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FINAL OPERATIONS AND MAINTENANCE PLAN FOR BUILDINGS S136, S137 AND S143
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I N C

Volume XVII
Final Submittal

Operations and Maintenance Plan for Buildings S136, S137, and S143 at Naval Air Station Memphis, Tennessee

Contract No. N62467-93-D-0664
Delivery Order No. 0003

Prepared for:

Department of the Navy
Southern Division
Naval Facilities Engineering Command
P.O. Box 10068
Charleston, SC

Prepared by:

Cape Environmental Management Inc.
2302 Parklake Dr., Ste 200
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PART 1 - GENERAL

1. INTRODUCTION

This Asbestos Materials Operations and Maintenance (O&M) Plan is designed to establish guidelines for use in controlling potential airborne asbestos fiber exposure to occupants, employees, and contractor personnel who work within or otherwise enter the Naval Air Station (NAS) Memphis facility which has asbestos-containing construction materials. All situations which could involve release of asbestos fibers into the air have been carefully considered and special work procedures set forth.

This plan is structured in two parts:

Part 1. General understanding of asbestos and asbestos-containing materials (Section 2), a discussion of the program for Organizing and Implementing the Asbestos Management Plan (Section 3), and General Management and Administrative Requirements, which are common to all asbestos management projects (Section 4).

Part 2. Specific Procedures for Managing Asbestos-Containing Materials and situations which may be encountered in the surveyed buildings (Sections 5-12).

This Operations and Maintenance Plan shall be used in conjunction with the individual Asbestos Survey Report prepared for each building at the NAS Memphis facility. Specific procedures for handling various asbestos-containing materials and situations identified in the individual Asbestos Survey Report for each building are presented in Part 2, Sections 5 through 12 of the O&M Plan.

Figure 3.1 - Asbestos Management Organizational Structure presents the lines of communication when managing asbestos-containing materials. The NAS Memphis Designated Person (Public Works Officer) shall periodically evaluate this organizational structure and modify it as necessary to meet changes in Federal, State and Local regulations and any future changes within the NAS Memphis facility.

Figure 3.2 - Implementation Flow chart of the Asbestos Management Plan along with the explanatory text in Section 3.5 shall be followed on a step-by-step basis when potential disturbance of a suspect asbestos material is anticipated.

The effective use of this manual requires a good working knowledge of the general information presented in Sections 2, 3 and 4 and also requires that the employee training described in Section 4.1 has been accomplished.

These procedures are designed to reduce the potential for airborne asbestos fiber contamination of building air during normal, emergency and maintenance conditions, to control the spread of contamination and to protect personnel from those situations where potential airborne fiber release may occur.

2. ASBESTOS

2.1 Properties and Uses

Asbestos is a general term used to refer to a group of naturally occurring fibrous minerals, all of which are chemically described as hydrated silicates. These minerals are divided on the basis of molecular structure into two groups: chrysotile, antigorite, and lizardite are the essential types of serpentine, while the other asbestos minerals--crocidolite, actinolite, tremolite, and anthophyllite--are all types of amphiboles (the various amphiboles differ from each other only in the proportions of different metals--aluminum, calcium, magnesium, iron--in the crystal). It is the combination of certain chemical composition and the asbestiform habit (a crystal form which breaks down into fibers when crushed) which make a given rock asbestos.

2.1.1 Occurrence and Properties

Chrysotile (also known as white asbestos) is mined primarily in Canada, Africa, the former U.S.S.R., and at scattered locations in the U.S. Chrysotile is the only fibrous (asbestiform) member of the serpentine mineral group. The most diagnostic physical property of a chrysotile fiber is its silky feel and appearance. A chrysotile fiber is usually very fine, elongated, flexible (hardness 3-4) and slightly curled. Since chrysotile demonstrates variegated color, the use of color as a diagnostic physical property is invalid. Chrysotile is very heat-resistant, but easily degraded by acids and alkalies. Historically about 95 percent of the asbestos used in this country was chrysotile from Canadian mines.

Both antigorite and lizardite (both members of the serpentine group) are non-fibrous (non-asbestiform) in occurrence and are therefore rarely encountered in commercial use unlike their co-member, chrysotile.

Crocidolite (amphibole group), or blue asbestos, is mined mainly in South Africa and Australia. The fibers are less silky, coarser, and less workable than chrysotile, but still flexible. Chemical resistance is good, but heat resistance is poor.

Amosite (amphibole group), or light brown asbestos (it may be yellow or gray) is a trade name (derived from the initials for the Asbestos Mines of South Africa) given to fibrous cummingtonite and gunerite, mined in South Africa. These fibers also appear silky, but are coarse to the touch, and not very flexible (hardness 5-1/2 - 6). Amosite has good chemical and thermal resistance because of the insulation provided by natural air pockets.

The other amphiboles (anthophyllite, tremolite, and actinolite) are mined in various locations (Finland, Italy, South America) in small quantities. The fibers of all three are brittle, with fair to good heat and chemical resistance. These materials are of minor commercial importance, but do have specialty uses such as laboratory filters (tremolite) and reinforcing certain plastics (anthophyllite).

2.1.2 Commercial Uses

Ancient references to the material indicate knowledge of asbestos has existed for a very long time--perhaps 2,000 years. Its use remained relatively restricted until the 1860's, when the growth of industry created a demand for heat and chemical-resistant fabrics and insulating materials. The world production of asbestos climbed steadily in the half century before 1940, then skyrocketed for the next 25 years with renewed economic growth and the introduction of new applications. Asbestos has been a very important industrial material with approximately 900,000 tons/year being used in the United States as of 1980--about 70 percent in the construction industry. It is very difficult to find substitute materials which fully duplicate all of its properties:

Flexibility
Tensile strength similar to steel
Resistance to heat, chemicals, and wear
Low abrasiveness
High availability

One of the uses of asbestos materials developed in the 1940's was the spraying of asbestos fireproofing onto structural steel for improved fire resistance. Countless multistory buildings received this treatment before 1973, when the EPA banned the use of asbestos in all spray-applied applications. Other EPA bans on the use of asbestos in building materials are friable pre-molded insulation (banned in 1979) and spray-applied decorative material (banned in 1978).

The greatest construction use for asbestos, up until 1985, had been in cement products--pipe, shingles and siding, electrical panels, etc. The longer fibers were generally used in textiles. Friction products (such as clutch and brake facings) contain chrysotile for its high abrasion resistance and low abrasiveness. Other uses include floor coverings, packings, gaskets, and insulation. In June 1990, the United States Environmental Protection Agency (EPA) proposed banning the production and sale of nearly all products which contain asbestos. By mid-summer of 1991 these final rules should be adopted.

2.2 Exposure Potential

Friable products (which are easily crushed by normal hand pressure and release fibers) present a potential source of exposure, and must be carefully guarded against damage or disturbance. In products where the fibers are firmly encased in a solid matrix (such as asbestos cement pipe or vinyl asbestos floor coverings), there is reduced danger of airborne asbestos fiber exposure except during manufacturing or cutting, demolition, drilling, grinding, and sanding operations.

Health concerns are sure to limit the possible applications of asbestos, but the material is unlikely to vanish completely from use.

2.3 Health Effects

The health effects of asbestos will remain a serious problem far into the future. In spite of increasing awareness of the dangers of asbestos, some exposure continues in mining and manufacturing, and in hundreds of thousands of buildings, particularly those which were constructed in the 30 years before the 1973 EPA ban on spraying asbestos fireproofing. These buildings are a potential source of exposure to millions of people unless the problem is properly and safely managed.

The diseases associated with asbestos exposure typically all have long latency periods (the time between first exposure and the appearance of the disease), on the order of 15 to 40 years. The epidemiologic studies which have been done to date clearly show that there is an increase in risk with increasing airborne fiber levels and increasing duration of exposure. There are weaknesses in the data, however, that leave several questions unanswered. Due to the long latency periods of asbestos-associated diseases, those appearing now are the result of exposures from 20 or more years ago. Exposure data gathered prior to 1970 was presented in terms of millions of particles per cubic foot (mppcf) without discrimination between fibers and other non-fibrous particles. This creates difficulties for researchers trying to relate disease occurrence with exposure levels.

Another problem involves the type of fiber: animal studies indicate that some types of asbestos are more dangerous than others. Fibers of different types are usually mixed together in industrial processes, so there are very few data available on human exposure to a single type of fiber. The question of the relative hazards of exposure to different asbestos minerals may never be fully answered.

2.3.1 Asbestosis

Asbestosis is a disabling fibrosis or scarring of the lung, which shows up on a chest X-ray as scattered opacities. Frequently the pleura (the membrane lining the lung) also shows thickening and calcification bone plaques. The scarring causes the lung to become less elastic (stiffer), making breathing difficult. Also the area available in the lung for the exchange of gases is reduced, leaving the body starved for oxygen. Many asbestosis patients have a bluish color to the lips and tongue for this reason. Other symptoms of the disease include broadening or "clubbing" of the tips of the fingers and pulmonary rattles, a crackling sound which can be heard during examination with a stethoscope. It is caused by the resistance of the scar tissue and pleural plaques to the movement of the lungs during breathing. The lung changes are irreversible and often continue to worsen even after exposure to asbestos has stopped. The disease was first described in 1906, 40 years after the beginning of the modern asbestos industry.

It was once thought that only workers with long exposure to high levels of asbestos dust were at risk in developing the disease. However, studies conducted in the later 1960's and early 1970's indicate that this is not so. Positive X-ray findings have been reported in persons

with very low-level asbestos fiber exposure histories: a floor covering installer whose duties included occasional sanding of the vinyl asbestos tiles, an individual exposed in an insulation plant for one day, and family members (sometimes even pet animals) of asbestos workers with no other known exposure.

Severe asbestosis may obstruct the blood vessels of the lungs, leading to pulmonary hypertension (high blood pressure) and possible heart failure. One study found four times the expected risk of death from non-malignant lung disease and heart disease among a group of workers employed 20 years or more in an asbestos manufacturing plant.

2.3.2 Cancers

Asbestos exposure has been associated with cancers in several sites: the lung, the pleura and peritoneum, and the gastrointestinal tract. The latency period of these diseases is longer than that for asbestosis--20 years or more. The asbestos-cancer connection is the main reason that the Occupational Safety and Health Administration (OSHA) set the permissible exposure limit (PEL) for work place asbestos at 0.2 fibers/cc 8-hour time-weighted average (TWA) and an action level of 0.1 fibers/cc 8-hour time-weighted average (TWA). Despite much research, efforts to establish a "safe" or "no effect" level of exposure for asbestos fibers have not yet been successful.

An association between asbestos and lung cancer was suspected as early as 1935, but the first epidemiologic study which solidly demonstrated an excess risk of lung cancer among asbestos workers was published 20 years later, in 1955. The lung cancer risk from asbestos exposure increases for smokers. Cigarette smoke and asbestos together are much worse--the effect is synergistic, which means that the risk from the combined exposure is more (up to ten times greater) than the sum of the risks of the two exposures taken separately.

Mesothelioma is a rare cancer of the pleura (the membrane between the lung and chest wall) or the peritoneum (the membrane covering the abdominal organs). This is a rapidly progressive cancer, almost always resulting in death within two years after discovery. Individuals with the disease almost always have a history of exposure to asbestos.

3. ORGANIZATION AND IMPLEMENTATION OF THE ASBESTOS MANAGEMENT PLAN

The asbestos management plan includes a building inspection by an accredited inspector (Cape Environmental Management Inc), development of an Asbestos Survey report which includes recommended response actions, and this Operations and Maintenance Plan. The organizational structure for the Asbestos Management Plan is presented in Figure 3.1. The Asbestos Management Plan implementation procedure is presented in Figure 3.2. A brief description of the major elements of the organizational structure is as follows:

NAS Memphis Designated Person (Public Works Officer) oversees and implements Asbestos Management Plan.

Public Works/Property Management supervisors direct asbestos management activities performed by their staff and are responsible to Designated Person (Public Works Officer) for performance of all activities in accordance with the Asbestos Management Plan.

Support is provided to the Designated Person (Public Works Officer) by appropriate legal, public relations, labor relations, medical, Architects/ Engineers, safety/health, and asbestos management consultants, as required, in addition to NAVFACENGCOM Southern Division technical support staff.

3.1 NAS Memphis Designated Person's (Public Works Officer) Duties and Responsibilities

The Designated Person (Public Works Officer) has direct responsibility for providing a safe and healthy environment for occupants, visitors, employees and contract personnel. Public Works/Property Management Service personnel, or, if required, outside asbestos contractor personnel are responsible for implementing the Asbestos Management Plan work procedures to reduce the potential for exposure to airborne asbestos fibers. In accordance with this Operations and Maintenance Plan, the Designated Person (Public Works Officer) shall:

3.1.1 Carefully follow all guidelines of the Operation and Maintenance Plan to reduce the potential for personal exposure to airborne asbestos fibers for occupants, visitors, employees, and contract personnel.

3.1.2 Become familiar with all asbestos-containing materials in all buildings. Ensure that all occupants, visitors, employees, and contract personnel are fully advised of the presence of asbestos-containing materials and the potential hazards of exposure to airborne asbestos fibers.

3.1.3 Assure that all personnel involved with the Asbestos Management Plan have received formal training as outlined in Section 4.1.

3.1.4 Ensure all occupants, visitors, employees, and contract personnel know where asbestos-containing materials exist prior to implementing work and handling asbestos-containing materials. This is typically accomplished by using barrier tape, labeling of ACM, signage around asbestos work areas (see Section 5.1.1), etc.

3.1.5 Attach warning labels immediately adjacent to any friable and non-friable ACBM or suspected ACBM in routine maintenance areas, such as boiler rooms, until the material is removed. This labeling responsibility typically applies to identifying ACM which because of its location and friability has a high potential for being physically damaged during routine maintenance activities (i.e., pipe fitting insulation which is very close to a frequently operated valve in a mechanical room). This labeling requirement does not apply to floor tile or similar materials, however, building occupants and especially maintenance and custodial staff, must be aware of these materials and the proper procedures for handling and maintaining them (i.e., drilling through transite wallboard, stripping and buffing floor tile, etc.). Also, entrances into areas where any physical disturbance of asbestos-containing materials may cause release of asbestos fibers into the building ventilation systems shall be marked with permanent asbestos warning signs. At a minimum, all labeling shall be done in compliance with State of Tennessee requirements. All warning signs and labeling shall be as detailed in Section 4.4.

3.1.6 Seek guidance from Southern Division NAVFACENGCOM personnel or qualified asbestos management consultants when the Designated Person (Public Works Officer) determines that the complexity or seriousness of any asbestos related situation is beyond their capabilities.

3.1.7 Update this O&M plan annually with review by Southern Division NAVFACENGCOM representative.

3.1.8 Implement policies established by OSHA, EPA, and Southern Division NAVFACENGCOM Regulations in conjunction with the legal, public relations, labor relations, medical, safety and asbestos management consultants. Further detailing of the Designated Person (Public Works Officer) duties is presented in Section 3.5.

FIG. 3.1 ASBESTOS MANAGEMENT ORGANIZATIONAL STRUCTURE

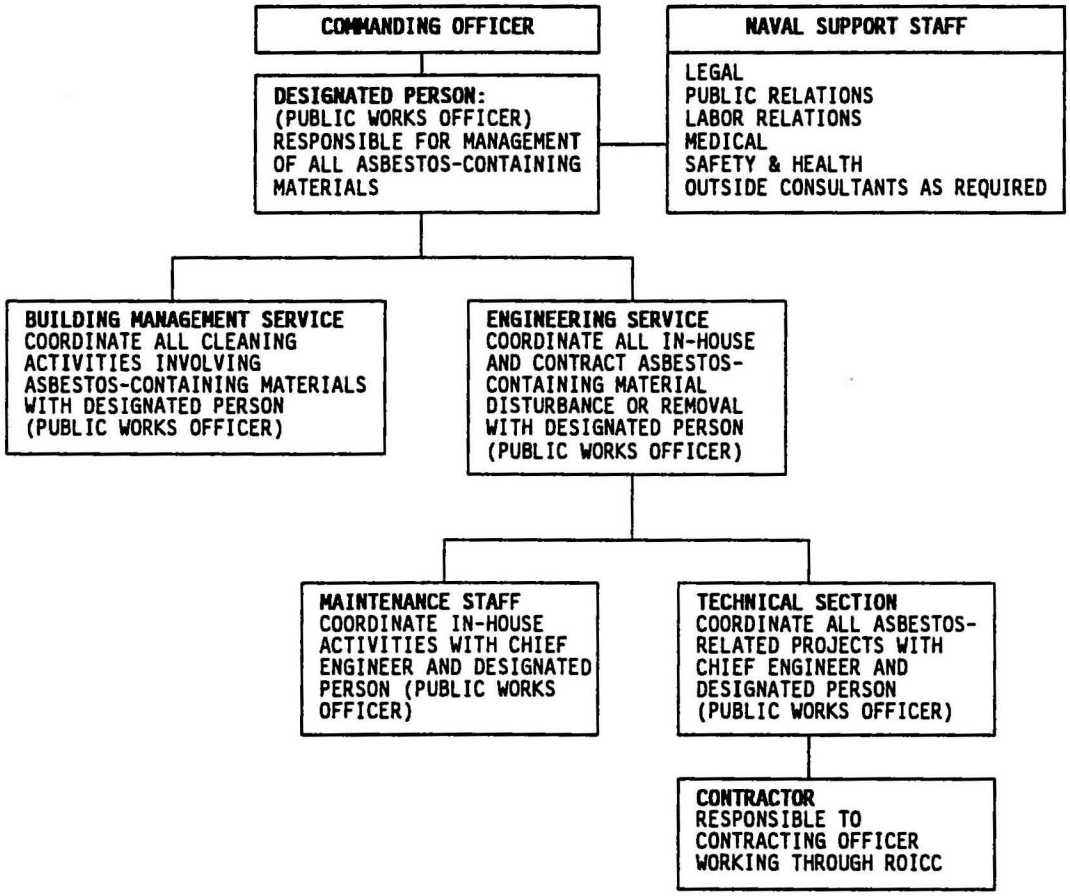
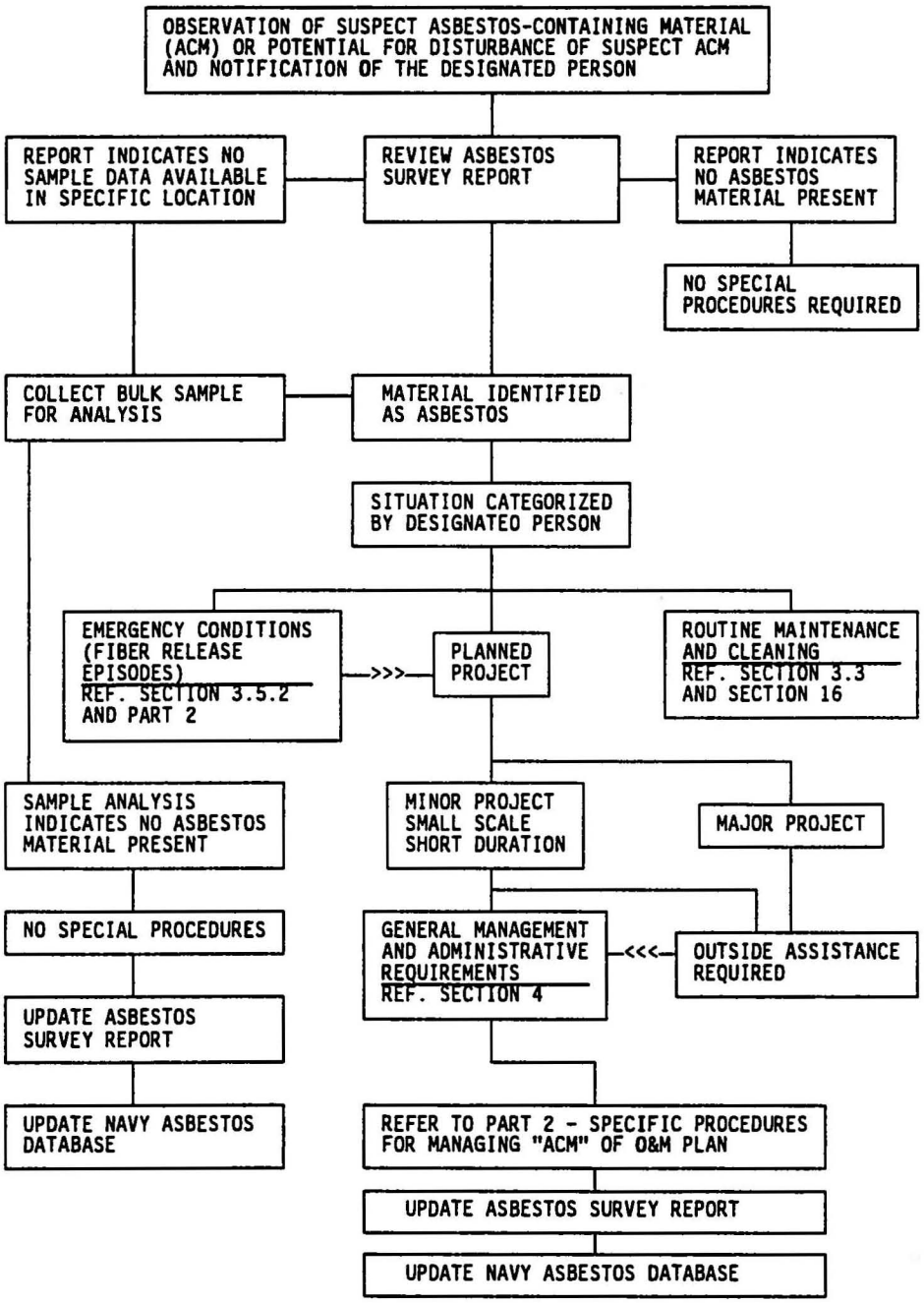


FIG. 3.2 IMPLEMENTATION FLOW CHART OF THE ASBESTOS MANAGEMENT PLAN



3.2 Equipment, Supplies and Selected References

If in-house personnel perform activities affecting asbestos-containing materials, then the following equipment and supplies shall be maintained and provided:

Signs and labels conforming to State regulations and current EPA and OSHA standards

Respiratory protection, NIOSH/MSHA approved

Vacuum cleaner (HEPA rated)

Disposable clothing

Gloves

Six mil polyethylene bags

Four and six mil polyethylene sheeting

Air sampling pumps

Mixed cellulose ester filter (25 mm) cassettes

Calibration equipment for pumps

Charger

Glove bags

Sprayer

Drums

Tape

Safety goggles

Tools

Encapsulating agents

Manufacturers and suppliers are listed in Table 3.1. This list is not all inclusive and is for reference use only and not an endorsement of any particular product or company.

The following selected references should be part of a complete asbestos management library:

USEPA. 1984. U.S. Environmental Protection Agency. *National Emission Standards for Hazardous Air Pollutants*. 40 CFR 61. April 5, 1984, as amended November 11, 1990.

USEPA. 1985. U.S. Environmental Protection Agency. *Measuring airborne asbestos following an abatement action.* Washington DC: USEPA. EPA 600/4-85-049. ("Silver Book")

USEPA. 1985. U.S. Environmental Protection Agency. *Asbestos in buildings: Simplified sampling scheme for surfacing materials.* Washington DC: USEPA. EPA 560/5-85-030A. ("Pink Book")

USEPA. 1985. U.S. Environmental Protection Agency. *Guidance for controlling asbestos-containing materials in buildings.* Washington DC: EPA 560/5-85-024. ("Purple Book")

USEPA. 1985. U.S. Environmental Protection Agency. *Asbestos in buildings: Guidance for service and maintenance personnel.* Washington DC: EPA 560/5-85-018. ("Custodial Pamphlet")

USEPA. 1986. U.S. Environmental Protection Agency. *Abatement of asbestos-containing pipe insulation.* Washington CD: Technical Bulletin No. 1986-2.

USEPA. 1986. U.S. Environmental Protection Agency. *A guide to respiratory protection for the asbestos abatement industry.* Washington DC: EPA 560/OPTS-86-001.

USEPA. 1988. *EPA Study of Asbestos-Containing Materials in Public Buildings: A Report to Congress.* February, 1988.

USEPA, 1990. Managing Asbestos in Place: A Building Owner's Guide to Operations and Maintenance Programs for Asbestos-Containing Materials (Green Book). Washington, DC: EPA 20T-2003, June 1990.

U.S. Department of Labor: OSHA Regulations. 29 CFR 1910.134 - *Respiratory Protection Standard.* June, 1974.

Keyes, Dale L. and Chesson, Jean. 1989. *A Guide to Monitoring Airborne Asbestos in Buildings.* Environmental Sciences, Inc., 105 E. Speedway Blvd., Tuscon, Arizona 85705.

Asbestos Laws and Regulations for the State of Tennessee.

TABLE 3.1. RESOURCES LIST, ASBESTOS MANAGEMENT SUPPLIES

This list is not all inclusive and is for reference use only and not an endorsement of any particular product or company.

SUPPLIER	SUPPLIES
Industrial Safety Products, Inc. 1502 Telegraph Rd. Mobile, AL 36611 205/457-4591 or 800-872-6406	All Supplies
Nilfisk of America, Inc. Gages Lake, Illinois 60030 312/223-6626	All Supplies
Fire Safe Equipment of Rockford 2420 Harrison Avenue Rockford, Illinois 61108 815/394-0100	All Supplies
American Coating Corporation 1500 Northwest 52nd Street Fort Lauderdale, Tennessee 33309 800/323-7580	All Supplies
DISPOSABLE CLOTHING	
Edmont-Wilson Division of Becton, Dickinson and Company Coshocton, OH 43812 614/622-4311	Kimberly Clark Corporation Indust Garment Fabrics ("Comfort Zone") 1400 Holcomb Bridge Road Roswell, GA 30076
Interex 3 Strathmore Road Natick, MA 01760 800/225-5910	Mine Safety Appliance Co. (MSA) 600 Penn Center Boulevard Pittsburgh, PA 15235 412/967-3000
Occupational Health and Safety Products Division 3M P. O. Box 4382 Stamford, CT 06907-0382	Defense Apparel 285 Murphy Road Hartford, CT 06114 800/243-3847

3.3 Initial Cleaning

In accordance with EPA Guidance for Controlling Asbestos-Containing Materials in Buildings (EPA 56015-85-024) and EPA Managing Asbestos in Place (EPA 20T-2003), in all areas of a building where exposed damaged thermal system insulation ACM is present, ACM dust or debris could be present. These areas, identified in the Asbestos Survey Report, shall have an initial cleaning implemented for all surfaces where possible ACM dust or debris could have accumulated. Asbestos cleaning techniques should supplement, not replace, repair or abatement actions for damaged or friable ACM.

Proper cleaning is important for two reasons:

A. The use of improper techniques to cleanup asbestos debris caused by previous deterioration or damage may result in widespread contamination, and potentially increase airborne asbestos fiber levels in the building.

B. Improper cleaning may cause damage to the ACM, thus releasing more airborne asbestos fibers.

Proper O&M cleaning will involve the use of wet cleaning or wet-wiping practices to pick up asbestos fibers. Dry sweeping or dusting can result in asbestos fibers being re-suspended into the building's air and therefore must not be used. Once wet cloths, rags, or mops have been used to pick up asbestos fibers, they must be properly discarded as asbestos waste while still wet. They must not be allowed to dry out, since the collected fibers might be released at some later time when disturbed. The use of special vacuum cleaners, commonly referred to as HEPA vacuums, may be preferable to wet cleaning or used in addition to wet cleaning in certain situations. These vacuums are equipped with filters designed to remove very small particles or fibers--such as asbestos--by filtering those particles from the air passing through the vacuum. Since the exhaust air from an ordinary (or shop) vacuum cleaner is not filtered sufficiently, it is possible for tiny asbestos fibers to pass through the filter and be dispersed into the building air, therefore, it is important to never allow NON-HEPA vacuum use in areas where asbestos dust could be present.

It is important for O&M personnel to use caution when emptying HEPA vacuums and changing the filters. Exposures could result from such activities. Employees should move the HEPA vacuum to a physically isolated area of the facility and put on proper personal protective equipment before carefully placing the dust and debris into properly labeled, sealed, and leak-tight containers for disposal as asbestos-containing waste. In general, the building would not need special O&M cleaning when the building contains only non-friable (not easily crumbled) ACM in good condition; ACM which has been encapsulated, encased, or enclosed behind air-tight barriers; or ACM known to be undamaged/undisturbed or inaccessible. Furthermore, where ACM is confined to a single room or area, special cleaning of just that area rather than other parts of the building may be sufficient.

If ACM has been released onto a carpeted area of a building, it may not always be possible to adequately clean the carpeted area. "Steam" cleaning and HEPA vacuuming methods are sometimes employed for this purpose. A preliminary study carried out by EPA in 1989 showed that hot water vacuums were more effective in carpet cleaning than HEPA vacuums, under the test conditions. Further field studies are planned to confirm these findings.

For carpets, successful cleaning will likely depend on factors such as the amount of ACM released onto the carpet, how long the situation has existed, traffic over the area, as well as the structure and composition of the carpet itself. It is prudent to evaluate individual situations on a case-by-case basis. The Designated Person (Public Works Officer) should evaluate the need for workers engaged in cleaning asbestos fiber-contaminated carpets to wear proper respiratory protection. It may also be prudent to arrange for this type of cleaning to be done after normal working hours or when the facility is less occupied. Additionally, it may be more cost effective to properly dispose of contaminated carpets and other fabrics as asbestos-containing waste if the remaining useful life of the carpet or fabric is questionable.

Where the ACM is damaged and located in an "air plenum"--where fibers can be transported by the heating, ventilation, or air conditioning (HVAC) system throughout the building--special cleaning practices may be extended to the entire building, including the HVAC system itself.

3.4 Routine and Episodic Cleaning

After an initial cleaning of the areas with exposed, damaged thermal system insulation identified in the Asbestos Survey Report, routine cleaning shall be implemented along with episodic cleaning when asbestos fiber release episodes are suspected and reported for these or any other ACM.

The guidelines and procedures for routine and episodic cleaning shall be in accordance with the same EPA guidelines referenced in Initial Cleaning (Section 3.3).

3.5 Implementation of the Asbestos Management Plan

All personnel who work in buildings having asbestos-containing materials shall be notified of the presence of these materials in the building and trained to identify activities which could result in disturbance of asbestos-containing materials. All personnel shall be totally familiar with the asbestos warning signs.

Contractors who work in buildings having asbestos-containing materials shall be notified of the presence of these materials and of the need to train their workers concerning identification of activities which could result in disturbance of asbestos-containing materials.

The key to successful implementation of the plan is the effective training, as outlined in Section 4.1, of all personnel involved with

asbestos management. The flow chart steps summarized in Figure 3.2 and described herein are designed to ensure that airborne asbestos fiber concentrations inside the building remain at the lowest feasible levels and within acceptable limits.

The following narrative describes the path through the Figure 3.2 Implementation Flow Chart on page 10.

3.5.1 Observation of Suspect Asbestos-Containing Material (ACM) or Potential for Disturbance of Suspect ACM and Notification of the Designated Person (Public Works Officer).

Any of the following observations made by employees or brought to the attention of employees by visitors, contract personnel, or any other building occupant must be reported immediately to the NAS Atlanta Designated Person (Public Works Officer) through the employee's supervisor.

3.5.1.1 Visual damage to or loose debris from the following asbestos-containing materials:

- Acoustical material
- Attic and wall insulation
- Ceiling tiles and wall tiles
- Cementitious materials (pipe, siding, wallboard, roofing, etc.)
- Fireproofing
- Floor coverings and mastic
- Floor penetration packing
- Insulation
- Mastics
- Mechanical system insulation (pipe, pipe fittings, ducts, equipment)
- Plaster materials
- Roofing materials (shingles, felts, tar, etc.)
- Wiring insulation
- Other suspect miscellaneous asbestos-containing materials (gaskets, curtains, etc.)

3.5.1.2 Damaged or missing asbestos warning signs.

3.5.1.3 Breaches or openings in the existing suspended ceiling system if asbestos materials are located above the ceiling.

3.5.1.4 Performance of any work involving potential disturbances of asbestos-containing materials, which is not in accordance with the work procedures described in this plan.

3.5.1.5 Possible disturbance of hidden or inaccessible (sealed pipe chases, above fixed plaster ceiling, etc.) locations with asbestos-containing materials such as fireproofing or insulation material or debris inside wall partitions. All piping insulation located in inaccessible areas shall be

assumed to contain asbestos until laboratory results are received and verification of asbestos presence or absence is established.

3.5.1.6 Entry into crawl spaces, where soil may have been contaminated with asbestos debris.

3.5.2 Review Asbestos Survey

The Designated Person (Public Works Officer), after receiving notification of observation or potential disturbance of suspect asbestos-containing materials shall immediately review the asbestos survey. After review of the asbestos survey, one of the three situations outlined below (3.5.3, 3.5.4 or 3.5.5) will exist. Additionally, the following considerations must be evaluated if the situation involves floor covering, other resinously-bound non-friable materials, or plaster or gypsum board construction.

3.5.2.1 Recent studies have found that polarized light microscopy (PLM) may not identify all asbestos fibers in floor covering materials and other resinously-bound materials. Further analysis to more positively confirm the absence of asbestos by qualitative transmission electron microscopy (TEM) is recommended for these materials if they are not assumed to contain asbestos and they are to be disturbed in any way, including scheduled demolition and routine maintenance and repair procedures.

3.5.2.2 At the NAS Memphis facility, representative samples were collected from plaster and gypsum board construction walls and ceilings in accordance with the scope of work. Even though the results of analysis may indicate these were non-asbestos-containing materials in any particular building, because of the large number of renovations and changes to walls and ceilings during the life of the buildings and the difficulty in determining the homogeneity of plaster or gypsum board materials, some homogeneous areas of suspect materials may not have been identified and sampled. It is recommended that more extensive sampling and analysis of these wall and ceiling materials be conducted if they are not assumed to contain asbestos and if specific areas are targeted for renovation, demolition or any type of disturbance to these materials.

3.5.3 Survey Indicates No Asbestos-Containing Material Present

In this situation no further action or special procedures are required.

3.5.4 Survey Indicates No Sample Data Available in Specific Location

Examples of situations in which no specific sampling data is available include inaccessible suspect asbestos-containing materials such as gaskets (shall always be assumed to contain asbestos), underground

piping, and piping located above plaster ceiling or inside plaster walls. In all areas where asbestos was identified in exposed piping insulation material or where exposed piping insulation material has been removed and replaced with non-ACM, inaccessible piping insulation in that area shall be considered asbestos-containing. Where no specific sampling data is available, bulk samples must be collected (unless assumed to be asbestos and treated accordingly) and analyzed. If sample analysis indicates no asbestos-containing materials are present, then no further action or special procedures are required and the asbestos survey database should be updated with this information. If bulk sample analysis indicates the presence of asbestos-containing material, proceed to notification of Designated Person (Public Works Officer).

3.5.5 Material Identified as Asbestos

When the asbestos survey indicates the presence of asbestos containing materials, the following steps shall be followed:

3.5.6 Situation Categorized by Designated Person (Public Works Officer)

After positive identification of the material as asbestos by the Designated Person (Public Works Officer), the Designated Person (Public Works Officer) or their representative will categorize the situation into one of the three following alternatives and immediately proceed with implementation. Typical situations and required work procedures for Routine Maintenance and Cleaning, Emergency Conditions, and for both Minor and Major projects involving various asbestos-containing materials are presented in Part 2 - Specific Procedures for Managing Asbestos-Containing Materials.

3.5.6.1 Routine Maintenance and Cleaning
Typical activities and required work procedures for this category are detailed in Section 12 - ROUTINE MAINTENANCE AND CLEANING.

3.5.6.2 Emergency Conditions and Fiber Release Episodes
Emergency conditions involve a potential for asbestos fiber contamination due to unexpected circumstances, posing an immediate threat to personnel safety or the environment. These situations may be handled by NAS Memphis in-house personnel if properly trained and under the supervision of the Designated Person (Public Works Officer) and the Chief Engineer. Major fiber release episodes exist where the amount of asbestos-containing material involved is greater than 3 square or linear feet and when other safety and health hazards may be present. The response action for a major fiber release episode must be designed by a Professional Industrial Hygienist and conducted by an accredited and licensed asbestos removal contractor.

Typical, major fiber release episodes include but are not limited to:

A. fires, explosions, earth tremor or other natural disaster affecting asbestos-containing materials

B. failure of structural members affecting asbestos-containing materials

C. major delaminations of asbestos-containing insulation, fireproofing or acoustical materials

D. water damage or physical damage to asbestos-containing materials.

During emergency conditions, the Designated Person (Public Works Officer) or his/her representative and emergency staffs must exercise careful judgement in implementing emergency procedures to minimize the potential for asbestos exposure and personal injury. Seriously injured personnel shall be immediately evacuated from the contaminated area. Asbestos decontamination procedures should be waived when greater safety and health hazards exist.

The primary concern during emergency evacuation conditions is to protect the employees' immediate life safety. After the employees evacuate to a safe location, they shall remove all gross asbestos contamination from body and clothing by vacuuming with HEPA filter equipped cleaners or by completely showering with clothes on. Once all visual asbestos contamination is removed from body and clothing, remove clothing, shower again and change into clean clothing as soon as possible. The waste shower water shall be disposed as contaminated waste. The contaminated clothing shall be disposed as contaminated waste or the contaminated clothing can be thoroughly laundered in accordance with 29 CFR 1926.58 to remove residual asbestos fibers.

The contaminated building areas shall be sealed off, locked, if possible, and signs posted warning personnel of the asbestos exposure hazard which exists.

As soon as possible, air samples shall be taken in accordance with Table 4.3. The analyses of air samples will provide documentation of the airborne fiber concentrations within the subject areas.

As soon as the emergency condition is stabilized, the Designated Person (Public Works Officer) or his/her representative shall determine whether building decontamination can be accomplished by in-house personnel or if outside assistance is required. Further explanation of Minor and Major Project alternatives is presented in the paragraphs below.

3.5.6.3 Planned Project

All projects not categorized as Emergency Conditions or Routine Maintenance and Cleaning shall be classified as a Planned Project. Planned Projects are categorized by the Designated Person (Public Works Officer) and Chief Engineer as either Minor (small scale - short duration) or Major Projects.

A major consideration for Planned Projects is the phasing of the work. Minor projects may be scheduled outside of normal working hours. Major Projects may require more complicated phasing on an area by area basis or may require the building be unoccupied, depending on feasibility, the cost-effectiveness analysis, and safety considerations. The Designated Person (Public Works Officer) and Chief Engineer in conjunction with the outside consultant, if required, will determine the appropriate phasing for each project.

3.5.6.3.1 Minor (Small Scale - Short Duration) Project - Minor Projects may be accomplished in-house or may be contracted to an accredited and licensed asbestos removal contractor. Minor Projects are classified as response actions involving 3 square or linear feet or less of asbestos-containing materials. Minor Projects shall be implemented in accordance with the General Management and Administrative Requirements in Section 4, and the specific procedures for the ACM involved as outlined in Part 2.

3.5.6.3.2 Major Project - Major Projects of asbestos-containing material abatement and/or complex situations and procedures are generally defined as response actions involving more than 3 square or linear feet. Major projects require the use of a Professional Industrial Hygienist to design and supervise the implementation response actions and shall be implemented in accordance with the General Management and Administrative Requirements in Section 4, and the specific procedures for the ACM involved as outlined in Part 2.

4. GENERAL MANAGEMENT AND ADMINISTRATIVE REQUIREMENTS

Special work procedures are required at all times when normal maintenance and renovation activities are undertaken and disturbance of asbestos-containing building materials may occur. This situation includes all asbestos management activities, and any entry into areas which may be contaminated with airborne asbestos fibers. These general requirements apply to employees and contract personnel.

Before starting any of the following listed projects or tasks, where the possibility of the disturbance of ACM exists, see the Asbestos Survey Report. If signs or labeling or reference to the Asbestos Survey Report indicates the presence of asbestos-containing materials, or the presence of asbestos-containing materials is suspected, the employee will contact his supervisor prior to beginning work. Supervisors should contact the Designated Person (Public Works Officer) and Chief Engineer for clarification of suspected materials and prior to beginning work involving potential disturbance of asbestos-containing materials (see Figure 3.2). Typical activities which could potentially disturb asbestos-containing materials include:

A. Electrical and telephone wiring repairs, mechanical system and piping repairs or any work involving penetration of walls, floors or ceilings.

B. Repairs, or modifications to heating, ventilating and air conditioning (HVAC) equipment.

C. Non-routine cleaning of accumulated dust and debris, especially from areas with asbestos-containing fireproofing and/or insulating materials.

D. Building renovation, maintenance or demolition.

E. Any other situations not listed where physical contact with suspect asbestos-containing materials (i.e. crawlspace contaminated soil, penetration into roof, floor covering disturbance, change out of gaskets, vehicle maintenance, etc.) may occur.

The following sections detail general management and administrative requirements for work on or near asbestos-containing materials. Further detail and discussion of specific requirements are provided in Part 2 - Specific Procedures for Managing Asbestos-Containing Materials.

4.1 Employee Training

In conjunction with implementing the asbestos materials Operation and Maintenance Plan, the Designated Person (Public Works Officer) shall institute a training program in accordance with OSHA and EPA. OSHA and EPA requires a worker training program for all employees exposed to fiber levels at or above the action level (0.1 f/cc in an 8-hour Time Weighted Average), and/or the excursion limit (1.0 f/cc in a 30-minute

Time Weighted Average). At least three levels of training can be identified:

Level One - Awareness training for workers involved in activities where ACM may be accidentally disturbed including, but not limited to, Public Works/Property Management Personnel. This training may vary from two to eight hours.

Level Two - Special Operation and Maintenance training for workers involved in general maintenance and incidental ACM repair tasks. This training shall be at least 16 hours (typically Industrial Hygiene section of the Environmental unit or the Preventative Medicine Unit).

Level Three - Abatement worker training for workers who may conduct in-house emergency asbestos abatement. This work involves direct, intentional contact with ACM. "Abatement worker" training may vary from 24 to 40 hours (typically Industrial Hygiene section of the Environmental Unit or the Preventative Medicine Unit and designated asbestos workers).

A typical training program includes, but is not limited to the following major topics. (All topics should be discussed for each level of training, however, the time, emphasis and hands-on training for the various topic sections will vary for the different levels of training).

Section 1 Course overview (use of O&M Plan)

Section 2 Background on asbestos-containing materials
1. Potential health effects of asbestos exposure
2. Methods of recognition

Section 3 Local, State and Federal regulations

Section 4 Medical surveillance

Section 5 Air Sampling

Section 6 Worker protection
1. Respirators
2. Personal protective clothing

Section 7 Safety concerns

Section 8 Work practice procedures
1. Site preparation
2. Decontamination procedures
3. Controlling airborne asbestos fibers
4. Cleaning the work area
5. Glove bag techniques
6. Hands on training for various types of asbestos-containing material encountered in each building.

4.2 Government Regulations

4.2.1 State

Appendix A contains the Asbestos Laws and Regulations for the State of Georgia. Where the state regulations are more stringent than federal regulations, state regulations shall be followed. WHERE THE FEDERAL (OSHA) STANDARD IS MORE STRINGENT THAN THE EXISTING STATE REQUIREMENTS, THE FEDERAL STANDARD MUST BE FOLLOWED.

4.2.2 Occupational Safety and Health Administration (29 CFR 1910.1001, 1926.58 and 1910.134)

The current OSHA standard (July 1986) is divided into two major sections:

Section 1. 29 CFR 1910.1001 Asbestos, Tremolite, Anthophyllite and Actinolite. This section applies to all occupational exposures to asbestos in all industries covered by OSHA except for construction work as defined in 29 CFR 1926.58. For the purposes of NAS Atlanta, 29 CFR 1910.1001 regulations would apply in all cases with the exception of remodeling or renovation activities, which would fall under 29 CFR 1926.58. The complete text is provided in Appendix B.

