 37mm filters

Analysis: 430X Phase Microscopy by Kettering Laboratories - University of Cincinnati Medical Center

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SNR00103

RULES AND REGULATIONS

Legend	Notation
Asbestos-----	1" Mass Serif, Gothic or Block.
Dust Hazard-----	1/2" Mass Serif, Gothic or Block.
Avoid Breathing Dust....	1" Gothic.
Wear Assigned Protective Equipment.	1" Gothic.
Do Not Remain In Area Unless Your Work Re- quires It.	1/2" 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 subdivision (i) of this subparagraph 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 Health Harm

(b) **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, contained 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 3 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) **Employee access.** Every employee and former employee shall have reasonable access to any record required to be maintained by subparagraph (1) of this

paragraph, which indicates the employee's own exposure to asbestos fibers.

(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.

(i) **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 x 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 (FEV₁).

(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 x 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 (FEV₁).

(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 roentgenogram (posterior-anterior 14 x 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 (FEV₁).

(5) **Recent examinations.** No medical examination is required of any employee, if adequate records show that the employer has been examined in accordance with this paragraph within the past 1-year period.

(6) **Medical records.**—(i) **Maintenance.** Employers of employees examined pursuant to this paragraph shall ensure to be maintained complete and accurate records of all such medical examinations. Records shall be retained by employers for at least 20 years.

(ii) **Access.** The contents of the records of the medical examinations required by this paragraph shall be made available, for inspection and copying,

to the Assistant Secretary of Labor for Occupational Safety and Health, the Director of NIOSH, to authorized physicians and medical consultants of either of them, and, upon the request of an employee or former employee, to his physician. Any physician who conducts a medical examination required by this paragraph shall furnish to the employer of the examined employee all the information specifically required by this paragraph, and any other medical information related to occupational exposure to asbestos fibers.

§ 1910.91 Ventilation.

(a) **Abrasive blasting.**—(1) **Definitions applicable to this paragraph.**—(i) **Abrasive.** A solid substance used in an abrasive blasting operation.

(ii) **Abrasive-blasting respirator.** A continuous flow air-line respirator constructed so that it will cover the wearer's head, neck, and shoulders to protect him from rebounding abrasive.

(iii) **Blast cleaning barrel.** A complete enclosure which rotates on an axis, or which has an internal moving tread to tumble the parts, in order to expose various surfaces of the parts to the action of an automatic blast gun.

(iv) **Blast cleaning room.** A complete enclosure in which blasting operations are performed and where the operator works inside of the room to operate the blasting nozzle and direct the flow of the abrasive material.

(v) **Blasting cabinet.** An enclosure where the operator stands outside and operates the blasting nozzle through an opening or openings in the enclosure.

(vi) **Clean air.** Air of such purity that it will not cause harm or discomfort to an individual if it is inhaled for extended periods of time.

(vii) **Dust collector.** A device or combination of devices for separating dust from the air handled by an exhaust ventilation system.

(viii) **Exhaust ventilation system.** A system for removing contaminated air from a space, comprising two or more of the following elements: (a) enclosure or hood, (b) duct work, (c) dust collecting equipment, (d) exhaust, and (e) discharge stack.

(ix) **Particulate-filter respirator.** An air purifying respirator, commonly referred to as a dust or a fume respirator, which removes most of the dust or fume from the air passing through the device.

(x) **Respirable dust.** Airborne dust in sizes capable of passing through the upper respiratory system to reach the lower lung passages.

(xi) **Rotary blast cleaning table.** An enclosure where the pieces to be cleaned are positioned on a rotating table and are passed automatically through a series of blast sprays.

(xii) **Abrasive blasting.** The forcible application of an abrasive to a surface by pneumatic pressure, hydraulic pressure, or centrifugal force.