Section 2. 29 CFR 1926.58 Asbestos, Tremolite, Anthophyllite and Actinolite. This section applies to all construction work including, but not limited to, the following:

Demolition or salvage of structures where asbestos, tremolite, anthophyllite, or actinolite is present;

Removal or encapsulation of materials containing asbestos, tremolite, anthophyllite, or actinolite;

Construction, alteration, repair, maintenance, or renovation of structures, substrates, or portions thereof, that contain asbestos, tremolite, anthophyllite, or actinolite;

Installation of products containing asbestos, tremolite, anthophyllite, or actinolite;

Asbestos, tremolite, anthophyllite, and actinolite spill/emergency cleanup;

Respiratory protection programs, protective clothing and decontamination of materials and personnel;

Transportation, disposal, storage, or containment of asbestos, tremolite, anthophyllite, or actinolite or products containing asbestos, tremolite, anthophyllite, or actinolite on the site or location at which construction activities are performed; and

The complete text is provided in Appendix B.

Section 3. 29 CFR 1910.134 Respiratory Protection and Respiratory Protection Program. This section applies to all personnel in an occupational environment who are required to wear respirators as part of their job and addresses but is not limited to the following:

Requirements for minimum acceptable programs;

Respirator used and applications;

Medical evaluation and employee training;

Maintenance and care of respirator; and

The complete text is provided in Appendix D.

4.2.3 Environmental Protection Agency (40 CFR 61, Subpart M)

The USEPA National Emission Standards for Hazardous Air Pollutants (NESHAPS) Asbestos Regulations (40 CFR 61, Subpart M) sets standards for asbestos mills, manufacturing, demolition/renovation, spraying, fabricating, insulating materials, and waste disposal. The complete text of this standard (Revised November 11, 1990) is provided in Appendix C.

4.3 Notifications and Permits

The Contracting Officer and Resident Officer in Charge of Construction (ROICC) shall assure that all required permits and approvals related to asbestos removal, transport, and disposal are secured before any affected project is initiated. Notice shall be made to the following personnel at EPA and State agencies.

Memphis - Shelby County
J. Carter, S. Gray
Technical Secretary
Memphis-Shelby Air Pollution Control Board
814 Jefferson Avenue
Memphis, TN 38105
(901) 576-7775

State Level
Harold E. Hodges
Technical Secretary/Director

Division of Air Pollution Control
701 Broadway
Nashville, TN 37219-5402
(615) 532-0554

National Level
U. S. Environmental Protection Agency
Region IV
Air Pesticide & Toxic Management, Asbestos Special Program
345 Courtland Street, NE
Atlanta, GA 30365
(404) 347-5014

4.4 Warning Signs and Labels

For all work areas where airborne asbestos fiber contamination may exist, warning signs specified below must be posted outside enclosing barriers to warn unprotected personnel against entry into contaminated areas. All containers with asbestos material or asbestos-contaminated debris shall display the labels specified below. Also, entrances into areas where any physical disturbance of asbestos-containing materials may cause release of asbestos fibers into the building ventilation systems shall be marked with permanent asbestos warning signs.

OSHA (29 CFR 1910 AND 1926.58) and the State of Tennessee required signs:

DANGER ASBESTOS
CANCER AND LUNG DISEASE HAZARD
AUTHORIZED PERSONNEL ONLY
RESPIRATORS AND PROTECTIVE CLOTHING ARE REQUIRED IN THIS AREA

OSHA (29 CFR 1910 and 1926.58) and the State of Tennessee required labels:

DANGER
CONTAINS ASBESTOS FIBERS
AVOID CREATING DUST
CANCER AND LUNG DISEASE HAZARD

4.5 Medical Surveillance

As noted in 29 CFR 1910.1001 and 29 CFR 1926.58, all personnel, who, by this operations and maintenance plan, are required to wear respirators, must receive a medical physical examination by the employee health physician to determine their ability to wear a respirator. This involves evaluation (using pulmonary function test to include forced vital capacity (FVC) and forced expiratory value at one second (FEV_1)) of the worker's ability to wear respiratory protection equipment, specifically, negative pressure type filtering devices (air purifying respirators) which place stress on the worker's respiratory and cardiovascular systems. If the examining physician determines that the

employee is capable of wearing an air purifying respirator, he may conduct a chest roentgenogram (posterior and anterior 14 x 17 inches) and a medical history check to determine past or current respiratory diseases. The examining physician shall conduct the required medical examination as required in OSHA Standard 29 CFR 1910.1001 and 29 CFR 1926.58.

These examinations must be given to workers within 30 days of employment, annually during length of employment, and at termination of employment.

All records of physical examination for employees shall be maintained in their personnel health files. These records are subject to OSHA regulations, and thus must be maintained for the duration of employment plus 30 years and be available to the worker, his designated representative, and the Director of NIOSH.

The Contracting Officer and ROICC shall require records of required physical examinations be provided by the asbestos abatement contractor, for contractor employees. These records shall be maintained with other contract documents to verify compliance with State and Federal regulations.

4.6 Personal Protective Equipment

All personnel working in areas contaminated with airborne asbestos fibers or performing functions which could potentially create an exposure to airborne asbestos fibers including routine cleaning, maintenance, minor work procedures and major work procedures shall wear adequate protective clothing and shall be provided with an enclosed decontamination area to remove protective work clothing, shower, and change into street clothing. Protective clothing shall consist of a full-body disposable fabric coveralls, complete with head and foot covering.

All personnel working in areas contaminated with airborne asbestos fibers or performing functions which could potentially create an exposure to airborne asbestos fibers shall be provided with respiratory protection in accordance with the following specifications; the OSHA regulations 29 CFR 1910.1001 (Appendix B), 29 CFR 1910.134 (Appendix D) and 29 CFR 1926.58 (Appendix B), EPA regulations 40 CFR 763.120, 121, ANSI standards Z88.2-1980, CGS Pamphlet G-7 and SOUTHNAVFACENGCOM Guide Specification, NFGS-02080B, the NIOSH and MSHA standards and the state and local requirements (Appendix A). In case of conflict, the most stringent requirements are applicable for this project. Specific respirator requirements for varying degrees of airborne asbestos fiber concentrations are presented in Table 4.1 - SUGGESTED RESPIRATORY PROTECTION FOR ASBESTOS, TREMOLITE, ANTHOPHYLLITE, AND ACTINOLITE FIBERS. At a minimum, all respirators shall be half-face dual-cartridge air purifying design. Filter cartridges shall carry high efficiency rating for use in asbestos-contaminated environments. Approved respirators and protective clothing must be worn at all times when inside asbestos fiber contaminated work area(s) and may not be removed

for talking, eating, smoking, drinking, or any other purpose. USE OF RESPIRATORS IS SUBJECT TO OSHA AND STATE RESPIRATORY PROTECTION PROGRAM REQUIREMENTS (Appendices A, B and D).

4.7 Recordkeeping

The Commanding Officer shall ensure that all records concerning the exposure of NAS Memphis employees are developed in consultation with, and reviewed by a qualified Industrial Hygienist; meet OSHA requirements; and are properly completed, maintained, and accessible. Each incident involving employees exposed to airborne asbestos fibers should be immediately reported to their supervisor to assure that the exposure incident is properly documented. Records directly involving asbestos which may provide information on general employee or visitor exposure must be maintained indefinitely. Particular attention must be given to the maintenance of records which show the air pressure differential established during asbestos removal projects, and that EPA's (Federal, State, and local) notification requirements were met. 29 CFR 1926.58(n) (Appendix B) and 29 CFR 1910.20 must be reviewed and followed.

File information shall include, but not be limited to:

1. Correspondence

2. Material Safety Data Sheets

3. Description of Project or Fiber Release Episode
   a. photographs (if applicable)
   b. names of architect, engineer, asbestos management consultant, in-house key personnel, and contractor's key personnel
   c. types, percentages and quantities of asbestos abated

4. Description of Project Execution
   a. project start-up procedures
   b. method of removal/disposal
   c. cleanup procedures

5. Personnel Records
   a. medical/physical exams
   b. records of worker training (asbestos, respirators, decontamination, State and Federal regulations)
   c. worker release forms for all workers involved in asbestos management work procedures
   d. respiratory protection program

6. Notifications
   a. letters to respective agencies, State, EPA, OSHA, etc.
   b. letter of notification to disposal and transport container/vehicle rental or leasing company
   c. permits
   d. signage and label(s)

7. Disposal Records
   a. verification of current license and approval of landfill for accepting asbestos waste
   b. disposal log
   c. trip tickets and manifest
   d. vehicle description and serial number

8. Testing and Analysis Records
   a. bulk sampling description/chain of custody forms
   b. laboratory analysis forms/reports
   c. air sampling records
   d. air sampling cassettes
   e. bulk samples

9. Contract Documents
   a. agreement
   b. record set of drawings and specifications including all changes which occurred in the project

10. Documentation of Potential Exposure or Emergency Conditions
   a. evacuation plan/procedures
   b. written reports of incidents where asbestos fiber release is experienced, including names of affected personnel and length of exposure
   c. emergency occurrences (e.g., fire, flooding, earthquake, etc.)
   d. accidents (e.g., delamination, broken ceiling tile, etc.)

11. Annual Asbestos Reassessment Requirements (Ref. Section 4.8)

12. Project Start-Up Procedure Checklist (Ref. Part 2)

13. One copy of Applicable Federal, State, and Local Regulations (another copy should be posted at the job site)

14. Strip Chart Recording or other Approved Monitoring Documentation of Pressure Differential

TABLE 4.1 SUGGESTED RESPIRATORY PROTECTION FOR ASBESTOS, TREMOLITE, ANTHOPHYLLITE AND ACTINOLITE FIBERS

REQUIRED RESPIRATOR	PROTECTION FACTOR	ALLOWABLE TIME WEIGHTED AVERAGE OF ASBESTOS IN THE BREATHING ZONE OUTSIDE THE RESPIRATOR (FIBERS LONGER THAN FIVE MICROMETERS PER CUBIC CENTIMETER OF AIR)
Half-mask air-purifying respirator equipped with high-efficiency filters	10	0.1 or less
Powered air-purifying respirator, loose fitting helmet or hood with high-efficiency filters or supplied-air respirator, loose fitting helmet or hood, operated in continuous flow mode	25	0.25 or less
Full face piece air-purifying respirator equipped with high-efficiency filters	50	0.5 or less
Powered air-purifying respirator, full face piece, equipped with high-efficiency filters or supplied-air respirator, full face pierce, operated in continuous flow mode	50	0.5 or less
Full face piece supplied-air respirator operated in pressure demand mode plus HEPA escape	1000	10 or less
Full-face piece supplied-air respirator operated in pressure demand mode equipped with an auxiliary positive pressure self-contained breathing apparatus	>1000	>10 or unknown

NOTE: a. Respirators assigned for higher environmental concentrations may be used at lower concentrations.

b. A high-efficiency filter means a filter that is at least 99.97 percent efficient against mono-dispersed particles of 0.3 micrometers in diameter.

c. Allowable fiber concentrations are based on achieving a maximum of 0.01 f/cc inside the respirator.

4.8 Annual Asbestos Reassessment Requirements

The asbestos-containing materials present in buildings are subject to deterioration with aging, the effects of building occupancy, and accidental damage. To monitor the ever-changing condition of these asbestos-containing materials in the building, a program of periodic inspection and possibly air sampling is recommended. This program is designed to track any trends that may increase the potential for airborne asbestos fiber concentrations inside the building. This data shall be used by the Designated Person (Public Works Officer) or his/her representative to identify areas which may require special corrective action. The results of the Annual Reassessment shall be kept by the Designated Person (Public Works Officer).

4.8.1 Annual Inspection

A reassessment of existing asbestos material should be conducted annually. This annual inspection should be used as a supplement to the informal day to day visual observation conducted by Public Works/Property Management personnel. Annual inspections may be conducted by the Designated Person (Public Works Officer) or a representative of the Designated Person (Public Works Officer). The annual inspection will include observation of all asbestos-containing materials identified in the Asbestos Survey Report and Management Plan, particularly including locations where any previous periodic observations have been made and photographs may have been taken. The asbestos-containing materials will be examined for general condition, and indications will be noted of deterioration, delamination, erosion, water damage, or physical abuse. If significant change (including increased accessibility to asbestos-containing materials) or deterioration is noted for the materials in a specific location, photographs (or other approved means of documentation) will be performed and asbestos management procedures implemented as necessary.

4.8.2 Annual Air Sampling

After completing the initial asbestos survey, a comprehensive annual reassessment program of area air sampling may be instituted in accordance with OSHA standards. Table 4.2 - SUGGESTED ASBESTOS REASSESSMENT AIR SAMPLING PROTOCOL provides guidelines concerning sampling locations, number of area air samples, volume of samples, frequency of sampling, analytical method and sampling period. This program will include the collection of area air samples from representative areas of the building, including corridors, office areas, mechanical rooms, etc., to determine representative airborne fiber concentrations throughout the building. Analyses will be conducted utilizing phase contrast microscopy in accordance with the National Institute for Occupational Safety and Health (NIOSH) Method 7400 (Appendix E). Samples collected and analyzed by phase contrast microscopy should be retained for possible future analysis by transmission electron microscopy.

NOTE: Personal air monitoring shall also be conducted during all work which involves the potential disturbance of asbestos-containing materials. The frequency shall be as described in the job specific asbestos removal specifications (Appendix F - SOUTHNAVFACENGCOM Guide Specifications, NFGS-02080B, Removal and Disposal of Asbestos Materials). Additionally, the Designated Person (Public Works Officer) or his/her representative shall conduct representative personal sampling for maintenance and custodial personnel during work which may potentially disturb asbestos-containing or asbestos-contaminated materials (i.e., disturbing asbestos-contaminated soil in the crawl space, buffing asbestos-containing floor tile, or clean-up in areas where friable asbestos-containing materials are present). The data will serve as a basis for future selection of respiratory protection, if required, when working with similar asbestos-containing materials under similar working conditions.

Air samples taken for Transmission Electron Microscopy (TEM) analysis shall include not less than 3,000 liters of air per sample at a collection rate of 2 to 12 liters per minute. Analyses of these samples shall be accomplished using transmission electron microscopy following methods prescribed by the U.S. EPA Method Number 600/2-77-178. Consultation with the applicable NAS Atlanta or Southern Division NAVFACENGCOM technical staff is necessary prior to TEM analysis.

The results of all air sampling and analyses and inspection logs shall be reviewed by the Designated Person (Public Works Officer), who shall make specific recommendations for any asbestos management procedures required. All results shall be maintained in the asbestos management plan file or in permanent storage (Section 4.7 -Recordkeeping).

TABLE 4.2 SUGGESTED ASBESTOS REASSESSMENT AIR SAMPLING PROTOCOL

Location of Samples	Number of Area Samples	Volume of Air (Liters)	Sampling Frequency	Analytical Method	Sampling Period
Inside Building (Note 4)	5*	minimum 3,000	Annually	PCM/TEM	8-hour
Outside Building	5	minimum 3,000	Annually	PCM/TEM	8-hour

*Note 3

PCM - Phase contrast microscopy
TEM - Transmission electron microscopy

NOTES:

1. The periodic air sampling requirements may serve as a database for prevalent airborne fiber levels normally collected prior to planned projects.

2. Air sampling shall occur during normal working hours for full shift 8-hour determination of airborne fiber levels.

3. Minimum of five samples both inside the subject area and outside the subject area shall be taken for each building. For areas over 5,000 S.F., an additional three samples shall be taken inside the subject area for each additional 5,000 S.F.

4. Each set of samples taken will include 10 percent blanks or a minimum of two field blanks and one sample lot blank from laboratory. The blank results shall be averaged and subtracted from the analytical results before reporting.

5. Where air sample analysis is performed on site, 10 percent or at least two asbestos samples up to a maximum of 10 samples, should be sent to a separate American Industrial Hygiene Association (AIHA) accredited laboratory for quality control.

4.9 Air Sampling Requirements for Minor, Major and Emergency Projects

In each situation where asbestos work procedures apply, the Designated Person (Public Works Officer) shall provide for industrial hygiene air sampling of affected workers and building areas in accordance with Table 4.3 - Suggested Air Sampling Protocol During Minor, Major and Emergency Projects. The referenced table is to be used as a guideline and the requirements may be adjusted by the industrial hygienist to fit each specific project. Deviations from Table 4.3 shall be approved by the Designated Person (Public Works Officer) before starting the project (Appendix F, SOUTHNAVFACENGCOM Guide Specification, NFGS-02080B, Removal and Disposal of Asbestos Materials).

Both area and personal air sampling shall be performed to determine the workers' 8 hour, time-weighted average (TWA) airborne fiber level exposures and 30 minute excursion concentrations (sampled during work procedures in which the greatest level of airborne fiber exposure is expected). If the work period is less than 8-hours (i.e. emergency or minor repair projects), air sampling shall be conducted for the full shift duration of the removal or repair project. The recommended frequency of air sampling is presented in Table 4.3.

The specific methods to be used for collecting and analyzing air samples are detailed in the NIOSH Method 7400 (Appendix E). These methods call for air sampling using pumps drawing air at calibrated flow rates through mixed cellulose ester membrane filters having an average pore size of 0.8 micrometers. (This type of filter can be used for analysis by either phase contrast microscopy or by transmission electron microscopy.) During the actual asbestos removal or repair phase, air samples are analyzed on-site using phase contrast microscopy, with the results reported as fibers (longer than 5 micrometers) per cubic centimeter of air (fibers/cc). Air samples collected by the industrial hygienist shall be analyzed on-site by individuals who successfully participate in National Institute for Occupational Safety and Health (NIOSH) Proficiency in Analytical Testing (PAT) program. Quality control samples shall then be forwarded to an American Industrial Hygiene Association (AIHA) accredited lab for confirmations.

Area air samples shall be taken outside the perimeter of the enclosed work area at locations such as air locks, negative air exhausts, potential penetration points or passageways and on adjacent floors above and below the enclosed work area to determine the effectiveness of the work area enclosure. Additional ambient air samples shall be taken outside the building to document ambient conditions which could potentially affect clearance results. Fiber levels which exceed the prevalent fiber levels in the building determined during the Annual Asbestos Reassessment Requirements (Section 4.8) would suggest that the barriers are ineffective in containing fibers to the work area. If fiber levels occur above prevalent levels or above 0.01 fibers/cc (whichever is greater) outside the work area, then the abatement work shall be stopped, fiber reduction techniques implemented and the situation reported immediately to the Designated Person (Public Works Officer). The Contractor has the option of using TEM analysis to

determine asbestos fiber level. The Designated Person (Public Works Officer) or Contractor's Industrial Hygienist, as appropriate, will identify the cause of the leakage, determine the method for reducing airborne fibers to acceptable levels prior to continuing work and perform the subsequent documentation and recordkeeping requirements. All personal and area air sampling data shall be collected and interpreted by a professional industrial hygienist.

During an emergency project, personal and area air sampling shall be conducted as soon as possible and in accordance with Table 4.3 - SUGGESTED AIR SAMPLING PROTOCOL DURING MINOR, MAJOR AND EMERGENCY PROJECTS. All procedures identified in the EMERGENCY CONDITIONS AND FIBER RELEASE EPISODES paragraph of Section 3.5, shall be directed by the Designated Person (Public Works Officer).

Following completion of the asbestos removal or repair project, a final clearance test shall be conducted in accordance with EPA, OSHA and Southern Division NAVFACENGCOM requirements. For the majority of planned projects, final clearance testing shall always be conducted except for minor repair projects such as glove bag removal of 3 linear feet or less of piping insulation. In these cases, air sampling data collected during the minor repair project shall be used to determine compliance with established clearance criteria. If contamination is indicated by fiber levels greater than 0.01 f/cc or background levels (whichever is greater), resulting from analysis of air samples taken during the minor repair procedure, then the work area shall be decontaminated using HEPA vacuum and wet wiping techniques, and final clearance testing will then be performed to document successful decontamination.

TABLE 4.3 SUGGESTED AIR SAMPLING PROTOCOL DURING MINOR, MAJOR AND EMERGENCY PROJECTS

Location of Area Samples	Minimum Number of Area Samples	Minimum Number of Personal Samples	Volume of Air	Analytical Method	Sampling Period
Inside the work area	3	Minimum 25% of work force	*	PCM	Full shift
Inside building, outside of work area	3	N/A	***	**PCM/TEM	Full shift
Outside of building	3	N/A	***	**PCM/TEM	Full shift

* - Depends on filter loading
** - Reference, See Note 6
*** - Volume shall be calculated by industrial hygienist to report a detection level at or below 0.01 f/cc.

NOTES:

1. Personal samples shall be taken to determine workers' 8-hour, time-weighted average (TWA) airborne fiber level exposure. If work period is less than 8 hours, air sampling shall be conducted for the full shift duration of the removal project. Air sampling rate shall be approximately two liters per minute.

2. Personal samples shall be taken for the 8-hour TWA determination of airborne fiber levels from each worker on the first day of asbestos removal. If type-C supplied air respirators operated in pressure demand mode are worn throughout the project and if the asbestos material being removed remains homogeneous, then no additional personal sampling is required. However, it is recommended that personal sampling be conducted at least weekly on all projects. If respirators which are not type-C supplied air, pressure demand mode are worn, personal sampling must be conducted daily unless a database established previously for similar removal procedures and similar asbestos material is available that indicates the exposure concentrations are within the acceptable protection factor for the respirators worn and this database is acceptable to OSHA.

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TABLE 4.3 SUGGESTED AIR SAMPLING PROTOCOL DURING MINOR, MAJOR AND EMERGENCY PROJECTS
(Continued)

NOTES: (Continued)

3. Area air samples inside the work area shall be taken for the 8-hour, TWA determination of airborne fiber levels during the first day of each particular type of asbestos disturbance. It is recommended that area air sampling be conducted at least once weekly on all projects.

4. Area air samples inside the building but outside of the work area shall be taken each day (minimum of three) for the 8-hour TWA determination of airborne fiber levels.

5. Area air samples outside of the building shall be taken for the 8-hour TWA determination of ambient airborne fiber levels during the first day of each asbestos disturbance. It is recommended that area air sampling outside of the building be conducted at least once weekly on all projects. Air samples of negative air handling machine exhaust should be taken daily.

6. Air sample analysis shall be conducted using phase contrast microscopy (PCM) with possible subsequent analysis by transmission electron microscopy (TEM) as determined by the Designated Person (Public Works Officer).

7. During an emergency project personal and area air sampling shall be implemented at the earliest possible time.

4.10 Asbestos Management Control Alternatives

The condition, accessibility and location of asbestos-containing materials shall be evaluated by the Designated Person (Public Works Officer) and reviewed by the Chief Engineer to determine the most appropriate remedial action(s). There are four general approaches to asbestos management under the Operations and Maintenance Plan:

A. Material Removal. The removal of all asbestos-containing material is considered the only final solution to the potential problem of asbestos exposure. If removal is performed properly, the potential for asbestos exposure is eliminated.

B. Enclosure. Enclosure involves construction of airtight walls and ceilings around areas contaminated with asbestos-containing materials. Because asbestos-containing materials will generally need to be removed when the building is renovated or demolished, or when maintenance occurs, enclosure may only be a temporary solution.

C. Encapsulation. Encapsulation involves application of a sealant onto the asbestos-containing material. Because asbestos-containing material will generally need to be removed when the building is renovated or demolished, or during maintenance, encapsulation is only a temporary solution. Encapsulation (e.g., sealing with encapsulating spray, painting) can be a good, short term solution for correcting minor damage to asbestos insulation coverings.

D. Repair and/or cleanup. This method involves returning damaged ACBM to an undamaged condition or to an intact state to prevent fiber release and cleaning up existing asbestos-containing debris.

4.11 Work Procedures and Responsibilities

Asbestos-containing materials present in buildings have the potential to release airborne asbestos fibers into the building air when they are disturbed or damaged. It will be the Public Works/Property Management supervisor's or engineering contractor personnel's responsibility to notify the Designated Person (Public Works Officer) immediately upon discovery of any potential disturbance to or damage of asbestos-containing materials, including maintenance activities or projects which may affect asbestos-containing material directly or indirectly.

Once the Designated Person (Public Works Officer) is advised of the potential for disturbance to asbestos-containing materials, he/she will proceed through the flow chart in Figure 3.2 - Implementation Flow Chart of the Asbestos Management Plan and Section 3.5 - Implementation of the Asbestos Management Plan which summarizes the steps for Figure 3.2 and, if required, determine which specific work procedures in Part 2 - Specific Procedures for Managing Asbestos-Containing Materials, shall be followed.

The Asbestos Management Project Checklist to be used by the Designated Person (Public Works Officer) during actual implementation of asbestos management projects is presented in Part 2 - Specific Procedures for Managing Asbestos-Containing Materials.

4.12 Disposal of ACM and ACE Waste Material

All materials which contain asbestos or have been contaminated with asbestos fibers are subject to special procedures and disposal requirements. Contamination of building materials, fixtures, furniture, and equipment may be caused by failure to use proper containment and isolation procedures during asbestos management projects. Asbestos-containing materials or potentially contaminated materials may include, but are not limited to:

Acoustical material
Attic and wall insulation
Carpets
Ceiling tiles and wall tiles
Cementitious materials (pipe, siding, wallboard, roofing, etc.)
Contaminated soil
Diffusers
Dust from repair to brakes and clutches
Fireproofing
Floor coverings and mastic
Floor penetration packing
Insulation
Light fixtures
Loose debris resulting from routine maintenance cleaning or asbestos removal
Mastic
Mechanical system insulation (pipe, pipe fittings, ducts, equipment)
Plaster materials
Roofing materials (shingles, felts, tar, etc.)
Wiring Insulation
Other suspect miscellaneous asbestos-containing materials (gaskets, curtains, etc.)

All asbestos contaminated materials which cannot be effectively cleaned of asbestos fibers must be disposed as asbestos-contaminated waste. These procedures include the following:

4.12.1 Handling and Transport

Asbestos-containing or contaminated waste shall be sealed and labeled as asbestos in airtight non-reusable containers (e.g., double 6 mil plastic bags, cartons, drums, cans or used in combination) from which fibers cannot escape. Wastes shall be placed within the container(s) in a wetted state to minimize the release of asbestos fibers in the event of container failure. Bags shall be labeled with the owner's name, address, date, phone number and contents.

Asbestos-containing or contaminated waste shall be transported to the approved landfill in closed vehicles (e.g., covered drop boxes or canvas-covered truck boxes). Wastes that are too bulky to enclose in sealed containers may be transported in closed vehicles, provided the wastes are wetted, wrapped and sealed in 6 mil polyethylene to prevent release of asbestos fibers. Caution must be exercised not to introduce excess water into the disposal bags which may cause rupture of the container. Each container must be labeled in accordance with Section 4.4 (warning labels) and Appendix A.

The sealed containers must be transported to a disposal site in a manner which does not permit the release of asbestos fibers into the air and which complies with applicable Federal, State, and local regulations.

4.12.2 Disposal

The non-reusable containers shall be carefully placed in the landfill and shall not be opened, broken or ruptured during disposal. Asbestos containing waste shall then be covered with compacted soil in accordance with EPA and local regulations. The public shall be prohibited from areas where uncovered asbestos is present. Landfill operators shall ensure that compacting equipment does not become contaminated with asbestos dust. Manifests for the asbestos disposal from the Landfill Operator are required for recordkeeping and shall be kept at the NAS Memphis facility in perpetuity.

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Part 2

Specific Procedures For Managing Asbestos-Containing Materials

PART 2 - SPECIFIC PROCEDURES FOR MANAGING ASBESTOS-CONTAINING MATERIALS

This second part of the Operations and Maintenance Plan is designed to assist the Designated Person (Public Works Officer) in identifying activities and external causes which may disturb asbestos-containing or contaminated materials. Additionally, Part 2 presents specific work procedures for managing various asbestos-containing materials or situations by properly trained personnel to reduce employee potential for exposure to airborne asbestos fibers. The materials and situations described in Sections 6-17 are typical and do not necessarily all apply to each building under this O&M Plan. The applicable sections should be determined by consulting the Asbestos Survey Report for each building.

Before performing any procedures that may disturb possible asbestos containing materials, the employee should consult the Asbestos Survey Report to determine if the material has asbestos (see Figure 3.2). If the material has asbestos, then follow the procedures as listed in the O&M Plan. If the material is not asbestos, then continue with work. If there is a question about whether the material is asbestos contaminated, then consult the Supervisor. If the Supervisor has questions, then consult the Designated Person (Public Works Officer).

The general guidelines for implementation of the Asbestos Management Plan are presented in Section 3 of Part 1 with General Management and Administrative Requirements listed in Section 4 of Part 1. The Asbestos Management Project Checklist, Form 5.1 on the following page (to become part of the asbestos management plan recordkeeping, Section 4.7 - Recordkeeping), for use by the Designated Person (Public Works Officer) in tracking the general requirements of an asbestos management project from its initiation to final clearance air sampling, is presented in Part 2. The checklist also documents the proper implementation of the execution requirements and procedures common to all asbestos management projects and the specific work procedures outlined in Sections 6 through 12 of Part 2. The EXECUTION REQUIREMENTS AND PROCEDURES FOR MINOR, MAJOR AND EMERGENCY PROJECTS is presented in Section 5, immediately following the Asbestos Management Project Checklist. Deviations from the general project execution requirements and procedures are identified in the specific material and situation work procedures outlined in Sections 6 through 12.

In addition to the Asbestos Management Project checklist (following page), additional forms provided in Part 6 of the Asbestos Survey shall be completed for response actions selected.

FORM 5.1
ASBESTOS MANAGEMENT PROJECT CHECKLIST

Answer all questions or check off boxes for any attached literature that is utilized as documentation.

A. DATE: _____

B. PROJECT LOCATION: Naval Air Station (NAS) Memphis: _____
Building Number(s): _____ Room Number(s) _____

C. DESCRIPTION OF ASBESTOS-CONTAINING OR -CONTAMINATED MATERIALS:
Piping insulation: ____ Floor tile: ____ Ceiling tile: ____
Other: _____

REASONS FOR REPAIRS OR REMOVAL: Degraded condition: ____
Removed for remodeling: ____ Other: _____

D. SPECIFIC WORK PROCEDURES: See attachment: ____ See Specs: _____
(or) Description below:

E. APPROXIMATE QUANTITY OF MATERIALS: See attachment: ____
See drawings and specs: ____ or Description below:

F. PERSON SUPERVISING PROJECT WORKERS: _____

G. PERSON(S) INVOLVED IN SPECIFIC WORK PROCEDURES: See Attachment: ____
(or) Listed below:

H. AIR SAMPLING CONTRACTOR'S INDUSTRIAL HYGIENIST: _____

I. AIR SAMPLING NAS MEMPHIS INDUSTRIAL HYGIENIST: _____

J. ESTIMATED DURATION OF PROJECT: _____ Actual: _____

K. NAMES OF UNPROTECTED PERSON(S) POTENTIALLY EXPOSED IN AREA PRIOR TO CORRECTIVE ACTION: None: ____ (or) Listed below:

L. Designated Person (Public Works Officer)
NAME:_____

The following items must be checked off as being completed (with any additional comments) prior to implementing the specific work procedures (Except as noted by "*" which will be checked off at project completion):

1. Flow chart (Fig. 3.2) for Implementation of the Asbestos Management Plan (Section 3.4) was followed: Yes: ____ No:____ Reason if not followed:

2. Equipment and supplies and selected references required are available (Section 3.2): Yes: ____ No: ____ Comments if answer is "No":

3. Workers have received required training: Yes: ____ No: ____ Comments if answer is "No":

4. Government regulations are followed (Section 4.2) and are available at job site: Yes: ____ No.: ____ Comments if answer is "No":

5. All notifications and permits are obtained (Section 4.3): Yes:____ No:____ Comments if answer is "No":

6. Warning signs are posted (Section 4.4.): Yes:____ or No:____ Comments if answer is "No":

7. All workers involved in project have had the required physical examinations (Section 4.5): Yes:____ No:____ Comments if answer is "No":

8. Personal protective equipment required is available (Section 4.6): Yes:____ No:____ Comments if answer is "No":

9. Air sampling arrangements have been made for air sampling before, during and after project (Section 4.9): Yes:____ No:____ Comments if answer is "No":

10. Copies of specific procedures for managing asbestos-containing materials in Part 2 are available at the job site: Yes:____ No:____ Comments if answer is "No":

11. *Waste disposal procedures followed (Section 4.12): Yes:____ No:____ Comments if answer is "No":

12. *Recordkeeping of project is complete including written report with air sampling results (Section 4.7): Yes:____ No:____ Comments if answer is "No":

Designated Person or ROICC Signature: _____ Date:_____

5. EXECUTION REQUIREMENTS AND PROCEDURES FOR MINOR, MAJOR AND EMERGENCY PROJECTS

5.1 Preparation (See also Appendix F, SOUTHNAVFACENGCOM Guide Specification, NFGS-02080B, Removal and Disposal of Asbestos Materials)

5.1.1 Work Areas

5.1.1.1 Restrict entry into the area by persons other than those necessary to perform the project, either by physically isolating the area or by scheduling.

5.1.1.2 Post signs to prevent entry by unauthorized persons.

5.1.1.3 Shut down and lock-out electric power. Provide ground-fault interrupter circuits as temporary power source for electrical equipment and lighting. Ensure safe installation of temporary power sources and equipment per applicable electrical code requirements. For projects where no potential contact with electric power is possible, this paragraph does not apply. Glovebag removal procedures do not typically require shut down of electric power.

5.1.1.4 Isolate (and shut down, if possible) heating, cooling, ventilating air systems to prevent contamination and fiber dispersal to other areas of the structure. Prior to sealing the heating, cooling and ventilation air system, contractor shall pre-clean with HEPA equipped vacuum all accessible duct work and air handling system equipment. Remove and dispose of all air system filters as asbestos-contaminated waste. Following completion of project install new air system filters. During the work, all vents within the work area shall at a minimum be double sealed with 6 mil polyethylene and secured with duct tape.

5.1.1.5 Remove all uncontaminated removable furniture, equipment and/or supplies from the work area, or completely cover with two layers of 6 mil polyethylene sheeting sealed with duct tape.

5.1.1.6 Seal off all penetrations and openings to the work area, including but not limited to corridors, doorways, ducts, vents, grilles, diffusers, etc. with at a minimum two layers of 6 mil polyethylene sheeting sealed with duct tape. Doorways and corridors which will not be used for passage during work must be sealed with a minimum two layers of 6 mil polyethylene.

5.1.1.7 Pre-clean fixed objects within the proposed work areas, using HEPA filtered vacuum equipment and wet cleaning methods as appropriate, and enclose with protective barriers of plywood (for added protection where construction project may damage sensitive equipment) covered with minimum 2 layers of 6 mil polyethylene sheeting sealed with duct tape.

5.1.1.8 Pre-clean the proposed work areas using HEPA filtered vacuum equipment and wet cleaning methods as appropriate. Methods that raise dust, such as dry sweeping or vacuuming with equipment not equipped with HEPA filters shall not be used.

5.1.1.9 Cover floor and wall surfaces with polyethylene sheeting sealed with duct tape. Use a minimum of two layers of 6 mil polyethylene on floors. Cover floors first so that polyethylene extends at least 18 inches up on walls, then cover walls with a minimum of 2 layers of 6 mil opaque polyethylene sheeting to the floor level, thus overlapping the floor material by a minimum of 16 inches. Where the area adjacent to the work area is accessible to the public, construct a solid barrier on the public side of the sheeting to protect the sheeting. Construct barrier with nominal 2 x 4 wood or metal studs 16" on center, securely anchored to prevent movement, covered with a minimum 1/2" plywood.

5.1.1.10 Provide warning signs at each visual and physical barrier per OSHA requirements.

5.1.1.11 Build air locks at entrances to and exits from work areas. (OSHA Standard 29 CFR 1926.58) in Appendix B.

5.1.1.12 Install negative air handling machines in sufficient quantities to provide a minimum of four air exchanges per hour. The calculations for determining how many air handling machines are required is as follows: The volume (in ft^3) of the work area is determined by multiplying the floor area by the final work area ceiling height. The total air flow requirement (in ft^3/min) for the work area is determined by dividing this volume by the recommended air change rate (i.e., one air change every 15 minutes or 4 air changes per hour).

Total air flow requirement in ft^3/min = volume of work area (in ft^3)/15 min

The number of air handling units needed (not including reserve units) for the application is determined by dividing the total ft^3/min by 75% of the rated capacity of the air handling unit.

Number of air handling units needed = [Total air flow requirement in ft^3/min]/[75% of Rated Capacity of unit (in ft^3/min.)] (not including reserve)

At least one reserve negative air handling machine shall be on site in the event of a mechanical breakdown or for routine unit shut-down for maintenance and filter changeout. If the negative air handling machines in use are not working at estimated capacity, reserve units shall be used to achieve the total air flow requirement, and additional units shall be provided immediately to fulfill the reserve functions.

5.1.1.13 Maintain emergency and fire exits from work areas.

5.1.1.14 For more information, refer to SOUTHNAVFACENGCOM Guide Specification, NFGS-02080B, Removal and Disposal of Asbestos Materials, Appendix F.

5.1.2 Personnel Decontamination Facility

5.1.2.1 Build suitable framing or use existing rooms connected with framed-in tunnels if necessary and line with minimum of 2 layers of 6 mil polyethylene on walls and ceiling and minimum of 2 layers of 6 mil polyethylene on floor, sealed with duct tape at lap joints in the polyethylene. A permanent mobile decontamination unit (Ref. Appendix B in the OSHA Standard 29 CFR 1926.58) may be acceptable.

5.1.2.2 Access between any two rooms within the personnel decontamination facility shall be through a polyethylene curtained doorway.

5.1.2.3 Personnel Decontamination Facility: Construct personnel decontamination facility contiguous to the work area consisting of three totally enclosed chambers as follows:

5.1.2.3.1 An equipment room, constituting an airlock, with two polyethylene curtained doorways, one to the work area and one to the shower room.

5.1.2.3.2 A shower room, constituting an airlock, with two polyethylene curtained doorways, one to the equipment room and one to the clean room. Shower room shall contain at least one shower with hot and cold or warm water. Careful attention shall be paid to the shower enclosure to ensure against leakage of any kind. Ensure a supply of soap at all times in the shower room. Shower water shall be filtered through a 5 micron filter to remove asbestos prior to being discharged to sanitary drain or shall be disposed as asbestos waste.

5.1.2.3.3 A clean room with one polyethylene curtained doorway into the shower and one entrance or exit to non-contaminated areas of the building. Clean room shall have sufficient space for secure storage of workers' street clothes, towels, and other non-contaminated items.

5.1.2.3.4 An airlock is formed by two polyethylene curtained doorways a minimum of 3 feet apart.

5.1.2.4 Equipment Decontamination Facility:

5.1.2.4.1 Provide or construct an equipment decontamination facility consisting of two totally enclosed chambers as follows:

5.1.2.4.1.1 A washroom, constituting an airlock, with a polyethylene curtained doorway to a designated area of the work area and a polyethylene curtained doorway to the holding area.

5.1.2.4.1.2 A holding area constituting an airlock, with a polyethylene curtained doorway to the washroom, and a polyethylene curtained doorway to an uncontaminated drum load out area.

5.1.2.5 For more information, refer to SOUTHNAVFACENGCOM Guide Specification, NFGS-02080B, Removal and Disposal of Asbestos Materials, Appendix F.

5.1.3 Separation of Work Areas from Occupied Areas.

5.1.3.1 Isolate parts of the building required to remain in use from parts of the building that will undergo asbestos removal, encapsulation or enclosure by means of airtight barriers, constructed as follows:

5.1.3.1.1 Build suitable wood or metal framing and apply 3/8" minimum thickness plywood sheathing on work side. Seal all seams with watertight caulking material. The framing and sheathing is required if no existing walls are available to be used as support for the polyethylene, such as a project located in an open floor area.

5.1.3.1.2. Cover sheathing on interior and exterior with minimum of two layers of 6 mil polyethylene sheet, sealed with duct tape.

5.1.4 Maintenance of Enclosure Systems:

5.1.4.1 Ensure that barriers and polyethylene linings are effectively sealed and taped. Repair damaged barriers and remedy defects immediately upon discovery.

5.1.4.2 Visually inspect enclosures at the beginning, during and end of each work period.

5.1.4.3 Use smoke tube methods to test effectiveness of barriers daily.

5.1.4.4 For more information, refer to SOUTHNAVFACENGCOM Guide Specification, NFGS-02080B, Removal and Disposal of Asbestos Materials, Appendix F.

5.1.5 Asbestos removal, enclosure or encapsulation work shall not commence until the Asbestos Management Project Checklist is completed and signed by the Designated Person (Public Works Officer).

5.2 Asbestos Removal, Encapsulation and Enclosure

The following procedures are typical for large scale major projects. For minor (small scale, short duration) projects as defined in Sections 6 through 17 for each type of material, portable containment

partition barriers may be substituted for full containment. Also, other requirements, such as negative pressure differential and showers immediately contiguous to the work area (vs. double suits and walking to nearest shower) may be relaxed at the discretion of the Designated Person (Public Works Officer) based on the friability and quantity of the material. However, no work shall be performed which is not in accordance with current interpretation of applicable regulations.

5.2.1 Asbestos Removal

5.2.1.1 Prepare site in accordance with Section 5.1 - Preparation.

5.2.1.2 Make sure negative air handling equipment is installed and operating (not required when repairing small exposed ends of asbestos-containing material with duct tape or encapsulant or for similar tasks).

5.2.1.3 Remove all ceiling systems, lights and diffusers necessary to obtain access to asbestos-containing or contaminated materials and extend containment to include space above ceiling.

5.2.1.4 Remove all asbestos-containing materials as specified in the Asbestos Management Project Checklist (Form 5.1).

5.2.1.5 Spray asbestos material continuously with amended water, using airless spray equipment capable of providing a "mist" application to reduce the release of fibers. Saturate material sufficiently to wet it to substrate without causing excess dripping or delamination of the material. Spray asbestos material repeatedly during work process to maintain wet condition and to minimize asbestos fiber dispersion (not required for encapsulation or enclosure).

5.2.1.6 Remove saturated asbestos material in small sections. As it is removed, pack material in sealable polyethylene bags of 6-mil minimum thickness and seal in either labeled second polyethylene bags (double bagging) or in labeled drum containers for transport. Material shall not be allowed to dry out prior to insertion into container. Where asbestos material is applied to a gypsum or fiber substrate or other material which may be difficult to fully decontaminate, both the substrate and the asbestos materials may be removed (not required for encapsulation or enclosure).

5.2.1.7 Seal the filled containers. Place caution labels on containers in accordance with OSHA regulation 29 CFR 1910.1001 and 29 CFR 1926.58. Clean external surfaces of bags or drum containers thoroughly by wet spraying in the designated area of the work area that is part of the equipment decontamination enclosure system. Move containers to washroom, wet clean each container thoroughly, and move to holding area pending removal to uncontaminated areas (not required during encapsulation or enclosure unless visible asbestos debris is observed). Ensure

that containers are removed from the holding area by workers who have entered from uncontaminated areas dressed in clean protective clothing and respirators. Ensure that workers do not enter from uncontaminated areas into the washroom or the work area; ensure that contaminated workers do not exit work area through equipment decontamination enclosure system.

5.2.1.8 After completion of removal work, surfaces from which asbestos has been removed shall be nylon brushed and/or wet sponged or cleaned by an equivalent method to remove all visible material. During this work, the surfaces being cleaned shall be kept wet (not required for encapsulation or enclosure).

5.2.1.9 Asbestos-containing material which is to remain in place in the work area can be encapsulated with a heavy mastic or paint. The encapsulant should be applied gently and in accordance with manufacturer's recommendations to minimize the disturbance of the asbestos-containing material. The same decontamination procedures used for removal shall be used if visual asbestos debris results from the encapsulation process.

5.2.1.10 Asbestos-containing material which is to remain in place in the work area can be enclosed air- and water-tight using aluminum jackets, wood partitions, or any other method of construction (sealed with appropriate caulking compound) which prevents direct physical contact with the asbestos-containing material. The same decontamination procedures used for removal shall be used if visual asbestos debris results from the enclosure process.

5.2.2 Asbestos Encapsulation and Enclosure

5.2.2.1 Prepare site in accordance with Section 5.1 - Preparation.

5.2.2.2 The NAS Memphis contracted professional Industrial Hygienist shall closely monitor and supervise the encapsulation or enclosure work to ensure protection of the workers and prevent asbestos contamination of the environment in accordance with SOUTHNAVFACENGCOM Guide Specification, NFGS-02080B, Removal and Disposal of Asbestos Materials (Appendix F). Secure the area where work is to be performed against unauthorized entry and erect warning signs and temporary barricades. At the conclusion of the work, the Industrial Hygienist will perform the final inspection and testing to determine satisfactory completion in accordance with the SOUTHNAVFACENGCOM Guide Specification, NFGS-02080B, Removal and Disposal of Asbestos Materials. The Navy Southern Division shall use their Designated Industrial Hygienist to perform a confirmation final inspection and testing. When the area is found to be acceptable to the NAS Memphis representative, the warning signs and temporary barricades will be removed and the area will be released as decontaminated.

5.2.2.3 Encapsulation of Architectural Finish: Provide encapsulation where shown on the design drawings and in accordance with

SOUTHNAVFACENGCOM Guide Specification, NFGS-02080B, Removal and Disposal of Asbestos Materials (Appendix F). Delivery and Storage: Deliver materials to the job site in original, new and unopened packages and containers bearing the manufacturer's name and label, and the following information:

5.2.2.3.1 Name or title of material

5.2.2.3.2 Manufacturer's stock number and date of manufacture

5.2.2.3.3 Manufacturer's name

5.2.2.3.4 Thinning instructions.

5.2.2.3.5 OSHA Material Safety Date Sheet (MSDS). MSDS shall be received and reviewed prior to approval of materials to be used.

5.2.2.4 Quality Assurance: Install spray-on materials by a firm and personnel approved by the manufacturer of the primary materials. Submit written Performance Warranty, executed by the manufacturer and co-signed by the contractor, agreeing to repair or replace spray-on work which has cracked, fallen from substrate, or otherwise deteriorated to a condition where it would not perform effectively for its intended purposes due substantially to defective materials or workmanship and not due to abuse by occupants, improper maintenance, non-foreseeable ambient exposures or other causes beyond anticipated conditions and manufacturer's or contractor's control.

5.2.2.5 Acceptable encapsulants: Penetrating and bridging encapsulants shall be rated acceptable when tested under the procedures of: BATTLELLE COLUMBUS LABORATORIES' TESTS FOR THE EVALUATION OF ENCAPSULANTS FOR FRIABLE ASBESTOS-CONTAINING MATERIALS. An updated list is maintained by the EPA.

5.2.2.5.1 Prior to general application of the encapsulating material, the professional industrial hygienist shall require testing to ensure application of the sealer will not cause the base material to fail and allow the sealed base material to fall of its own weight or separate from the substrate. Do not commence application of encapsulating materials until all removal work required within the work area has been completed. Before beginning work with any material for which a Material Safety Data Sheet has been submitted, provide workers with the required protective equipment. Require that appropriate protective equipment be used at all times. In addition to protective breathing equipment required by OSHA requirements or by this specification, use combination HEPA/OV (organic vapor) respirator cartridges with negative air purifying when an organic solvent-based encapsulant is used. Provide worker protection, respiratory protection, complete enclosure of work area and

decontamination facilities in accordance with SOUTHNAVFACENGCOM Guide Specification, NFGS-02080B, Removal and Disposal of Asbestos Materials (Appendix F).

5.2.2.5.2 Examine existing conditions to determine if the friable asbestos material to be encapsulated remains sufficiently bonded to receive the encapsulation process and if process will effectively prevent release of asbestos fibers from the material. If the existing asbestos material is loose or deteriorated, immediately notify the NAS Atlanta representative that removal of friable asbestos material must be accomplished before encapsulation.

5.2.2.5.3 Comply with all manufacturer's instructions for particular conditions of installation in each case. Consult with manufacturer's technical representative for conditions not covered. Encapsulate all surfaces in full compliance with manufacturer's procedures. At completion of encapsulation and before removal of work area enclosures and negative pressure system, decontaminate space in accordance with requirements specified in the SOUTHNAVFACENGCOM Guide Specification, NFGS-02080B, Removal and Disposal of Asbestos Materials (Appendix F). At completion of work, submit manufacturer's record of inspection of completed work and Manufacturer's Performance Guarantee executed by both the manufacturer and contractor.

5.3 Repair of ACM Insulation and Lagging

5.3.1 Products: Provide all material required for an adequate repair project. Mineral wool insulating cement, job mixed and manufactured for use on plumbing equipment, water proof cement pre-mixed or job mixed, manufactured for coating of thermal insulation laggings. Non-woven fibrous glass mat felt approximately 3/32" thick, fabricated from glass fibers. Open weave glass fiber mat cloth with approximately 1/4" openings in weave, fabricated from glass fibers twisted or braided into strands approximately 1/128" in diameter. Bridging type encapsulant. If area to be repaired and encapsulated has potential for future damage or will be walked upon, use a high temperature, high strength mastic coating layered at 1/16 inch thick minimum.

5.3.2 Procedures:

The following procedures are typical for minor (small scale, short duration) repair projects. Refer to Sections 6 through 17 for additional procedural information for each type of material. Portable containment partition barriers may be substituted for full containment. Also, other requirements, such as negative pressure differential and showers immediately contiguous to the work area (vs. double suits and walking to nearest shower) may be relaxed at the discretion of the Designated Person (Public Works

Officer) based on the friability and quantity of the material. However, no work shall be performed which is not in accordance with current interpretation of applicable regulations.

5.3.2.1 Piping: Remove loose material with HEPA vacuum. No existing jacket material is to be removed. Fill holes with mineral wool insulating cement and cover damaged areas with non-woven fibrous glass mat completely saturated with bridging type encapsulant. Wrap open joints with non-woven fibrous glass mat embedded in bridging type encapsulant. Smooth mat to a wrinkle free condition. Allow to dry and coat entire surface of mat with an additional coat of bridging type encapsulant or high strength mastic and brush to a smooth uniform appearance.

5.3.2.2 Fittings: Patch damaged fittings as required, using mineral wool insulating cement. Smooth insulation to a uniform appearance, continuous with and not overlapping adjacent straight insulation runs. Cover entire surface of fitting with non-woven fibrous glass mat embedded in bridging type encapsulant. Stretch to conform to shape of fitting and smooth to a uniform appearance without wrinkles. Overlap jackets of adjacent straight insulation sections by 3". Allow to dry and coat entire surface of mat with bridging type encapsulant and brush to a smooth finished appearance.

5.3.2.3 Equipment Laggings: (Hot water tanks, converters, etc.). Fill damaged portion of lagging with mineral wool insulating cement and cover with non-woven fibrous glass mat completely embedded in bridging type encapsulant. Coat area of repair and six inches on all sides with bridging type encapsulant, brush out to a uniform appearance. Completely coat laggings which do not possess a canvas jacket with two coats of bridging type encapsulant.

5.3.2.4 Boiler and Breeching Laggings: Fill damaged portions of laggings with mineral wool insulating cement. Coat entire surface of lagging with 1/4" minimum thickness of rated insulating cement reinforced with openweave glass fiber mat. Trowel surface smooth finish.

5.4 Decontamination of Work Area

5.4.1 Remove visible accumulations of asbestos material and debris. Wet clean or clean with HEPA vacuum all surfaces within the work area to remove asbestos residue.

5.4.2 After cleaning, perform a complete visual inspection of the work area to ensure that the work area is free of any debris or residue.

5.4.3 Upon completion of the visual inspection, notify the Designated Person (Public Works Officer) or ROICC as appropriate, in advance that the work area is ready for review.

5.4.4 Upon successful compliance with the review, encapsulate surfaces (must be clean and dry) from which asbestos material has been removed. Apply lock-down encapsulant in sufficient amounts to render the affected surface's tacky to the touch.

5.4.4.1 During lock-down encapsulation procedures, apply either bridging or penetrating-type encapsulant in accordance with the manufacturer's recommendation. Apply encapsulant using airless spray equipment.

5.4.4.3 Because application by spraying could cause dissemination of residual fibers, encapsulant must be applied with as much caution and at as low a nozzle pressure as possible. Encapsulation is typically applied in two coats of contrasting pigment with a 24 hour drying period before application of the second coat.

5.4.5 Upon completion of encapsulation work, notify the Designated Person (Public Works Officer) or ROICC as appropriate, in advance that the encapsulated surfaces are ready for inspection.

5.4.6 Upon successful compliance with the inspection of the Designated Person (Public Works Officer) or ROICC as appropriate, remove outer layer of polyethylene on the walls and floor. Inner polyethylene layer and critical barriers covering vents, grilles, diffusers, etc. shall remain in place.

5.4.7 Wet clean work area, wait 24 hours to allow for settlement of dust, and again wet clean, or clean with HEPA vacuum equipment, the surfaces within the work area. After the completion of the second cleaning operation, perform complete visual inspection of the work area to ensure that work area is free of visible dust and debris. Once approval is obtained from Designated Person (Public Works Officer) or ROICC as appropriate, remove remaining layer of polyethylene on the walls (critical barriers shall remain in place) and clean any debris generated as a result of the dismantling operation.

5.4.8 Sealed drums, bags, and equipment used in work area shall be included in the clean-up and shall be removed from the work area, via the Equipment Decontamination Enclosure at the appropriate time in the cleaning sequence.

5.4.9 Upon completion of the second cleaning operation, notify the Designated Person (Public Works Officer) or ROICC as appropriate, that the work area is ready for review and Clearance Testing. Refer to Section 4.9, Air Sampling Requirements for Minor, Major and Emergency Projects.

5.4.10 After notification from the Designated Person (Public Works Officer) or ROICC as appropriate, that the work area has successfully passed clearance testing, remove critical barrier and proceed with any remaining repairs or refinishing work and the re-establishment of objects and systems as specified.

5.5 Re-establishment of Objects and Systems

5.5.1 When clean-up and installation of replacement finishes are complete:

5.5.1.1 Relocate objects moved to temporary locations in the course of the work to their former positions.

5.5.1.2 Re-secure mounted objects removed in the course of work in their former positions.

5.5.1.3 Re-establish HVAC, mechanical and electrical systems in proper working order. Install new air system filters as required.

5.5.1.4 Install new ceiling system and architectural replacement items as required.

5.6 Glovebag Removal Procedure

The glovebag consists of 6 or 12 mil bag fitted with long sleeve gloves, a tool pouch and an opening used for water application. Contractors shall purchase ready-made bags. The size, quality, style and cost vary depending on the manufacturer. In addition to the glovebag, several other tools and materials are required to perform the project successfully. These materials include:

5.6.1 Materials

5.6.1.1 Glovebag (one or more depending on project size)

5.6.1.2 Pump-up garden sprayer (2-3 gallon size) - airless sprayer-type

5.6.1.3 Amended water (surfactant)

5.6.1.4 Duct tape (3-inch width)

5.6.1.5 Polyethylene disposal bags (6 mil)

5.6.1.6 Smoke tubes with aspirator bulb

5.6.1.7 HEPA-filtered vacuum cleaner

5.6.1.8 Bone saw

5.6.1.9 Utility knife with retractable blade

5.6.1.10 Wire cutters

5.6.1.11 Tin snips (if aluminum jacket is present)

5.6.1.12 Polyethylene plastic (roll of 4 and 6 mil)

5.6.1.13 Dual cartridge respirators with high efficiency cartridges

5.6.1.14 Disposable full-body suits with hood and foot coverings

5.6.1.15 Small scrub brush

5.6.1.16 Stapler

5.6.1.17 Several rags

5.6.1.18 Wettable cloth

5.6.1.19 Asbestos warning signs and labels

5.6.1.20 Re-insulation materials as necessary

5.6.1.21 HEPA equipped air handling unit(s) (not necessarily required depending on scope of removals performed by in-house personnel)

5.6.2 Before Starting the Project

Two persons are required to perform the glovebag removal project. A third person is often desirable, however, to assist with supplies, keep unwanted visitors out of the area, and to conduct the air monitoring. Each of these team members require training on the use and limitations of glovebag removal projects. They shall be included in the respiratory protection program and medical surveillance program.

Before any work begins, all necessary materials and supplies shall be brought into the work area. All employees not required to be in the area shall be temporarily relocated to a non-asbestos work area. The HVAC serving the work area shall be shut down and sealed. The work area shall be isolated air and water tight from the non-work areas by the installation of 2 layers of 6 mil polyethylene at all critical penetration points. The work areas shall be effectively isolated from unauthorized personnel. Warning signs shall be posted on the perimeter to minimize the chance of unauthorized visitors entering this area. Contractor shall install and have operating HEPA equipped air handling unit or units as required to create a minimum negative pressure differential of 0.02 inches of water inside the work area with respect to non-work areas. If it is not feasible to create a negative pressure isolation system, or if the quantity and nature of the work is limited (not more than one glovebag operation), then the Designated Person (Public Works Officer) may waive the negative pressure isolation system requirement. Employees shall be trained in emergency procedures should the glovebag rupture. This usually includes wet cleaning and/or HEPA vacuuming procedures and a shower facility available near the work area. With this preparation phase completed, the following generic guidelines may be used for most pipe insulation projects. REMEMBER! NEVER PERFORM GLOVEBAG REMOVAL ON HOT PIPES (OVER 150 °F.) This may cause the bag or gloves to melt over the workers' hands and arms.

5.6.3 Removal Procedures

5.6.3.1 Following the manufacturer's directions, mix the surfactant with water in the garden sprayer.

5.6.3.2 Have each employee put on a cartridge respirator and check the face-fit.

5.6.3.3 Have each employee put on a disposable full-body suit. Remember, the hood goes over the respirator straps.

5.6.3.4 Check the pipe where the work will be performed. If it is damaged (broken insulation, hanging, etc.), wrap the entire length of the pipe in polyethylene plastic and "candy stripe" it with duct tape. A common error when performing glovebag work is forgetting that loose pipe insulation several feet or even several yards away from the glovebag work may be jarred loose by the activity. This is one of the common causes of high airborne fiber concentrations during glovebag work. The other problem is failure to clean up debris on the floor and other surfaces which has accumulated and contains asbestos. If the pipe is undamaged it is still necessary to place one layer of duct tape around the pipe at each location where the glovebag will be attached. This serves two purposes. First, it gives a good surface on which to seal the ends of the glovebag. Second, it minimizes the chance of releasing fibers when the tape at the ends of the glovebag is peeled off at the completion of the job.

5.6.3.5 Slit the top of the glovebag open (if necessary) and cut down the sides to accommodate the size of the pipe (about two inches longer than the pipe circumference). One brand has a zipper top and straps at each end, facilitating installation of the bag on the pipe.

5.6.3.6 Place the necessary tools into the pouch located inside the glovebag. This will usually include the bone saw, utility knife, rags, scrub brush, wire cutters, tin snips and wettable cloth. Note: It is easiest to pre-cut the wettable cloth at this point. Cut out a donut shape with the inner diameter 1/2-inch smaller than the diameter of the pipe beneath the insulation. The outer diameter of the donut shall be three inches longer than the diameter of the pipe insulation being removed. Finally, cut a slit in each of the two donuts so they can be slipped around the pipe.

5.6.3.7 Place one strip of duct tape along the edge of the open top slit of the glovebag for reinforcement.

5.6.3.8 Place the glovebag around the section of pipe to be worked on and staple the top together through the reinforcing duct tape. Staple at intervals of approximately one inch. Next, fold the stapled top flap back and tape it down with a strip of duct tape. This shall provide an adequate seal along the top. Next, duct tape the ends of the glovebag to the pipe itself, previously covered with plastic or duct tape (see 5.6.3.4).

5.6.3.9 Using the smoke tube and aspirator bulb, place the tube into the water sleeve (two-inch opening to glovebag). By squeezing the bulb, fill the bag with visible smoke. Remove the smoke tube and twist the water sleeve closed. While holding the water sleeve tightly, gently squeeze the glovebag and look for smoke leaking out, especially at the top and ends of the glovebag. If leaks are found, they shall be taped closed using duct tape and the bag shall be re-tested with smoke. All glovebag manufacturer's instructions should be followed.

5.6.3.10 Insert the wand from the water sprayer through the water sleeve. Using duct tape, tape the water sleeve tightly around the wand to prevent air leakage.

5.6.3.11 One person places his hands into the long-sleeved gloves while the second person directs the water spray at the work.

5.6.3.12 If the section of pipe is covered with an aluminum jacket, this is removed first using the wire cutters to cut any bands and the tin snips to remove the aluminum. It is important to fold the sharp edges in to prevent cutting the bag when it is placed in the bottom. Use caution to prevent cuts--these edges are sharp! However, aluminum jacket is not to be removed prior to installing glovebag.

5.6.3.13 With the insulation exposed, use the bone saw to cut the insulation at each end of the section to be removed inside the glovebag. Note: A bone saw is a serrated heavy-gauge wire with ring-type handles at each end. Throughout this process, water is sprayed on the cutting area to keep dust to a minimum. Care should be taken to not damage the pipe itself with the bone saw.

5.6.3.14 Once the ends are cut, the section of insulation shall be slit from end to end using the utility knife. The cut shall be made along the bottom of the pipe and water continuously supplied. Again, care shall be taken when using the knife not to puncture the bag. Some insulation may have wire to be clipped as well.

5.6.3.15 Spray all tools with water inside the bag and place back into pouch.

5.6.3.16 The insulation can now be lifted off the pipe and gently placed in the bottom of the bag.

5.6.3.17 Using the scrub brush, rags and water, scrub and wipe down the exposed pipe inside the glovebag. Note: The inexpensive horse rub-down mittens work well for this.

5.6.3.18 Place and wet the donut-shaped pieces of wettable cloth over the exposed ends of insulation remaining on the pipe. Wettable cloth is a plaster impregnated fiberglass webbing available at many hardware and/or plumbing supply stores.

5.6.3.19 Remove the water wand from the water sleeve and attach the small nozzle from the HEPA-filtered vacuum. Turn on the vacuum only briefly to collapse the bag.

5.6.3.20 Remove the vacuum nozzle and twist the water sleeve closed and seal with duct tape.

5.6.3.21 From outside the bag, pull the tool pouch away from the bag and twist it to separate it from the bag. Place duct tape over the twisted portion, then cut the tool bag from the glovebag, cutting through the twisted/taped section. In this manner, the contaminated tools may be placed directly into the next glovebag without cleaning. Alternatively, the tool pouch with the tools can be placed in a bucket of water, opened underwater, and the tools cleaned and dried without releasing asbestos into the air. Note: Rags and the scrub brush cannot be cleaned in this manner and shall be discarded with the asbestos waste. If more than one adjacent section of pipe is to be removed, the glovebag may be loosened at each end and slid along the pipe to the next section. In this case, the tools would remain in the bag for continued use.

5.6.3.22 With the removed insulation in the bottom of the bag, twist the bag several times and tape it to keep the material in the bottom during removal of the glovebag from the pipe.

5.6.3.23 Slip a 6 mil disposal bag over the glovebag (still attached to the pipe). Remove the tape and open the top of the glovebag and fold it down into the disposal bag.

5.6.3.24 Remove the disposable suits and place these into the bag with the waste.

5.6.3.25 Twist the top of the bag closed, fold this over, and seal with duct tape. Label the bag with an asbestos warning label.

5.6.3.26 Using a clean damp rag, wipe the exterior of the respirator and leave the work area. Remove the respirator.

5.6.3.27 Asbestos-containing material must be disposed of at an approved landfill in accordance with EPA, state and local regulations.

6. MECHANICAL SYSTEM INSULATION INCLUDING MASTIC (PIPING, DUCTS AND MECHANICAL EQUIPMENT)

Typical activities and external forces which may disturb insulation materials and increase the risk of building occupants' exposure to airborne asbestos fibers include the following:

A. Installation or removal of piping, equipment and supports.

B. Installation, removal or repair of valves, fittings, or other piping appurtenances.

C. Removal of insulated covering on piping, ducts or tanks.

D. Repair of accidentally damaged insulation.

E. Repair of portions of insulated equipment.

F. Water damage, fire damage, earthquakes or other natural disasters.

G. Replacement of asbestos gaskets (Note: All gaskets shall be assumed to contain asbestos, replace when feasible with non-asbestos gasket and label as non-asbestos containing material for future reference.

H. Other activities which could cause damage, abrasions, vibration, etc. to the insulation coverings.

6.1 Minor (Small-Scale, Short Duration Projects) Work Procedures

These procedures are guidelines for minor work involving 3 square/linear feet or less of asbestos-containing materials.

A. Proceed through Flow Chart, Figure 3.2 - Implementation Flow Chart of the Asbestos Management Plan and corresponding written description in Section 3.5.

B. Complete Asbestos Management Project Checklist (Form 5.1) at the beginning of Part 2.

C. Proceed through Execution Requirements and Procedures for Minor, Major and Emergency Projects in Section 5 as they apply. If glovebag removal procedures are used, refer to the Glovebag Removal Procedures in Section 5.6. If repair procedures are used, refer to Section 5.3.

D. Use of a portable containment partition barrier may be substituted for full preparation requirements in occupied areas if asbestos material is localized. Negative air requirements and showering requirements shall be addressed by the Designated Person (Public Works Officer) based on the quantity, location, condition, friability and other specific aspects of the work on a case-by-case basis.

6.2 Major Work Procedures

These procedures are guidelines for major work involving asbestos-containing mechanical system insulation in quantities greater than 3 square/linear feet of asbestos.

A. Proceed through Flow Chart, Figure 3.2 - Implementation Flow Chart of the Asbestos Management Plan and corresponding written description in Section 3.5.

B. Complete Asbestos Management Project Checklist (Form 5.1) at the beginning of Part 2.

C. Proceed through Execution Requirements and Procedures for Minor, Major and Emergency Projects in Section 5 as they apply. If glovebag removal procedures are used, refer to the Glovebag Removal Procedures in Section 5.6.

D. Use of a portable containment partition barrier may be substituted for full preparation requirements in occupied areas if asbestos material is localized. Negative air requirements and showering requirements shall be enforced regardless of method used.

7. FLOOR COVERINGS AND MASTIC

Typical activities and external forces which may cause the disturbance of floor covering material and increase the risk of building occupants' exposure to airborne asbestos fibers include the following:

A. Replacement of damaged floor covering. (Note: Methods that allow floor tile to be removed intact may be allowed under certain conditions. If mastic is asbestos-containing, it cannot be disturbed unless additional precautions are taken.)

B. Repeated floor covering abrasion from mechanical equipment

C. Breakage from short duration, high intensity loads

D. Coring of floor slabs

E. Construction, renovation or demolition damage such as nailing, screwing, sawing, cutting, grinding or drilling into the floor.

F. Water damage, fire, earthquake, or other natural disasters.

G. Routine maintenance activities including stripping, grinding, sanding, and buffing.

H. Other activities which could cause damage, abrasions, etc. to the coverings.

7.1 Procedures for Cleaning Asbestos-Containing or Asbestos-Contaminated Floor Coverings

A. Procedures for cleaning asbestos-containing or asbestos-contaminated floor coverings shall be limited to wet stripping and waxing only.

B. Dry stripping, grinding or sanding shall not be permitted, however, soft textured buffing pads on electric buffing machines are permissible. If buffing machines are used, their speed is restricted not to exceed 190 RPM.

C. Asbestos respiratory protection is not required if using wet cleaning methods (cleaning methods include stripping, waxing, and buffing).

D. Any change in damage to floor coverings observed during cleaning procedures shall be reported to supervisors.

7.2 Minor (Small-Scale, Short Duration Projects) Work Procedures

These procedures are guidelines for minor work involving 3 square feet or less of asbestos-containing floor coverings.

A. Proceed through flow chart Figure 3.2 - Implementation Flow Chart of the Asbestos Management Plan, and corresponding written description in Section 3.5.

B. Complete Asbestos Management Project Checklist (Form 5.1) at the beginning of Part 2.

C. Proceed through Execution Requirements and Procedures for Minor, Major and Emergency Projects in Section 5 as they apply.

D. Preparation general requirements may be altered by the Designated Person (Public Works Officer) if area remains unoccupied by unprotected workers if the following procedure modifications are followed:

1. Workers equipped with personal protection clothing and respirators shall work in two-man teams.

2. For all procedures, one worker shall continuously spray the floor covering with a surfactant from a garden sprayer while the other worker removes or otherwise disturbs the floor covering. Dry ice or heat may be a suitable method for removing floor covering from mastic. Mastic may then be subsequently removed with a citrus based mastic remover.

3. If drilling, cutting, grinding or sanding of floor covering is conducted, ensure that equipment is equipped with a HEPA vacuum system.

4. Wet wipe and HEPA vacuum work area within a 10 foot perimeter of the floor covering being removed.

5. Dispose of asbestos-containing floor covering in accordance with Section 4.12.

E. Use of a portable containment partition barrier may be substituted for full preparation requirements in occupied areas if asbestos material is localized. Negative air requirements and showering requirements shall be addressed by the Designated Person (Public Works Officer) based on the quantity, location, condition, friability and other specific aspects of the work on a case-by-case basis. (Can be waived if dry ice or heat is used to completely lift up floor covering in tact.)

7.3 Major Work Procedures

These procedures are guidelines for major work involving greater than 3 square feet of asbestos-containing floor covering.

A. Proceed through flow chart Figure 3.2 - Implementation Flow Chart of the Asbestos Management Plan, and corresponding written description in Section 3.5.

B. Complete Asbestos Management Project Checklist (Form 5.1) at the beginning of Part 2.

C. Proceed through Execution Requirements and Procedures for Minor, Major and Emergency Projects in Section 5 as they apply.

D. Preparation general requirements may be altered by the Designated Person (Public Works Officer) if area remains unoccupied by unprotected workers if the following procedure modifications are followed:

1. Workers equipped with personal protection clothing and respirators shall work in two man teams.

2. For all procedures, one worker shall continuously spray the floor covering with a surfactant from a garden sprayer while the other worker removes or otherwise disturbs the floor covering. Dry ice may be a suitable method for removing floor covering from mastic. Mastic may then be removed with a citrus based mastic remover.

3. If drilling, cutting, grinding or sanding of floor covering is conducted, ensure that equipment is equipped with a HEPA vacuum system.

4. Wet wipe and HEPA vacuum work area within a 10 foot perimeter of the floor covering being removed.

5. Dispose of asbestos-containing floor covering in accordance with Section 4.12.

E. Use of a portable containment partition barrier may be substituted for full preparation requirements in occupied areas if asbestos material is localized. Negative air requirements and showering requirements shall be enforced regardless of method used. (Exception-when dry ice or heat is used to completely lift up floor covering intact.)

8. MECHANICAL ROOM DEBRIS

Typical activities and external forces which may create debris in a mechanical room and increase the risk of building occupant exposure to airborne asbestos fibers include the following:

A. Removal of asbestos insulation from fittings, piping or mechanical systems.

B. Physical or water damage to or deterioration of fittings, piping or mechanical systems which are insulated with asbestos-containing materials.

C. Other activities which cause damage, abrasion, etc. to asbestos-containing materials located in the mechanical room.

D. Any activity such as walking, or any physical disturbance (including air erosion) of the debris in locations where the mechanical room is known to be contaminated with asbestos.

8.1 Work Procedures

A. Proceed through flow chart Figure 3.2 - Implementation Flow Chart of the Asbestos Management Plan, and corresponding written description in Section 3.5.

B. Complete Asbestos Management Project Checklist (Form 5.1) at the beginning of Part 2.

C. Proceed through Execution Requirements and Procedures for Minor, Major and Emergency Projects in Section 5 as they apply.

D. In uncontaminated or decontaminated mechanical rooms, proper work procedures must be implemented to assure that any disturbance of asbestos-containing materials does not result in contamination of the mechanical room or of adjacent areas or fixtures. This can be accomplished by use of containment barriers and negative pressure requirements. The Designated Person (Public Works Officer) may waive these requirements based on the nature and quantity of the disturbance and allow substitution with use of glovebag techniques or other approved procedures to prevent any contamination of the mechanical room or adjacent areas or fixtures.

E. In mechanical rooms where asbestos contamination has been confirmed based on bulk sample analysis of the debris or on air sampling analysis results, the mechanical room should be isolated and access restricted to properly trained personnel. Recommended procedures for entering the contaminated mechanical room when necessary for maintenance purposes include the following:

1. All workers will wear appropriate respiratory protection. Half-mask air purifying, or powered air-purifying respirators (PAPR) are recommended as a minimum. Respirators with a higher degree

of protection may be required if personal air sampling results indicate airborne fiber levels which would cause the fiber concentration inside the respirator to exceed 0.01 fibers/cc.

2. All workers will wear personal protective clothing.

3. Reasonable measures should be taken to reduce disturbance of the debris including:

   a. Lightly wetting the debris in the vicinity of the activity.

   b. Spreading a layer of plastic, over the debris in the vicinity of the activity.

4. All fixtures including piping, equipment, etc. should be sprayed with an amended water solution in the vicinity of the activity to reduce the production of potentially contaminated airborne dust from these surfaces.

5. Depending on the extent of the disturbance to the debris, containment barriers, negative pressure requirements and showering requirements may be waived by the Designated Person (Public Works Officer) if the mechanical room is effectively isolated and if other effective means of personnel decontamination can be accomplished such as using double suits, with HEPA vacuuming of the outer suit, and thoroughly washing shoes and other equipment prior to exiting the mechanical room.

F. Debris removal can be accomplished by hand (shoveling the debris into bags or drums) or by using a suction hose device ("Vac-Loader"). Removing all of the ACM in the mechanical room, including the debris, at one time should be considered as a cost saving measure.

9. CEMENTITIOUS TRANSITE-TYPE ASBESTOS MATERIAL (PIPING, SIDING, WALL OR CEILING BOARD, ROOFING, ETC.)

Typical activities and external forces which may cause the disturbance of cement asbestos piping, siding, wallboard or roofing materials and may increase the risk of building occupant exposure to airborne asbestos fibers include the following:

A. Sawing and/or sanding.

B. Coring, drilling or nailing.

C. Breakage from short duration, high intensity impact.

D. Removal and disposal of piping lengths

E. Removal and disposal of full cement asbestos sheets

F. Large scale damage and/or abrasion to existing cement asbestos-containing materials.

G. Water damage, fire, earthquake, or other natural disasters.

H. Other activities which could cause damage, abrasion, vibration, etc.

9.1 Minor (Small-Scale, Short Duration Projects) Work Procedures

These procedures are guidelines for minor work involving 3 square feet or less asbestos-containing cementitious type piping, siding, wallboard or roofing materials.

A. Proceed through flow chart Figure 3.2 - Implementation Flow Chart of the Asbestos Management Plan, and corresponding written description in Section 3.5.

B. Complete Asbestos Management Project Checklist (Form 5.1) at the beginning of Part 2.

C. Proceed through Execution Requirements and Procedures for Minor, Major and Emergency Projects in Section 5 as they apply.

D. Preparation general requirements may be altered by the Designated Person (Public Works Officer) if area remains unoccupied by unprotected workers if the following procedure modifications are followed:

1. Workers equipped with personal protection clothing and respirators shall work in two-man teams.

2. One worker shall continuously spray the cementitious transite-type material with a surfactant from a garden sprayer while the other worker removes the material (Note: Keep cementitious

transite-type material intact during demolition as much as feasible).

3. If drilling or cutting of cementitious transite-type material is conducted, ensure that equipment is equipped with a HEPA vacuum system.

4. Use of portable containment partition barriers may be substituted for the full preparation activities if cementitious transite-type material is localized or on exterior of buildings. However, containment barriers are not required for exterior removals if it is not feasible and if the material can be removed without visible emissions (for removal of non-friable pitched roofing materials, for example). The minimum requirement for external access restriction is to rope off a 30 foot wide perimeter around the removal site.

5. Wet wipe and HEPA vacuum work area within a 10 foot perimeter of the asbestos material being removed.

6. Dispose of asbestos-containing material in accordance with Section 4.12.

E. Negative air requirements and showering requirements shall be addressed by the Designated Person (Public Works Officer) based on the quantity, location, condition, friability and other specific aspects of the work on a case-by-case basis.

9.2 Major Work Procedures

These procedures are guidelines for major work involving greater than 3 square feet of asbestos-containing piping, siding, wallboard or roofing materials.

A. Proceed through flow chart Figure 3.2 - Implementation Flow Chart of the Asbestos Management Plan, and corresponding written description in Section 3.5.

B. Complete Asbestos Management Project Checklist (Form 5.1) at the beginning of Part 2.

C. Proceed through Execution Requirements and Procedures for Minor, Major and Emergency Projects in Section 5 as they apply.

D. Preparation general requirements may be altered by the Designated Person (Public Works Officer) if area remains unoccupied by unprotected workers if the following procedure modifications are followed:

1. Workers equipped with personal protection clothing and respirators shall work in two-man teams.

2. For all procedures, one worker shall continuously spray the cementitious transite-type material with a surfactant from a garden sprayer while the other worker removes or otherwise disturbs the material (Note: Keep cementitious transite-type material intact during demolition as much as feasible).

3. If drilling or cutting of cementitious transite-type material is conducted, ensure that equipment is equipped with a HEPA vacuum system.

4. Use of portable containment partition barriers may be substituted for the full preparation activities if cementitious transite-type material is localized or on exterior of buildings. However, containment barriers are not required for exterior removals if it is not feasible and if the material can be removed without visible emissions (for removal of non-friable pitched roofing materials, for example). The minimum requirement for external access restriction is to rope off a 30 foot wide perimeter around the removal site. Showering requirement shall be enforced regardless of method.

5. Wet wipe and HEPA vacuum work area within a 10 foot perimeter of the material being removed.

6. Dispose of asbestos-containing material in accordance with Section 4.12.

10. WINDOW PUTTY

Typical activities and external forces which may cause the disturbance of window putty material and increase the risk of building occupants' exposure to airborne asbestos fibers include the following:

A. Natural weathering over extended time periods.

B. window pane/frame removal or replacement.

C. Fire damage, earthquakes, or other natural disasters.

D. Vibration from external sources such as mechanical equipment, construction operations, etc.

E. Other activities which could cause damage, abrasions, vibrations, etc. to the window putty.

10.1 Minor (Small-Scale, Short Duration Projects) Work Procedures

These procedures are guidelines for minor work involving three or less square feet asbestos-containing window putty.

A. Proceed through flow chart Figure 3.2 - Implementation Flow Chart of the Asbestos Management Plan, and corresponding written description in Section 3.5.

B. Complete Asbestos Management Project Checklist (Form 5.1) at the beginning of Part 2.

C. Proceed through Execution Requirements and Procedures for Minor, Major and Emergency Projects in Section 5 as they apply.

D. Use of a portable containment partition barrier may be substituted for full preparation requirements in occupied areas if asbestos material is localized. However containment barriers are not required for exterior removals if it is not feasible and if the material can be removed without visible emissions (for removal of complete window frame units, for example). The minimum requirement for external access restriction is to rope off a 30 foot wide perimeter around the removal site. Negative air requirements and showering requirements shall be addressed by the Designated Person (Public Works Officer) based on the quantity, location, condition, friability and other specific aspects of the work on a case-by-case basis. Should fiber levels consistently remain at or below 0.01 fibers/cc, then the Designated Person (Public Works Officer) shall have the option to discontinue protective measures as long as the same window putty materials are being removed with the same procedures.

10.2 Major Work Procedures

These procedures are guidelines for major work involving greater than three square feet asbestos-containing window putty.

A. Proceed through flow chart Figure 3.2 - Implementation Flow Chart of the Asbestos Management Plan, and corresponding written description in Section 3.5.

B. Complete Asbestos Management Project Checklist (Form 5.1) at the beginning of Part 2.

C. Proceed through Execution Requirements and Procedures for Minor, Major and Emergency Projects in Section 5 as they apply.

D. Use of a portable containment partition barrier may be substituted for full preparation requirements in occupied areas if asbestos material is localized. However, containment barriers are not required for exterior removals if it is not feasible and if the material can be removed without visible emissions (for removal of complete window frame units, for example). The minimum requirement for external access restriction is to rope off a 30 foot wide perimeter around the removal site. Negative air requirements and showering requirements shall be enforced regardless of method used. Should fiber levels consistently remain at or below 0.01 fibers/cc, then the Designated Person (Public Works Officer) shall have the option to discontinue protective measures as long as the same window putty materials are being removed with the same procedures.

11. CONTAMINATED SOIL

Typical activities and external forces which may cause asbestos contamination of the soil or may cause the disturbance of existing asbestos-contaminated soil (typically located in crawl spaces and pipe basements), and thereby increase the risk of building occupant exposure to airborne asbestos fibers include the following:

A. Removal of asbestos insulation from fittings, piping or mechanical systems.

B. Physical or water damage to or deterioration of fittings, piping or mechanical systems which are insulated with asbestos-containing materials.

C. Other activities which cause damage, abrasion, etc. to asbestos-containing materials located in the vicinity of soil.

D. Any activity such as walking, crawling, or any physical disturbance (including air erosion) of the soil in locations where the soil is known to be contaminated with asbestos.

11.1 Work Procedures

A. Proceed through flow chart Figure 3.2 - Implementation Flow Chart of the Asbestos Management Plan, and corresponding written description in Section 3.5.

B. Complete Asbestos Management Project Checklist (Form 5.1) at the beginning of Part 2.

C. Proceed through Execution Requirements and Procedures for Minor, Major and Emergency Projects in Section 5 as they apply.

D. In uncontaminated or decontaminated crawl space areas, proper work procedures must be implemented to assure that any disturbance of asbestos-containing materials does not result in contamination of the soil or of adjacent areas or fixtures in the crawl space. This can be accomplished by use of containment barriers and negative pressure requirements. The Designated Person (Public Works Officer) may waive these requirements based on the nature and quantity of the disturbance and allow substitution with use of glovebag techniques or other approved procedures to prevent any contamination of the soil or adjacent areas or fixtures.

E. In crawl spaces where asbestos contamination of the soil has been confirmed based on bulk sample analysis of the soil or on air sampling analysis results, the crawl space should be isolated and access restricted to properly trained personnel. Recommended procedures for entering the contaminated crawl space when necessary for maintenance purposes include the following:

1. All workers will wear appropriate respiratory protection. Half-mask air purifying, or powered air-purifying respirators (PAPR) are recommended as a minimum. Respirators with a higher degree of protection may be required if personal air sampling results indicate airborne fiber levels which would cause the fiber concentration inside the respirator to exceed 0.01 fibers/cc.

2. All workers will wear personal protective clothing.

3. Reasonable measures should be taken to reduce disturbance of contaminated soil including:

   a. Lightly wetting the soil in the vicinity of the activity.

   b. Spreading a layer of plastic, sand and/or gravel over the contaminated soil in the vicinity of the activity.

4. All fixtures including piping, equipment, etc. should be sprayed with an amended water solution in the vicinity of the activity to reduce the production of potentially contaminated airborne dust from these surfaces.

5. Depending on the extent of the disturbance to the contaminated soil, containment barriers, negative pressure requirements and showering requirements may be waived by the Designated Person (Public Works Officer) if the crawl space is effectively isolated and if other effective means of personnel decontamination can be accomplished such as using double suits, with HEPA vacuuming of the outer suit, and thoroughly washing shoes and other equipment prior to exiting the crawl space.

F. If certain areas of the contaminated crawl space (or the entire crawl space) are to be abated so that maintenance work can be accomplished in a less restrictive manner, then several alternatives are available.

1. Removal - This can be accomplished by hand (shoveling the contaminated soil into bags or drums) or by using a suction hose device ("Vac-Loader"). This alternative could be a problem if the contamination of the soil is significant or if there are burial sites of old asbestos insulation.

2. Encapsulation - Effective encapsulation of soil is still a young technology and care must be exercised in selecting and testing the proper encapsulant and installation contractor. If possible other previous installations of the encapsulant should be inspected.

3. Enclosure - Several forms of enclosure can be considered including plastic, sand, gravel, concrete, or combinations of these materials. Care should be exercised in designing this abatement solution to assure proper drainage and accessibility is maintained.

12. ROUTINE MAINTENANCE AND CLEANING

Typical activities and external causes which may involve the disturbance of asbestos-containing materials and increase the risk of exposure to asbestos fibers through routine maintenance and cleaning include the following:

A. Sweeping and vacuuming

B. Replacement or repair of light fixtures or diffusers in ceiling areas.

C. Replacement of ceiling tiles

D. Regular maintenance of piping and mechanical systems.

E. Other activities which could cause damage, abrasion, etc. to asbestos-containing materials.

F. Cleaning of floor coverings (See Floor Coverings and Mastic - Section 10).

The following general procedures shall be utilized as cleaning procedures to decrease the potential for airborne asbestos fiber dispersal.

A. Proceed through flow chart Figure 3.2 - Implementation Flow Chart of the Asbestos Management Plan, and corresponding written description in Section 3.5.

B. Complete Asbestos Management Project Checklist (Form 5.1) at the beginning of Part 2.

1. Small areas of visible dust or debris shall be wet wiped, HEPA vacuumed and disposed of before beginning another area.

2. Walls, floors and furnishings shall be cleaned with a damp cloth and HEPA vacuumed following debris removal.

3. Any asbestos-containing materials which are removed and/or cleaned up shall be bagged in 6-mil polyethylene, placed in labeled drums or double-bagged and disposed of as asbestos-contaminated waste in accordance with Section 4 - General Management and Administrative Requirements.

12.1 Air Handler Filters

Even though asbestos-containing spray-applied fireproofing may not exist in a particular building and no other evidence may have been observed to indicate contamination of air handler filters, the following procedures are presented for use if a situation develops where the air handler filters may have become contaminated.

Typical activities and external forces which may cause the disturbance of air handler filters (containing asbestos or asbestos contaminated) and increase the risk of building occupant exposure to airborne asbestos fibers include the following:

A. Routine filter removal and replacement

B. Maintenance of air handling equipment

C. Other activities which could cause damage, disturbances, etc. to the filters.

The following procedures shall be implemented to minimize potential for airborne asbestos fibers to be dispersed:

A. The personnel performing the activity shall wear asbestos respiratory protection, minimum type to be half-face, dual cartridge HEPA equipped respirators and full body protective clothing.

B. The air handling unit shall be turned off prior to beginning the activity.

C. The room or area in which the maintenance activity is to occur shall be vacated of all personnel not required to perform the maintenance activity.

D. The filters shall be misted with amended water and very carefully removed.

E. The filters shall be double wrapped in 6-mil polyethylene, placed and sealed in drums or double-bagged, labeled and disposed as asbestos-contaminated waste.

F. Accessible surfaces in the vicinity of the air filters shall be wet wiped and HEPA vacuumed.

APPENDIX A

Asbestos Laws and Regulations for Tennessee

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Asbestos Laws and Regulations for Tennessee

CHAPTER 25
AIR POLLUTION CONTROL

SECTION

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68-25-101. Short title. - This part shall be known and may be cited as the "Tennessee Air Quality Act." (Acts 1967, ch. 367, § 1; 1971, ch. 362, § 1; 1979, ch. 299, § 7; T.C.A., § 53-3403.)