(2) **Dust hazards from abrasive blasting.** (i) Abrasives and the surface coatings on the materials blasted are shattered and pulverized during blasting

RULES AND REGULATIONS

TABLE G-1

Material	8-hour time weighted average	Acceptable ceiling concentration	Acceptable maximum peak above the acceptable ceiling concentration for 15 minute shift:	
			Concentration	Maximum duration
Resorcinol (Z37.3-1970)	10 p.p.m.	25 p.p.m.	50 p.p.m.	10 minutes
Barbituric acid and barbituric compounds (Z37.3-1970)	2 mg./m ³	5 mg./m ³	10 mg./m ³	10 minutes
Cadmium dust (Z37.3-1970)	0.1 mg./m ³	0.5 mg./m ³	1.0 mg./m ³	10 minutes
Cadmium chloride (Z37.3-1970)	0.2 mg./m ³	1.0 mg./m ³	2.0 mg./m ³	10 minutes
Cadmium sulfate (Z37.3-1970)	0.5 p.p.m.	2.5 p.p.m.	5.0 p.p.m.	10 minutes
Calcium telluride (Z37.3-1970)	10 p.p.m.	25 p.p.m.	50 p.p.m.	10 minutes
Phthalic anhydride (Z37.3-1970)	5 p.p.m.	10 p.p.m.	20 p.p.m.	10 minutes
Styrene (Z37.3-1970)	100 p.p.m.	200 p.p.m.	400 p.p.m.	10 minutes
Formaldehyde (Z37.3-1970)	0.1 mg./m ³	0.5 mg./m ³	1.0 mg./m ³	10 minutes
Hydrogen fluoride (Z37.3-1970)	0.1 mg./m ³	0.5 mg./m ³	1.0 mg./m ³	10 minutes
Lead and its compounds (Z37.3-1970)	0.1 mg./m ³	0.5 mg./m ³	1.0 mg./m ³	10 minutes
Methyl chloride (Z37.3-1970)	100 p.p.m.	200 p.p.m.	400 p.p.m.	10 minutes
Methylene chloride (Z37.3-1970)	200 p.p.m.	400 p.p.m.	800 p.p.m.	10 minutes
Ozone (Z37.3-1970)	0.1 mg./m ³	0.5 mg./m ³	1.0 mg./m ³	10 minutes
Styrene (Z37.3-1970)	100 p.p.m.	200 p.p.m.	400 p.p.m.	10 minutes
Trichloroethylene (Z37.3-1970)	100 p.p.m.	200 p.p.m.	400 p.p.m.	10 minutes
Tetrahydrofuran (Z37.3-1970)	100 p.p.m.	200 p.p.m.	400 p.p.m.	10 minutes
Toluene (Z37.3-1970)	100 p.p.m.	200 p.p.m.	400 p.p.m.	10 minutes
Hydrogen sulfide (Z37.3-1970)	10 p.p.m.	25 p.p.m.	50 p.p.m.	10 minutes
Mercury (Z37.3-1970)	0.1 mg./m ³	0.5 mg./m ³	1.0 mg./m ³	10 minutes
Urea and its compounds (Z37.3-1970)	100 p.p.m.	200 p.p.m.	400 p.p.m.	10 minutes

TABLE G-2—MINERAL FIBERS		
Substance	Upper limit	Lower limit
Asbestos		
Crystalline		
Quartz (respirable)	200 f	10 mg./m ³
Quartz (total dust)	5 mg./m ³	10 mg./m ³
Crystalline: 1% of the value calculated from the count or mass fraction for quartz		
Talc: 1% of the value calculated from the count or mass fraction for talc		
Amorphous: In bulk material	20	10 mg./m ³
Asbestos (less than 5% crystalline silica)		
Chrysotile	20	10 mg./m ³
Tremolite	20	10 mg./m ³
Talc (fibrous, less than 5% crystalline silica)	20	10 mg./m ³
Tremolite (less than 5% crystalline silica)	20	10 mg./m ³
Graphite (natural)	10	10 mg./m ³
Coal dust (respirable fraction less than 5% silica)	2.5 mg./m ³	10 mg./m ³
For more than 5% SiO ₂		
Asbestos (less than 5% crystalline silica)	20	10 mg./m ³
Chrysotile	20	10 mg./m ³
Tremolite	20	10 mg./m ³
Talc (fibrous, less than 5% crystalline silica)	20	10 mg./m ³
Tremolite (less than 5% crystalline silica)	20	10 mg./m ³
Graphite (natural)	10	10 mg./m ³
Coal dust (respirable fraction less than 5% silica)	2.5 mg./m ³	10 mg./m ³