68-25-102. Definitions. - The following terms used in this part shall, unless the context otherwise requires, have the following meanings:

(1) "Air contaminant" is particulate matter, dust, fumes, gas, mist, smoke, or vapor, or any combinations thereof;

(2) "Air contaminant source" is any and all sources of emission of air contaminants, whether privately or publicly owned or operated. Without limiting the generality of the foregoing, this term includes all types of business, commercial and industrial plants, works, shops and stores, and heating and power plants and stations, buildings and other structures of all types, including multiple family residences, apartments, houses, office buildings, hotels, restaurants, schools, hospitals, churches and other institutional buildings, automobiles, trucks, tractors, buses and other motor vehicles, garages and vending and service locations and stations, railroad locomotives, ships, boats, and other waterborne craft, portable fuel-burning equipment, incinerators of all types, indoor and outdoor, refuse dumps and piles, and all stack and other chimney outlets from any of the foregoing; provided, however, that neither automobiles, trucks, tractors, buses or other motor vehicles powered by any fuel other than diesel oil and which are manufactured prior to September 1, 1967, automobiles, trucks, tractors, buses or other motor vehicles powered by diesel oil and manufactured prior to January 1, 1970, nor automobiles, trucks, tractors, buses or other motor vehicles which are equipped to comply and do comply with the federal Motor Vehicle Air Pollution Control Act (compiled at 42 U.S.C. subsection 1857f-1 - 1857f-8) shall be considered or determined to be an "air contaminant source";

(3) "Air pollution" is presence in the outdoor atmosphere of one or more air contaminants in sufficient quantities and of such characteristics and duration as to be injurious to human, plant or animal life or to property, or which unreasonably interfere with the enjoyment of life and property;

(4) "Board" is the air pollution control board of the state of Tennessee;

(5) "Commissioner" is the commissioner of the Tennessee department of health and environment or his duly authorized representative; or in the event of his absence or a vacancy in the office of the commissioner, the deputy commissioner;

(6) "Department" is the department of health and environment of the state of Tennessee;

(7) "Person" is any individual, partnership, copartnership, firm, company, corporation, association, joint stock company, trust, estate, political subdivision, an agency, authority, commission or department of the United States government or of the state of Tennessee government, or any other legal entity, or their legal representative, agent, or assigns;

(8) "Political subdivision" is any municipality, city, incorporated town, county, district or authority, or any portion or combination of two (2) or more thereof;

(9) "Regulations" shall mean the standards, policies, rules and regulations promulgated by the board to attain and maintain ambient air quality standards within the intent and purpose of this part; and

(10) "Technical secretary" is the technical secretary of the air pollution control board of the state of Tennessee. (Acts 1967, chapter 367, subsection 2; 1971, chapter 362, subsection 2; 1977, chapter 169, subsection 1; 1979, chapter 299, subsections 1, 7; T.C.A., subsection 53-3409.)

63-25-103. Intent and purpose. - It is the intent and purpose of this part to maintain purity of the air resources of the state consistent with the protection of normal health, general welfare and physical property of the people, maximum employment and the full industrial development of the state. The board and department shall seek the accomplishment of these objectives through the prevention, abatement and control of air pollution by all practical and economically feasible method. It is also the intent of this part to qualify for receipt of federal funds available for state air pollution control programs and to that end, this chapter shall be construed to give the authority to so qualify and maintain such qualification. (Acts 1967, chapter 367, subsection 3; 1971, chapter 362, subsection 3; 1979, chapter 299, subsection 7; T.C.A., subsection 53-3410.)

63-25-104. Creation of air pollution control board - Members - Meetings - Organization.

(a) There is hereby created an agency to be known as the air pollution control board of the state of Tennessee.

(b) The members of the board shall be the commissioner of the Tennessee department of health and environment, the director of the state planning office, and ten (10) other members who shall be appointed by the governor, as follows:

(1) One (1) shall be a registered professional engineer as defined in subsection 63-2-101 et seq., who shall have at least five (5) years' experience in the field of air pollution control;

(2) One (1) shall be a physician, licensed in compliance with chapter 6 of title 63, who shall be experienced in the health effects of air contaminants;

(3) One (1) shall be engaged in a field which is directly related to agriculture or conservation;

(4) One (1) shall be actively engaged in the management of a private manufacturing concern;

(5) One (1) shall be a county executive or chief executive officer of a Tennessee county;

(6) One (1) shall be engaged in municipal government;

(7) Two (2) shall be from Tennessee industry having technical training and experience in air pollution abatement;

(8) One (1) shall be involved in the program of an institute of higher learning in the state of Tennessee involved in the conducting of training in air pollution evaluation and control; and

(9) One (1) shall be appointed from a list of nominees submitted to the governor by the Tennessee conservation league.

The ten (10) appointed members' terms of office shall be four (4) years and until their successors are selected and qualified, except that the terms of those first appointed shall expire as follows: two (2) at the end of one (1) year after date of appointment, two (2) at the end of two (2) years after date of appointment, two (2) at the end of three (3) years after date of appointment, two (2) at the end of four (4) years after the date of appointment, and of the two (2) appointed in 1970 pursuant to clauses (3) and (9), above, one (1) at the end of two (2) years after date of appointment and one (1) at the end of four (4) years after date of appointment as designated by the governor at the time of appointment. If a vacancy occurs the governor may appoint a member for the remaining portion of the unexpired term created by the vacancy. The governor may remove any appointed member for cause. Each member shall be reimbursed for travel in accord with the provisions of comprehensive travel regulations as approved by the attorney general and the commissioner of finance and administration. A per diem allowance of fifty dollars ($50.00) shall only be paid to members for meetings at which a quorum is present.

(c) The board shall hold at least two (2) regular meetings each calendar year at a place and time to be fixed by the board. The commissioner of health and environment shall be chairman of the board and the board shall select at its first meeting one (1) of its members to serve as vice chairman. At the first regular meeting in each calendar year thereafter, the vice chairman for the ensuing year shall be selected from among the members of the board. The director of the air pollution control division or service of the Tennessee department of health and environment shall be technical secretary of the board. He shall receive no additional compensation for such services. Special meetings may be called by the chairman or by three (3) members of the board upon delivery of written notice to the office of each member of the board. Seven (7) members of the board shall constitute a quorum, and a quorum may act for the board in all matters. The decision of a majority of a quorum shall be determinative of any question before the board except as otherwise specially provided herein. (Acts 1967, chapter 367, subsection 4; 1970 (Adj. S.) chapter 538, subsections 1, 2; 1971, chapter 108, subsection 1; 1971, chapter 362, subsections 4, 5; modified; impl. am. Acts 1972 (Adj. S.), chapter 542, subsection 15; Acts 1976 (Adj. S.), chapter 639, subsection 1; 1976 (Adj. S.), chapter 806, subsection 1(5); impl. am. Acts 1973 (Adj. S.), chapter 934, subsections 16, 36; T.C.A., subsection 53-3411.)

68-25-105. Powers and duties of board and department. - (a) Powers and duties of the board:

(1) Promulgate rules and regulations to effect the intent and purpose of the part, pursuant to the provisions of the Uniform Administrative Procedures Act, Sections 4-5-101 et seq. Such rules and regulations may include, but are not necessarily limited to, those defining; ambient air quality standards; emission standards; general policies or plans; a system of permits; and a schedule of fees for review of plans and specifications, issuance or renewal of permits or inspection of air contaminant sources. Emission standards for stationary sources adopted by the board shall include regulations based on the weight of materials entering the process causing the emission as an optional alternative to regulations previously adopted.

(2) Hold hearings and issue such orders and determinations as may be necessary to effect the intent and purpose of this part;

(3) Establish, modify, or amend, without hearing, policies, practices, rules or regulations with respect to procedural aspects of board activities; and

(4) Cause to be instituted in a court of competent jurisdiction, legal proceedings to compel compliance with any order issued by the board, requirement of this part, or rule or regulation adopted pursuant to this part.

(5) Powers and duties of the department:

(1) Develop and recommend to the board plans for a comprehensive air pollution control program for the state of Tennessee, to review such plans from time to time and recommend to the board such changes as may be deemed appropriate;

(2) Require that any person furnish the department information required by it in discharge of its duties under this part, if the department has reason to believe such person is, or may be about to, causing or contributing to air pollution, provided, however, that no such person shall be required to disclose any secret formulae, processes, or methods used in any manufacturing operation carried on by him or under his direction. The composition of air contaminants shall not be considered secret unless so declared by the department and the department shall have the power to issue protection orders to prevent public dissemination;

(3) Enter at all reasonable times in or upon any private or public property except private residences for the purpose of inspecting and investigating any condition which the department shall have reasonable cause to believe to be an air contaminant source;

(4) Provide such technical, scientific and other services as may be required for carrying out the provisions of this part. The basic personnel for such purposes shall be those employed by the department; however, the department may, by agreement, secure these or other services from any other agency, and within budgetary limitations may arrange compensation for such services;

(5) Receive, budget, receipt for and administer such moneys as are duly appropriated or granted for the purpose of this part provided that all such moneys shall be deposited with the state treasurer;

(6) Represent the state of Tennessee in matters pertaining to plans, procedures or negotiations for interstate compacts relative to air pollution or in matters pertaining to air quality control regions;

(7) Collect and disseminate information relative to air pollution; encourage voluntary cooperation of affected persons or groups in preserving and restoring a reasonable degree of air purity; advise, consult and cooperate with other agencies, persons or groups in matters pertaining to air pollution; and encourage authorized air pollution agencies of political subdivisions to handle air pollution problems within their respective jurisdictions to the greatest extent possible and to provide technical assistance to political subdivisions requesting same; and

(3) Cause to be instituted in a court of competent jurisdiction legal proceedings to compel compliance with any order issued by the board.

(c) In exercising their powers and duties relative to major energy projects, as defined in subsection 13-13-102, the board and the department shall participate in the joint review process and expedited review process provided for by chapter 13 of title 13. (Acts 1967, chapter 367, subsection 5; 1971, chapter 321, subsection 1; 1971, chapter 362, subsections 6, 11; modified; Acts 1979, chapter 299, subsection 7; 1981, chapter 131, subsection 27; T.C.A., subsection 53-3412.)

63-25-106. Matters to be considered in exercising powers. - Nothing in this part shall be deemed to grant the board or department any jurisdiction or authority with respect to air pollution existing solely within commercial or industrial plants, works or shops or to affect the relations between employers and employees with respect to or arising out of any condition of air pollution. In exercising powers to prevent, abate and control air pollution the board or department shall give due consideration to all pertinent facts including, but not necessarily limited to:

(1) The character and degree of injury to, or interference with the protection/of the health, general welfare and physical property of the people;

(2) The social and economic value of the air contaminant source;

(3) The suitability or unsuitability of the air pollution source to the area in which it is located. In this respect it is expressly anticipated that the board may establish zones and categories of air contaminant sources in which the standards, rules and regulations may differ according to zone and category of air contaminant source; and

(4) The technical practicability and economic reasonableness of reducing or eliminating the emission of such air contaminants. (Acts 1967, chapter 367, subsection 6; 1971, chapter 362, subsection 7; 1979, chapter 299, T.C.A., subsection 53-3413.)

(5) The economic benefit gained by the air contaminant source through any failure to comply with provisions of this part and regulations promulgated thereunder; and

(6) The amount or degree of effort put forth by the air contaminant source to attain compliance.

63-25-107. Powers and duties of technical secretary. - The technical secretary or his authorized representative shall have the following powers and duties:

(1) Attend all meetings of the board, but not be entitled to a vote;

(2) Exercise general supervision over all persons employed by the board and by the air pollution control division or service of the department;

(3) Make or cause to be made such investigations as the board may direct or authorize, or as may be warranted due to receipt of information concerning an alleged violation of this part or of any rule, regulation or order promulgated hereunder; or as he may otherwise deem advisable, and for this purpose he shall have the right to enter at all reasonable times in or upon any private or public property except private residences;

(4) Endeavor to the fullest extent possible to obtain compliance with this part and with rules and regulations promulgated pursuant thereto by conference, conciliation and persuasion;

(5) Issue formal notice of complaint and prosecute such complaints before the board;

(6) Handle correspondence, keep records, prepare reports and perform such other duties as the board may direct or authorize or as may ensue as an employee of the department;

(7) Initiate alert, warning and emergency action in accordance with emergency episode plans and procedures promulgated as rules or regulations by the board; and

(8) At his discretion, request the presence of an alleged violator of this part or of the regulations at an informal meeting of the staff of the division of air pollution control to show cause why further enforcement action ought not be taken by the department. The proceedings of this meeting need not be recorded.

68-25-108. Conduct of hearings. - (a) Hearings before the board shall be conducted in the following manner:

(a) A person aggrieved by a decision or action of the technical secretary on a permit, order, or assessment may request a hearing before the board pursuant to the provisions of this part. Such hearing and hearings before the board on requests for variances, certificates of exemption, and permits shall be conducted as contested cases in accordance with the Uniform Administrative Procedures Act, T.C.A., Section 4-5-301, et seq.

(b) The board or the commissioner or his representative may hold public hearings on any matter, within their jurisdiction under this part. The board may promulgate regulations concerning subjects on which public hearings are required and the procedures for those hearings. Reasonable notice of such public hearings shall be given.

68-25-109. Emergency stop orders for air contaminant sources - Hearings. - Any other provisions of law to the contrary notwithstanding, if the commissioner finds that emissions from the operation of one (1) or more air contaminant sources is causing imminent danger to human health and safety he may with the approval of the governor order the person or persons responsible for the operation or operations in question, or the person or persons causing or contributing to the air pollution to reduce or discontinue immediately the emission of air contaminants, and such order shall fix a place and time, not later than twenty-four (24) hours thereafter, for a hearing to be held before the commissioner. Not more than twenty-four (24) hours after the commencement of such hearing, and without adjournment thereof, the commissioner shall affirm, modify or set aside his previous order. The commissioner shall cause a transcript to be made of the proceedings in any such hearing, copies of which shall be made available to all parties affected, at a reasonable cost. (Acts 1967, chapter 367, subsection 9; T.C.A., subsection 53-3416.)

68-25-110. Judicial Review. An appeal may be taken from any final order or other final determination pursuant to this part by any party, except the department, who is or may be adversely affected thereby. Such appeals shall be conducted in accordance with the Uniform Administrative Procedures Act, T.C.A., Sections 4-5-301 et seq.; provided, however that no hearing shall be allowed by the Chancery Court from any disposition made by the board if such disposition has become final as a result of a person's failure to appear at a hearing after having requested such hearing or after having received adequate notice.

68-25-111. Right of board or commissioner to injunctive relief. - The board or commissioner may cause to be instituted a civil action in any court of competent jurisdiction for injunctive relief to prevent violation of any duly promulgated rule or regulation or of any order of the board. (Acts 1967, chapter 367, subsection 11; 1971, chapter 362, subsection 9; T.C.A., subsection 53-3403.)

63-25-112. Penalty for violations - Duty of district attorneys general - Abatement of public nuisance. - (a) Any person who wil fully and knowingly violates or fails to comply with any provision of this part, any board or administrative order, or any duly promulgated air pollution control regulation, or any ordinance adopted pursuant to this part, shall be guilty of a misdemeanor and shall be punished by a fine of not less than fifty dollars ($50.00) nor more than one thousand dollars ($1,000) for each offense. For the purpose of this section each day of continued violation will constitute a separate offense and shall be punishable as such.

(b) No warrant, presentment or indictment arising under this chapter shall be issued except upon application, authorized in writing, by the board, the commissioner, or either of them, or by a local pollution control program operating under a certificate of exemption pursuant to subsection 63-25-115, for a violation within its jurisdiction.

(c) It shall be the duty of the district attorneys general in the various circuits throughout the state to assist the board or commissioner, upon request, either by prosecuting or by assisting the board or the commissioner in prosecuting those persons the board or commissioner has reasonable cause to believe are violating any provision of this part or any rule or regulation duly promulgated in accordance with the provisions of this part.

(d) In addition and supplemental to any criminal action which may be prosecuted under this section, the board and commissioner shall have and are vested with jurisdiction and authority to determine whether or not any provisions of this part, or rules or regulations adopted pursuant thereto, or any order of the board has been violated and whether or not such violation constitutes a public nuisance. Upon such finding that a public nuisance does exist, the board or commissioner has authority to abate any such public nuisance in the manner provided by the general law relating to the abatement of public nuisances. (Acts 1967, chapter 367, subsection 12; 1970 (Adj. S.), chapter 540, subsection 1; 1971, chapter 362, subsection 10; 1976 (Adj. S.), chapter 639, subsection 2; 1979, chapter 299, subsections 2, 7; 1979, chapter 422, subsection 17; T.C.A., subsection 53-3419.)

63-25-113. Existing civil or criminal remedies not impaired. - No existing civil or criminal remedy for any wrongful action which is a violation of any provision of this part of which is a violation of any rule or regulation of the board promulgated hereunder shall be impaired by this part. (Acts 1967, chapter 367, subsection 13; 1979, chapter 299, subsection 7, T.C.A., subsection 53-3420.)

63-25-115. Local pollution control programs - Adoption by reference - Exemption from state supervision - Current local programs. - (a) Any municipality or county in this state may enact, by ordinance or resolution respectively, air pollution control regulatons not less stringent than the standards adopted for the state pursuant to this part, or any such municipality or county may also adopt or repeal an ordinance or resolution which incorporated by reference any or all of the regulations of the board, including any changes in such regulations, when such regulations are properly identified as to date and source without setting forth the provisions of such regulations in full. At least three (3) copies of such regulations which are incorporated by reference shall be filed in the office of the county clerk and there kept for public use, inspection and examination. The filing requirements shall not be deemed to be complied with unless the required copies of such regulations are filed with the clerk for a period of thirty (30) days before the adoption of the ordinance or resolution which incorporated such regulations by reference. No ordinance or resolution incorporating regulations by reference shall be effective until published in a newspaper having a general circulation in the municipality or county.

(b) Before such ordinances or resolutions enacting air pollution control regulations shall become effective, such municipality or county must apply for and receive from the board a certificate of exemption by the following procedure:

(1) Any political subdivision desiring to be exempted from the provisions of this part may file a petition for certificate of exemption with the technical secretary. The technical secretary shall promptly investigate such petition and make recommendation to the board as to the disposition thereof;

(2) Upon receiving the recommendation of the technical secretary, the board may, if such recommendation is for the grant of the petition, do so without hearing. If the recommendation of the technical secretary is against the granting of the petition or the board, in its discretion, concludes that a hearing would be advisable, then a hearing shall be held not later than sixty (60) days after receipt of recommendation of the technical secretary by the board;

(3) The certificate of exemption shall be granted if the board determines that the municipality or county has enacted provisions for the control of air pollution not less stringent than the provisions of this part and that such enactments are being, or will be, adequately enforced.

(4) The board may grant a certificate of exemption in whole or in part, may prescribe a time schedule for various parts of an exemption to become effective, and may make a certificate of exemption conditional or provisional as is deemed appropriate.

(5) In granting any certificate of exemption, there is reserved to the state the right to initiate proceedings to enforce any applicable resolution, ordinance or regulation of the municipality or county should it fail to obtain compliance therewith. Such proceedings shall be the same as for enforcement of any duly promulgated rule or regulation of the board.

(6) In granting any certificate of exemption, the exemption is to be strictly construed as limited to the language of the exemption. No power or authority which is not expressly stated in the certificate or exemption may be implied. The municipality or county may further petition the board for such power or authority.

(7) The department shall frequently determine whether or not any exempted municipality or county meets the terms of the exemption granted and continues to comply with the provisions of this section. If a determination is made that the municipality or county does not meet the terms of the exemption granted or does not comply with the provisions of this section, the department shall so notify the board, and the board upon reasonable notice to the municipality, may suspend the exemption in whole or in part until such time as the municipality or county complies with the state standards.

(c) Exemptions already granted to any municipality or county shall expire on July 1, 1986. All new certificate of exemption, including those expiring on the above date, shall be for a fixed term not to exceed two (2) years. Provided, however, that the provisions of this part shall not apply to emissions from any air contaminant source, as that term is defined in this chapter, which burns wood waste solely for the disposition of such wood waste.

(d) Local government actions taken in accordance with this section shall be conducted in accordance with chapter 13 of title 13 when the action includes a major energy project, as defined in subsection 13-13-102, (Acts 1967, chapter 367, subsection 15;

1971, chapter 266, subsection 1; 1971, chapter 365, subsections 1, 2; 1972, (Adj. S.), chapter 787, subsection 1; 1973, chapter 325, subsections 4, 6; 1974 (Adj. S.) chapter 593, subsection 1; 1975, chapter 359, subsection 1; 1977, chapter 116, subsection 1; 1977, chapter 169, subsection 2; impl. am. Acts 1978 (Adj. S.), chapter 934, subsections 22, 36; Acts 1979, chapter 299, subsection 7; 1981, chapter 131, subsection 29; T.C.A., subsection 53-3422.)

63-25-116. Orders and Assessments of Damages and Civil Penalty Appeal

(a) When the technical secretary discovers that any provision of this part or of any regulation promulgated thereunder has been violated, he may issue an order for correction to the responsible person, and this order shall be complied with within the time limit specified in the order. Such order shall be served by personal service or sent by certified mail, return receipt requested. The recipient of such an order may be appealed in the same manner as an assessment of damages or civil penalty under paragraph (b) of this section.

(b) (1) In addition to the criminal penalties of Section 63-25-115, any person who violates or fails to comply with any provision of this chapter or any rule, regulation, or standard adopted pursuant to this chapter shall be subject to a civil penalty of up to twenty-five thousand dollars ($25,000) per day for each day of violation. Each day such violation continues shall constitute a separate punishable offense, and such person shall also be liable for any damages to the state resulting therefrom.

(2) Any civil penalty or damages shall be assessed in the following manner:

(A) The technical secretary may issue an assessment against any person responsible for the violation or damages. Such person shall receive notice of such assessment by certified mail, return receipt requested;

(B) Any person against whom an assessment has been issued may petition the board for a review of the assessment by filing a petition for review with the technical secretary within thirty (30) days of receipt of the assessment, setting forth the grounds and reasons for his objections and asking the board to hold a hearing;

(C) If a petition for review of the assessment is not filed within thirty (30) days after the date the assessment and it shall become final;

(D) Whenever any assessment has become final because of a person's failure to appeal either the technical secretary's assessment or the board's order, the commissioner or the board may apply to the appropriate court for a judgment and seek execution on such judgment. The court, in such proceedings, shall treat the failure to appeal such assessment as a confession of judgment in the amount of the assessment; and

(E) The commissioner may institute such proceedings for judgment and execution in the chancery court of Davidson County or in the chancery court of the county in which all or part of the violation or failure to comply occurred.

(c) In assessing such civil penalty the factors specified in Section 63-25-106 may be considered. Damages to the state may include any expenses incurred in investigating the enforcing this part, in removing, correction, or terminating the effects of air pollution and also compensation for any expense, loss or destruction of plant or animal life or any other actual damages or clean-up expenses causes by the pollution or by the violation. The plea of financial inability to prevent, abate or control pollution by the polluter or

violator shall not be a valid defense to liability for violations of the provisions of this part or of regulations promulgated thereunder.

63-25-117. Levy of noncompliance and nonpayment penalties - Suits for collection or assessment of penalty. - The technical secretary, the board, and within their respective jurisdictions, the local pollution control programs operating under a certificate of exemption pursuant to subsection 63-25-115 are authorized to levy noncompliance and nonpayment penalties after appropriate notice and hearing, against any air contaminant source not in final compliance with the applicable Tennessee air pollution control regulations by July 1, 1979. The technical secretary, the board, and the duly exempted local pollution control programs are specifically authorized to accept enforcement responsibility for these civil penalties from the United States environmental protection agency. These penalties are to be equivalent to the economic value a person may realize by a delay in compliance beyond July 1, 1979, including the amount it would have cost the person to comply with all applicable air pollution control regulations had the person chosen to do so. The board will promulgate regulations specifying the procedures to be used in calculating the penalty and providing for quarterly payment of annualized cost. The board, the technical secretary, and the duly exempted local pollution control programs shall consider the matters in subsection 120 of the federal Clean Air Act in their actions. The commissioner, the board, and the duly exempted local pollution control programs are also authorized to file suit for the assessment and said penalties as part of any other civil action brought under this part. The commissioner, the board, and the duly exempted local pollution control programs are authorized to file suits for collection or assessment of the civil penalty along with other equitable relief pursuant to subsection 63-25-111 in the chancery courts of the county where the pollution is occurring or where the violator or polluter is doing business. The chancery court shall treat a failure to appeal a civil penalty assessment as a confession of judgment by the polluter or violator to the amount of the assessment; and the court is authorized to render judgment and provide for execution of such civil penalties. Such actions for civil penalties shall be triable without a jury. (Act 1979, chapter 299, subsection 6; T.C.A., subsection 53-3424.)

(a) Any person seeking a variance shall do so by filing a petition for variance with the technical secretary. The technical secretary shall promptly investigate such petition and make recommendation to the board as to the disposition thereof;

(b) Upon receiving the recommendation of the technical secretary, the board may, if such recommendation is for the grant of a variance, do so without hearing. If the recommendation of the technical secretary is against the granting of a variance or the board, in its discretion, concludes that a hearing would be advisable, then a hearing shall be held not later than sixty (60) days after receipt of recommendation of the technical secretary by the board;

(c) The petitioner shall be given written notice at the earliest practicable time as to the time and place of such hearing;

(d) Any member of the board, or with the approval of the governor, any person licensed to practice law in the state of Tennessee and designated by the board to act as hearing examiner, may act as hearing examiner to conduct hearings, administer oaths, subpoena withnesses, and enforce the attendances of witnesses at the hearing. Any member of the board, the hearing examiner or counsel representing the board may examine or cross-examine all witnesses. A complete record of the hearing shall be made for review by the board members;

(e) All testimony shall be under oath and stenographically recorded. The transcript so recorded shall be made available to the petitioner or any party to the hearing upon payment of the usual charges thereof;

(f) The board in considering the granting of a variance shall give due consideration to the equities of the petitioner and others who may be affected by granting or denial of the petition;

(g) The board may make the granting of a petition for variance contingent upon such other requirements or restrictions on the petitioner as it may deem appropriate and reasonable;

(h) Any variance granted shall be for a period not to exceed one (1) year, but may be extended from time to time but in no case for longer than one (1) year at a time upon recommendation of the technical secretary and affirmative action by the board;

(i) The board shall issue, enter and mail to the petitioner in writing, by certified mail, return receipt requested, within sixty (60) days following receipt of the recommendation of the technical secretary when no hearing is held, its final order or determination. Such order or determination shall be approved in writing by at least seven (7) members of the board;

(j) Upon failure of the board to issue, enter and mail to the petitioners a final order or determination within sixty (60) days after the final argument in any such hearing or within sixty (60) days following receipt of the recommendation of the technical secretary when no hearing is held, the petitioner shall be entitled to treat for all purposes such failure to act as a grant of the variance requested; and

(k) The burden of proof in such hearings shall be upon the petitioner.

63-25-201. Provisions not applicable to cotton gins. - The provisions of this chapter shall not apply to cotton gins. (Acts 1975, chapter 155, subsection 1; T.C.A. subsection 53-3425.)

63-25-202. Local ordinances. - Any city, town or county having a population of six hundred thousand (600,000) or more according to the federal census of 1960, is authorized to enact by its chief legislative body, ordinances, or regulations not less stringent than the provisions of part 1 of this chapter. Violation of any of the ordinances or enactments of the chief legislative body is declared to be a misdemeanor, punishable under the general punishment statute relating to misdemeanors.

Actions taken in accordance with this section shall be conducted in accordance with chapter 13 of title 13 when the action involves a major energy project as defined in subsection 13-13-192. (Acts 1969, chapter 39, subsection 1; 1979, chapter 299, subsections 3, 7; T.C.A., subsection 53-3423; Acts 1931, chapter 131, subsection 30; T.C.A., subsection 53-3426.)

63-25-203. Emissions from light duty vehicles. - (a) This section may be cited as the "Voluntary Inspection and Maintenance Program to Study Emissions from Light Duty Vehicles."

(b) The purpose of this section is to obtain improvements in air quality with respect to the levels of photochemical oxidants in the metropolitan area in and around Davidson County by:

(1) Undertaking a voluntary automobile inspection program to determine the benefit to air quality that could be achieved by reducing emissions from light duty vehicles; and

(2) Collecting data from vehicles belonging to members of the public on a volunteer basis to determine if such vehicles emit excessive amounts of hydrocarbons, nitrogen oxides, and other harmful chemicals.

(c) The Tennessee air pollution control board of the state of Tennessee shall initiate a voluntary inspection and maintenance program to study emissions from light duty vehicles.

(d) The air pollution control board of the state of Tennessee shall prepare a detailed and comprehensive report of the findings of the inspection and maintenance program. Such report shall be submitted to the governor and the general assembly.

(e) Implementation of this program is contingent upon availability of federal appropriations and other federal and local funds which may be appropriated for this purpose, in addition to any presently budgeted state funds.

(f) This section shall not apply to farm vehicles including tractors and pickup trucks. (Acts 1973 (Adj.S.), chapter 394, subsections 1-3, T.C.A., subsections 53-3426, 53-3431.)

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The UAPA provides a legal framework within which administrative agencies, such as environmental regulatory agencies may conduct business. The UAPA prescribes how activities such as rulemaking and contested cases will be handled to insure uniformity in administrative agencies. The procedures are complex and time consuming adding to and sometimes conflicting requirements in environmental statutes. In cases of conflict, the UAPA generally prevails.

Below is an overview of the provisions of the UAPA.

4-5-101 ADMINISTRATIVE RULES AND PROCEDURES

There are three parts to this act: General Provisions, Rulemaking and Publications, and Contested Cases.

The General Provisions part (seven sections) contains these provisions:

4-5-102 Definitions.
4-5-103 Construction of Chapter. This section gives the purpose of the act and indicates that these rules supercede others in case of conflict.
4-5-104 Suspension of Provisions when Necessary to Avoid Loss of Federal Funds. The section allows the governor under certain conditions to exempt an agency from the provisions of this act if necessary to conform to federal law or regulation or to avoid loss of federal funds. This is a limited-time exemption and the legislature must approve further exemptions.
4-5-105 Informal Settlements. Informal settlement of disputes is encouraged.
4-5-106 Application. Lists exemptions from this chapter, including: military, governor, legislature, courts, county and municipal boards, etc.
4-5-107 Majority Needed to Determine Rules or Contested Cases. No state board may make rules, declaratory rulings or determine contests cases without a majority of the board present.
4-5-108 Changes in Chapter - Delegation of Rule-making Authority - Referral to Government Operation Committee. The Government Operations Committee is to review changes to the UAPA and legislation which delegates rulemaking authority.

The Rulemaking and Publications part contains sections 4-5-201 through 4-5-225 and is summarized as follows:

4-5-201 Petition for Rules. Except where restricted, any five or more interested persons may petition an agency requesting rule adoption, amendment, or repeal. Requirements for the petition are given. The agency must promptly grant or deny the petition.
4-5-202 When Hearings Required. Notice is given and a public hearing held except for emergency or public necessity rules or proposed rules published in the Tennessee Administrative Register. If a petition for public hearing signed by 25 or more people is received regarding proposed rules, a hearing must be held. Exemption from hearings does not apply if another statute requires the agency to hold hearings.
4-5-203 Notice of Hearing. This section describes the procedure to be followed for public notice of hearings.
4-5-204 Conduct of Hearing. This section indicates how public hearings are to be run. Persons testifying at the hearing may request in writing the opportunity to speak to the board, if the board is not present at the

hearing. This section supplements specific statutes for agency hearings, but , in case of conflict, this section prevails.

4-5-205 Proposed Rules - Agency Consideration of Submissions - Advisory Committees. Agency must consider public comments on rules. Agency must give reasons for adoption of rules if requested. Agency may appoint advisory committee to consider rulemaking.

4-5-206 Filing of Rules. Secretary of State shall file rules of each agency. Prior to filing, rules must be approved by the attorney general. The secretary of state may refuse to accept rules which do not conform to requirements.

4-5-207 Effective Dates of Rules. Except for emergency and public necessity rules, all rules become effective only after approval and passage of a 30-day period after filing. Emergency and public necessity rules are effective the date they are filed.

4-5-208 Emergency Rules. In cases of immediate danger to public health, agencies may adopt rules without public hearing. Emergency rules become effective when filed with the Secretary of State and remain in effect for 120 days. A similar emergency rule may not be adopted within the same year unless reasons are given why the emergency continues or may recur. The agency shall notify affected persons of the emergency rules.

4-5-209 Public Necessity Rules. A rule, approved by the attorney general and filed with the secretary of state, may become effective immediately or within less time than normal rulemaking requires if the agency files a statement indicating certain conditions are met. The rule will be in effect for 120 days and may be readopted under the same conditions as readoption of emergency rules. The agency is to notify affected persons of the public necessity rule. If contested, the burden of proof is on the agency to demonstrate that rules met criteria for adoption as public necessity rules.

4-5-210 (Reserved)

4-5-211 Approval of Rules by Attorney General. Rules must be approved by the Attorney General prior to filing with the secretary of state.

4-5-212-213 (Reserved)

4-5-214 Withdrawal of Rules. Rules may be withdrawn at any time before the effective date.

4-5-215 Stay of Effective Date of Rules. During the running of the 30-day period before a rule becomes effective, an agency may ask for a stay of the effective date of the rule for up to 60 days. After the stay has expired or is withdrawn, the balance of the 30-day period resumes running.

4-5-216 Invalidity of Rules Not Properly Adopted. Rules not adopted in compliance with provisions of this chapter are void.

4-5-217 Required Rulemaking. Each agency shall adopt rules of practice describing formal and informal procedures available.

4-5-218 Public Inspection and Copying of Agency Rules, Final Orders, and Decisions. Agencies must provide access to specified documents and may charge a reasonable fee for providing documents.

4-5-219 Model Rules of Procedure. The Secretary of State shall adopt model rules of procedure appropriate for use by many agencies. Agencies must adopt as much of the model as practicable or state reasons why model is not practicable.

4-5-220 Publication of Rules. The secretary of state will publish a monthly register concerning rulemaking and an official compilation of rules.

4-5-221 Powers of Secretary of State - Legal Effect of Certification of Administrative Code and Register. This section allows the secretary of

state to correct minor errors in regulations as long as the effect is not altered. The text of the compilation and registers is the official compilation of regulatory law in the state.

4-5-222 Record of Voting on Policy or Rule Adoption - Filing. This section requires roll call vote on rules and policies.

4-5-223 Declaratory Orders. Affected persons may petition agency for ruling on applicability of statutes. Required response is indicated.

4-5-224 Declaratory Judgments. Chancery Court of Davidson County may determine legal validity and applicability of rules if agency refuses to issue declaratory order.

4-5-225 Expiration of Rules. All rules filed after 7/1/82 expire June 30 of the following year unless legislation is enacted to delete expiration date. In addition, all current rules expire according to a schedule (Rules 1200-1499 expire on 7/1/85). Before expiration, rules will be considered by legislative committee. A rule summary must be completed for each rule filed.

Part 3 of the UAPA is Contested Cases. These provisions contain the following:

4-5-301 Conduct of Contested Cases. This section details the requirements for conducting contested cases.

4-5-302 Disqualification and Substitution of Administrative Judges, Hearing Officers and Agency Members. Officials presiding in a contested case may be disqualified for a number of reasons including bias or prejudice. Any party may petition for disqualification and the individual named must answer petition. Substitutes may be named for disqualified persons.

4-5-303 Separation of Functions. This section gives restrictions to insure against conflict of interest.

4-5-304 Ex Parte Communications. Unless authorized by statute, officials presiding in a contested case may not discuss any issue of the proceeding without providing notice and opportunity for all affected persons to participate. Method for disclosing ex parte communication is given.

4-5-305 Representation. A party may participate in the hearing in person or by an authorized representative.

4-5-306 Prehearing Conferences. This section gives authority for conferences and lists items which may be considered.

4-5-307 Notice of Hearing. All parties shall be given notice for hearing of contested case. List of items for inclusion in notice is given.

4-5-308 Pleadings, Briefs, Motions, Service. All parties have full opportunity to file pleadings, motions, etc.

4-5-309 Default. If party fails to attend, proceedings may be adjourned or conducted without participation of party. Party may petition to have default set aside.

4-5-310 Intervention. Petitions for intervention are discussed in this section.

4-5-311 Discovery - Subpoenas. This section gives information regarding subpoenas.

4-5-312 Procedure of Hearing. A description of the conduct of the hearing is given.

4-5-313 Rules of Evidence - Affidavits - Official Notice. This section contains requirements concerning affidavits and notice to the opposing party of affidavits. Opportunity to contest or rebut facts or material noticed must be given.

4-5-314 Final Order - Initial Order. An initial or final order must include conclusions of law and findings of fact.

4-5-315 Review of Initial Order. An agency shall review the initial order unless statute prohibits. Agency may delegate review. Petition for appeal must be filed within 10 days.

4-5-316 Stay. Within 7 days of entry, a party may petition for stay of effectiveness of order.

4-5-317 Reconsideration. Within 10 days of entry, any party may ask for reconsideration of a final or initial order.

4-5-318 Effectiveness of New Order. Unless otherwise specified, an order becomes effective upon entry.

4-5-319 Record. Agency shall maintain records of contested cases for at least 3 years.

4-5-320 Proceedings Affecting Licenses. The existing license does not expire until the application has been finally determined and the appeal period has elapsed.

4-5-321 Administrative Procedures Division - Duties. This section describes the function of the Administrative Procedures Division.

4-5-322 Judicial Review. This section describes actions or rulings subject to judicial review and gives a timetable of actions.

4-5-323 Appeals to Court of Appeals. Parties may obtain a review of final judgment of chancery court in the Court of Appeals of Tennessee.

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RULES
OF
TENNESSEE DEPARTMENT OF HEALTH AND ENVIRONMENT
BUREAU OF ENVIRONMENT
DIVISION OF AIR POLLUTION CONTROL

CHAPTER 1200-3-11
HAZARDOUS AIR CONTAMINANTS

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1200-3-11-.01 GENERAL

(1) Hazardous air contaminants are any air contaminants which may cause, or contribute to, an increase in serious irreversible or incapacitating reversible illness, and has been so designated by the Board. The Board shall, from time to time, after public hearing, designate additional hazardous air contaminants. The following are hereby designated hazardous air contaminants:

(a) Asbestos

(b) Beryllium

(c) Mercury

(d) Vinyl Chloride

(2) The sources covered by emission standards in this Chapter are still subject to all provisions in the other chapters of the Tennessee Air Pollution Control Regulations.

(3) Permit and information requirements.

(a) Any person constructing or modifying an air contaminant source that is subject to an emission standard in this Chapter must obtain a construction permit as outlined in Rule 1200-3-9-.01. For these sources, the Technical Secretary cannot grant a waiver under subparagraph (3)(a) of said Rule.

(b) Any person planning to construct or modify a source of hazardous air contaminants shall file with the Technical Secretary, following the time frame outlined in Rule 1200-3-9-.01, sufficient information to allow evaluation of the air pollution potential of the source. This information shall be submitted on forms provided by the Technical Secretary and as a minimum shall include:

1. Name and address of owner or operator;

2. Location of the source;

3. Nature, size, design, operating design capacity, and method of operation of the source;

4. Identification of the hazardous air contaminant;

5. Total weight of hazardous air contaminant released per day, per month, and per year over the last 12 months preceeding the date of the report;

6. Period or periods of operation;

7. Composition of the hazardous air contaminant;

8. Temperature and moisture content of the air or gas stream in which the hazardous air contaminant is contained;

9. Characterization of the variability of hazardous air contaminant release with respect to rate, composition, and physical characteristics;

10. Height, velocity, and direction of air or gas stream at the point where released to the atmosphere;

11. A description of the control equipment for each emission point.

    (i) Primary control device(s) for each hazardous pollutant.

    (ii) Secondary control device(s) for each hazardous pollutant.

    (iii) Estimated control efficiency (percent) for each control device.

12. Identify each point of emission for each hazardous air contaminant.

13. Such other information as may be specifically requested by the Technical Secretary.

(c) The owner or operator of one or more sources of hazardous air contaminants shall, within 90 days after notification by the Technical Secretary, submit to the Technical Secretary the information outlined in parts 1 through 12 of subparagraph (b) above.

(d) Any owner or operator of a source which has an initial startup after the effective date of a standard prescribed under this chapter shall furnish written notification to the Technical Secretary as follows:

1. A notification of the anticipated date of initial startup of the source not more than 60 days nor less than 30 prior to such date.

2. A notification of the actual date of initial startup of the source within 15 days after such date.

(e) Ninety (90) days after the effective date of any emission standard in this Chapter, the owner or operator of a source to which the standard applies in existence or under construction on the effective date of the standard shall submit the information outlined in parts 1 through 12 in subparagraph (b) above. Along with this package of information, the owner or operator shall submit a statement as to whether he can comply with the standards prescribed in this Chapter within ninety (90) days of the said effective date.

(f) Changes in the information provided under subparagraphs (b), (c), and/or (e) shall be provided by the source to the Technical Secretary within 30 days after such change, except that if changes will result from modification of the source, as defined in Chapter 1200-3-2, then the provisions in subparagraphs (a) and (b) of this paragraph apply.

(g) The owner or operator of any air contaminant source not previously required to have a permit (operating and/or construction) by the provisions of Chapter 1200-3-9 must do so within 90 days after one of the sources' emissions has been designated by the Board as a hazardous air contaminant.

(h) Emission tests and monitoring.

1. Within sixty (60) days after achieving the maximum production rate at which the new or modified hazardous air contaminant source will be operated, but not later than 180 days after initial startup of such source and at such other times as may be required by the Technical Secretary, the owner or operator of such facility shall conduct performance test(s) and furnish the Technical Secretary a written report of the results of such performance test(s).

2. Performance tests shall be conducted and data reduced in accordance with the reference test methods and procedures contained in each applicable rule unless the Technical Secretary:

(i) Specifies or approves the use of a reference method with minor changes in methodology,

(ii) Approves the use of an equivalent method,

(iii) Approves the use of an alternative method, the results of which are determined to be adequate for indicating whether a specific source is in compliance.

3. Performance tests shall be conducted under such conditions as the Technical Secretary shall specify to plant operator based on representative performance of the affected facility. The owner or operator shall make available to the Technical Secretary such records as may be necessary to determine the conditions of the performance tests. Operations during periods of startup, shutdown, and malfunction shall not constitute representative conditions of performance tests unless otherwise specified in the applicable standard.

4. The owner or operator of an affected facility shall provide the Technical Secretary ten (10) days prior notice of the performance test to afford the Technical Secretary the opportunity to have an observer present.

5. The owner or operator of an affected facility shall provide, or cause to be provided, performance testing facilities as follows:

   (i) Sampling ports adequate for test methods applicable to such facility.

   (ii) Safe sampling platform(s).

   (iii) Safe access to sampling platform(s).

   (iv) Utilities for sampling and testing equipment.

Authority: T.C.A. Section 68-25-105 and 4-5-202. Administrative History. Original Rule certified June 7, 1974. Amended effective February 9, 1977. Amended effective June 16, 1978.

1200-3-11.-02 ASBESTOS

(1) Definitions. Terms used in this rule not defined herein shall have the meaning given to them in Chapter 1200-3-2.

   (a) "Asbestos" means actinolite, amosite, anthophyllite, chrysotile, crocidolite, tremolite.

   (b) "Asbestos material" means asbestos or any material containing asbestos.

   (c) "Particulate asbestos material" means finely divided particles of asbestos material.

   (d) "Asbestos tailings" means any solid waste product of asbestos mining or milling operations which contain asbestos.

   (e) "Outside air" means the air outside buildings and structures.

   (f) "Visible emissions" means any emissions which are visually detectable without the aid of instruments and which contain particulate asbestos material.

(g) "Asbestos mill" means any facility engaged in the conversion or any intermediate step in the conversion of asbestos ore into commercial asbestos. Outside storage of asbestos materials is not considered a part of such facility.

(h) "Commercial asbestos" means any variety of asbestos which is produced by extracting asbestos from asbestos ore.

(i) "Manufacturing" means the combining of commercial asbestos, or in the case of woven friction products the combining of textiles containing commercial asbestos, with any other material(s), including commercial asbestos, and the processing of this combination into a product as specified in subparagraph (2)(c) of this Rule.

(j) "Demolition" means the wrecking or taking out of any load-supporting structural member and any related removing or stripping of friable asbestos materials.

(k) "Friable asbestos material" means any material that contains more than one percent asbestos by weight and that can be crumbled, pulverized, or reduced to powder, when dry, by hand pressure.

(l) "Control device asbestos waste" means any asbestos-containing waste material that is collected in a pollution control device.

(m) "Renovation" means the removing or stripping of friable asbestos material used to insulate or fireproof any pipe, duct, boiler, tank, reactor, turbine, furnace, or structural member. Operations in which load-supporting structural members are wrecked or taken out are excluded.

(n) "Planned renovation" means a renovation operation, or a number of such operations, in which the amount of friable asbestos material that will be removed or stripped within a given period of time can be predicted. Operations that are individually non-scheduled are included, provided a number of such operations can be predicted to occur during a given period of time based on operating experience.

(o) "Emergency renovation" means a renovation operation that results from a sudden, unexpected event, and is not a planned renovation. Operations necessitated by non-routine failures of equipment are included.

(p) "Adequately wetted" means sufficiently mixed or coated with water or an aqueous solution to prevent dust emissions.

(q) "Removing" means taking out friable asbestos materials used to insulate or fireproof any pipe, duct, boiler, tank, reactor, turbine, furnace, or structural member from any building, structure, facility, or installation.

(r) "Stripping" means taking off of friable asbestos materials used for insulation or fireproofing of any pipe, duct, boiler, tank, reactor, turbine, furnace, or structural member.

(s) "Fabricating" means any processing of a manufactured product containing commercial asbestos, with the exception of processing at temporary sites for the construction or restoration of buildings, structures, facilities, or installations.

(t) "Inactive waste disposal site" means any disposal site or portion thereof where additional asbestos-containing waste material will not be deposited and where the surface is not disturbed by vehicular traffic.

(u) "Active waste disposal site" means any disposal site other than an inactive site.

(v) "Roadways" means surfaces on which motor vehicles travel including, but not limited to, highways, roads, streets, parking areas, and driveways.

(w) "Asbestos-containing waste materials" means any waste which contains commercial asbestos and is generated by a source subject to the provisions of this rule, including asbestos mill tailing, control device asbestos waste, friable asbestos waste material, and bags or containers that previously contained commercial asbestos.

(2) Emission Standard for Asbestos

(a) Asbestos mills: There shall be no visible emissions to the outside air from any asbestos mill except as provided in subparagraph (f) of this paragraph.

(b) Roadways: The surfacing of roadways with asbestos tailing or with asbestos-containing waste that is generated by any source subject to subparagraphs (c), (d), (e), and (h) of this Rule is prohibited, except for temporary roadways on an area of asbestos ore deposits. The disposition of asbestos tailing or asbestos-containing waste on roadways covered with snow or ice is considered "surfacing".

(c) Manufacturing: There shall be no visible emissions to the outside air, except as provided in subparagraph (f) of this paragraph, from any of the following operations if they use commercial asbestos or from any building or structure in which such operations are conducted.

1. The manufacture of cloth, cord, wicks, tubing, tape, twine, rope, thread, yarn, roving, lap, or other textile materials.

2. The manufacture of cement products.

3. The manufacture of fireproofing and insulating materials.

4. The manufacture of friction products.

5. The manufacture of paper, millboard, and felt.

6. The manufacture of floor tile.

7. The manufacture of paints, coatings, caulks, adhesives, sealants.

8. The manufacture of plastics and rubber materials.

9. The manufacture of chlorine.

10. The manufacture of shotgun shells.

11. The manufacture of asphalt concrete.

(d) Demolition and renovation: The requirements of this paragraph shall apply to any owner or operator of a demolition or renovation operation who intends to demolish any institutional, commercial, or industrial building (including apartment buildings having more than four dwelling units), structure, facility, installation, or portion thereof which contains any pipe, duct, boiler, tank, reactor, turbine, furnace, or structural member that is insulated or fireproofed with friable asbestos material, except as provided in part (d) 1. of this paragraph; or who intends to renovate any institutional, commercial, or industrial building, structure, facility, installation, or portion thereof where more than 30 meters (ca. 260 feet) of pipe insulated or fireproofed with friable asbestos material are stripped or removed, or more than 15 square meters (ca. 160 square feet) of friable asbestos material used to insulate or fire proof any duct, boiler, tank, reactor, turbine, furnace, or structural member are stripped or removed.

1. (i) The owner or operator of a demolition operation is exempted from the requirements of this paragraph provided, (1) the amount of friable asbestos material in the building or portion thereof to be demolished is less than 30 meters (ca. 260 feet) used to insulate pipes, and less than 15 square meters (ca. 160 square feet) used to insulate or fireproof any duct, boiler, tank, reactor, turbine, furnace, or structural member, and (2) the notification requirements of subpart (d) 1. (ii) are met.

(ii) Written notification shall be postmarked or delivered to the Technical Secretary at least 20 days prior to commencement of demolition and shall include the information required by part (d) 2. of this paragraph, with the exception of the information required by subparts (d) 2. (iii), (vi), (vii), (viii), and (ix), shall state the measured or estimated amount of friable asbestos material used for insulation and fireproofing which is present. Techniques of estimation shall be explained.

2. Written notice of intent to demolish or renovate shall be provided to the Technical Secretary by the owner or operator of the demolition or renovation operation. Such notice shall be postmarked or delivered to the Technical Secretary at least 10 days prior to commencement of renovation. Such notice shall include the following information.

(i) Name of owner or operator.

(ii) Address of owner or operator.

(iii) Description of the building, structure, facility, or installation to be demolished or renovated, including the size, age, and prior use of the structure, and the approximate amount of friable asbestos material used for insulation and fireproofing.

(iv) Address or location of the building, structure, facility, or installation.

(v) Scheduled starting and completion dates of demolition or renovation.

(vi) Nature of planned demolition or renovation and method(s) to be employed.

(vii) Procedures to be employed to meet the requirements of this subparagraph and subparagraph (j) of this paragraph.

(viii) The name and address or location of the waste disposal site where friable asbestos waste will be deposited.

(ix) Name, title, and authority of the State or local governmental representative who has ordered a demolition which is subject to part (d) 6. of this paragraph.

3. (i) For purposes of determining whether a planned renovation operation constitutes a renovation within the meaning of this paragraph, the amount of friable asbestos material to be removed or stripped shall be:

I. For planned renovating operations involving individually nonscheduled operations, the additive amount of friable asbestos material that can be predicted will be removed or stripped at a source over the maximum period of time for which a prediction can be made. The period shall be not less than 30 days and not longer than one year.

II. For each planned renovating operation not covered by item (d) 3. (i) (I), the total amount of friable asbestos material that can be predicted will be removed or stripped at a source.

(ii) For purposes of determining whether an emergency renovating operation constitutes a renovation within the meaning of this subpart, the amount of friable asbestos material to be removed or stripped shall be the

total amount of friable asbestos material that will be removed or stripped as a result of the sudden, unexpected event that necessitated the renovation.

4. The following procedures shall be used to prevent emissions of particulate asbestos material to outside air:

(i) Friable asbestos materials used to insulate or fireproof any pipe, duct, boiler, tank, reactor, turbine, furnace, or structural member, shall be removed from any building, structure, or facility or installation subject to this paragraph. Such removal shall occur before wrecking or dismantling of any other portion of such building, structure, facility, or installation that would break up the friable asbestos materials and before wrecking or dismantling of any portion of such building, structure, facility, or installation that would preclude access to such materials for subsequent removal. Removal of friable asbestos materials used for insulation or fireproofing of any pipe, duct, or structural members which are encased in concrete or other similar structural material is not required prior to demolition, but such material shall be adequately wetted whenever exposed during demolition.

(ii) Friable asbestos materials used to insulate or fire-proof pipes, ducts, boilers, tanks, reactors, turbines, furnaces, or structural members shall be adequately wetted during stripping, except as provided in subparts (d) 4. (iv), (vi), or (vii) of this paragraph.

(iii) Pipes, ducts, boilers, tanks, reactors, turbines, furnaces, or structural members that are insulated or fire-proofed with friable asbestos materials may be taken out of any building, structure, facility, or installation subject to this paragraph as units or in sections provided the friable asbestos materials exposed during cutting or disjointing are adequately wetted during the cutting or disjointing operation. Such units shall not be dropped or thrown to the ground, but shall be carefully lowered to ground level.

(iv) The stripping of friable asbestos material used to insulate or fire-proof any pipe, duct, boiler, tank, reactor, turbine, furnace, or structural member that has been removed as a unit or in sections as provided in subpart (d) 4. (iii) of this paragraph shall be performed in accordance with subpart (d) 3. (ii) of this paragraph. Rather than comply with the wetting requirements, a local exhaust ventilation and collection system may be used to prevent emissions to the outside air. Such local exhaust ventilation systems shall be designed and operated to capture the asbestos particulate matter produced by the stripping of friable asbestos material.

There shall be no visible emissions to the outside air from such local exhaust ventilation and collection systems except as provided in subparagraph (f) of the paragraph.

(v) All friable asbestos materials that have been removed or stripped shall be adequately wetted to ensure that such materials remain wet during all remaining stages of demolition or renovation and related handling operations. Such materials shall not be dropped or thrown to the ground or a lower floor. Such materials that have been removed or stripped more than 50 feet above ground level, except those materials removed as units or in sections, shall be transported to the ground via dust-tight chutes or containers.

(vi) Except as specified below, the wetting requirements of this subpart are suspended when the temperature at the point of wetting is below 0°C (32°F). When friable asbestos materials are not wetted due to freezing temperatures, such materials on pipes, ducts, boilers, tanks, reactors, turbines, furnaces, or structural members shall, to the maximum extent possible, be removed as units or in sections prior to wrecking. In no case shall the requirements of subparts (d)4.(iv) or (d)4.(v) be suspended due to freezing temperatures.

(vii) For renovation operations, local exhaust ventilation and collection systems may be used, instead of wetting as specified in subpart (d) 4. (ii), to prevent emissions of particulate asbestos material to outside air when damage to equipment resulting from the wetting would be unavoidable. Upon request and supply of adequate information, the Technical Secretary will determine whether damage to equipment resulting from wetting to comply with the provisions of this subpart would be unavoidable. Such local exhaust ventilation systems shall be designed and operated to capture the asbestos particulate matter produced by the stripping and removal of friable asbestos material. There shall be no visible emissions to the outside air from such local exhaust ventilation and collection systems, except as provided in subparagraph (f) of this rule.

(viii) The owner or operator of an existing source to which this subpart is applied shall provide the pertinent information within 90 days.

5. Sources subject to this subparagraph are exempted from the requirements of paragraph (3) under General Provisions of this Chapter.

6. The demolition of a building, structure, facility, or installation, pursuant to an order of an authorized

representative, of a State or local governmental agency, issued because that building is structurally unsound and in danger of imminent collapse is exempt from all but the following requirements of subparagraph 4. (d) of this Rule:

(i) The notification requirements specified by part (d) 2. of this paragraph;

(ii) The requirements on stripping of friable asbestos materials from previously removed units or section as specified in subpart (d) 4. (vi) of this paragraph;

(iii) The wetting, as specified by (d) 4. (v) of this paragraph, of friable asbestos materials that have been removed or stripped;

(iv) The portion of the structure being demolished that contains friable asbestos materials shall be adequately wetted during the wrecking operation.

(e) Spraying: There shall be no visible emissions to the outside air from the spray-on application of materials containing more than 1 percent asbestos, on a dry weight basis, used to insulate or fireproof equipment and machinery, except as provided in subparagraph (f) of this paragraph. Spray-on materials used to insulate or fireproof buildings, structures, pipes, and conduits shall contain less than 1 percent asbestos on a dry weight basis.

1. Sources subject to this paragraph are exempt from the requirements of paragraph (3), General Provisions, of this Chapter.

2. Any owner or operator who intends to spray asbestos materials which contain more than 1 percent asbestos on dry weight basis to insulate or fireproof equipment and machinery shall report such intention to the Technical Secretary at least 20 days prior to the commencement of the spraying operation. Such report shall include the following information:

(i) Name of owner or operator.

(ii) Address of owner or operator.

(iii) Location of spraying operation.

(iv) Procedure to be followed to meet the requirements of this rule.

(f) Rather than meet the no-visible emission requirements as specified by subparagraphs (a), (c), (d), (e), (h), (j), and (k), an owner or operator may elect to use the methods specified by subparagraph 3(b) to clean emissions containing particulate asbestos material before such emission escape to or are vented to the outside air.

(g) Where the presence of uncombined water is the sole reason for failure to meet the no-visible emission requirement of subparagraphs (a), (c), (d), (e), (h), (j), or (k) of this paragraph, such failure shall not be a violation of such emission requirements.

(h) Fabricating: There shall be no visible emissions to the outside air, except as provided in subparagraph (f) of this paragraph from any of the following operations if they use commercial asbestos or from any building or structure in which such operations are conducted.

1. The fabrication of cement building products.

2. The fabrication of friction products, except those operations that primarily install asbestos friction materials on motor vehicles.

3. The fabrication of cement or silicate board for ventilation hoods; ovens; electrical panels; laboratory furniture; bulkheads, partitions, and ceilings for marine construction; and flow control devices for the molten metal industry.

(i) Insulating: Molded insulating materials which are friable after drying, installed after February 9, 1977, shall contain no commercial asbestos. The provisions of this subparagraph do not apply to insulating material which is spray applied: such materials are regulated under subparagraph (e).

(j) Waste disposal for manufacturing, fabricating, demolition, renovation, and spraying operations: The owner or operator of any source covered under the provisions of subparagraphs (c), (d), (e), or (h) of this paragraph shall meet the following standards:

1. There shall be no visible emissions to the outside air, except as provided in part (j) 3. of this paragraph, during the collection, processing; including incineration, packaging, transporting, or deposition of any asbestos containing waste material which is generated by such a source.

2. All asbestos-containing waste materials shall be deposited at waste disposal sites which are operated in accordance with the provisions of paragraph (5).

3. Rather than meet the requirement of part (j) 1. of this paragraph, an owner or operator may elect to use either of the disposal methods specified subpart (1) 3. (i) and (ii) of this part or an alternative disposal method which has received prior approval by the Technical Secretary:

(i) Treatment of asbestos containing waste material with water.

(I) Control device asbestos waste shall be thoroughly mixed with water into a slurry and other asbestos containing waste material shall be

adequately wetted. There shall be no visible emissions to the outside air from the collection, mixing, and wetting operations, except as provided in subparagraph (f) of this paragraph.

(II) After wetting, all asbestos containing waste material shall be sealed into leak-tight containers while wet, and such containers shall be deposited at waste disposal sites which are operated in accordance with the provisions of paragraph (5).

(III) The containers specified under item (j) 3. (i) (II) of this paragraph shall be labeled with a warning label that states:

CAUTION

Contains Asbestos
Avoid Opening or Breaking Container
Breathing Asbestos is Hazardous
to Your Health

Alternatively, warning labels specified by Occupational Safety and Health Standards of the Department of Labor, Occupational Safety and Health Administration (OSHA) under 29 CFR 1910-93a(2) (ii) may be used.

(ii) Processing of asbestos containing waste material into non-friable forms:

(I) All asbestos containing waste material shall be formed into non-friable pellets or other shapes and deposited at waste disposal sites which are operated in accordance with the provisions of paragraph (5).

(II) There shall be no visible emissions to the outside air from the collection and processing of asbestos containing waste material, except as specified in subparagraph (f) of this paragraph.

4. For the purpose of this subparagraph, the term all asbestos containing waste materials as applied to demolition and renovation operations covered by subparagraph (d) of this paragraph includes only friable asbestos waste and control device asbestos waste.

(k) Waste disposal for asbestos mills: The owner or operator of any source covered under the provisions of subparagraph (a) of this paragraph shall meet the following standard:

1. There shall be no visible emissions to the outside air, except as provided in part (k) 1. of this paragraph during the collection,

processing, packaging, transporting, or deposition of any asbestos containing waste material which is generated by such source.

2. All asbestos containing waste material shall be deposited at waste disposal sites which are operated in accordance with the provisions paragraph (5).

3. Rather than meet the requirement of part (k) 1. of this paragraph an owner or operator may elect to meet the following requirements in subparts (k) 3. (i) and (ii), or use an alternative disposal method which has received prior approval by the Technical Secretary.

   (i) There shall be no visible emissions to the outside air from the transfer of control device asbestos waste to the tailings conveyor, except as provided in subparagraph (f) of this paragraph. Such waste shall be subsequently processed either as specified in subpart (k) 3. (ii) of this paragraph or as specified in part (j) 3. of this paragraph.

   (ii) All asbestos containing waste material shall be adequately mixed with a wetting agent recommended by the manufacturer of the agent to effectively wet dust and tailings, prior to deposition at a waste disposal site. Such agent shall be used as recommended for the particular dust by the manufacturer of the agent. There shall be no discharge of visible emissions to the outside air from the wetting operation except as specified in subparagraph (f) of this paragraph. Wetting may be suspended when the ambient temperature at the waste disposal site is less than -9.5°C (ca. 15°F). The ambient air temperature shall be determined by an appropriate measurement method with an accuracy of ±1°C (±2°F) and recorded at least at hourly intervals during the period that the operation of the wetting system is suspended. Records of such temperature measurements shall be retained at the source for a minimum of two years and made available for inspection by the Technical Secretary.

(l) The owner of any inactive waste disposal site, which was operated by sources covered under subparagraphs (2) (a), (c), or (h) and where asbestos-containing waste material produced by such sources was deposited, shall meet the following standards:

1. There shall be no visible emissions to the outside air from an inactive waste disposal site subject to this paragraph, except as provided in part (l)3. of this paragraph.

2. Warning signs shall be displayed at the entrance, and along the property line of the site or along the perimeter of the sections of the site where asbestos containing waste material was

deposited, at intervals of 100 m (ca. 330 f.) or less, except as specified in part (I) 4. of this paragraph. Signs shall be posted in such a manner and location that a person may easily read the legend. The warning signs required by this paragraph shall conform to the requirements of 20" x 14" upright format signs and this paragraph. The signs shall display the following legend in the lower panel, with letter sizes and styles of a visibility at least equal to those specified in this part.

LEGEND

Asbestos Waste Disposal Site
Do Not Create Dust
Breathing Asbestos is Hazardous
to your Health
1" Sans Serif, Gothic or Block
3/4" Sans Serif, Gothic or Block
14 Point Gothic

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

3. The perimeter of the site shall be fenced in a manner adequate to deter access by the general public, except as specified in part (I) 4. of this paragraph.

4. Warning signs and fencing are not required where the requirements of subparts (I) 3. (i) or (ii) of this paragraph are met, or where a natural barrier adequately deters access by the general public. Upon request and supply of appropriate information, the Technical Secretary will determine whether a fence of a natural barrier adequately deters access to the general public.

5. Rather than meet the requirement of part (I) 1. of this paragraph, an owner may elect to meet the requirements of this part or may use an alternative control method for emissions from inactive waste disposal sites which has received prior approval by the Technical Secretary.

   (i) The asbestos containing waste material shall be covered with at least 15 centimeters (ca. 6 inches) of compacted non-asbestos containing material and cover of vegetation shall be grown and maintained on the area adequate to prevent exposure of the asbestos-containing waste material; or

   (ii) The asbestos containing waste material shall be covered with at least 60 centimeters (ca. 2 feet) of compacted non-asbestos-containing material and maintained to prevent exposure of the asbestos containing waste; or

   (iii) For inactive waste disposal sites for asbestos tailings, a resinous petroleum-based dust suppression agent which

effectively binds dust and controls wind erosion shall be applied. Such agent shall be used as recommended for the particular asbestos tailings by the dust suppression agent manufacturer. Other equally effective dust suppression agents may be used upon prior approval by the Technical Secretary. For purposes of this subpart, waste crankcase oil is not considered a dust suppression agent.

(3) Air-Cleaning

(a) If air cleaning is elected, as permitted by subparagraph (2) (f) and subpart (2) (d) 3. (iv), the requirements of this paragraph must be met.

(b) Fabric filter collection devices must be used, except as noted in paragraphs (c) and (d) of this paragraph. Such devices must be operated at a pressure drop of no more than 4 inches water gauge, as measured across the filter fabric. The airflow permeability as determined by ASTM method D737-69, must not exceed 30 $ft^3/min/ft^2$ for woven fabrics or 35 $ft^3/min/ft^2$ for felted fabrics, except that 40 $ft^3/min/ft^2$ for woven and 45 $ft^3/min/ft^2$ for felted fabrics is allowed for filtering air from asbestos ore dryers. Each square yard of felted fabric must weigh at least 14 ounces and be at least one-sixteenth inch thick throughout. Synthetic fabrics must not contain fill yarn other than that which is spun.

(c) If the use of fabric filters creates a fire or explosion hazard, the Technical Secretary may authorize the use of wet collectors designed to operate with a unit contacting energy of at least 40 inches water gauge pressure.

(d) The Technical Secretary may authorize the use of filtering equipment other than that described in subparagraphs (b) and (c) of this paragraph if the owner or operator demonstrates to the satisfaction of the Technical Secretary that the filtering of particulate asbestos material is equivalent to that of the described equipment.

(e) All air-cleaning equipment authorized by this paragraph must be properly installed, used, operated, and maintained. Bypass devices may be used only during upset or emergency conditions and then only for so long as it takes to shut down the operation generating the particulate asbestos material.

(4) Reporting. The owner or operator of an existing source to which this rule is applicable shall before July 22, 1976, provide the following information to the Technical Secretary:

(a) A description of the emission control equipment used for each process;

(b) If a fabric filter device is used to control emissions, the pressure drop across the fabric filter in inches water gauge.

1. If the fabric filter device utilizes a woven fabric, the airflow permeability in $ft^3/min/ft^2$; and if the fabric is synthetic, indicate whether the fill yarn is spun or not spun.

2. If the fabric filter device utilizes a felted fabric, the density in oz/yd^2, the minimum thickness in inches, and the airflow permeability in $ft^3/min/ft^2$.

(c) For sources subject to subparagraphs (2) (j) and (2) (k):

1. A brief description of each process that generates asbestos-containing waste material.

2. The average weight of asbestos containing waste material disposed of, measured in kg/day.

3. The emission control methods used in all stages of waste disposal.

4. The type of disposal site or incineration site used for ultimate disposal, the name of the site operator, and the name and location of the disposal site.

(d) For sources subject to subparagraph (2) (l):

1. A brief description of the site.

2. The method or methods used to comply with the standard or alternative to be used.

Such information shall accompany the information required by rule .01 of this Chapter.

(5) Waste disposal sites.

(a) In order to be an acceptable site for disposal of asbestos containing waste materials under subparagraphs (2) (j) and (k), an active waste disposal site shall meet the requirements of this Rule.

(b) There shall be no visible emissions to the outside air from any active waste disposal site where asbestos containing waste material has been deposited, except as provided in subparagraph (f) of this paragraph.

(c) Warning signs shall be displayed at all entrances, and along the property at all entrances, and along the property line of the site or along the perimeter of the sections of the site where asbestos containing waste material is deposited, at intervals of 100 m (ca. 330 ft.) or less except as specified in subparagraph (e) of this paragraph. Signs shall be posted in such a manner and location that a person may easily read the legend. The warning signs required by this subparagraph shall conform to the requirements of 20" x 14" upright format signs and this subparagraph. The signs shall display the following legend in the lower panel, with the letter sizes and styles of a visibility at least equal to those specified in this subparagraph.

LEGEND

Asbestos Waste Disposal Site
Do Not Create Dust
Breathing Asbestos
is Hazardous to Your Health
Notation
1" Sans Serif, Gothic or Block
3/4" Sans Serif, Gothic or Block
14 Point Gothic

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

(d) The perimeter of the disposal site shall be fenced in order to adequately deter access to the general public except as specified in subparagraph (e) of this paragraph.

(e) Warning signs and fencing are not required where the requirements of part (f) 1. of this paragraph are met, or where a natural barrier adequately deters access to the general public. Upon request and supply of appropriate information, the Technical Secretary will determine whether a fence or a natural barrier adequately deters access to the general public.

(f) 1. Rather than meet the requirement of subparagraph (b) of this paragraph, an owner or operator may elect to meet the requirements of parts (f) 2. or (f) 3. of this paragraph, or may use an alternative control method for emissions from active waste disposal sites which has received prior approval by the Technical Secretary.

2. At the end of each operating day, or at least once every 24-hour period while the site is in continuous operation, the asbestos-containing waste material which was deposited at the site during the operating day or previous 24-hour period shall be covered with at least 15 centimeters (ca. 6 inches) of compacted non-asbestos-containing material.

3. At the end of each operating day, or at least once every 24-hour period while the disposal site is in continuous operation, the asbestos-containing waste material which was deposited at the site during the operating day or previous 24-hour period shall be covered with a resinous or petroleum-based dust suppression agent which effectively binds dust and controls wind erosion. Such agent shall be used as recommended for the particular dust by the dust suppression agent manufacturer. Other equally effective dust suppression agents may be used upon prior approval by the Technical Secretary. For purposes of this part, waste crankcase oil is not considered a dust suppression agent.

Authority: T.C.A., Section 68-25-105 and 4-5-202. Administrative History. Original Rule filed January 10, 1977; effective February 9, 1977. Amended: filed

CHAPTER 6
GENERAL CONTRACTORS

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62-6-101. Short Title.—This chapter shall be known and may be cited as the Contractors Licensing Act of 1976. (Acts 1976 (Adj. S.), ch. 822, 1.)

62-6-102. Definitions.—For the purposes of this chapter: (1) (A) "Contracting" shall mean undertaking, for a fixed price, fee, commission, or gain of whatever nature, to construct, erect, alter or repair, or have constructed, erected, altered, or repaired part or all of any structure, or private work or utility of any nature or character whatsoever, including railroads, municipal works, water supply systems, sewerage and drainage systems, levees, locks and dams, canals, industrial works, or any highway, road, bridge, or similar structure or project, where the cost of the completed work, or of different projects under a single contract, equals or exceeds twenty-five thousand dollars ($25,000), provided that this definition shall not include architects or engineers duly licensed by the State Board of Examiners for Land Surveyors whose only financial interest in the project shall be the professional fee for preparing plans and specifications, supervision, and normal and ordinary engineering services, that is, usual architectural or engineering services, or both, and they shall not be liable for any other fees, licenses, or assessments other than those provided by the laws of the State of Tennessee; provided that when an architect, engineer, or land surveyor receives an additional fee for employment or direction of labor, he shall be considered as a contractor within the purview of this chapter; provided further that solely the purchase of materials or subletting of separate contracts for various phases or aspects of the construction by the architect or engineer on behalf of the owner shall be considered normal architectural and engineering services, however, the supervision, superintendence, overseeing, directing or in any manner assuming charge of such purchase of subletting shall be considered "contracting."

(B) However, the term "contracting" shall not included:

(i) Subcontracting, unless a subcontract involves:

(A) Fifty thousand dollars ($50,000) or more of electrical work;

(B) Fifty thousand dollars ($50,000) or more of plumbing work, or

(C) Fifty thousand dollars ($50,000) or more of heating, ventilating or air conditioning work.

(ii) Undertaking in one's county of residence solely to construct residences or dwellings on private property for the purpose of resale, if such county has a population of sixty thousand (60,000) or less according to the U.S. Census of Population of 1980 or any subsequent federal census.

(2) "Contractor" shall mean any person, firm, or corporation who engages or offers to engage in contracting. (Acts 1976 (Adj. S.), ch. 822, 2; 1977, ch. 101, 1; 1977, ch. 406, 1; 1980 (Adj. S.), ch. 652, 3; 1981, ch. 399, 1; T.C.A. 62-602; Acts 1982 (Adj. S.), ch. 737, 1.)

62-6-103. License requirement—Recovery of expenses by unlicensed contractor.—(a)(1) Any person, firm or corporation engaged in contracting in this state shall be required to submit evidence that he is qualified to engage in contracting, and shall be licensed as hereinafter provided; it shall be unlawful for any person, firm or corporation to engage in or offer to engage in contracting in the state, unless such person, firm or corporation has been duly licensed under the provisions of this chapter, as hereinafter provided. Any person, firm, or corporation engaged in contracting, including such person, firm, or corporation that engages in the construction of residences or dwellings constructed on private property for the purpose of resale, lease, rent, or any other similar purpose shall be required to submit evidence that he is qualified to engage in contracting and/or building, and shall be licensed. It shall be unlawful for any person, firm, or corporation to engage in, or offer to engage in contracting or building as hereinabove described, unless such person, firm or corporation has been duly licensed under the provisions of this chapter.

(2)(A) Notwithstanding the provisions of subdivision (a)(1), any person, firm, or church that owns property and constructs thereon single residences, farm buildings or other buildings for individual use, and not for resale, lease, rent or other similar purpose, is exempt from the requirements of this chapter.

(B) Except in counties with a population of not less than seven hundred seventy-seven thousand one hundred thirteen (777,113) or not less than three hundred nineteen thousand six hundred twenty-five (319,625) nor more than three hundred nineteen thousand seven hundred twenty-five (319,725) both according to the 1980 federal census or any subsequent federal census, a per-

son or firm specified in subdivision (a)(2)(A) shall not make more than one (1) application for a permit to construct a single residence or shall not construct more than one (1) single residence within a period of one (1) year. There shall be a rebuttable presumption that such person or firm intends to construct for the purpose of resale, lease, rent, or any other similar purpose if more than one (1) application is made for a permit to construct a single residence or if more than one (1) single residence is constructed within a period of one (1) year. No provision of this subdivision shall be construed to alter the definition of the word "contracting" as defined in § 62-6-102.

(3) Nothwithstanding subdivisions (1) and (2), the license of any person, firm or corporation licensed as a general contractor on March 29, 1976, shall continue in force until the natural expiration thereof.

(b) Contracts entered into by a person who is licensed by the board shall clearly state that such person is licensed by the state board for licensing contractors and that the board is authorized to receive complaints relative to such person's professional conduct.

(c) Any unlicensed general contractor covered by the provisions of this chapter shall be permitted in a court of equity to recover actual documented expenses only upon a showing of clear and convincing proof. [Acts 1976, ch. 822, § 3; 1977, ch. 9, § 1; 1979, ch. 59, § 7; 1980, ch. 652, § 5; T.C.A., § 62-603; Acts 1986, ch. 913, § 1.]

62-6-104. Licensing board—Composition.—(a) There is created a state board for licensing contractors, hereinafter called the "board." The board shall be composed of seven (7) members, at least one of this number shall be a subcontractor in privity with the owner, at least one (1) of this number shall be a contractor actively engaged in homebuilding, and one (1) of this number shall be a person who is not engaged in the business of contracting in any county of this state. The other members of the board shall be contractors as defined in 62-6-102, all of whom shall have been actively engaged in said business for a period of not less than ten (10) years next preceding their appointment. Not less than two (2) members of the board shall be residents of the same grand division of the state.

(b) All subsequent appointments of successor members shall be made by the governor at the expiration of the respective terms of the members in the way and manner provided by this chapter. (Acts 1976 (Adj. S.), ch. 822, 4; 1979, ch. 59, 2; T.C.A., 62-604.)

62-6-105. Qualification of members—Terms—Vacancies—Removal.—(a) Each member of the board shall be at least twenty-five (25) years of age and of good moral character. Each member shall be of recognized standing in his branch of the contracting business; provided, however, that the provisions of this sentence shall not apply to the member who is not engaged in the business of contracting.

(b) The terms of members shall be for a seven-year period and staggered so that the term of at least one member shall expire each December 31.

(c) In event of death, resignation or failure of a member to serve his full term, his successor shall be appointed to his unexpired term. Each member shall hold over after the expiration of his term until his successor shall have been duly appointed and qualified. If vacancies shall occur in the board for any cause, the same shall be filled by appointment of the governor.

(d) The governor may remove any member of the board for official misconduct, incompetency or willful neglect of duty. (Acts 1976 (Adj. S.), ch. 822, 5; 1979, ch. 59, 3; T.C.A. 62-605.)

62-6-106. Certificate of appointment—Valid license required—Legal assistance.—(a) Each member of the board shall receive a certificate of appointment from the governor, and before entering upon the discharge of the duties of his office shall file with the secretary of state the constitutional oath of office.

(b) No one shall be eligible for appointment on the board who does not at the time hold an unexpired license to operate as a contractor under this chapter; provided, however, that the provisions of this sentence shall not apply to appointment of a member who by law is not permitted to be engaged in the business of contracting in any county of this state.

(c) The board, or any committee thereof, shall be entitled to the services of the attorney general, or the legal department of Tennessee, in connection with the affairs of the board. (Acts 1976 (Adj. C.), ch. 822, 6; 1979, ch. 59, 4; T.C.A. 62-606.)

62-6-107. Executive director.—The director of the division of regulatory boards in the department of insurance, or his designee, shall serve as executive director, and shall provide all administrative functions for the board. (Acts 1945, ch. 135, 5; mod. C. Supp. 1950, 7182.28 (Williams, 7182.29); Acts 1972 (Adj. S.), ch. 633, 2; 1978 (Adj. S.), ch. 906, 20; T.C.A. 62-607.)

62-6-108. By-laws and rules—Seal.—(a) The board shall have the power to make such by-laws, rules and regulations, not inconsistent with the laws of Tennessee, as it shall deem best, subject to the final approval of the commissioner of insurance.

(b) The board shall adopt a seal for its own use. The seal shall have thereon the words "Board for Licensing Contractors, State of Tennessee" and the executive director shall have care, charge and custody thereof. (Acts 1976 (Adj. S.), ch. 822, 9; T.C.A. 62-609.)

62-6-109. Board meetings—Officers—Compensation. —(a) The board shall meet in January, March, May, July, September and November for the purpose of transacting business.

(b) At the January meeting of each year, the board shall elect officers including a chairman, vice chairman and secretary.

(c) Special meetings of the board shall be held at such times as the board may provide.

(d) Four (4) members shall constitute a quorum at a board meeting.

(e) Due notice of each meeting and the time and place thereof shall be given each member in such manner as the bylaws may provide.

(f) Each member of the board shall receive fifty dollars ($50.00) per diem for each meeting actually attended. (Acts 1976 (Adj. S.), ch. 822, 10; 1979, ch. 59, 8; T.C.A. 62-610.)

62-6-110. Register of applicants—Roster for licensees. —(a) The executive director shall keep a register of all applicants for license, showing of each, date of application, name, qualifications, place of business, place of residence and whether license was granted or refused.

(b) The books and register of the board shall be prima facie evidence of all matters recorded therein.

(c) A roster showing the name and place of business and residence of each licensed contractor shall be prepared by the executive director of the board during the month of January in each odd-numbered year and shall be supplemented every six (6) months; such roster shall be printed by the board, the expense of which shall be part of the expenses of the said board, as provided in 54-1-302, and a copy mailed to and placed on file by the clerk of each incorporated city, town and county in the state, and to each licensed contractor, architect and engineer. (Acts 1976 (Adj. S.), ch. 822, 11; 1980, (Adj. S.), ch. 652, 1; T.C.A. 62-611.)

62-6-111. License and examination—Transfer of license.—(a)(1) Anyone desiring to be licensed as a contractor for this state shall make written application to the board on such forms as are prescribed by the board and shall furnish the board with an affidavit stating that the applicant is not currently performing any construction work where the amount of his contract exceeds twenty-five thousand dollars ($25,000). The application shall be accompanied by an application fee of seventy-five dollars ($75.00).

(2) If the application is satisfactory to the board, then the applicant shall be entitled to an examination to determine his qualifications. This examination may be written and/or oral. The Board shall be entitled to charge each applicant an examination fee, not to exceed, thirty-five dollars ($35.00) for each written and/or oral examination.

(3) If the results of the examination of any applicant shall be satisfactory to the board, then it shall issue to the applicant a certificate authorizing the applicant to operate as a contractor in this state. The Board shall state the general construction classifications and/or the specialty classifications in which the applicant is qualified to engage in as a contractor and for each classification shall list the monetary limitations thereon as determined by the board.

(4) Whenever any applicant is advised to appear before the board for an examination and fails to appear at the scheduled time and place without notifying the board at least three (3) days in advance, such applicant shall pay an additional fee of twenty-five dollars ($25.00) before being rescheduled for examination. In the event of failure to appear for examination on three separate occasions, a new application and fee shall be required.

(b)(1) The board shall promulgate rules and regulations which establish uniform criteria to govern issuance by the board of the general construction classifications, specialty classifications, and monetary limitations required by subsection (a)(3); provided, however, that the board shall have discretionary authority in individual cases to modify such criteria for an applicant if the public safety and welfare clearly requires such modification and if the board furnishes the applicant with a written statement justifying such modification.

(2) The criteria so established by the board shall include, but not be limited to, a letter of reference from a

past client or employer of the applicant as well as a financial statement of the applicant.

(3) If an applicant requests a monetary limitation of greater than one million dollars ($1,000,000) his financial statement shall be audited and attested to by a licensed public accountant or certified public accountant.

(4) The financial statement of any applicant requesting a monetary limitation of one million ($1,000,000) or less shall be either reviewed or audited by a licensed public accountant or certified public accountant, provided, however, that the board may, in its discretion, require the financial statement of such an applicant to be audited and attested to by a licensed public accountant or certified public accountant.

(c) The issuance by the board of a certificate of license authorizing the licensee to engage in any general construction classification(s) of contracting shall not authorize him to engage in twenty-five thousand dollars ($25,000) or more of electrical, plumbing, or heating, ventilating or air conditioning work unless he is additionally licensed in such specialty classification.

(d) A contractor may bid on a contract requiring work in some classification(s) other than the one(s) in which he is licensed if and only if such work is incidental or supplemental to the performance of work in which he is licensed to engage. However, such contractor shall not actually perform under such contract twenty-five thousand dollars ($25,000) or more of work in any one general construction or specialty classification unless he is licensed in such classification.

(e)(1) Upon application of any individual who was formerly a general partner in a dissolved partnership, the board shall transfer to such individual the license formerly held by the partnership upon a showing that:

(A) The individual was a general partner in a dissolved partnership;

(B) The individual has assets equal to or greater than the assets of the partnership as evidenced by sworn statements of the applicant; and,

(C) All liabilities of the partnership were satisfied prior to dissolution or will be satisfied by the individual.

(2) The board for transferring such license shall collect a fee of ten dollars ($10.00).

(3) The individual shall record the transfer certificate in the same manner as provided in 62-6-112, for original certificates.

(f)(1) The board shall transfer, upon application and payment of a fee of ten dollars ($10.00), by any proprietorship or partnership which subsequently incorporates as a Tennessee corporation, the license formerly held by such proprietorship or partnership to such corporation upon a showing that:

(A) The officers or directors or management of the corporation were the owners or managers of the proprietorship or partnership;

(B) A copy of the corporation's charter has been filed with the board;

(C) The partnership or proprietorship is currently in good standing with the board;

(D) The corporation has assets equal to or greater than the assets of the proprietorship or partnership, and as evidenced by sworn statements of the applicant; and

(E) All liabilities of the proprietorship or partnership were satisfied prior to incorporation or will be satisfied by the corporation.

(2) The board shall develop an application for such transfer of license which shall not exceed one (1) page in length.

(3) The corporation shall record the transfer certificate in the same manner as provided in 62-6-112, for original certificates. (Acts 1976 (Adj. S.), ch. 822, 12; 1977, ch. 101, 2; 1977, ch. 406, 2; 1979, ch. 59, 5; 1980 (Adj. S.), ch. 652, 2, 3; 1981, ch. 497, 1, 3, 4; T.C.A. 62-612.)

62-6-112. Recording of certificate of license—Fee.—(a)(1) Any person thus receiving a certificate of license, or any renewal thereof, from the board shall forthwith have it recorded in the office of the county clerk of the county or in the office of the corresponding officer of the municipality in which he is engaged in business, and the date of the recording shall be evidenced thereon; however, no licensed contractor working under the supervision of either a licensed architect or engineer shall be required to record with the county clerk or municipal official.

(2) The clerk or the appropriate municipal official shall be paid a fee of one dollar ($1.00) for recording said certificate.

(b) Until the license is recorded, the holder thereof shall not exercise any of the rights and privileges therein conferred, and in case such license is not so recorded within three (3) months from the date of issuance it shall become invalid.

(c) The county clerk of each county or the appropriate municipal official shall keep in a book to be provided for the purpose, a complete list of the certificates of license recorded by him, together with date of each and the date of the recording.

(d) The certificate of license and any renewal thereof shall be recorded as provided in each county in which the contractor engages in business during the term of the license unless such contractor is being supervised by either a licensed architect or engineer. (Acts 1976 (Adj. S.), ch. 822, 13; 1978 (Adj. S.), ch. 551, 1, 2; impl. am. Acts 1978 (Adj. S.), ch. 934, 22, 36; 1979, ch. 72, 1-4; T.C.A. 62-613.)

62-6-113. Issuance of duplicate certificate.—A duplicate license certificate to replace any certificate lost, destroyed or mutilated, may be issued subject to the rules and regulations of the board. (Acts 1976 (Adj. S.), ch. 822, 14; T.C.A. 62-614.)

62-6-114. Certificate as evidence of rights.—The issuance of a certificate of license shall be evidence that the person, firm, or corporation named therein is entitled to all the rights and privileges of a licensed contractor while the license remains unrevoked or unexpired; provided that such contractor has paid his privilege tax and recorded his certificate of license in accordance with 62-6-112. (Acts 1976 (Adj. S.), ch. 822, 15; 1977, ch. 406, 1; T.C.A. 62-615.)

62-6-115. Corporations and partnerships.—Corporations or partnerships may engage in the business of contracting, provided, at least one (1) of the principals of such corporation or partnership is in responsible charge of such business, if the corporation or partnership is licensed as herein required of contractors. (Acts 1976 (Adj. S.), ch. 822, 16; T.C.A. 62-616.)

62-6-116. Expiration of license—Renewal.—(a) Certificate of license shall expire on the last day of the twelfth month following its issuance or renewal, and shall become invalid on such date unless renewed.

(b) Renewal may be effected at any time during such month by filing with the board a financial statement, which the board may, in its discretion, require to be audited, a report of any personal or corporate bankruptcies, and other such information as the board may require and by the payment of a fee of fifty dollars ($50.00) to the executive director of the board.

(c) The board shall not grant any renewal until it has received satisfactory evidence that the licensee has paid all business taxes due to the state, or any of its counties and municipalities for the preceding year, if the licensee was liable for such tax.

(d) It shall be the duty of the executive director to notify by mail, every person licensed hereunder, of the date of expiration of his certificate of license and the amount of fee required for its renewal for one (1) year; such notice shall be mailed at least one month in advance of the date of expiration of said certificate.

(e) The fee to be paid for the renewal of a certificate of license after the expiration date shall be increased ten percent (10%) for each month or fraction of a month that payment for renewal is delayed; provided, however, that the maximum fee for a delayed renewal shall not exceed twice the normal fee.

(f) No contractor shall be qualified to receive a renewal license when he has been in default in complying with the provisions of this chapter for a period of one (1) year, and in such event the contractor, in order to qualify under the law, shall make a new application as in the case of the issuance of the original license.

(f) The board shall promulgate rules and regulations which establish uniform criteria to govern the review and adjustment of the general construction classifications, specialty classifications, and monetary limitations of certificates of license which are subject to renewal by the board. Such criteria shall also establish a method for identifying those licensees applying for renewal who may require a greater degree of scrutiny by the board than usual. (Acts 1976 (Adj. S.), ch. 822, 17; 1977, ch. 406, 4; 1979, ch. 59, 6; T.C.A. 62-617.)

62-6-117. Certificate issued to person who enters or has entered military service.—Any certificate of license issued by the state board for licensing contractors to any person now in any branch of the armed service of the United States, or who hereafter enlists or is called into said service, shall remain in full force and effect until one (1) year after said person is discharged from said service and shall be subject to renewal at that time by the payment of the annual fee set out in this chapter. (Acts 1976 (Adj. S.), ch. 822, 18; T.C.A. 62-618.)