NOTE: Conversion factors—
 1 mg./m³ = 1.36 million particles per cubic meter
 1 p.p.m. = 1 mg./m³
 • Minimum of particles per cubic foot of air, based on Institute of Occupational Medicine (IOM) technique.
 • The percentage of crystalline silica in the formula is the amount determined from x-ray fluorescence, or by other means, in which case the formula is used to determine the amount of silica in the sample.
 • Both concentrations and percent silica are the applicable values for the formula to be determined from the formula using a multiplier with the following characteristics:
 • Containing < 5% quartz; if > 5% quartz, use quartz limit.

Asbestos (less than 5% crystalline silica)	Percent passing
2.5	100
2.0	75
1.5	50
1.0	25
0.5	0

The measurements under this table refer to the use of an AFI instrument. If the respirable fraction of dust is determined with a 30 H R the figure corresponding to that of 2.5 mg./m³ in the table for dust is 1.5 mg./m³.

(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 (c) 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 (c) 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 (c) of this section.

(c) Methods of compliance—(1) 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.

(2) 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.

(3) 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, scrapers, abrasive wheels, and drills, shall be provided with local exhaust ventilation systems in accordance with subdivision (ii) of this subparagraph.

(3) 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 containers in which they are shipped, without being either wetted, or enclosed, or ventilated so as to prevent effectively the release of airborne asbestos fibers in excess of the limits prescribed in paragraph (b) of this section.

(iii) Spraying, demolition, or removal. Employees engaged in the spraying of asbestos, the removal, or demolition of pipes, structures, or equipment covered or insulated with asbestos, and in the removal or demolition of asbestos insulation or coverings shall be provided with respiratory equipment in accordance with paragraph (d) (3) (iii) of this section and with special clothing in accordance with paragraph (d) (3) of this section.

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

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

(ii) In work situations in which the methods prescribed in paragraph (c) of

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section are either technically not or feasible to an extent insufficient to reduce the airborne concentrations of asbestos fibers below the limits prescribed by paragraph (b) of this section; or

(iii) In emergencies.

(iv) Where both respirators and personnel rotation are allowed by subdivisions (i), (ii), or (iii) of this subparagraph, and both are practicable, personnel rotation shall be preferred and used.

(2) Where a respirator is permitted by subparagraph (i) of this paragraph, it shall be selected from among those approved by the Bureau of Mines, Department of the Interior, or the National Institute for Occupational Safety and Health, Department of Health, Education, and Welfare, under the provisions of 30 CFR Part 11 (37 FR 6344; Mar. 23, 1972), and shall be used in accordance with subdivisions (i), (ii), (iii), and (iv) of this subparagraph.

(3) *Air purifying respirators.* A reusable or single use air purifying respirator, or a respirator described in subdivision (ii) or (iii) of this subparagraph, 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.

Powered air purifying respirators. Facepieces powered air purifying respirator, or a powered air purifying respirator, or a respirator described in subdivision (ii) of this subparagraph, 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. 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 requirements of the American National Standards Practices for Respiratory Protection, ANSI Z89.2-1969, which is incorporated by reference herein.

See § 1910.6 concerning the availability of ANSI Z89.2-1969 and the maintenance of an historic file in connection with it. The address of the American National Standards Institute is given in § 1910.100.

No employee shall be assigned to 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 locker, or lockers for each employee, one separated or isolated as to prevent contamination of the employee's street clothes from his work clothes.

(iii) *Laundrying.* (a) Laundrying of asbestos-contaminated clothing shall be done so as to prevent the release of airborne 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 laundrying shall inform such person of the requirement in (a) of this subdivision 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 (a) of this section.

(d) *Method of measurement.* All determinations of airborne concentrations of asbestos fibers shall be made by the membrane filter method at 400-450 X (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 employee, 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 subparagraph (1) of this paragraph, 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 subparagraph (1) of this paragraph, samples shall be of such frequency 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 subdivision (1) of this subparagraph shall conform to the requirements of 20" x 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 size and style of a visibility at least equal to that specified in this subdivision.

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