62-6-118. Revocation or suspension of license—Reinstatement.—(a)(1) Whenever any person, firm, or corporation claims to have been damaged or injured by the gross negligence, incompetency, fraud, dishonest dealing

and/or misconduct in the practice of contracting on the part of any person, firm, or corporation licensed hereunder and shall file suit upon such claim in any of the courts of record in this state and recover judgment thereon such court may, as a part of its decree or judgment in such case, revoke the certificate of license under which such contractor is operating at the time of the aforesaid wrongdoing.

(2) It shall be the duty of the clerk of the court to notify the executive director of the board of such revocation.

(b) The board may reissue a license to any person, firm, or corporation, whose license has been revoked, provided all the members of the board vote in favor of such reissuance for reasons the board may deem sufficient.

(c) The executive director shall immediately notify the secretary of state and the clerk of each county in the state, of any revocation of a license or the reissuance of a revoked license.

(d) The board shall have the power to revoke or suspend any license or renewal granted by it for any of the reasons stated in this section, or for a failure to observe the terms and conditions of any license or renewal granted under the provisions of this chapter or any bylaws, rules or regulations adopted or promulgated by it as provided in 62-6-108, or for a violation of the terms of any license.

(e) The board shall in all cases before hearing any charges against a contractor, furnish a written copy of the charges against the accused, including notice of the time and place where the charges will be heard, and give reasonable opportunity for the accused to be present and offer any evidence he may wish. The accused shall have the right to an attorney if he so desires.

(f) The affirmative vote of a majority of the board shall be necessary to revoke or suspend a license or renewal.

(g) The board may refuse to issue or renew a license to any person, firm, or corporation for lack of financial stability, lack of expertise, submission of false evidence with regard to application of license or renewal, conviction of a felony, and any other conduct which constitutes improper, fraudulent or dishonest dealing, or violation of the statute. (Acts 1976 (Adj. S.), ch. 822, 19; 1977, ch. 406, 5; 1978 (Adj. S.), ch. 891, 1; T.C.A. 62-619.)

62-6-119. Notice of requirements given in invitation to bidders.—(a) All architects and engineers preparing plans and specifications for work to be contracted in the state, or where the work to be done is located in the state, shall include in their invitation to bidders, and in their specifications, a copy of this chapter, or such portions thereof, as are deemed necessary to convey to the invited bidder whether he is a resident of this state or not, and whether a license has been issued to him or not, the information that it will be necessary for him to show evidence of a license before his bid is considered.

(b) The architect or engineer shall direct that the license number, expiration date, and that part of classification applying to the bid, appear on the envelope containing the bid, otherwise the bid shall not be opened.

(c) Architects, engineers, and awarding authorities, public and private, failing to observe this section of the chapter shall be penalized in the same manner as any person under 62-6-120 who accepts a bid from a person who is not licensed in accordance with the provisions of this chapter. (Acts 1976 (Adj. S.), ch. 822, 20; T.C.A. 62-620.)

62-6-120. Penalties for violations.—(a) Any person, firm or corporation who engages or offers to engage in contracting without a license as required by Section 62-6-103, or who violates the terms and conditions of any license or renewal granted by the Board pursuant to this chapter, shall be liable to a fine of not less than five hundred dollars ($500) nor more than ten percent (10%) of the total contract or bid amount, whichever is greater.

(b) Any person, firm or corporation who accepts a bid in excess of twenty-five thousand dollars ($25,000) from a contractor who is not licensed, with appropriate classifications and sufficient monetary limitations, in accordance with the provisions of this chapter, shall be liable to a fine of not less than one thousand dollars ($1,000) nor more than five thousand dollars ($5,000).

(c) No official of the state other than of the Department of Transportation, or any political subdivision of the state, shall issue a permit or contract work order to any applicant therefore, to engage in contracting, unless such applicant holds a license as a contractor with appropriate classifications and sufficient monetary limitations, in accordance with the provisions of this chapter. Any such official violating this subsection shall be subject to a fine of not less than one thousand dollars

($1,000) nor more than five thousand dollars ($5,000) upon conviction. (Acts 1976 (Adj. S.), ch. 822, 21; 1981, ch. 399, 2; 1981, ch. 497, 2; T.C.A. 62-621.)

62-6-121. **Enforcement of chapter by board.**—The board shall inquire into the identity of any person, firm, or corporation operating under the general classifications of this chapter and shall prosecute any person, firm, or corporation violating the provisions of this chapter. (Acts 1976 (Adj. S.), ch. 822, 22; 1978 (Adj. S.), ch. 906, 22; T.C.A. 62-622.)

62-6-122. **Injunctions.**—(a) In order to secure the effective enforcement of this chapter, jurisdiction is conferred on the chancery court of this state to grant injunctive relief against any person, firm, or corporation undertaking to engage in the contracting business in violation of the terms of this chapter.

(b) Such injunction suit shall be filed in the name of the state of Tennessee on relation of the board for licensing contractors, or any member thereof without bond being required for prosecution of the suit or for the issuance of injunction.

(c) Any expenses incurred, such as depositions, travel expenses, attorney fees, required for the prosecution suit shall be paid in the same manner as other expenses incurred by the board. (Acts 1976 (Adj. S.), ch. 822, 23; T.C.A. 62-623.)

62-6-123. **Indemnity or hold harmless agreement invalid.**—A covenant promise, agreement or understanding in or in connection with or collateral to a contract or agreement relative to the construction, alteration, repair or maintenance of a building, structure, appurtenance and appliance, including moving, demolition and excavating connected therewith, purporting to indemnify or hold harmless the promisee against liability for damages arising out of bodily injury to persons or damage to property caused by or resulting from the sole negligence of the promisee, his agents or employees, or indemnitee, is against public policy and is void and unenforceable. (Acts 1976 (Adj. S.), ch. 822, 24; T.C.A. 62-624.)

62-6-124. **Access to and use of financial statements.**—(a) The financial statements submitted by contractors shall be treated as confidential and shall be used by the board only for the purposes of determining the qualifications of applicants for licenses and the monetary limitations.

(b) The comptroller of the treasury or his designated representative shall be accorded access to and may examine any financial statement solely for the purpose of a legitimate audit, 10-7-508 to the contrary notwithstanding. (Acts 1979, ch. 165, 1; T.C.A. 62-625.)

62-6-125. **Hearings and judicial review.**—The provisions of the Uniform Administrative Procedures Act, chapter 5, of title 4, shall govern all matters and procedures respecting the hearing and judicial review of any contested case (as defined therein) arising under this chapter. [Acts 1980, ch. 451, § 11; T.C.A. § 62-626.]

RULES
OF
TENNESSEE BOARD FOR LICENSING GENERAL CONTRACTORS

CHAPTER 0680-1
LICENSING

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0680-1-.01 **Application for License.** Any application for a license as a contractor shall be accompanied by:

(a) a non-refundable fee in the amount established in Tennessee Code Annotated Section 62-6-111;

(b) references from an architect or engineer, bank, material dealer, contractor, and past client or former employer; and

(c) a questionnaire form covering finances, equipment, and experience.

0680-1-.02 **Consideration of Applications.**

(1) All applications for licenses will be considered at the regular meetings of the Board. Such meetings shall be held in Nashville, Tennessee, in the months of January, March, May, July, September and November; provided, however, that the board may change the location of meetings at its discretion. Applicants will receive adequate notice of any such change.

(2) At each regular meeting the Board will consider applications which have been properly completed and received in the Office of the Board by the twentieth (20th) day of the preceding month.

(3) Applicants will be notified of the date when they shall appear before the Board for consideration of their applications. Any individual proposing to engage in contracting as a sole proprietorship must appear personally before the Board and cannot have representation. If the applicant is a partnership, at least one of the partners shall appear before the Board. If the applicant is a corporation, an officer or someone with a power-of-attorney to represent the corporation, shall appear.

0689-1-.03 **Special Meetings.** Special meetings of the Board may be held at the call of the Chairman when requested by at least three (3) Board members.

0680-1-.04 **Signatures on Licenses.** The signatures of the Chairman and Secretary of the Board shall be affixed on original and renewal certificates of license.

0680-1-.05 **Replacement License.** A duplicate certificate of license may be issued by the Board upon receipt of a written request accompanied by a fee of ten dollars ($10.00).

0680-1-.06 **Reinstatement of Invalid License.** Any license which has become invalid because of failure to record the license in accordance with TCA Section 62-6-112 may be reinstated within one (1) year from the date of issuance upon submission of a new application and fee.

0680-1-.07 **Repealed**

0680-1-.08 **Change of Address or Officers.** A licensee shall notify the Office of the Board in writing within thirty (30) days of any change of address or (in the case of a corporation) officers.

0680-1-.09 **Change in mode of operation.**

(1) Whenever a partnership licensed as a contractor dissolves, no former member of the partnership shall further undertake contracting before filing a new application with the Board and receiving a license.

(2) In case of a merger, purchase by non-stockholders of the majority interest, or reorganization pursuant to a bankruptcy proceeding, of any corporation engaged in contracting, the corporation shall make written applications to the Board and obtain a new license before further undertaking contracting.

0680-1-.10 **Renewal of Licenses.** Any person, firm or corporation desiring to renew a license shall make application to the Board on the prescribed forms. The application shall be accompanied by a financial statement attested to by a public accountant or certified public accountant; except, however, that if a renewal applicant request a monetary limitation of one million dollars ($1,000,000) or less, he may submit a notarized statement that the information contained in his financial statement is true and correct to the best of his knowledge and belief.

0680-1-.011 **Joint Ventures.** A joint venture provides a means by which licensed contractors may combine their monetary limitations in order to undertake a larger project than each would otherwise be able to perform as separate contractors. No contractor may participate in a joint venture unless:

(a) he is licensed in a classification which is a necessary and integral part of the total project; and

(b) the monetary limitation on such classification is equal to or greater than the portion of the total cost of the project involving that classification.

0780-1-.12 **General and Specialty Classifications.** The Board will utilize the system of general and specialty classifications, of contracting set forth in Appendix A of this rule. However, in view of the increasing specialization and technological advances in the construction industry, the Board reserves the right to depart from the classification system in appropriate individual cases.

A contractor licensed in one or more sub-classifications under a general construction classification may perform work in such sub-classification(s) under any other general construction classification, provided that such work:

(a) is consistent with established usage and procedures in the construction business; and

(b) is related to that which he is licensed to perform.

Generally, for purposes of determining the classifications in which an applicant is qualified to engage, the Board will primarily consider whether or not the applicant:

(1) has adequate experience in the classifications requested; (2) has an established plant (office; warehouse; equipment areas) from which his business is conducted; and (3) has (or has the ability to acquire) the necessary equipment for the classifications requested, and the experience to operate such equipment. The "experience" of an applicant will be considered to be that of one or more of the partners in the case of a partnership applicant; and one or more of the officers in the case of a corporate applicant.

0680-1-.13 **Monetary Limitations**

(1) Generally, the monetary limitation placed on a classification of a license will be determined as follows:

(a) For applicants having at least five (5) years of direct experience in such classification and no apparent deficiency with respect to plant or equipment, the lesser of:

1. ten (10) times the applicant's net worth; or
2. ten (10) times the applicant's working capital.*

(b) For renewal applicants having at least five (5) years of direct experience in such classification, and no apparent deficiency with respect to plant or equipment, but with limited working capital, the greater of:

1. ten (10) times the applicant's working capital; or
2. fifty percent (50%) of the applicant's net worth.

(c) For other applicants, a lesser amount reflecting the degree of lack of experience, plant, or equipment.

(2) Letters of credit and indemnities (on forms furnished by the Board) may be considered to raise a monetary limitation. Letters of credit may be added at their full value to the applicant's working capital. Credit for indemnities will be limited to fifty percent (50%).

*current assets less current liabilities.

(3) A tolerance of ten percent (10%) will be allowed on the monetary limitation placed on any classification of a license.

(4) Subject to such tolerance, no contractor shall engage, or offer to engage, in any project of which the cost (including all material and labor furnished by or through another source other than the owner) would exceed the monetary limitation (or, if licensed in more than one classification, the highest monetary limitation) placed on his license.

0680-1-.14 **Request for change of classification or limitation.** A licensee may request the Board to consider revision of his classification(s) and/or monetary limitation(s) at any of its regular meetings. Such request shall be made by letter, which shall be accompanied by financial, equipment, and experience statements accurate as of no more than two (2) months prior to the

date of the request. The request must be received in the Office of the Board by the twentieth (20th) day of the month preceding the month in which it is to be considered. Financial statements shall be attested to by a public accountant; except, however, that if the requested limitation is one million dollars ($1,000,000) or less, the licensee may submit a notarized statement that the information contained in his financial statement is true and correct to the best of his knowledge and belief.

0680-1-.15 **Review and adjustment of classifications and monetary limitations.** The Board may require that financial statements submitted by contractors in conjunction with an application for renewal of a license or a request for change of classification(s) or limitation(s) be examined by the Comptroller of the Treasury or his designated representative. The Board may, because of the results of an audit, changing financial conditions, or any other relevant factors:

(1) require the submission of additional financial information prior to acting on a renewal application or request for change of classification(s) or limitation(s); and (2) change the general or specialty classifications or monetary limitations of any license when in the public interest. However, before changing adversely the classification(s) and/or monetary limitation(s) of any license, the Board shall afford the licensee the opportunity for a hearing to show cause why such action should not be taken.

0680-1-.16 (Appendix A of Rule 0680-1-.12) is amended by deleting the text thereof in its entirety and substituting instead the following:

(A) OUTLINE OF CLASSIFICATIONS

(1) BC —Building Construction

(a) Residential
(b) Commercial
(c) Industrial

(i) Building Categories

(2) HC —Heavy Construction

(a) Marine
(Wharves, Docks, Harbor Improvements and Terminals)
(b) Tunnel and Shaft
(c) Energy and Power Plants
(d) Dams, Dikes, Levees and Canals
(e) Mining Surface and Underground
(f) Oil Field Construction
(g) Oil Refineries

(i) Heavy Categories

(3) HRA —Highway, Railroad and Airport Construction

(a) Grading and Drainage
(b) Base and Paving
(c) Bridges and Culverts
(d) Railroad Construction and Related Items
(e) Miscellaneous and Specialty Items

(4) MU —Municipal and Utility Construction

(a) Underground Piping
(b) Water and Sewer Plants and Sewer Disposal
(c) Grading and Drainage (Streets and Roads)
(d) Base and Paving

(5) MC —Mechanical Contracting

(a) Plumbing
(b) Process Piping
(c) Heating, Ventilating, Air Conditioning and Refrigeration
(d) Sprinklers and Fire Protection
(e) Insulation of Mechanical Work
(f) Pollution Control
(g) Pneumatic Tube Systems
(h) Temperature Controls (Pneumatic)
(i) Boiler Construction and Repairs

(6) E —Electrical Contracting

(a) Electrical Transmission Lines
(b) Electrical Work for Buildings and Structures
(c) Underground Electrical Conduit Installation
(d) Sound and Intercom Systems, Fire Detection Systems, Signal and Burglar Alarm Systems
(e) Electrical Signs
(f) Telephone Lines and Ducts
(g) Cable T.V.
(h) Substations
(i) Electrical Temperature Controls

(7) S —Specialty (Specify)

BC —Building Construction

A. Residential

"Residential building contractors" are those whose services are limited to construction, remodeling, repair, or improvement of one, two, three or four family unit residences not exceeding two stories in height and accessory use structures in connection therewith.

B. Commercial

A commercial building contractor is authorized to bid on and contract for the construction,

erection, alteration, repair or demolition of any building or structure for use and occupancy by the general public.

C. Industrial

A contractor under this classification is authorized to bid on and contract for the erection, alteration, repair and demolition of buildings or structures used for industrial production and service, such as manufacturing plants.

Building Categories

1. Acoustical Treatments
2. Carpentry, Framing and Millwork
3. Drywall
4. Floor Covering
5. Foundations
6. Glass, Window and Door Construction
7. Institutional and Recreational Equipment
8. Lathe, Plaster and Stucco
9. Masonry
10. Ornamental and Miscellaneous Metal
11. Painting, Interior Decorating
12. Roof Decks
13. Site and Subdivision Development
14. Special Coatings and Waterproofing
15. Tile, Terrazo and Marble
16. Insulation
17. Elevators, Escalators, and Dumbwaiters
18. Erection and Fabrication of Structural Steel
19. Concrete
20. Sheet Metal
21. Roofing
22. Conveyors
23. Sandblasting
24. Golf Courses
25. Tennis Courts
26. Swimming Pools
27. Outdoor Advertising
28. Excavation
29. Landscaping
30. Fencing
31. Demolition
32. Millwright

HC —Heavy Construction

A. Marine
(Wharves, Docks, Harbor Improvements and Terminals)
B. Tunnel and Shaft
C. Energy and Power Plants
D. Dams, Dikes, Levees and Canals
E. Mining Surface and Underground
F. Oil Field Construction
G. Oil Refineries

Heavy Construction Categories (Apply to all areas)

1. Structural Steel Erection
2. Tower and Stack Construction
3. Foundation Construction, Pile Driving, Foundation Drilling, and Stabilization
4. Demolition and Movement of Structures
5. Clearing, Grubbing, Snagging and Rip Rap
6. Slipform Concrete Structures
7. Rigging and Crane Rigging
8. Welding

HRA —Highway, Railroad and Airport Construction

A. Grading and Drainage
Includes grading, drainage pipe and structures, clearing and grubbing.

B. Base and Paving
1. Base Construction
2. Hot and Cold Mix Asphalt
3. Surface Treatment Asphalt
4. Concrete Paving

C. Bridges and Culverts
1. Painting
2. Repair
3. Demolition
4. Bridge Deck Overlay (Sealant)
5. Gunite
6. Cofferdam
7. Steel Erection

D. Railroad Construction and Related Items

E. Miscellaneous and Specialty Items
1. Traffic Safety
a. Pavement Markers
b. Signing
c. Guardrail and Fencing
d. Attenuators, Signalization and Roadway Lighting
2. Landscaping
Includes seeding, sodding, planting, and chemical weed and brush control.
3. Pavement Rehabilitation
Includes pressure grouting, grinding and grooving, concrete joints, and underdrains.
4. Well Drilling
5. Miscellaneous Concrete
Includes sidewalks, driveways, curb and gutter, and box culverts.

MU —Municipal and Utility Construction

Municipal and Utility Construction includes all supervision, labor, materials and equipment to complete underground piping, water and sewer plants and sewer disposal, grading and drainage, and paving (unless restricted to specific area named.)

A. Underground Piping

Furnish supervision, labor, materials and equipment to complete all underground piping for municipal and utility construction (unless restricted to specific area named).

1. Gas Distribution and Transmission Lines
2. Sewer Lines, Storm Drains, Rehabilitation and Structures
3. Water Lines
4. Underground Conduit

B. Water and Sewer Plants and Sewer Disposal

C. Grading and Drainage
Includes grading, drainage pipe and structures, clearing and grubbing.

D. Base and Paving
   1. Base Construction
   2. Hot and Cold Mix Asphalt
   3. Surface Treatment Asphalt
   4. Concrete Pavement
   5. Miscellaneous Concrete
      Includes sidewalks, driveways, curb and gutter, and box culverts.

MC —Mechanical Contracting

A. Plumbing

B. Process Piping

C. Heating, Ventilating, Air Conditioning and Refrigeration
   1. Solar HVAC

D. Sprinklers and Fire Protection
E. Insulation of Mechanical Work
F. Pollution Control
G. Pneumatic Tube Systems
H. Temperature Controls (Pneumatic)
I. Boiler Construction and Repairs

E —Electrical Contracting

A. Electrical Transmission Lines

B. Electrical Work for Buildings and Structures

C. Underground Electrical Conduit Installation

D. Sound and Intercom Systems, Fire Detection Systems, Signal and Burglar Alarm Systems

E. Electrical Signs

F. Telephone Lines and Ducts

G. Cable T.V.

H. Substations

I. Electrical Temperature Controls

S —Specialty (Specify)

A. Asbestos Material Handling/Removing.

1. In order to be eligible for licensure in this specialty classification, the applicant shall furnish evidence satisfactory to the Board that the applicant has on its staff at least one (1) designated employee who has completed an Asbestos Abatement Contractors Training Course approved or sponsored by the United States Environmental Protection Agency (EPA).

2. A contractor holding a license in this specialty classification shall, as a condition for renewal of such license, require its designated employee(s) to keep abreast of all applicable EPA requirements to insure "state of the art" handling and removing of materials containing asbestos.

3. A contractor shall, whenever work in this specialty classification is in progress, have physically on the job site at least one (1) such designated employee directly responsible for the work.

4. A contractor shall notify the Board of any citation lodged against it, or any of its employees, relative to work in this specialty classification within (10) days of receipt of the citation.

5. This amendment shall take effect on January 1, 1986.

0680-1-.17 REPEALED.

0680-1-.18 Unlawful bidding.—No person, firm or corporation that bids on a project which constitutes "contracting" (as defined in T.C.A. § 62-6-102) without a valid contractor's license, or in violation of the terms and conditions of such license, shall be awarded any contract for the project, or permitted to participate in any re-bidding of the project.

0680-1-.19 Civil Penalties.

(1) The Board may, in a lawful proceeding respecting licensing (as defined in the Uniform Administrative Procedures Act), in addition to or in lieu of any other lawful disciplinary action, assess civil penalties against any license found by the Board to be guilty of any of the causes mentioned in T.C.A. § 62-6-118(a)(1); or for a failure to observe the terms and conditions of any license or renewal granted under T.C.A. § 62-6-101 et seq. or any bylaws, rules or regulations adopted or promulgated by the Board, or for a violation of the terms of any license in accordance with the following schedule:

Violation	Penalty
Gross negligency, incompetence, fraud, dishonest dealing and/or misconduct	not more than $500 nor less than $50
Failure to observe the terms and conditions of any license or renewal	not more than $500 nor less than $50
Bylaws, rules or regulations	not more than $500 nor less than $50
Violation of the terms of any license	not more than $500 nor less than $50

(2) In determining the amount of any penalty to be assessed pursuant to this rule, the Board may consider such factors as the follows:

(a) Willfulness of the violation.

(b) Repetitions of the violation.

(c) Magnitude of risk or harm caused by the violation.

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CHAPTER 31
SOLID WASTE DISPOSAL

SECTION.

PART 1—SOLID WASTE DISPOSAL ACT

68-31-101. Title.
68-31-102. Public policy.
68-31-103. Definitions.
68-31-104. Unlawful methods of disposal.
68-31-105. Supervision over construction of disposal facilities.
68-31-106. Registration of facilities.
68-31-107. Supervision of operation — Rules and regulations.
68-31-108. Delegation of duties to local health officers.
68-31-109. Federal grants to counties and municipalities — Review and approval.
68-31-110. Disposal on own land.
68-31-111. Solid waste disposal control board — Members — Rules and regulations — Procedures — Compensation.
68-31-112. Orders for correction — Preliminary conference with alleged violator.
68-31-113. Review of correction order — Hearing — Appeal.
68-31-114. Criminal penalties.
68-31-115. Injunctions restraining violations.
68-31-116. Performance bonds — Conditions of obligation.
68-31-117. Civil penalties.

Revised September 1988 to include 1988 amendments

PART 1—SOLID WASTE DISPOSAL ACT

68-31-101. Title. — This part shall be known and may be cited as the "Tennessee Solid Waste Disposal Act." [Acts 1969, ch. 295, § 1; T.C.A., § 53-4301.]

Cross-References. County garbage disposal service, §§ 5-19-101 — 5-19-116.

Hazardous waste management, §§ 68-46-101 — 68-46-115.

Major energy projects, coordination of regulation, §§ 13-18-101 — 13-18-128.

Local joint and regional solid waste recovery-disposal systems authorized, §§ 7-56-102 — 7-56-110.

Elk regional resource authority, title 64, ch. 5, pt. 1.

Section to Section References. This chapter is referred to in §§ 7-54-103, 7-54-110, 68-46-215.

Sections 7-82-302, 68-1-104, 68-31-101 — 68-31-115 are referred to in § 68-3-108.

Comparative Legislation. Solid waste disposal acts:

Ala. Code §§ 22-27-1 et seq.
Ariz. Stat. Ann. § 49-701 et seq.
Ga. O.C.G.A. § 12-8-20 et seq.
Ky. Rev. Stat. Ann. § 224.830 et seq., 224.866 et seq.
Miss. Code Ann. § 17-17-1 et seq.
Mo. Rev. Stat. § 260.200 et seq.
N.C. Gen. Stat. § 130-166.16 et seq.
Va. Code §§ 32.1-177 — 32.1-188.

Collateral References. 61A Am. Jur. 2d Pollution Control §§ 244-246.

39A C.J.S. Health and Environment §§ 44, 45.

Attorney General Opinions. Participation of technical secretary of the solid waste disposal control board, OAG 85-013 (1-25-85).

68-31-102. Public policy. — In order to protect the public health, safety and welfare, prevent the spread of disease and creation of nuisances, conserve our natural resources, enhance the beauty and quality of our environment and provide a coordinated statewide solid waste disposal program, it is declared to be the public policy of the state of Tennessee to regulate solid waste disposal to:

(1) Provide for safe and sanitary processing and disposal of solid wastes;

(2) Develop long-range plans for adequate solid waste disposal systems to meet future demands;

(3) Provide a coordinated statewide program of control of solid waste processing and disposal in cooperation with federal, state, and local agencies responsible for the prevention, control, or abatement of air, water, and land pollution; and

(4) Encourage efficient and economical solid waste disposal systems. [Acts 1969, ch. 295, § 2; T.C.A., § 53-4302.]

68-31-103. Definitions. — The terms used in this part are defined as follows:

(1) "Board" means unless otherwise indicated, the solid waste disposal control board created in § 68-31-111;

(2) "Commissioner" means the commissioner of the department of health and environment or his authorized representative;

(3) "Department" means the department of health and environment;

(4) "Health officer" means the director of a city, county, or district health department having jurisdiction over the community health in a specific area, or his authorized representative;

(5) "Person" means any and all persons, natural or artificial, including any individual, firm or association, and municipal or private corporation organized or existing under the laws of this state or any other state, and any governmental agency or county of this state and any department, agency, or instrumentality of the executive, legislative, and judicial branches of the federal government.

(6) "Registration" means a process by which a solid waste processing or processing operation is granted a permit to operate. In this part, the words "registration" and "permit" are synonymous and may be used interchangeably;

(7) "Solid waste" means any garbage, refuse, including without limitation recyclable materials when they become discarded, or sludge from a waste treatment plant, water supply treatment plant, or air pollution control facility and any other discarded material, including solid, liquid, semisolid, or contained gaseous material resulting from industrial, commercial, and agricultural operations, and from community activities, but does not include solid or dissolved material in domestic sewage, or solid or dissolved materials in irrigation return flows or industrial discharges which are point sources subject to permits under § 402 of the Federal Water Pollution Control Act (compiled at 33 U.S.C. § 1342), as amended, or source, special nuclear, or by-product material as defined by the Atomic Energy Act of 1954 (compiled at 42 U.S.C. § 2011 et seq.) as amended;

(8) "Solid waste disposal" means the process of placing, confining, compacting, or covering solid waste except when such solid waste is for reuse, removal, reclamation, or salvage;

(9) "Solid waste disposal system" means the relationship of the coordinated activities of and resources for processing and disposal of solid wastes within a common geographical area and under the supervision of any person or persons engaging in such activities; and

(10) "Solid waste processing" means an operation for the purpose of modifying the characteristics or properties of solid waste to facilitate transportation or disposal of solid wastes including, but not limited to, incineration, composting, separation, grinding, shredding, and volume reduction. [Acts 1969, ch. 295, § 3; 1975, ch. 109, § 1; 1980 (Adj. S.), ch. 662, § 1; 1980 (Adj. S.), ch. 899, § 1; T.C.A., § 53-4303; Acts 1983, ch. 225, § 4.]

68-31-104. Unlawful methods of disposal. — It shall be unlawful to:

(1) Place or deposit any solid waste into the waters of the state except in a manner approved by the department and the Tennessee stream pollution control board;

(2) Burn solid wastes except in a manner and under conditions prescribed by the department and the Tennessee air pollution control board; or

(3) Construct, alter, or operate a solid waste processing or disposal facility or site in violation of the rules, regulations, or orders of the commissioner or in such a manner as to create a public nuisance. [Acts 1969, ch. 295, § 4; impl. am. Acts 1971, ch. 164, § 4; T.C.A., § 53-4304.]

68-31-105. Supervision over construction of disposal facilities. — (a) The department shall exercise general supervision over the construction of solid waste processing facilities and disposal facilities or sites throughout the state. Such general supervision shall apply to all features of construction of solid waste processing facilities and disposal facilities or sites which do or may affect the public health and safety or the quality of the environment, and which do or may affect the proper processing or disposal of solid wastes.

(b) No new construction shall be initiated nor shall any change be made in any solid waste processing facility or disposal facility or site until the plans for such new construction or change have been submitted to and approved by the department. Records of construction or plans for existing facilities or sites shall be made available to the department upon request of the commissioner. In granting approval of such plans, the department may specify such modifications, conditions, and regulations as may be required to fulfill the purposes of this part.

(c) The board is empowered to adopt and enforce rules and regulations for the construction of new facilities and sites and the alteration of existing facilities and sites.

(d) The commissioner is authorized to investigate solid waste processing facilities and disposal facilities or sites throughout the state as often as he deems necessary.

(e) When the site or location of any new solid waste processing facility or disposal facility is situated within one (1) mile of the boundaries of any municipality, no new construction of any such facility shall be approved by the department without the governing body of such municipality consenting to the location of the facility; provided, however, that the provisions of this subsection shall not apply in a county having a metropolitan form of government; a county having a metropolitan form of government shall not have the authority to approve or disapprove such site or location adjacent to such metropolitan government; and no adjacent county or municipality to a county having a metropolitan form of government shall have the authority to approve or disapprove such site or location within the boundaries of such metropolitan government.

(f) Subsection (e) of this section shall not apply to counties having a population, according to the 1970 federal census or any subsequent federal census, of:

Not less than 14,000 nor more than 14,500
Not less than 19,500 nor more than 20,000
Not less than 20,000 nor more than 20,500
Not less than 25,500 nor more than 29,000
Not less than 30,000 nor more than 30,500
Not less than 35,475 nor more than 36,000
Not less than 47,700 nor more than 50,000
Not less than 59,000 nor more than 60,000
Not less than 234,000 nor more than 235,000.

(g) The provisions of subsection (e) of this section shall apply only to counties of the first class.

(h) When the commissioner disapproves plans for the construction of, or change in, any solid waste processing facility or disposal facility or site, he shall notify in writing the person having submitted such plans, and state the grounds for his disapproval.

(i) Actions taken by the department, commissioner, or board in accordance with this part shall be conducted in accordance with the provisions of chapter 15 of title 13 when the action involves a major energy project, as defined in § 13-15-102. [Acts 1969, ch. 258, § [illegible]; 1974 (Adj. S.), ch. 446, §§ 1-3; 1974 (Adj. S.), ch. 485, § 1; 1980 (Adj. S.), ch. [illegible], § 2; 1982, ch. [illegible], § [illegible]; T.C.A., § 53-4308.]

Compiler's Notes. For table of U.S. decennial populations of Tennessee counties, see the supplement to volume 13 tables.

Cross-References. Classification of counties, § 8-24-101.

Section to Section References. This section is referred to in §§ 68-31-[illegible], 68-31-[illegible].

68-31-10[illegible]. Registration — Exemption from part — Permits-by-rule. — (a)(1) No solid waste processing facility or disposal facility or site in any political subdivision of the state of Tennessee shall be operated or maintained by any person unless he has registered with the commissioner in the name of such person for the specified facility or site. All registrations, including those of persons who dispose of only their own wastes on their own land, except as

out in § 68-31-110, shall be with the commissioner. The board is authorized to specify procedures for registration by means of rules and regulations duly promulgated under the authority of this part. Such rules and regulations shall include provisions for public notice and an opportunity for a public hearing on permit applications.

(2) After public notice and an opportunity for comment, the commissioner may, to the extent allowed in regulations adopted by the board, grant variances and waivers for persons; and the board may, through the rulemaking process, establish exemptions from the requirements of this part and permits-by-rule for classes of activities subject to the requirements of this part, provided that it is demonstrated to a reasonable degree of certainty that design or operating practices will prevent degradation of the environment and will adequately protect the public health, safety and environment.

(b) Disposal or processing facilities or sites currently registered with the department shall not need a new permit unless and until their current registration must be amended to encompass any process modifications or expansions of operations currently allowed.

(c) Other program approval, prior to the issuance of a solid waste permit, may be fulfilled by a certification from the applicable program stating the extent of application to that program or that an application for a permit has been submitted to the applicable program. The division of solid waste management using technical support and advice, to the extent available, from the division of water quality control shall evaluate the proposed application in order to determine that water quality standards have been adequately addressed to prevent pollution of the waters of the state.

(d) The commissioner may deny or revoke any registration if he finds that the applicant or registrant has failed to comply with the provisions of this part or the rules promulgated pursuant hereto.

(e) Actions taken by the department, commissioner, or board in accordance with the provisions of this section shall be conducted in accordance with the provisions of chapter 16 of title 13 when the action involves a major energy project, as defined in § 13-16-102. [Acts 1969, ch. 295, § 6; 1970, ch. 662, § 9; 1970, ch. 599, § 3; 1982, ch. 731, § 22; 1981, ch. 174, § 1; T.C.A., § 53-4306; Acts 1985, ch. 337, § 1; 1988, ch. 644, § 1.]

Amendments. The 1985 amendment in (a)(1) in the first sentence deleted "or board" following "commissioner," deleted the former second sentence as set forth in the second volume, and in the present second sentence deleted "other" preceding "registrations."

The 1988 amendment added (a)(2).

Effective Dates. Acts 1985, ch. 337, § 7. October 1, 1985.

Acts 1988, ch. 644, § 22. July 1, 1988. Section 20 also provides that the 1988 amendment by that act takes effect April 1, 1988, for rulemaking purposes.

Section to Section References. This section is referred to in § 54-20-122.

68-31-107. Supervision of operation — Rules and regulations. — (a) The department shall exercise general supervision over the operation and maintenance of solid waste processing facilities and disposal facilities or sites. Such general supervision shall apply to all the features of operation and maintenance which do or may affect the public health and safety or the quality of the environment and which do or may affect the proper processing and disposal of solid wastes. The board is empowered to adopt and enforce rules and regulations governing the operation and maintenance of such facilities, operations, and sites. Provided further, municipalities, cities, towns, and local boards of health may adopt and enforce such rules, ordinances, and regulations equal to or exceeding those adopted by the commissioner, and consistent with the purposes of this part. For exercising such general supervision, the commis-

sioner is authorized to investigate such facilities, operations, and sites as often as he deems necessary.

(b) Actions taken by the department, commissioner, or board in accordance with the provisions of this section shall be conducted in accordance with the provisions of chapter 18 of title 13 when the action involves a major energy project, as defined in § 13-18-102. [Acts 1969, ch. 295, § 7; 1971, ch. 165, § 1; 1960 (Adj. S.), ch. 899, § 4; 1931, ch. 131, § 33; T.C.A., § 53-4307.]

Section to Section References. This section is referred to in § 68-31-111.

Attorney General Opinions. Landfills, OAG 85-031 (2/8/85).

68-31-108. Delegation of duties to local health officers. — The commissioner and board are authorized to delegate the duties and responsibilities granted to them by this part to local health officers to the extent deemed necessary by the commissioner and board to implement the provisions of this part. [Acts 1969, ch. 295, § 8; 1960 (Adj. S.), ch. 899, § 5; T.C.A., § 53-4308.]

68-31-109. Federal grants to counties and municipalities — Review and approval. — The department is authorized to review and approve grants and loans from the federal government and other sources to counties, cities, towns, municipalities, or any combination thereof to assist them in designing, acquiring, constructing, altering, or operating solid waste processing facilities and disposal facilities or sites. The department is authorized further to accept and consider only those applications for grants from counties, cities, towns, and municipalities who have officially adopted a plan for a solid waste disposal system or who are included in an officially adopted plan for a solid waste disposal system which covers two (2) or more such jurisdictions. The department is authorized to approve or disapprove such plans in accordance with the purposes of this part. [Acts 1969, ch. 295, § 9; T.C.A., § 53-4309.]

Section to Section References. This section is referred to in § 68-31-111.

68-31-110. Disposal on own land. — This part shall not apply to any private, natural person disposing waste generated in his own household upon land owned by him, provided such disposal does not create a public nuisance or a hazard to the public health. [Acts 1969, ch. 295, § 10; 1960 (Adj. S.), ch. 899, § 3; T.C.A., § 53-4310.]

Collateral References. Right to maintain nuisance consisting of pollution caused solely by emissions from public sources as affected by [illegible]

68-31-111. Solid waste disposal control board — Members — Rules and regulations — Procedures — Compensation. — (a) There is created a solid waste disposal control board which shall be composed of eleven (11) members as follows:

(1) One (1) person who is engaged in a field which is directly related to agriculture to be appointed by the governor from a list of three (3) persons nominated by the Tennessee Farm Bureau;

(2) Two (2) persons who are employed by a private manufacturing concern with experience in management of solid wastes or hazardous materials to be appointed by the governor from a list of six (6) persons nominated by the Tennessee Manufacturer Association;

(3) One (1) person who is a registered engineer or geologist or qualified land surveyor with knowledge of management of solid wastes or hazardous materials from the faculty of an institution of higher learning to be appointed by the governor from a list of four (4) persons, two (2) of whom shall be nominated by the board of trustees of the University of Tennessee system, and the other two (2) of whom shall be nominated by the board of regents of the state university and community college system;

(4) One (1) person with knowledge of management of solid wastes or hazardous materials to be appointed by the governor from a list of three (3) persons nominated by the Tennessee Environmental Council to represent environmental interests;

(5) One (1) person engaged in the business of management of solid wastes or hazardous materials to be appointed by the governor from a list of three (3) persons nominated by the National Solid Wastes Management Association;

(6) One (1) person to be appointed by the governor from a list of three (3) persons nominated by the County Services Association;

(7) One (1) person to be appointed by the governor from a list of three (3) persons nominated by the Tennessee Municipal League;

(8) Three (3) persons shall be ex officio members and shall be the commissioner of the department of economic and community development or his designee, the commissioner of health and environment or his designee and the director of the Tennessee state planning office or his designee;

(9) The director of the division of solid waste management of the department or his designee shall serve as the technical secretary of the board but shall have no vote at board meetings.

(10) If the governor does not choose to appoint one of the persons recommended to him under the terms of subdivisions (1), (2), (3), (4), (5), (6), or (7) of this subsection, the appropriate organization shall submit a new list of nominations to him equal in number to their original nominations.

(b) The members appointed by the governor shall serve four-year terms and until their successors are appointed; provided, however, that the first appointments shall be as follows: The present agricultural representative shall serve the remainder of his term, one (1) industry representative shall be appointed for a term of two (2) years, one (1) industry representative shall be appointed for a term of three (3) years, the representative of higher education institutions shall be appointed for a term of two (2) years, the representative of environmental interests shall be appointed for a term of three (3) years, the representative of waste management shall be appointed for a term of four (4) years, the representative of counties shall be appointed for one (1) year, and the representative of municipalities shall be appointed for four (4) years.

(c) All vacancies in appointed positions shall be filled by the original appointing authority to serve the remainder of the unexpired term.

(d) It shall be the duty of the board to adopt, modify, repeal, promulgate after due notice and enforce rules and regulations which the board deems necessary for the proper administration of this part. Prior to promulgating, adopting, modifying or repealing rules and regulations the board shall conduct, or cause to be conducted, public hearings in connection therewith. All such acts relative to rules and regulations shall be in accordance with the provisions of chapter 5 of title 4.

(e) Notice of any hearing shall be given not less than thirty (30) days before the date of such hearing and shall state the date, time, and place of hearing, and the subject of the hearing. Any person who desires to be heard relative to solid waste matters at any such public hearing shall give notice thereof in writing to the board on or before the first date set for the hearing. The board is authorized to set reasonable time limits for the oral presentation of views by any person at any such public hearing.

(f) Within (1) year next following July 1, 1960, the board shall review all rules and regulations theretofore adopted by the commissioner pursuant to the provisions of §§ 68-31-105 — 68-31-107 prior to their amendment by Chapter 699 of the Public Acts of 1960 and shall make such modifications or amendments as the board deems advisable. It shall also be the duty of the board to act as a board of appeals as provided in § 68-31-113.

(g) The board shall hold at least four (4) regular meetings each calendar year at a place and time to be fixed by the board. The board shall also meet at the request of the commissioner of public health or of the chairman of the board, or upon request of three (3) members of the board. Five (5) members constitute a quorum, and a quorum may act for the board in all matters. The board shall select a chairman from its members annually. The department of public health shall provide all necessary staff for the board.

(h) Each member of the board other than the ex officio members, shall be entitled to be paid fifty dollars ($50.00) for each day actually and necessarily employed in the discharge of official duties, and each member shall be entitled to receive the amount of his traveling and other necessary expenses actually incurred while engaged in the performance of any official duties when so authorized by the board, but such expenses shall be reimbursed in accordance with the comprehensive state travel regulations promulgated by the commissioner of finance and administration and approved by the attorney general.

(i) No member of the board shall participate in making any decision of a permit or upon a case in which the municipality, firm, or organization which he represents, or by which he is employed, or in which he has a direct substantial financial interest, is involved. [Acts 1969, ch. 288, § 11; 1975, ch. 109, § 2; 1980 (Adj. S.), ch. 898, § 8; 1981, ch. 374, §§ 2-4; T.C.A., § 53-4311; Acts 1988, ch. 644, §§ 2, 3.]

Compiler's Notes. The solid waste disposal control board created by this section terminates on June 30, 1989 by § 4-29-220. See also § 4-29-112.

Amendments. The 1988 amendment in (a)(4) deleted "who is a registered engineer" preceding "with knowledge of" and in (c) substituted "Five (5)" for "Six (6)" at the beginning of the third sentence.

Effective Dates. July 1, 1988. Acts 1988, ch. 644, § 22 also provided that the 1988 amendment by that act take effect April 1, 1988 for rulemaking purposes.

Section to Section References. This section is referred to in § 4-29-210.

Attorney General Opinions. Terminal secretary, OAG 85-112 (12/9/85).

68-31-112. Orders for correction — Preliminary conference with alleged violator. — When the commissioner finds upon investigation that any provisions of this part are not being carried out, and that effective measures are not being taken to comply with provisions of this part, he may issue an order for correction to the responsible person, and this order shall be complied with within the time limit specified in the order. Such order shall be made by personal service or shall be sent by registered mail. Investigations made in accordance with this section may be made on the initiative of the commissioner. Prior to the issuance of any order or the execution of any other enforcement action, the commissioner, or his designee, may request the presence of an alleged violator of this part at a meeting of the staff of the division of solid waste management to show cause why enforcement action ought not to be taken by the department. [Acts 1968, ch. 295, § 12; 1980 (Adj. S.), ch. 662, § 4; T.C.A., § 53-4312.]

68-31-113. Review of correction order — Hearing — Appeal. — (a) Except in counties having populations of not less than two hundred thousand (200,000) nor more than two hundred seventy-five thousand (275,000), any person against whom an order is issued may secure a review of the necessity for or reasonableness of such order by filing with the commissioner a written petition, setting forth the grounds and reasons for his objections and asking for a hearing in the matter involved before the solid waste disposal control board. Any such order shall become final and not subject to review unless the person or persons named therein shall file such petition for a hearing before the solid waste disposal control board no later than thirty (30) days after the date such order is served.

(b) Any person whose plans for the construction of, or change in, any solid waste processing facility or disposal facility or site are disapproved by the commissioner, may secure a review of the commissioner's disapproval by filing with the commissioner a written petition setting forth the grounds and reasons for his objections to the commissioner's disapproval, and asking for a hearing before the solid waste disposal control board. Any disapproval of such plans shall become final and not subject to review unless such petition for a hearing before the solid waste disposal control board is filed no later than thirty (30) days after notice of disapproval is served. For purposes of review, approval of plans subject to modifications, conditions or regulations specified by the commissioner with which the persons submitting the plans disagree, shall constitute disapproval.

(c) In the event the commissioner shall fail to take any action on plans for the construction of, or change in, a solid waste processing facility or disposal facility or site within forty-five (45) days after they are submitted to him, the person having submitted such plans may appeal to the board as though notice of disapproval were received at the expiration of such period; provided, in lieu of setting forth the objections to the grounds for the commissioner's disapproval the petition shall recite the failure of the commissioner to act on the plans.

(d) Notwithstanding any law to the contrary except §§ 68-33-101 — 68-33-108 and § 68-31-108 et., the approval of the commissioner of a solid waste processing facility or disposal facility or site shall be final and not subject to review by any administrative board, commission or other administrative officer or body.

(e) Upon receipt of a written petition as provided in subsections (a) and (b) of this section, the commissioner shall forthwith deliver the petition and all papers relating to the case to the chairman of the solid waste disposal control board who shall thereupon determine the time and place for a hearing before the board. The chairman shall give the commissioner and petitioner thirty (30) days' written notice of the time and place of the hearing, and such hearing shall be held not later than sixty (60) days from receipt of the written petition by the commissioner; provided, however, that upon request of the petitioner or upon the agreement of the petitioner, such hearing may be held not later than one hundred twenty (120) days from receipt of the written petition by the commissioner. At such hearing before the solid waste disposal control board, the commissioner, the petitioner, and any other interested party may appear in person, and by counsel present witnesses, and submit evidence. The chairman shall have the power to administer oaths and issue subpoenas in behalf of the department or at the request of the petitioner.

(f) On the basis of the evidence, produced at the hearing, the board shall make findings and enter such orders as in its opinion will best further the purposes of this part and shall give written notice of such decisions and orders to the parties affected. The order issued under this subsection shall be issued no later than thirty (30) days following the close of the hearing.

(g) The chancery court of Davidson County shall have exclusive original jurisdiction of all review proceedings instituted under the authority and provisions of this part. Appeals from orders and decrees of the chancery court and proceedings brought under the provisions of this part shall lie to the Supreme Court despite the fact that controverted questions of fact may be involved therein.

(h) Any person may file with the commissioner a signed complaint against any person allegedly violating any provisions of this part. Unless the commissioner determines that such complaint is duplicitous or frivolous, he or it shall immediately serve a copy of it upon the person or persons named therein, promptly investigate the allegations contained therein, and shall notify the alleged violator of what action, if any, he or it will take. In all cases, he or it shall notify the complainant of his or its action or determination within ninety (90) days from the date of his or its receipt of the written complaint. If either the complainant or the alleged violator believes that the commissioner's action or determination is or will be inadequate or too severe, he may appeal to the board for a hearing. Such appeal must be made within thirty (30) days after receipt of the notification sent by the commissioner. If the commissioner fails to take the action stated in his notification, the complainant may make an appeal to the board within thirty (30) days from the time at which the complainant knows or has reason to know of such failure. The department shall not be obligated to assist a complainant in gathering information or making investigations or to provide counsel for the purpose of drawing his complaint. [Acts 1968, ch. 535, § 13; 1974 (Adj. S.), ch. 488, § 2; 1978, ch. 106, § 4; 1980 (Adj. S.), ch. 888, § 7; T.C.A., § 53-4313; Acts 1988, ch. 887, § 2.]

Amendments. The 1988 amendment deleted "the board" and "the boards" wherever they appear in this section as set forth in the second volume and in (e) and (f) and inserted "the board."

Effective Dates. Acts 1988, ch. 887, § 7. October 1, 1988.

68-31-114. Criminal penalties. — Any person willfully violating any of the provisions of this part, or failing, neglecting or refusing to comply with any order of the commissioner or board lawfully issued shall be guilty of a misdemeanor and upon conviction, shall be liable to a fine of not less than fifty dollars ($50.00) nor more than twenty-five hundred dollars ($2,500) for each violation, within the discretion of the court, and each day of continued violation shall constitute a separate offense. [Acts 1969, ch. 295, § 14; 1975, ch. 109, § 5; 1980 (Adj. S.), ch. 662, § 5; T.C.A., § 53-4314.]

Collateral References. Validity of state statutory provision permitting administrative agency to impose monetary penalties for violation of environmental pollution statute. 81 A.L.R.3d 1258.

68-31-115. Injunctions restraining violations. — In addition to the penalties herein provided the commissioner may cause the enforcement of any orders, rules or regulations issued by him or orders issued by the board to carry out the provisions of this part by instituting legal proceedings to enjoin the violation of the provisions of this part, and the orders, rules or regulations of the commissioner or orders of the board in any court of competent jurisdiction, and such court may grant a temporary or permanent injunction restraining the violation thereof. The district attorney general in whose jurisdiction a violation of this part occurs or the attorney general of the state shall institute and prosecute such suits when necessity therefor has been shown by those herein clothed with the power of investigation. [Acts 1969, ch. 295, § 15; 1975, ch. 109, § 6; T.C.A., § 53-4315.]

Law Reviews. The Tennessee Court System — Presentment, 8 Mem. St. U. L. Rev. 477.

Collateral References. Fellmer control. Preliminary mandatory injunction to prevent, correct, or reverse effects of polluting practices. 48 A.L.R.3d 1223.

68-31-116. Performance bonds — Contracts of obligation. — (a) A performance bond or equivalent cash or securities shall be filed with the commissioner, payable to the state of Tennessee and shall be executed by the operator of a registered facility and a corporate surety who is approved by the commissioner and properly authorized to act as such surety and licensed to do business in the state of Tennessee. The operator may elect to deposit cash or negotiable United States treasury bonds or negotiable general obligation municipal or corporate bonds which municipal or corporate bonds have at least

an "A" rating by Moodys and or Standard and Poors rating services, with the treasurer of the state of Tennessee in lieu of a corporate surety. The treasurer shall receive and hold the deposits in the name of the state of Tennessee, in trust, for the purposes for which the deposit is made, and shall at all times be responsible for the custody and safekeeping of the deposits. The operator making the deposit shall be entitled from time to time to demand and receive from the treasurer, on the written order of the commissioner, the whole or any portion of any securities so deposited upon depositing with him, in lieu thereof, other negotiable securities of the classes herein specified having a market value at least equal to the sum of the bond, and also to demand and recover the interest income from the securities as the same becomes due and payable. The state treasurer, at the request of the operator, shall convert the securities into such other negotiable securities of the classes herein specified as may be designated by the operator. However, any operator having outstanding corporate bonds with at least an "A" rating by Moodys and/or Standard and Poors rating service, may execute its own bond as surety.

(b) The bond or cash deposit or marketable value of the securities, which shall be conditioned upon the proper operation and closure of the registered solid waste disposal operation shall be not less than one thousand dollars ($1,000) for each estimated acre or fraction thereof affected by the operation. Liability under the bond shall be continuous until the operation is properly closed and ended.

(c) A municipality or county may, in lieu of a performance bond or equivalent cash or securities, execute a contract of obligation with the commissioner. Such contract of obligation will be a binding agreement on the municipality or county, allowing the commissioner or his designee to collect not less than one thousand dollars ($1,000) for each estimated acre or fraction thereof affected by the disposal operation from any funds being disbursed or to be disbursed from the state to the municipality or county on failure of the municipality or county to operate or to close the registered solid waste disposal operation properly. The amount of the contract of obligation shall be set by the commissioner. The contract shall be filed with the commissioner of finance and administration who shall act on the terms of the contract on notice from the commissioner of public health of failure to operate or to close the disposal operation, after notice to the operator, as set out below.

(d) The amount of the bond or contract of obligations shall be increased or decreased to take account of any change in the acreage covered by the registration, as set out in § 68-31-105. If any of the requirements of this part or rules and regulations adopted pursuant thereto or the orders of the commissioner have not been complied with within the time limits set by the commissioner or by this part, the commissioner shall cause a notice of noncompliance to be served upon the operator, or where found necessary, the commissioner shall order suspension of registration. Such notice or order shall be handed to the operator in person or served by certified mail addressed to the permanent address shown on the application for registration. The notice of noncompliance or order of suspension shall specify in what respects the operator has failed to

comply with this part or the regulations or orders of the commissioner. If the operator has not reached an agreement with the commissioner or has not complied with the requirements set forth in the notice of noncompliance or order of suspension within time limits set therein, the registration may be revoked by order of the commissioner and the performance bond shall then be forfeited to the commissioner. When a bond is forfeited pursuant to the provisions of this part, the commissioner shall give notice to the attorney general who shall collect the forfeiture. [Acts 1980 (Adj. S.), ch. 662, § 7; T.C.A., § 53-4343.]

68-31-117. Civil penalties. — (a)(1) Any person who violates or fails to comply with any provision of this part or any rule, regulation, or standard adopted pursuant to this part shall be subject to a civil penalty of not less than one hundred dollars ($100) nor more than five thousand dollars ($5,000) per day for each day of violation.

(2) Each day such violation continues shall constitute a separate violation. In addition, such person shall also be liable for any damages to the state resulting therefrom, without regard to whether any civil penalty is assessed.

(b) Any civil penalty or damages shall be assessed in the following manner:

(1) The commissioner may issue an assessment against any person responsible for the violation or damages. Such person shall receive notice of the assessment by certified mail, return receipt requested;

(2) Any person against whom an assessment has been issued may secure a review of the assessment by filing with the commissioner a written petition setting forth the grounds and reasons for his objections and asking for a hearing in the matter involved before the solid waste disposal control board. Such a hearing shall be a contested case and the provisions of chapter 5 of title 4 shall apply. The solid waste disposal control board shall have the power to enter such orders as in its opinion will best further the purposes of this part;

(3) If a petition for review of the assessment is not filed within thirty (30) days after the date the assessment is served, the violator shall be deemed to have consented to the assessment and it shall become final;

(4) Whenever any assessment has become final because of a person's failure to appeal either the commissioner's assessment or the board's order, the commissioner may apply to the appropriate court for a judgment and seek execution on such judgment. The court, in such proceedings, shall treat the failure to appeal such assessment as a confession of judgment in the amount of the assessment; and

(5) The commissioner may institute proceedings for assessment in the chancery court of Davidson County or in the chancery court of the county in which all or part of the violation or failure to comply occurred. Such court shall have venue over such actions. The provisions of § 20-4-101, as to the summary nonwithstanding.

(c) In assessing a civil penalty, the following factors may be considered:

(1) The harm done to public health or the environment;

(2) The economic benefit gained by the violator;

(3) The amount of effort put forth by the violator to attain compliance; and

(4) Any unusual or extraordinary enforcement costs incurred by the commissioner.

(d) Damages to the state may include any reasonable expenses incurred in investigating and enforcing violations of this part, and in restoring the air, water, land and other property, including animal, plant and aquatic life, of the state to their former condition. [Acts 1980 (Adj. S.), ch. 662, § 6; T.C.A., § 53-4344.]

PUBLIC CHAPTER NO. 967

HOUSE BILL NO. 151

By Davis (Knox)

Substituted for: Senate Bill No. 101

By Atchley

AN ACT relative to the Tennessee Solid Waste Disposal Act and to amend Tennessee Code Annotated, Title 68, Chapters 31 and 31.

BE IT ENACTED BY THE GENERAL ASSEMBLY OF THE STATE OF TENNESSEE:

SECTION 1. Tennessee Code Annotated, Section 68-31-105, is amended by adding the following new subsection immediately following subsection (d) and by redesignating subsequent subsections accordingly:

( ) The Commissioner shall not approve any plans submitted in accordance with subsection (d) unless the applicant has submitted proof satisfactory to the Commissioner that the geological formation of the proposed site and the design of the proposed facility are capable of containing the disposed wastes to prevent the pollution of waters of the state.

SECTION 2. This Act shall take effect upon becoming a law, the public welfare requiring it.

PASSED: April 28, 1988

SPEAKER OF THE HOUSE OF REPRESENTATIVES

SPEAKER OF THE SENATE

APPROVED this 12th day of May, 88

GOVERNOR

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Tennessee

21.05.15
9/1/88

Tennessee

PUBLIC CHAPTER NO. 966

HOUSE BILL NO. 355

By Davis (Knox)

Substituted for: Senate Bill No. 587

By Atchley

AN ACT relative to the application procedure for solid waste disposal facilities, and to amend Tennessee Code Annotated, Title 68, Chapters 31 and 33.

BE IT ENACTED BY THE GENERAL ASSEMBLY OF THE STATE OF TENNESSEE:

SECTION 1. Tennessee Code Annotated, Section 68-31-104(a), is amended by adding the following as a new subdivision to be appropriately designated:

( )

A. In order to inform interested persons in the area of solid waste disposal of the proposed facility and its tentative approval, public notice shall be circulated within the geographical area of the proposed facility by any of the following means:

(1) Posting in the post office and public places of the municipality nearest the site under consideration; or

(2) Publishing in local newspapers and periodicals, or, if appropriate, in a daily newspaper of general circulation.

B. Public notice of a proposed site approval shall include the following:

(1) Name, address, phone number of the solid waste management division of the department of health and environment;

(2) Name and address of the site owner and/or operator;

(3) Location and size of the proposed site;

(4) Brief description of the type operation to be operated at the site and the type waste that will be accepted;

(5) A description of the time frame and procedures for making a final determination on the facility application approval or disapproval; and

(6) Address and phone number of the premises at which persons may obtain further information, request copies of data on the site, and inspect that data.

C. A copy of the public notice and fact sheet shall be sent to any person who specifically requests one. The commissioner of the department of health and environment shall send a copy of such notice of applications and fact sheet within the state on a periodic group mailing list to those persons who have requested the addition of their names to a mailing list. The commissioner may annually purge the mailing list of those persons who do not renew their request.

D. Interested persons may submit written comments on the tentative determinations within thirty (30) days of the public notice or such greater period as the commissioner allows. All written comments submitted shall be retained and made available to the solid waste disposal control board in its final determination of registration of the proposed site.

E. Interested persons may request in writing that the commissioner hold a public hearing on any proposed solid waste management facility registration. The request must be filed within the period allowed for public comment and must indicate the interest of the party filing it and the reasons why a hearing is warranted. If there is a significant public interest in having a hearing, the commissioner shall hold one in the geographical area of the proposed site. Instances of doubt should be resolved in favor of holding a hearing. The commissioner shall investigate or request the comments made at the hearing to assist him in his final determination of registration of the proposed site.

F. No less than fifteen (15) days in advance of the hearing, public notice of it shall be circulated at least as widely as was the notice of the proposed site approval and registration. Procedure for circulation of public notice for the hearing shall include the following:

(1) Publication in a newspaper of general circulation within the geographical area of the site; and

(2) Sending notice to all persons who received a copy of the notice or fact sheet for the site registration and any person who specifically requests a copy of the notice of the hearing.

G. Each notice of a public hearing shall include at least the following contents:

(1) Name, address and phone number of the solid waste management division of the department of health and environment;

(2) Name and address of each site and site owner or operator that will be heard at the hearing;

(3) A description of the type facility that will be located on the site;

(4) A brief reference to the public notice issued for each proposed site;

(5) Information regarding the time and location for the hearing;

(6) The purpose of the hearing;

(7) A concise statement of the issues raised by the persons requesting the hearing;

21.05.16
9/1/88

(viii) Address and phone number of the premises at which interested persons may obtain further information, request a copy of each draft permit, request a copy of each fact sheet, and inspect and copy forms and related documents;

(ix) A brief description of the nature of the hearing, including the rules and procedures to be followed.

SECTION 3. This Act shall take effect upon becoming a law, the public welfare requiring it.

PASSED: April 29, 1988

SPEAKER OF THE HOUSE OF REPRESENTATIVES

SPEAKER OF THE SENATE

APPROVED this 12th day of May, 1988

GOVERNOR

Tennessee

21.05.17
9/1/88

PUBLIC CHAPTER NO. 334

SENATE BILL NO. 1388

By Cohen

Substituted for: House Bill No. 1383

By Williams, Herron, DeBerry, Bivens, Swann, Moore (Shelby)

AN ACT Relative to the penalty for revealing certain information concerning inspections conducted by the Department of Health and Environment and to amend Tennessee Code Annotated, Title 68.

BE IT ENACTED BY THE GENERAL ASSEMBLY OF THE STATE OF TENNESSEE:

SECTION 1. Tennessee Code Annotated, Title 68, Chapter 1, Part 1, is amended by adding the following as a new section:

Section __.

(a) It shall be prohibited conduct for any Department of Health and Environment employee to knowingly reveal, or cause to be revealed, any information to a person not authorized by the authority of the commissioner to receive or have knowledge of such information that can reasonably be expected to provide such person with advance notification of the date, time or place that an inspection to be conducted by the Department of Health and Environment will occur.

(b) If the commissioner finds that any Department of Health and Environment employee revealed information in violation of subsection (a) of this section, then the commissioner shall have the authority to terminate such employee from state employment in accordance with the same procedures, safeguards and rights of appeal as are generally provided by law or regulation for the discipline or termination of state employees.

(c) The commissioner shall publish a memorandum to employees explaining subsections (a) and (b) of this section and shall post appropriate notices of this law.

SECTION 2. This act shall take effect on July 1, 1988, the public welfare requiring it.

HB

PASSED: April 26, 1988

SPEAKER OF THE SENATE

SPEAKER OF THE HOUSE OF REPRESENTATIVES

APPROVED this 12th day of May 19 88

GOVERNOR

Tennessee

21.06.18
9/1/88

RULEMAKING HEARING RULES

OF

TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION

BUREAU OF ENVIRONMENT

DIVISION OF AIR POLLUTION CONTROL

CHAPTER 1200-3-11

HAZARDOUS AIR CONTAMINANTS

AMENDMENT

Chapter 1200-3-11 HAZARDOUS AIR CONTAMINANTS is amended by the deletion of the language of rule .02 in its entirety and substituting therefore the following language so that, as amended, rule .02 shall read as follows:

1200-3-11-.02 ASBESTOS

The provisions of this rule are applicable to those sources specified in 1200-3-11-.02(2)(a) through 1200-3-11-.02(2)(l), 1200-3-11-.02(5), and 1200-3-11-.02(6).

1200-3-11-.02(1) Definitions.

All terms that are used in this rule and are not defined below are given the same meaning as provided in Chapter 1200-3-2 DEFINITIONS.

(a) "Active waste disposal site" means any disposal site other than an inactive site.

(b) "Adequately wet" means sufficiently mix or penetrate with liquid to prevent the release of particulates. If visible emissions are observed coming from asbestos-containing material, then that material has not been adequately wetted. However, the absence of visible emissions is not sufficient evidence of being adequately wet.

(c) "Asbestos" means the asbestiform varieties of serpentinite (chrysotile), riebeckite (crocidolite), cummingtonite-grunerite, anthophyllite, and actinolite-tremolite.

(d) "Asbestos-containing material" (ACM) means asbestos or any asbestos containing material, which contains more than 1 percent asbestos as determined using Polarized Light Microscopy according to the method specified in Appendix A, Subpart F, 40 CFR, Part 763, Section 1, Polarized Light Microscopy, as contained in the 7-1-91 Edition of the CFR.

(e) "Asbestos-containing waste materials" means mill tailings or any waste that contains commercial asbestos and is generated by a source subject to the provisions of this (subpart). This term includes filters from control devices, friable asbestos waste material, and bags or other similar packaging contaminated with commercial asbestos. As applied to demolition and renovation operations, this term also includes regulated asbestos-containing material waste and materials contaminated with asbestos including disposable equipment and clothing.

(f) "Asbestos mill" means any facility engaged in converting, or in any intermediate step in converting, asbestos ore into commercial asbestos. Outside storage of asbestos material is not considered a part of the asbestos mill.

(g) "Asbestos tailings" means any solid waste that contains asbestos and is a product of asbestos mining or milling operations.

(h) "Asbestos waste from control devices" means any waste material that contains asbestos and is collected by a pollution control device.

(i) "Category I nonfriable ACM" means asbestos-containing packings, gaskets, resilient floor covering, and asphalt roofing products, containing more than 1 percent asbestos as determined using polarized light microscopy according to the method specified in Appendix A, Subpart F, 40 CFR Part 763, section 1, Polarized Light Microscopy, as contained in the 7-1-91 Edition of the CFR.

(j) "Category II nonfriable ACM" means any material, excluding Category I nonfriable ACM, containing more than 1 percent asbestos, as determined using polarized light microscopy according to the methods specified in Appendix A, Subpart F, 40 CFR Part 763, section 1, Polarized Light Microscopy, as contained in the 7-1-91 Edition of the CFR, that, when dry, cannot be crumbled, pulverized, or reduced to powder by hand pressure.

(k) "Commercial asbestos" means any material containing asbestos that is extracted from ore and has value because of its asbestos content.

(l) "Cutting" means to penetrate with a sharp-edged instrument and includes sawing but does not include shearing, slicing, or punching.

(m) "Demolition" means the wrecking or taking out of any load-supporting structural member of a facility together with any related handling operations or the intentional burning of any facility.

(n) "Emergency renovation operation" means a renovation operation that was not planned but results from a sudden, unexpected event that, if not immediately attended to, presents a safety or public health hazard, is necessary to protect equipment from damage, or is necessary to avoid imposing an unreasonable financial burden. This term includes operations necessitated by nonroutine failures of equipment.

(o) "Fabricating" means any processing (e.g., cutting, sawing, drilling) of a manufactured product that contains commercial asbestos, with the exception of processing at temporary sites (field fabricating) for the construction or restoration of facilities. In the case of friction products, fabricating includes bonding, debonding, grinding, sawing, drilling, or other similar operations performed as part of fabricating.

(p) "Facility" means any institutional, commercial, public, industrial, or residential structure, installation, or building (including any structure, installation, or building containing condominiums or individual dwelling units operated as a residential cooperative, but excluding residential buildings having four or fewer dwelling units); any ship; and any active or inactive waste disposal site. For purposes of this definition, any building, structure, or installation that contains a loft used as a dwelling is not considered a residential structure, installation, or building. Any structure, installation or building that was previously subject to this (subpart) is not excluded, regardless of its current use or function.

(q) "Facility component" means any part of a facility including equipment.

(r) "Friable asbestos material" means any material containing more than 1 percent asbestos as determined using the method specified in Appendix A, Subpart F, 40 CFR Part 763, section 1, Polarized Light Microscopy, as contained in the 7-1-91 Edition of the CFR, that, when dry, can be crumbled, pulverized, or reduced to powder by hand pressure. If the asbestos content is less than 10 percent as determined by a method other than point counting by polarized light microscopy (PLM), verify the asbestos content by point counting using PLM.

(s) "Fugitive source" means any source of emissions not controlled by an air pollution control device.

(t) "Glove bag" means a sealed compartment with attached inner gloves used for the handling of asbestos-containing materials. Properly installed and used, glove bags provide a small work area enclosure typically used for small-scale asbestos stripping operations. Information on glove-bag installation, equipment and supplies, and work practices is contained in

the Occupational Safety and Health Administration's (OSHA's) final rule on occupational exposure to asbestos (Appendix G to 29 CFR 1926.58, as contained in the 7-1-91 Edition of the CFR).

(u) "Grinding" means to reduce to powder or small fragments and includes mechanical chipping or drilling.

(v) "Inactive waste disposal site" means any disposal site or portion of it where additional asbestos-containing waste material has not been deposited within the past year.

(w) "In poor condition" means the binding of the material is losing its integrity as indicated by peeling, cracking, or crumbling of the material.

(x) "Installation" means any building or structure or any group of buildings or structures at a single demolition or renovation site that are under the control of the same owner or operator (or owner or operator under common control).

(y) "Leak-tight" means that solids or liquids cannot escape or spill out. It also means dust-tight.

(z) "Malfunction" means any sudden and unavoidable failure of air pollution control equipment or process equipment or of a process to operate in a normal or usual manner so that emissions of asbestos are increased. Failures of equipment shall not be considered malfunctions if they are caused in any way by poor maintenance, careless operation, or any other preventable upset conditions, equipment breakdown, or process failure.

(aa) "Manufacturing" means the combining of commercial asbestos--or, in the case of woven friction products, the combining of textiles containing commercial asbestos--with any other material(s), including commercial asbestos, and the processing of this combination into a product. Chlorine production is considered a part of manufacturing.

(bb) "Natural barrier" means a natural object that effectively precludes or deters access. Natural barriers include physical obstacles such as cliffs, lakes or other large bodies of water, deep and wide ravines, and mountains. Remoteness by itself is not a natural barrier.

(cc) "Nonfriable asbestos material" means any material containing more than 1 percent asbestos by area as determined by the method specified in Appendix A, Subpart F, 40 CFR Part 763 section 1, Polarized Light Microscopy, as contained in the 7-1-91 Edition of the CFR, that, when dry, cannot be crumbled, pulverized, or reduced to powder by hand pressure.

(dd) "Nonscheduled renovation operation" means a renovation operation necessitated by the routine failure of equipment, which is expected to occur within a given period based on past operating experience, but for which an exact date cannot be predicted.

(ee) "Owner or operator of a demolition or renovation activity" means any person who owns, leases, operates, controls, or supervises the facility being demolished or renovated or any person who owns, leases, operates, controls, or supervises the demolition or renovation operation, or both.

(ff) "Outside air" means the air outside buildings and structures, including, but not limited to, the air under a bridge or in an open air ferry dock.

(gg) "Particulate asbestos material" means finely divided particles of asbestos or material containing asbestos.

(hh) "Planned renovation operations" means a renovation operation, or a number of such operations, in which some RACM will be removed or stripped within a given period of time and that can be predicted. Individual nonscheduled operations are included if a number of such operations can be predicted to occur during a given period of time based on operating experience.

(ii) "Regulated asbestos containing material (RACM)" means (a) Friable asbestos material, (b) Catagory I nonfriable ACM that has become friable, (c) Catagory I nonfriable ACM that will be or has been subjected to sanding, grinding, cutting, or abrading, or (d) Catagory II nonfriable ACM that has a high probability of becoming or has become crumbled, pulverized, or reduced to powder by the forces expected to act on the material in the course of the demolition or renovation operations regulated by this subpart.

(jj) "Remove" means to take out RACM or facility components that contain or are covered with RACM from any facility.

(kk) "Renovation" means altering a facility or one or more facility components in any way, including the stripping or removal of RACM from a facility component. Operations in which load-supporting structural members are wrecked or taken out are demolitions.

(ll) "Resilient floor covering" means asbestos-containing floor tile, including asphalt and vinyl floor tile, and sheet vinyl floor covering containing more than 1 percent asbestos as determined using polarized light microscopy according to the method specified in Appendix A, Subpart F, 40 CFR Part 763, section 1, Polarized Light Microscopy, as contained in the 7-1-91 Edition of the CFR.

(mm) "Roadways" means surfaces on which vehicles travel. This term includes public and private highways, roads, streets, parking areas, and driveways.

(nn) "Strip" means to take off RACM from any part of a facility or facility components.

(oo) "Structural member" means any load supporting member of a facility, such as beams and load supporting walls; or any nonload supporting member, such as ceilings and nonload-supporting walls.

(pp) "Visible emissions" means any emissions, which are visually detectable without the aid of instruments, coming from RACM or asbestos-containing waste material, or from any asbestos milling, manufacturing, or fabricating operation. This does not include condensed, uncombined water vapor.

(qq) "Waste generator" means any owner or operator of a source covered by this (rule) whose act or process produces asbestos-containing waste material.

(rr) "Waste shipment record" means the shipping document, required to be originated and signed by the waste generator, used to track and substantiate the disposition of asbestos-containing waste material.

(ss) "Working day" means Monday through Friday and includes holidays that fall on any of the days Monday through Friday.

1200-3-11-.02(2) Standard for various sources of asbestos.

1200-3-11-.02(2)(a) Standard for asbestos mills.

1 Each owner or operator of an asbestos mill shall either discharge no visible emissions to the outside air from that asbestos mill, including fugitive sources, or use the methods specified by 1200-3-11-.02(3) to clean emissions containing particulate asbestos material before they escape to, or are vented to, the outside air.

2 Each owner or operator of an asbestos mill shall meet the following requirements:

(i) Monitor each potential source of asbestos emissions from any part of the mill facility, including air cleaning devices, process equipment, and buildings that house equipment for material processing and handling, at least once each day, during daylight hours, for visible emissions to the outside air during periods of operation. The monitoring shall be by visual observation of at least 15 seconds duration per source of emissions.

(ii) Inspect each air cleaning device at least once each week for proper operation and for changes that signal the potential for malfunction, including, to the maximum extent possible without dismantling other than opening the device, the presence of tears,

holes, and abrasions in filter bags and for dust deposits on the clean side of bags. For air cleaning devices that cannot be inspected on a weekly basis according to this subpart, submit to the Technical Secretary, and revise as necessary, a written maintenance plan to include, at a minimum, the following:

(I) Maintenance schedule.

(II) Recordkeeping plan.

(iii) Maintain records of the results of visible emissions monitoring and control device inspections using the forms shown in Figures 1 and 2 and include the following:

(I) Date and time of each inspection.

(II) Presence or absence of visible emissions.

(III) Condition of fabric filters, including presence of any tears, holes, and abrasions.

(IV) Presence of dust deposits on clean side of fabric filters.

(V) Brief description of corrective actions taken, including date and time.

(VI) Daily hours of operation for each control device.

(iv) Furnish upon request, and make available during normal business hours for inspection by the Technical Secretary, all records required under this section.

(v) Retain a copy of all monitoring and inspection records for at least 2 years.

(vi) Submit quarterly a copy of the visible emission monitoring records to the Technical Secretary if visible emissions occurred during the report period.

Quarterly reports shall be postmarked by the 30th day following the end of the calendar quarter.

1200-3-11-.02(2)(b) Standard for roadways.

No person may construct or maintain a roadway with asbestos tailings or asbestos-containing waste material on that roadway, unless, for asbestos tailings,

1 It is a temporary roadway on an area of asbestos ore deposits (asbestos mine); or

2 It is a temporary roadway at an active asbestos mill site and is encapsulated with a resinous or bituminous binder. The encapsulated road surface must be maintained at a minimum frequency of once per year to prevent dust emissions; or

3 It is encapsulated in asphalt concrete meeting the specifications contained in Section 401 of Standard Specifications for Construction of Roads and Bridges on Federal Highway Projects, FP-85, 1985, or their equivalent.

1200-3-11-.02(2)(c) Standard for manufacturing.

1 Applicability. This standard applies to the following manufacturing operations using commercial asbestos:

(i) The manufacture of cloth, cord, wicks, tubing, tape, twine, rope, thread, yarn, roving lap, or other textile materials.

(ii) The manufacture of cement products.

(iii) The manufacturing of fireproofing and insulating materials.

(iv) The manufacture of friction products.

(v) The manufacture of paper, millboard, and felt.

(vi) The manufacture of floor tile.

(vii) The manufacture of paints, coatings, caulks, adhesives, and sealants.

(viii) The manufacture of plastics and rubber materials.

(ix) The manufacture of chlorine utilizing asbestos diaphragm technology.

(x) The manufacture of shotgun shell wads.

(xi) The manufacture of asphalt concrete.

2 Standard. Each owner or operator of the manufacturing operations to which this subparagraph (2)(c) applies shall either:

(i) Discharge no visible emissions to the outside air from these operations or from any building or structure in which they are conducted or from any other fugitive sources; or

(ii) Use the methods specified by 1200-3-11-.02(3) to clean emissions from these operations containing particulate asbestos material before they escape to, or are vented to, the outside air.

(iii) Monitor each potential source of asbestos emissions from any part of the manufacturing facility, including air cleaning devices, process equipment, and buildings housing material processing and handling equipment, at least once each day during daylight hours for visible emissions to the outside air during periods of operation. The monitoring shall be by visual observation of at least 15 seconds duration per source of emissions.

(iv) Inspect each air cleaning device at least once each week for proper operation and for changes that signal the potential for malfunctions, including, to the maximum extent possible without dismantling other than opening the device, the presence of tears, holes, and abrasions in filter bags and for dust deposits on the clean side of bags. For air cleaning devices that cannot be inspected on a weekly basis according to this subpart, submit to the Technical Secretary, and revise as necessary, a written maintenance plan to include, at a minimum, the following:

(I) Maintenance schedule.

(II) Recordkeeping plan.

(v) Maintain records of the results of visible emission monitoring and air cleaning device inspections using a format similar to that shown in Figures 1 and 2 and include the following:

(I) Date and time of each inspection.

(II) Presence or absence of visible emissions.

(III) Condition of fabric filters, including presence of any tears, holes, and abrasions.

(IV) Presence of dust deposits on clean side of fabric filters.

(V) Brief description of corrective actions taken, including date and time.

(VI) Daily hours of operation for each control device.

(vi) Furnish upon request, and make available during normal business hours for inspection by the Technical Secretary, all records required under this subparagraph (2)(c).

(vii) Retain a copy of all monitoring and inspection records for at least 2 years.

(viii) Submit quarterly a copy of the visible emission monitoring records to the Technical Secretary if visible emissions occurred during the report period. Quarterly reports shall be postmarked by the 30th day following the end of the calendar quarter.

1200-3-11-.02(2)(d) Standard for demolition and renovation.

1 Applicability. To determine which requirements of parts 1, 2, and 3 of this subparagraph apply to the owner or operator of a demolition or renovation activity and prior to the commencement of the demolition or renovation, thoroughly inspect the affected facility or part of the facility where the demolition or renovation operation will occur for the presence of asbestos, including Category I and Category II nonfriable ACM. The requirements of parts 2 and 3 of this subparagraph apply to each owner or operator of a demolition or renovation activity, including the removal of RACM as follows:

(i) In a facility being demolished, all the requirements of parts 2 and 3 of this subparagraph apply, except as provided in subpart 1(iii) of this subparagraph, if the amount of RACM is

(I) At least 80 linear meters (260 linear feet) on pipes or at least 15 square meters (160 square feet) on other facility components, or

(II) At least 1 cubic meter (35 cubic feet) of facility components where the length or area could not be measured previously.

(ii) In a facility being demolished, only the notification requirements of subparts 2(i), (ii), (iii)(I) and (IV), and (iv)(I) through (VII) and (iv)(IX) and (XVI) of this subparagraph apply, if the amount of RACM is

(I) Less than 80 linear meters (260 linear feet) on pipes and less than 15 square meters (160 square feet) on other facility components, and

(II) Less than one cubic meter (35 cubic feet) of facility components where the length or area could not be measured previously, or there is no asbestos.

(iii) If the facility is being demolished under an order of a State or local government agency, issued because the facility is structurally unsound and in danger of imminent collapse, only the requirements of subparts 2(i), 2(ii),2(iii)(III), 2(iv) (except 2(iv)(VIII)), 2(v), and 3(iv) through 3(ix) of this subparagraph apply.

(iv) In a facility being renovated, including any individual nonscheduled renovation operation, all the requirements of

(iii) Monitor each potential source of asbestos emissions from any part of the manufacturing facility, including air cleaning devices, process equipment, and buildings housing material processing and handling equipment, at least once each day during daylight hours for visible emissions to the outside air during periods of operation. The monitoring shall be by visual observation of at least 15 seconds duration per source of emissions.

(iv) Inspect each air cleaning device at least once each week for proper operation and for changes that signal the potential for malfunctions, including, to the maximum extent possible without dismantling other than opening the device, the presence of tears, holes, and abrasions in filter bags and for dust deposits on the clean side of bags. For air cleaning devices that cannot be inspected on a weekly basis according to this subpart, submit to the Technical Secretary, and revise as necessary, a written maintenance plan to include, at a minimum, the following:

(I) Maintenance schedule.

(II) Recordkeeping plan.

(v) Maintain records of the results of visible emission monitoring and air cleaning device inspections using a format similar to that shown in Figures 1 and 2 and include the following:

(I) Date and time of each inspection.

(II) Presence or absence of visible emissions.

(III) Condition of fabric filters, including presence of any tears, holes, and abrasions.

(IV) Presence of dust deposits on clean side of fabric filters.

(V) Brief description of corrective actions taken, including date and time.

(VI) Daily hours of operation for each control device.

(vi) Furnish upon request, and make available during normal business hours for inspection by the Technical Secretary, all records required under this subparagraph (2)(c).

(vii) Retain a copy of all monitoring and inspection records for at least 2 years.

(viii) Submit quarterly a copy of the visible emission monitoring records to the Technical Secretary if visible emissions occurred during the report period. Quarterly reports shall be postmarked by the 30th day following the end of the calendar quarter.

1200-3-11-.02(2)(d) Standard for demolition and renovation.

1 Applicability. To determine which requirements of parts 1, 2, and 3 of this subparagraph apply to the owner or operator of a demolition or renovation activity and prior to the commencement of the demolition or renovation, thoroughly inspect the affected facility or part of the facility where the demolition or renovation operation will occur for the presence of asbestos, including Category I and Category II nonfriable ACM. The requirements of parts 2 and 3 of this subparagraph apply to each owner or operator of a demolition or renovation activity, including the removal of RACM as follows:

(i) In a facility being demolished, all the requirements of parts 2 and 3 of this subparagraph apply, except as provided in subpart 1(iii) of this subparagraph, if the amount of RACM is

(I) At least 80 linear meters (260 linear feet) on pipes or at least 15 square meters (160 square feet) on other facility components, or

(II) At least 1 cubic meter (35 cubic feet) of facility components where the length or area could not be measured previously.

(ii) In a facility being demolished, only the notification requirements of subparts 2(i), (ii), (iii)(I) and (IV), and (iv)(I) through (VII) and (iv)(IX) and (XVI) of this subparagraph apply, if the amount of RACM is

(I) Less than 80 linear meters (260 linear feet) on pipes and less than 15 square meters (160 square feet) on other facility components, and

(II) Less than one cubic meter (35 cubic feet) of facility components where the length or area could not be measured previously, or there is no asbestos.

(iii) If the facility is being demolished under an order of a State or local government agency, issued because the facility is structurally unsound and in danger of imminent collapse, only the requirements of subparts 2(i), 2(ii),2(iii)(III), 2(iv) (except 2(iv)(VIII)), 2(v), and 3(iv) through 3(ix) of this subparagraph apply.

(iv) In a facility being renovated, including any individual nonscheduled renovation operation, all the requirements of

parts 2 and 3 of this subparagraph apply if the combined amount of RACM stripped, removed, dislodged, cut, drilled, or similarly disturbed is

(I) At least 80 linear meters (260 linear feet) on pipes or at least 15 square meters (160 square feet) on other facility components, or

(II) At least 1 cubic meter (35 cubic feet) off facility components where the length or area could not be measured previously.

(III) To determine whether subpart 1(iv) of this subparagraph applies to planned renovation operations involving individual nonscheduled operations, predict the combined additive amount of RACM to be removed or stripped during a calendar year of January 1 through December 31.

(IV) To determine whether subpart 1(iv) of this subparagraph applies to emergency renovation operations, estimate the combined amount of RACM to be removed or stripped as a result of the sudden, unexpected event that necessitated the renovation.

(v) Owners or operators of demolition and renovation operations are exempt from the requirements of paragraph 1200-3-11-.01(3).

2 Notification requirements. Each owner or operator of a demolition or renovation activity to which this subparagraph applies shall:

(i) Provide the Technical Secretary with written notice of intention to demolish or renovate. Delivery of the notice by U.S. Postal Service, commercial delivery service, or hand delivery is acceptable.

(ii) Update notice, as necessary, including when the amount of asbestos affected changes by at least 20 percent.

(iii) Postmark or deliver the notice as follows:

(I) At least 10 working days before asbestos stripping or removal work or any other activity begins (such as site preparation that would break up, dislodge or similarly disturb asbestos material), if the operation is described in subparts 1(i) and (iv) (except 1(iv)(III) and 1(iv)(IV)) of this subparagraph. If the operation is as described in subpart 1(ii) of this subparagraph, notification is required 10 working days before demolition begins.

(II) At least 10 working days before the end of the calendar year preceding the year for which notice is being given for renovations described in item 1(iv)(III) of this subparagraph.

(III) As early as possible before, but not later than, the following working day if the operation is a demolition ordered according to subpart 1(iii) of this subparagraph or, if the operation is a renovation described in item 1(iv)(IV) of this subparagraph.

(IV) For asbestos stripping or removal work in a demolition or renovation operation, described in subparts 1(i) and (iv) (except 1(iv)(III) and 1(iv)(IV)) of this subparagraph, and for a demolition described in subparts 1(ii) of this subparagraph, that will begin on a date other than the one contained in the original notice, notice of the new start date must be provided to the Technical Secretary as follows:

I When the asbestos stripping or removal operation or demolition operation covered by this subpart will begin after the date contained in the notice,

A Notify Technical Secretary of the new start date by telephone as soon as possible before the original start date, and

B Provide Technical Secretary a written notice of the new start date as soon as possible before, and no later than, the original start date. Delivery of the updated notice by U.S. Postal Service, commercial delivery service, or hand delivery is acceptable.

II When the asbestos stripping or removal operation or demolition operation covered by this subparagraph will begin on a date earlier than the original start date,

A Provide the Technical Secretary a written notice of the new start date at least 10 working days before asbestos stripping or removal work begins.

B For demolitions covered by subpart 1(ii) of this subparagraph, provide the Technical Secretary with written notice of a new start date at least 10 working days before commencement of demolition. Delivery of updated notice by U.S. Postal Service, commercial delivery service, or hand delivery is acceptable.

III In no event shall an operation covered by this subparagraph begin on a date other than the date contained in the written notice of the new start date.

(iv) Include the following in the notice:

(I) An indication of whether the notice is the original or a revised notification.

(II) Name, address, and telephone number of both the facility owner and operator and the asbestos removal contractor owner or operator.

(III) Type of operation: demolition or renovation.

(IV) Indicate whether or not asbestos is present in the building.

(V) Location and address (including building number or name and floor or room number, if appropriate), street address, city, county, and state, of the facility being demolished or renovated. Description of the facility or affected part of the facility including the size (square meters [square feet] and number of floors), age, and present and prior use of the facility.

(VI) Procedure, including analytical methods, employed to detect the presence of RACM and category I and category II nonfriable ACM.

(VII) Estimate of the approximate amount of RACM to be removed from the facility in terms of length of pipe in linear meters (linear feet), surface area in square meters (square feet) on other facility components, or volume in cubic meters (cubic feet) if off the facility components. Also, estimate the approximate amount of Category I and Category II nonfriable ACM in the affected part of the facility that will not be removed during renovation or before demolition.

(VIII) Scheduled starting and completion dates of asbestos removal work (or any other activity, such as site preparation that would break up, dislodge, or similarly disturb asbestos material) in a demolition or renovation; planned renovation operations involving individual nonscheduled operations shall only include the beginning and ending dates of the report period as described in item 1(iv)(III) of this subparagraph. Also report the day(s) of the week and work hours the project will take place.

(IX) Scheduled starting and completion dates of demolition or renovation.

(X) Description of planned demolition or renovation work to be performed and method(s) to be employed, including demolition or renovation techniques to be used and description of affected facility components.

(XI) Description of work practices and engineering controls to be used to comply with the requirements of this subpart, including asbestos removal and waste-handling emission control procedures.

(XII) Name, address, phone number and contact of the firm who will transport the asbestos material to the waste disposal site. If a second transporter is involved, also list this firm.

(XIII) Name and location of the waste disposal site where the asbestos-containing waste material will be deposited.

(XIV) For facilities described in subpart 1(iii) of this subparagraph, the name, title, and authority of the State or local government representative who has ordered the demolition, the date that the order was issued, and the date on which the demolition was ordered to begin. A copy of the order shall be attached to the notification.

(XV) For emergency renovations described in item 1(iv)(IV) of this subparagraph, the date and hour that the emergency occurred, a description of the sudden, unexpected event, and an explanation of how the event caused an unsafe condition, or would cause equipment damage or an unreasonable financial burden.

(XVI) Description of procedures to be followed in the event that unexpected RACM is found or Category II nonfriable ACM becomes crumbled, pulverized, or reduced to powder.

(XVII) A certification that only a person trained as required by subpart 3(viii) of this subparagraph will supervise the stripping and removal described by this notification.

(XVIII) The signature of the Owner/Operator and the date certifying that the notification information is correct.

(v) The information required in subpart 2(iv) of this subparagraph must be reported using the form shown in Figure 3.

3 Procedures for asbestos emission control. Each owner or operator of a demolition or renovation activity to whom this subparagraph applies, according to subpart 1 of this subparagraph, shall comply with the following procedures:

(i) Remove all RACM from a facility being demolished or renovated before any activity begins that would break up, dislodge, or similarly disturb the material or preclude access to the material for subsequent removal. RACM need not be removed before demolition if:

(I) It is Category I nonfriable ACM that is not in poor condition and is not friable.

(II) It is on a facility component that is encased in concrete or other similarly hard material and is adequately wet whenever exposed during demolition; or

(III) It was not accessible for testing and was, therefore, not discovered until after demolition began and, as a result of the demolition, the material cannot be safely removed. If not removed for safety reasons, the exposed RACM and any asbestos-contaminated debris must be treated as asbestos-containing waste material and must be adequately wet at all times until disposed of.

(IV) They are Category II nonfriable ACM and the probability is low that the materials will become crumbled, pulverized, or reduced to powder during demolition.

(ii) When a facility component that contains, is covered with, or is coated with RACM is being taken out of the facility as a unit or in sections:

(I) Adequately wet all RACM exposed during cutting or disjoining operations; and

(II) Carefully lower each unit or section to the floor and to ground level, not dropping, throwing, sliding, or otherwise damaging or disturbing the RACM.

(iii) When RACM is stripped from a facility component while it remains in place in the facility, adequately wet the RACM during the stripping operation.

(I) In renovation operations, wetting is not required if:

I The owner or operator has obtained prior written approval from the Technical Secretary after his consultation with the EPA Regional Administrator, based on a written application that wetting to comply with this subparagraph would unavoidably damage equipment or present a safety hazard; and

II The owner or operator uses one of the following emission control methods:

A A local exhaust ventilation and collection system designed and operated to capture the particulate asbestos material produced by the stripping and removal of the asbestos materials. The system must exhibit no visible emissions to the outside air or be designed and operated in accordance with the requirements in 1200-3-11-.02(3).

B A glove-bag system designed and operated to contain the particulate asbestos material produced by the stripping of the asbestos materials.

C Leak-tight wrapping to contain all RACM prior to dismantlement.

(II) In renovation operations where wetting would result in equipment damage or a safety hazard, and the methods allowed in item 3(iii)(I) of this subparagraph cannot be used, another method may be used after obtaining written approval from the Technical Secretary after his consultation with the EPA Regional Administrator, based upon a determination that it is equivalent to wetting in controlling emissions or to the methods allowed in item 3(iii)(I) of this subparagraph.

(III) A copy of the Technical Secretary's written approval shall be kept at the worksite and made available for inspection.

(iv) After a facility component covered, coated, or containing RACM has been taken out of the facility as a unit or in sections pursuant to subpart 3(ii) of this subparagraph, it shall be stripped or contained in leak-tight wrapping, except as described in subpart 3(v) of this subparagraph. If stripped, either:

(I) Adequately wet the RACM during stripping; or

(II) Use a local exhaust ventilation and collection system designed and operated to capture the particulate asbestos material produced by the stripping. The system must exhibit no visible emissions to the outside air or be designed and operated in accordance with the requirements in 1200-3-11-.02(3).

(v) For large facility components such as reactor vessels, large tanks, and steam generators, but not beams (which must be handled in accordance with subpart 3(ii), (iii), and (iv) of this subparagraph), the RACM is not required to be stripped if the following requirements are met:

(I) The component is removed, transported, stored, disposed of, or reused without disturbing or damaging the RACM.

(II) The component is encased in a leak-tight wrapping.

(III) The leak-tight wrapping is labeled according to 1200-3-11-.02(2)(k)4(i) (I), (II), and (III) during all loading and unloading operations and during storage.

(vi) For all RACM, including material that has been removed or stripped:

(I) Adequately wet the material and ensure that it remains wet until collected and contained or treated in preparation for disposal in accordance with 1200-3-11-.02(2)(j); and

(II) Carefully lower the material to the ground and floor, not dropping, throwing, sliding, or otherwise damaging or disturbing the material.

(III) Transport the material to the ground via leak-tight chutes or containers if it has been removed or stripped more than 50 feet above ground level and was not removed as units or in sections.

(IV) RACM contained in leak-tight wrapping that has been removed in accordance with subpart 3(iv) and 3(iii)(I) II C of this subparagraph need not be wetted.

(vii) When the temperature at the point of wetting is below 0 ^{o}C (32 ^{o}F):

(I) The owner or operator need not comply with item 3(ii)(I) and the wetting provisions of subpart 3(iii) of this subparagraph.

(II) The owner or operator shall remove facility components containing, coated, or covered with RACM as units or in sections to the maximum extent possible.

(III) During periods when wetting operations are suspended due to freezing temperatures, the owner or operator must record the temperature in the area containing the facility components at the beginning, middle, and end of each workday and keep daily temperature records available for inspection by the Technical Secretary during normal business hours at the demolition or renovation site. The owner or operator shall retain the temperature records for at least 2 years.

(viii) No RACM shall be stripped, removed, or otherwise handled or disturbed at a facility regulated by this subparagraph unless at

least one on-site representative, such as a foreman or management-level person or other authorized representative, trained in the provisions of this regulation and the means of complying with them is present. Every 2 years, the trained on-site individual shall receive refresher training in the provisions of this regulation. The required training shall include as a minimum: applicability; notifications; material identification; control procedures for removals, including, at least, wetting, local exhaust ventilation, negative pressure enclosures, glove-bag procedures, and High Efficiency Particulate Air (HEPA) filters; waste disposal work practices; reporting and recordkeeping; and asbestos hazards and worker protection. Evidence that the required training has been completed shall be posted and made available for inspection by the Technical Secretary at the demolition or renovation site.

(ix) For facilities described in subpart 1(iii) of this subparagraph, adequately wet the portion of the facility that contains RACM during the wrecking operation.

(x) If a facility is demolished by intentional burning, all RACM including Category I and Category II nonfriable ACM must be removed in accordance with this rule before burning.

1200-3-11-.02(2)(e) Standard for spraying.

The owner or operator of an operation in which asbestos-containing materials are spray applied shall comply with the following requirements:

1 For spray-on application on buildings, structures, pipes, and conduits, do not use material containing more than 1 percent asbestos as determined using the method specified in Appendix A, Subpart F, 40 CFR Part 763, section 1, Polarized Light Microscopy, as contained in the 7-1-91 Edition of the CFR, except as provided in part 3 of this subparagraph.

2 For spray-on application of materials that contain more than 1 percent asbestos as determined using method specified in Appendix A, Subpart F, 40 CFR Part 763, section 1, Polarized Light Microscopy, as contained in the 7-1-91 Edition of the CFR, on equipment and machinery, except as provided in part 3 of this subparagraph:

(i) Notify the Technical Secretary at least 20 days before beginning the spraying operation. Include the following information in the notice:

(I) Name and address of owner or operator.

(II) Location of spraying operation.

(III) Procedures to be followed to meet the requirements of this subparagraph.

(ii) Discharge no visible emissions to the outside air from spray-on application of the asbestos-containing material or use the methods specified by 1200-3-11-.02(3) to clean emissions containing particulate asbestos material before they escape to, or are vented to, the outside air.

3 The requirements of subparts 1 and 2 of this subparagraph do not apply to the spray-on application of materials where the asbestos fibers in the materials are encapsulated with a bituminous or resinous binder during spraying and the materials are not friable after drying.

4 Owners or operators of sources subject to this subparagraph are exempt from the requirements of paragraph 1200-3-11-.01(2)(a) and (d).

1200-3-11-.02(2)(f) (Reserved)

1200-3-11-.02(2)(g) (Reserved)

1200-3-11-.02(2)(h) Standard for fabricating.

1 Applicability. This subparagraph applies to the following fabricating operations using commercial asbestos:

(i) The fabrication of cement building products.

(ii) The fabrication of friction products, except those operations that primarily install asbestos friction materials on motor vehicles.

(iii) The fabrication of cement or silicate board for ventilation hoods: ovens; electrical panels; laboratory furniture, bulkheads, partitions, and ceilings for marine construction; and flow control devices for the molten metal industry.

2 Standard. Each owner or operator of any of the fabricating operations to which this subparagraph applies shall either:

(i) Discharge no visible emissions to the outside air from any of the operations or from any building or structure in which they are conducted or from any other fugitive sources; or

(ii) Use the methods specified by 1200-3-11-.02(3) to clean emissions containing particulate asbestos material before they escape to, or are vented to, the outside air.

(iii) Monitor each potential source of asbestos emissions from any part of the fabricating facility, including air cleaning devices, process equipment, and buildings that house equipment for material processing and handling, at least once each day, during daylight

hours, for visible emissions to the outside air during periods of operation. The monitoring shall be by visual observation of at least 15 seconds duration per source of emissions.

(iv) Inspect each air cleaning device at least once each week for proper operation and for changes that signal the potential for malfunctions, including, to the maximum extent possible without dismantling other than opening the device, the presence of tears, holes, and abrasions in filter bags and for dust deposits on the clean side of bags. For air cleaning devices that cannot be inspected on a weekly basis according to this subpart, submit to the Technical Secretary, and revise as necessary, a written maintenance plan to include, at a minimum, the following:

(I) Maintenance schedule.

(II) Recordkeeping plan.

(v) Maintain records of the results of visible emission monitoring and air cleaning device inspections using the form(s) shown in Figures 1 and 2 and include the following:

(I) Date and time of each inspection.

(II) Presence or absence of visible emissions.

(III) Condition of fabric filters, including presence of any tears, holes, and abrasions.

(IV) Presence of dust deposits on clean side of fabric filters.

(V) Brief description of corrective actions taken, including date and time.

(VI) Daily hours of operation for each control device.

(vi) Furnish upon request and make available during normal business hours for inspection by the Technical Secretary, all records required under this subparagraph.

(vii) Retain a copy of all monitoring and inspection records for at least 2 years.

(viii) Submit quarterly a copy of the visible emission monitoring records to the Technical Secretary if visible emissions occurred during the report period. Quarterly reports shall be postmarked by the 30th day following the end of the calendar quarter.

1200-3-11-.02(2)(i) Standard for insulating materials.

No owner or operator of a facility may install or reinstall on a facility component any insulating materials that contain commercial asbestos if the materials are either molded and friable or wet-applied and friable after drying. The provisions of this subparagraph do not apply to spray-applied insulating materials regulated under 1200-3-11-.02(2)(e).

1200-3-11-.02(2)(j) Standard for waste disposal for manufacturing, fabricating, demolition, renovation, and spraying operations.

Each owner or operator of any source covered under the provisions of 1200-3-11-.02(2)(c), 1200-3-11-.02(2)(d), 1200-3-11-.02(2)(e), and 1200-3-11-.02(2)(h) shall comply with the following provisions:

1 Discharge no visible emissions to the outside air during the collection, processing (including incineration), packaging, or transporting of any asbestos-containing waste material generated by the source, or use one of the emission control and waste treatment methods specified in subparts 1(i) through (iv) of this subparagraph.

(i) Adequately wet asbestos-containing waste material as follows:

(I) Mix control device asbestos waste to form a slurry; adequately wet other asbestos-containing waste material; and

(II) Discharge no visible emissions to the outside air from collection, mixing, wetting, and handling operations, or use the methods specified by 1200-3-11-.02(3) to clean emissions containing particulate asbestos material before they escape to, or are vented to, the outside air; and

(III) After wetting, seal all asbestos-containing waste material in leak-tight containers while wet; or, for materials that will not fit into containers without additional breaking, put materials into leak-tight wrapping; and

(IV) Label the containers or wrapped materials specified in item 1(i)(III) of this subparagraph using warning labels specified by Occupational Safety and Health Standards of the Department of Labor, Occupational Safety and Health Administration (OSHA) under 29 CFR 1910.1001(j)(2) or 1926.58(k)(2)(iii), as contained in the 7-1-91 Edition of the CFR. The labels shall be printed in letters of sufficient size and contrast so as to be readily visible and legible.

(V) For asbestos-containing waste material to be transported off the facility site, label containers or wrapped materials with the name of the waste generator and the location at which the waste was generated.

(ii) Process asbestos-containing waste material into nonfriable forms as follows:

(I) Form all asbestos-containing waste material into nonfriable pellets or other shapes;

(II) Discharge no visible emissions to the outside air from collection and processing operations, including incineration, or use the method specified by 1200-3-11-.02(3) to clean emissions containing particulate asbestos material before they escape to, or are vented to, the outside air.

(iii) For facilities demolished where the RACM is not removed prior to demolition according to 1200-3-11-.02(2)(d)3(i)(I), (II), (III), and (IV) or for facilities demolished according to 1200-3-11-.02(2)(d)3(ix), adequately wet asbestos-containing waste material at all times after demolition and keep wet during handling and loading for transport to disposal site. Asbestos-containing waste materials covered by this subparagraph do not have to be sealed in leak-tight containers or wrapping but may be transported and disposed of in bulk.

(iv) Use an alternative emission control and waste treatment method that has received prior approval by the Administrator of the EPA and the Technical Secretary according to the procedure described in 1200-3-11-.02(2)(k)3(ii).

(v) As applied to demolition and renovation, the requirements of part 1 of this subparagraph do not apply to Catagory I nonfriable ACM waste and Catagory II nonfriable ACM waste that did not become crumbled, pulverized, or reduced to powder.

2 All asbestos-containing waste material shall be deposited as soon as is practical by the waste generator at:

(i) A waste disposal site operated in accordance with the provisions of 1200-3-11-.02(5), or

(ii) An EPA-approved site that converts RACM and asbestos-containing waste material into nonasbestos (asbestos-free) material according to the provisions of 1200-3-11-.02(6).

(iii) The requirements of part 2 of this subparagraph do not apply to Category I nonfriable ACM that is not RACM.

3 Mark vehicles used to transport asbestos-containing waste material during the loading and unloading of waste so that the signs are visible. The markings must conform to the requirements of 1200-3-11-.02(2)(k)4(i)(I), (II), and, (III).

4 For all asbestos-containing waste material transported off the facility site:

(i) Maintain waste shipment records, using the form shown in Figure 4, and include the following information:

(I) The name, address, and telephone number of the waste generator.

(II) The name and address of the local or State agency responsible for administering the asbestos NESHAP program.

(III) The approximate quantity in cubic meters (cubic yards).

(IV) The name and telephone number of the disposal site operator.

(V) The name and physical site location of the disposal site and the disposal facility permit number.

(VI) The date transported.

(VII) The name, address, and telephone number of the transporter(s).

(VIII) A certification that the contents of this consignment are fully and accurately described by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and government regulations.

(ii) Provide a copy of the waste shipment record, described in subpart 4(i) of this subparagraph, to the disposal site owners or operators at the same time as the asbestos-containing waste material is delivered to the disposal site.

(iii) For waste shipments where a copy of the waste shipment record, signed by the owner or operator of the designated treatment or disposal site, is not received by the waste generator within 35 days of the date the waste was accepted by the initial transporter, contact the transporter and/or the owner or operator of the designated treatment or disposal site meeting the requirements of this rule to determine the status of the waste shipment.

(iv) Report in writing to the local or State office responsible for administering the asbestos NESHAP program for the waste generator if a copy of the waste shipment record, signed by the owner or operator of the designated waste treatment or disposal site, is not received by the waste generator within 45 days of the date the waste was accepted by the initial transporter. Include in the report the following information.

(I) A copy of the waste shipment record for which a confirmation of delivery was not received, and

(II) A cover letter signed by the waste generator explaining the efforts taken to locate the asbestos waste shipment and the results of those efforts.

(v) Retain a copy of all waste shipment records, including a copy of the waste shipment record signed by the owner or operator of the designated waste disposal site, for at least 2 years.

5 Furnish upon request, and make available for inspection by the Technical Secretary, all records required under this subparagraph.

1200-3-11-.02(2)(k) Standard for waste disposal for asbestos mills.

Each owner or operator of any source covered under the provisions of 1200-3-11-.02(2)(a) shall:

1 Deposit all asbestos-containing waste material at a waste disposal site operated in accordance with the provisions of 1200-3-11-.02(5); and

2 Discharge no visible emissions to the outside air from the transfer of control device asbestos waste to the tailings conveyor, or use the methods specified by 1200-3-11-.02(3) to clean emissions containing particulate asbestos material before they escape to, or are vented to, the outside air. Dispose of the asbestos waste from control devices in accordance with 1200-3-11-.02(2)(j)1 or part 3 of this subparagraph; and

3 Discharge no visible emissions to the outside air during the collection, processing, packaging, or on-site transporting of any asbestos-containing waste material, or use one of the disposal methods specified in subparts 3(i) or (ii) of this subparagraph, as follows:

(i) Use a wetting agent as follows:

(I) Adequately mix all asbestos-containing waste material with a wetting agent recommended by the manufacturer of the agent to effectively wet dust and tailings, before depositing the material at a waste disposal site. Use the agent as recommended for the particular dust by the manufacturer of the agent.

(II) Discharge no visible emissions to the outside air from the wetting operation or use the methods specified by 1200-3-11-.02(3) to clean emissions containing particulate asbestos material before they escape to, or are vented to, the outside air.

(III) Wetting may be suspended when the ambient temperature at the waste disposal site is less than -9.5 ^{0}C (15 ^{0}F), as determined by an appropriate measurement method with an accuracy of $\pm$ 1 ^{0}C ($\pm$ 2 ^{0}F). During periods when wetting operations are suspended, the temperature must be recorded at least at hourly intervals, and records must be retained for at least 2 years in a form suitable for inspection.

(ii) Use an alternative emission control and waste treatment method that has received prior written approval by the Administrator of the EPA and the Technical Secretary. To obtain approval for an alternative method, a written application must be submitted to the Technical Secretary demonstrating that the following criteria are met:

(I) The alternative method will control asbestos emissions equivalent to currently required methods.

(II) The suitability of the alternative method for the intended application.

(III) The alternative method will not violate other regulations.

(IV) The alternative method will not result in increased water pollution, land pollution, or occupational hazards.

4 When waste is transported by vehicle to a disposal site:

(i) Mark vehicles used to transport asbestos-containing waste material during the loading and unloading of the waste so that the signs are visible. The markings must:

(I) Be displayed in such a manner and location that a person can easily read the legend.

(II) Conform to the requirements for 51 cm x 36 cm (20 in x 14 in) upright format signs specified in 29 CFR 1910.145(d)(4), as contained in the 7-1-91 Edition of the CFR, and this subparagraph; and

(III) Display the following legend in the lower panel with letter sizes and styles of a visibility at least equal to those specified in this subparagraph.

Legend
DANGER
ASBESTOS DUST HAZARD
CANCER AND LUNG DISEASE HAZARD
Authorized Personnel Only
Notation
2.5 cm (1 inch) Sans Serif, Gothic or Block
2.5 cm (1 inch) Sans Serif, Gothic or Block
1.9 cm (3/4 inch) Sans Serif, Gothic or Block
14 Point Gothic

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

(ii) For off-site disposal, provide a copy of the waste shipment record, described in part 5(i) of this subparagraph, to the disposal site owner or operator at the same time as the asbestos-containing waste material is delivered to the disposal site.

5 For all asbestos-containing waste material transported off the facility site:

(i) Maintain asbestos waste shipment records, using the form shown in Figure 4, and include the following information:

(I) The name, address, and telephone number of the waste generator.

(II) The name and address of the local or State agency responsible for administering the asbestos NESHAP program.

(III) The quantity of the asbestos-containing waste material in cubic meters (cubic yards).

(IV) The name and telephone number of the disposal site operator.

(V) The name and physical site location of the disposal site and the disposal facility permit number.

(VI) The date transported.

(VII) The name, address, and telephone number of the transporter(s).

(VIII) A certification that the contents of this consignment are fully and accurately described by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and government regulations.

(ii) For waste shipments where a copy of the waste shipment record, signed by the owner or operator of the designated disposal site, is not received by the waste generator within 35 days of the date the waste was accepted by the initial transporter, contact the transporter and/or the owner or operator of the designated disposal site to determine the status of the waste shipment.

(iii) Report in writing to the Technical Secretary if a copy of the waste shipment record, signed by the owner or operator of the designated waste disposal site is not received by the waste generator within 45 days of the date the waste was accepted by the initial transporter. Include in the report the following information:

(I) A copy of the waste shipment record for which a confirmation of delivery was not received, and

(II) A cover letter signed by the waste generator explaining the efforts taken to locate the asbestos waste shipment and the results of those efforts.

(iv) Retain a copy of all waste shipment records, including a copy of the waste shipment record signed by the owner or operator of the designated waste disposal site, for at least 2 years.

6 Furnish upon request, and make available for inspection by the Technical Secretary, all records required under this subparagraph.

1200-3-11-.02(2)(l) Standard for inactive waste disposal sites for asbestos mills and manufacturing and fabricating operations.

Each owner or operator of any inactive waste disposal site that was operated by sources covered under 1200-3-11-.02(2)(a), 1200-3-11-.02(2)(c), or 1200-3-11-.02(2)(h) and received deposits of asbestos-containing waste material generated by the sources, shall:

1 Comply with one of the following:

(i) Either discharge no visable emissions to the outside air from an inactive waste disposal site subject to this subparagraph; or

(ii) Cover the asbestos-containing waste material with at least 15 centimeters (6 inches) of compacted nonasbestos-containing material, and grow and maintain a cover of vegetation on the area adequate to prevent exposure of the asbestos-containing waste material. In desert areas where vegetation would be difficult to maintain, at least 8 additional centimeters (3 inches) of well-graded, nonasbestos crushed rock may be placed on top of the final cover instead of vegetation and maintained to prevent emissions; or

(iii) Cover the asbestos containing waste material with at least 60 centimeters (2 feet) of compacted nonasbestos-containing material, and maintain it to prevent exposure of the asbestos-containing waste; or

(iv) For inactive waste disposal sites for asbestos tailings, a resinous or petroleum-based dust suppression agent that effectively binds dust to control surface air emissions may be used instead of the methods in subparts 1(i), (ii), and (iii) of this subparagraph. Use the agent in the manner and frequency recommended (for the particular asbestos tailings) by the manufacturer of the dust suppression agent to achieve and maintain dust control. Obtain prior written approval of the Technical Secretary to use other equally effective dust suppression agents. For purposes of this subparagraph, any used, spent, or other waste oil is not considered a dust suppression agent.

2 Unless a natural barrier adequately deters access by the general public, install and maintain warning signs and fencing as follows, or comply with subparts 1(ii) or 1 (iii) of this subparagraph.

(i) Display warning signs at all entrances and at intervals of 100 m (328 feet) or less along the property line of the site or along the perimeter of the sections of the site where asbestos-containing waste material was deposited. The warning signs must:

(I) Be posted in such a manner and location that a person can easily read the legend; and

(II) Conform to the requirements for 51 cm x 36 cm (20" x 14") upright format signs specified in 29 CFR 1910.145(d) (as published in (7-1-91 Edition)) and this subparagraph; and

(III) Display the following legend in the lower panel with letter sizes and styles of a visability at least equal to those specified in this subparagraph.

Legend	Notation
Asbestos Waste Disposal Station	2.5 cm (1 inch) Sans Serif, Gothic or Block
Do Not Create Dust	1.9 cm (3/4 inch) Sans Serif, Gothic or Block
Breathing Asbestos is Hazardous to Your Health	14 point Gothic

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

(ii) Fence the perimeter of the site in a manner adequate to deter access by the general public.

(iii) When requesting a determination on whether a natural barrier adequately deters public access, supply information enabling the Technical Secretary to determine whether a fence or a natural barrier adequately deters access by the general public.

3 The owner or operator may use an alternative control method that has received prior approval of the Administrator of the EPA and the Technical Secretary rather than comply with the requirements of parts 1 or 2 of this subparagraph.

4 Notify the Technical Secretary in writing at least 45 days prior to excavating or otherwise disturbing any asbestos-containing waste material that has been deposited at a waste disposal site under this subparagraph, and follow the procedures specified in the notification. If the excavation will begin on a date other than the one contained in the original notice, notice of the new start date must be provided to the Technical Secretary at least 10 working days before the excavation begins and in no event shall excavation begin earlier than the date specified in the original notification. Include the following information in the notice:

(i) Scheduled starting and completion dates.

(ii) Reason for disturbing the waste.

(iii) Procedures to be used to control emissions during the excavation, storage, transport, and ultimate disposal of the excavated asbestos-containing waste material. If deemed necessary, the Technical Secretary may require changes in the emission control procedures to be used.

(iv) Location of any temporary storage site and the final disposal site.

5 Within 60 days of a site becoming inactive and after the effective date of this subpart, record, in accordance with State law, a notation on the deed to the facility property and on any other instrument that would normally be examined during a title search; this notation will in perpetuity notify any potential purchaser of the property that:

(i) The land has been used for the disposal of asbestos-containing waste material;

(ii) The survey plot and record of the location and quantity of asbestos-containing waste disposed of within the disposal site required in 1200-3-11-.02(5)(f) have been filed with the Technical Secretary; and

(iii) The site is subject to 40 CFR 61 Subpart M, as contained in the 7-1-91 Edition of the CFR.

1200-3-11-.02(3) Air Cleaning

(a) The owner or operator who uses air cleaning, as specified in 1200-3-11-.02(2)(a)1, 1200-3-11-.02(2)(c)2(ii), 1200-3-11-.02(2)(d)3(iii)(I)IIA, 1200-3-11-.02(2)(d)3(iv)(II), 1200-3-11-.02(2)(e)2(ii), 1200-3-11-.02(2)(h)2(ii), 1200-3-11-.02(2)(k)2, 1200-3-11-.02(2)(k)3(i)(II), 1200-3-11-.02(2)(j)1(i)(II), 1200-3-11-.02(2)(j)1(ii)(II), and 1200-3-11-.02(6)(e) shall:

1. Use fabric filter collection devices, except as noted in subparagraph (b) of this paragraph, doing all of the following:

(i) Operating the fabric filter collection devices at a pressure drop of no more than .995 kilopascal (4 inches water gage), as measured across the filter fabric; and

(ii) Ensuring that the airflow permeability, as determined by ASTM Method D737-75, does not exceed 9 $m^3/min/m^2$ (30 $ft^3/min/ft^2$) for woven fabrics or 11 $m^3/min/m^2$ (35 $ft^3/min/ft^2$) for felted fabrics, except that 12 $m^3/min/m^2$ (40 $ft^3/min/ft^2$) for woven and 14 $m^3/min/m^2$ (45 $ft^3/min/ft^2$) for felted fabrics is allowed for filtering air from asbestos ore dryers; and

(iii) Ensuring that felted fabric weighs at least 475 grams per square meter (14 ounces per square yard) and is at least 1.6 millimeters (one-sixteenth inch) thick throughout; and

(iv) Avoiding the use of synthetic fabrics that contain fill yarn other than that which is spun.

2. Properly install, use, operate, and maintain all air-cleaning equipment authorized by this section. Bypass devices may be used only during upset or emergency conditions and then only for so long as it takes to shut down the operation generating the particulate asbestos material.

3. For fabric filter collection devices installed after January 10, 1989, provide for easy inspection for faulty bags.

(b) There are the following exceptions to part (a)1:

1. After January 10, 1989, if the use of fabric creates a fire or explosion hazard, or the Technical Secretary determines that a fabric filter is not feasible, the Technical Secretary may authorize as a substitute the use of wet collectors designed to operate with a unit contacting energy of at least 9.95 kilopascals (40 inches water gage pressure).

2. Use a HEPA filter that is certified to be at least 99.97 percent efficient for 0.3 micron particles.

3. The Technical Secretary may authorize the use of filtering equipment other than described in parts (a)1 and (b) 1 and 2 of this paragraph if the owner or operator demonstrates to the satisfaction of the Administrator of the EPA and the Technical Secretary that it is equivalent to the described equipment in filtering particulate asbestos material.

1200-3-11-.02(4) Reporting.

(a) Any new source to which this paragraph applies (with the exception of sources subject to 1200-3-11-.02(2)(b), 1200-3-11-.02(2)(e), and 1200-3-11-.02(2)(i)), which has an initial startup date preceding the effective date of this revision, shall provide the following information to the Technical Secretary postmarked or delivered within 90 days of the effective date. In the case of a new source that does not have an initial startup date preceding the effective date, the information shall be provided, postmarked or delivered, within 90 days of the initial startup date. Any owner or operator of an existing source shall provide the following information to the Technical Secretary within 90 days of the effective date of this subpart unless the owner or operator of the existing source has previously provided this information to the Technical Secretary. Any changes in the information provided by any existing source shall be provided to the Technical Secretary, postmarked or delivered, within 30 days after the change.

1. A description of the emission control equipment used for each process; and

2. If a fabric filter device is used to control emissions,

   (i) The airflow permeability in $m^3/min/m^2$ ($ft^3/min/ft^2$) if the fabric filter device uses a woven fabric, and, if the fabric is synthetic, whether the fill yarn is spun or not spun; and

   (ii) If the fabric filter device uses a felted fabric, the density in g/m^2 (oz/yd^2), the minimum thickness in millimeters (inches), and the airflow permeability in $m^3/min/m^2$ ($ft^3/min/ft^2$).

3. If a HEPA filter is used to control emissions, the certified efficiency.

4. For sources subject to 1200-3-11-.02(2)(k) and 1200-3-11-.02(2)(j):

   (i) A brief description of each process that generates asbestos-containing waste material; and

   (ii) The average volume of asbestos-containing waste material disposed of, measured in m^3/day (yd^3/day); and

   (iii) The emission control methods used in all stages of waste disposal; and

   (iv) The type of disposal or incineration site used for ultimate disposal, the name of the site operator, and the name and location of the disposal site.

5. For sources subject to 1200-3-11-.02(2)(l) and 1200-3-11-.02(5):

   (i) A brief description of the site; and

   (ii) The method or methods used to comply with the standard, or alternate procedures to be used.

(b) The information required by subparagraph (a) of this paragraph must accompany the information required by Appendix A to 40 CFR CH.1 (7-1-91 Edition). Active waste disposal sites subject to 1200-3-11-.02(5) shall also comply with this provision. Roadways, demolition and renovation, spraying, and insulating materials are exempted from the requirements of reporting the information required by Appendix A to 40 CFR CH.1 (7-1-91 Edition).

1200-3-11-.02(5) Standard for active waste disposal sites.

Each owner or operator of an active waste disposal site that receives asbestos-containing waste material from a source covered under 1200-3-11-.02(2)(k), 1200-3-11-.02(2)(j), or 1200-3-11-.02(6) shall meet the requirements of this paragraph:

(a) Either there must be no visible emissions to the outside air from any active waste disposal site where asbestos-containing waste material has been deposited, or the requirements of subparagraph (c) or (d) of this paragraph must be met.

(b) Unless a natural barrier adequately deters access by the general public, either warning signs and fencing must be installed and maintained as follows, or the requirements of subparagraph (c), part 1 of this paragraph must be met.

1. Warning signs must be displayed at all entrances and at intervals of 100 m (328 feet) or less along the property line of the site or along the perimeter of the sections of the site where asbestos-containing waste material is deposited. The warning signs must:

   (i) Be posted in such a manner and location that a person can easily read the legend; and

   (ii) Conform to the requirements for 51 cm x 36 cm (20" x 14") upright format signs specified in 29 CFR 1910 .145(d) (as published in (7-1-91 Edition)) and this subparagraph; and

   (iii) Display the following legend in the lower panel with letter sizes and styles of a visability at least equal to those specified in this subparagraph.

Legend	Notation
Asbestos Waste Disposal Station	2.5 cm (1 inch) Sans Serif, Gothic or Block
Do Not Create Dust	1.9 cm (3/4 inch) Sans Serif, Gothic or Block
Breathing Asbestos is Hazardous to Your Health	14 point Gothic

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

2. The perimeter of the disposal site must be fenced in a manner adequate to deter access by the general public.

3. Upon request and supply of appropriate information, the Technical Secretary will determine whether a fence or natural barrier adequately deters access by the general public.

(c) Rather than meet the no visible emission requirement of subparagraph (a) of this paragraph, at the end of each operating day, or at least once every 24-hour period while the site is in continuous operation, the asbestos-containing waste material that has been deposited at the site during the operating day or previous 24-hour period shall:

1. Be covered with at least 15 centimeters (6 inches) of compacted nonasbestos-containing material, or

2. Be covered with a resinous or petroleum-based dust suppression agent that effectively binds dust and controls wind erosion. Such an agent shall be used in the manner and frequency recommended for the particular dust by the dust suppression agent manufacturer to achieve and maintain dust control. Other equally effective dust suppression agents may be used upon prior approval by the Technical Secretary. For purposes of this paragraph, any used, spent, or other waste oil is not considered a dust suppression agent.

(d) Rather than meet the no visible emission requirement of subparagraph (a) of this paragraph, use an alternative emissions control method that has received prior written approval by the Administrator of the EPA and the Technical Secretary according to the procedures described in 1200-3-11-.02(2)(k)3(ii).

(e) For all asbestos-containing waste material received, the owner or operator of the active waste disposal site shall:

1. Maintain waste shipment records, using the form shown in Figure 4, and include the following information:

(i) The name, address, and telephone number of the waste generator.

(ii) The name, address, and telephone number of the transporter(s).

(iii) The quantity of the asbestos-containing waste material in cubic meters (cubic yards).

(iv) The presence of improperly enclosed or uncovered waste, or any asbestos-containing waste material not sealed in leak-tight containers. Report in writing to the Technical Secretary by the following working day, the presence of a significant amount of improperly enclosed or uncovered waste. Submit a copy of the waste shipment record along with the report.

(v) The date of receipt.

2. As soon as possible and no longer than 30 days after receipt of the waste, send a copy of the signed waste shipment record to the waste generator.

3. Upon discovering a discrepancy between the quantity of waste designated on the waste shipment records and the quantity actually received, attempt to reconcile the discrepancy with the waste generator. If the discrepancy is not resolved within 15 days after receiving the waste, immediately report it in writing to the

Technical Secretary. Describe the discrepancy and attempts to reconcile it, and submit a copy of the waste shipment record along with the report.

4. Retain a copy of all records and reports required by this subparagraph for at least 2 years.

(f) Maintain, until closure, records of the location, depth and area, and quantity in cubic meters (cubic yards) of asbestos-containing waste material within the disposal site on a map or diagram of the disposal area.

(g) Upon closure, comply with all the provisions of 1200-3-11-.02(2)(l).

(h) Submit to the Technical Secretary, upon closure of the facility, a copy of records of asbestos waste disposal locations and quantities.

(i) Furnish upon request, and make available during normal business hours for inspection by the Technical Secretary, all records required under this paragraph.

(j) Notify the Technical Secretary in writing at least 45 days prior to excavating or otherwise disturbing any asbestos-containing waste material that has been deposited at a waste disposal site and is covered. If the excavation will begin on a date other than the one contained in the original notice, notice of the new start date must be provided to the Technical Secretary at least 10 working days before excavation begins and in no event shall excavation begin earlier than the date specified in the original notification. Include the following information in the notice:

1. Scheduled starting and completion dates.

2. Reason for disturbing the waste.

3. Procedures to be used to control emissions during the excavation, storage, transport, and ultimate disposal of the excavated asbestos-containing waste material. If deemed necessary, the Technical Secretary may require changes in the emission control procedure to be used.

4. Location of any temporary storage site and the final disposal site.

1200-3-11-.02(6) Standard for operations that convert asbestos-containing waste material into nonasbestos (asbestos-free) material.

Each owner or operator of an operation that converts RACM and asbestos-containing waste material into nonasbestos (asbestos-free) material shall:

(a) Obtain the prior written approval of the Administrator of the EPA and the Technical Secretary to construct the facility. To obtain approval, the owner or operator shall provide the Technical Secretary with the following information:

1. Application to construct pursuant to paragraph 1200-3-11-.01(2).

2. In addition to the information requirements of paragraph 1200-3-11-.01(2), a

   (i) Description of waste feed handling and temporary storage.

   (ii) Description of process operating conditions.

   (iii) Description of the handling and temporary storage of the end product.

   (iv) Description of the protocol to be followed when analyzing output materials by transmission electron microscopy.

3. Performance test protocol, including provisions for obtaining information required under subparagraph (b) of this paragraph.

4. The Administrator of the EPA or the Technical Secretary may require that a demonstration of the process be performed prior to approval of the application to construct.

(b) Conduct a start-up performance test. Test results shall include:

1. A detailed description of the types and quantities of nonasbestos material, RACM, and asbestos-containing waste material processed, e.g., asbestos cement products, friable asbestos insulation, plaster, wood, plastic, wire, etc. Test feed is to include the full range of materials that will be encountered in actual operation of the process.

2. Results of analyses, using polarized light microscopy, that document the asbestos content of the wastes processed.

3. Results of analyses, using transmission electron microscopy, that document that the output materials are free of asbestos. Samples for analysis are to be collected as 8-hour composite samples (one 200-gram (7-ounce) sample per hour), beginning with the initial introduction of RACM or asbestos-containing waste material and continuing until the end of the performance test.

4. A description of operating parameters, such as temperature and residence time, defining the full range over which the process is expected to operate to produce nonasbestos (asbestos-free)

materials. Specify the limits for each operating parameter within which the process will produce nonasbestos (asbestos-free) materials.

5. The length of the test.

(c) During the initial 90 days of operation,

1. Continuously monitor and log the operating parameters identified during start-up performance tests that are intended to ensure the production of nonasbestos (asbestos-free) output material.

2. Monitor input materials to ensure that they are consistent with the test feed materials described during start-up performance tests in subparagraph (b)1 of this paragraph.

3. Collect and analyze samples, taken as 10-day composite samples (one 200-gram (7-ounce) sample collected every 8 hours of operation) of all output material for the presence of asbestos. Composite samples may be for fewer than 10 days. Transmission electron microscopy (TEM) shall be used to analyze the output material for the presence of asbestos. During the initial 90-day period, all output materials must be stored on-site until analysis shows the material to be asbestos-free or disposed of as asbestos-containing waste material according to 1200-3-11-.02(2)(j).

(d) After the initial 90 days of operation,

1. Continuously monitor and record the operating parameters identified during start-up performance testing and any subsequent performance testing. Any output produced during a period of deviation from the range of operating conditions established to ensure the production of nonasbestos (asbestos-free) output materials shall be:

(i) Disposed of as asbestos-containing waste material according to 1200-3-11-.02(2)(j), or

(ii) Recycled as waste feed during process operation within the established range of operating conditions, or

(iii) Stored temporarily on-site in a leak-tight container until analyzed for asbestos content. Any product material that is not asbestos-free shall be either disposed of as asbestos-containing waste material or recycled as waste feed to the process.

2. Collect and analyze monthly composite samples (one 200-gram (7-ounce) sample collected every 8 hours of operation) of the output material. Transmission electron microscopy shall be used to analyze the output material for the presence of asbestos.

(e) Discharge no visible emissions to the outside air from any part of the operation, or use the methods specified by 1200-3-11-.02(3) to clean emissions containing particulate asbestos material before they escape to, or are vented to, the outside air.

(f) Maintain records on-site and include the following information:

1. Results of start-up performance testing and all subsequent performance testing, including operating parameters, feed characteristics, and analyses of output materials.

2. Results of the composite analyses required during the initial 90 days of operation under 1200-3-11-.02(6)(c).

3. Results of the monthly composite analyses required under 1200-3-11-.02(6)(d).

4. Results of continuous monitoring and logs of process operating parameters required under 1200-3-11-.02(6)(c) and (d).

5. The information on waste shipments received as required in 1200-3-11-.02(5)(e).

6. For output materials where no analyses were performed to determine the presence of asbestos, record the name and location of the purchaser or disposal site to which the output materials were sold or deposited, and the date of sale or disposal.

7. Retain records required by subparagraph (f) of this paragraph for at least 2 years.

(g) Submit the following reports to the Technical Secretary:

1. A report for each analysis of product composite samples performed during the initial 90 days of operation.

2. A quarterly report, including the following information concerning activities during each consecutive 3-month period:

(i) Results of analyses of monthly product composite samples.

(ii) A description of any deviation from the operating parameters established during performance testing, the duration of the deviation, and steps taken to correct the deviation.

(iii) Disposition of any product produced during a period of deviation, including whether it was recycled, disposed of as asbestos-containing waste material, or stored temporarily on-site until analyzed for asbestos content.

(iv) The information on waste disposal activities as required in 1200-3-11-.02(5)(f).

(h) Nonasbestos (asbestos-free) output material is not subject to any of the provisions of this rule. Output materials in which asbestos is detected, or output materials produced when the operating parameters deviated from those established during the start-up performance testing, unless shown by TEM analysis to be asbestos-free, shall be considered to be asbestos-containing waste and shall be handled and disposed of according to 1200-3-11-.02(2)(j) and 1200-3-11-.02(5) or reprocessed while all of the established operating parameters are being met.

Statutory Authority: T.C.A. 68-25-105 and 4-5-202.

RB/F1301234

Figure 1

RECORD OF VISIBLE EMISSION MONITORING

Date of Inspection (mo/day/yr)	(Time of) Inspection Also Indicate (a.m./p.m.)	Air Cleaning Device or Fugitive Source Designation or Number	Visible Emissions Observed (Yes / No) Corrective Action Taken	Daily Operating Hours	Inspectors Initials

RB/F1281234

Figure 2

AIR CLEANING DEVICE INSPECTION CHECKLIST

1. Air cleaning device designation or number:				
2. Dates of inspection:				
3. Times of inspection:				
4. Is air cleaning device operating properly? (Yes / No)				
5. Tears, holes or abrasions in fabric filter? (Yes / No)				
6. Dust on clean side of fabric filter? (Yes / No)				
7. Other signs of malfunctions or potential malfunctions? (Yes / No)				
8. Describe other malfunctions or signs of potential malfunctions.				
9. Describe corrective action(s) taken.				
10. Date and time corrective action taken				

11. Inspected by:

(Print/Type Name)	(Title)	(Signature)	(Date)
(Print/Type Name)	(Title)	(Signature)	(Date)

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FIGURE 3
TENNESSEE DIVISION OF AIR POLLUTION CONTROL
NOTIFICATION OF ASBESTOS DEMOLITION OR RENOVATION

OPERATOR PROJECT #	POSTMARK	DATE RECEIVED	NOTIFICATION #

I. Type of Notification (O-Orig. R-Revised C-Cancelled)

II. Facility Information (Identify Owner, Removal Contractor, Operator)

Owner Name:
Address:
City: State: Zip:
Contact: Telephone:
Removal Contractor:
Address:
City: State: Zip:
Contact: Telephone:
Other Operator:
Address:
City: State: Zip:
Contact: Telephone:

III. Type of Operation (D-Demo. O-Ordered Demo. R-Renov. E-Emer. Renov.)

IV. Is Asbestos Present? (Yes/No)

V. Facility Description (Include Building Name, Number and Floor or Room Number)

Building Name:
Address:
City: State: Zip:
Site Location:
Building Size: Total Sq. Ft. # of Floors: Age in Years:
Present Use: Prior Use:

VI. Procedure and Analytical Method Used to Detect the Presence of Asbestos Material

VII. Approximate Amount of Asbestos In Work Area Including 1. Regulated ACM to be Removed 2. Category I ACM Not Removed 3. Category II ACM Not Removed	RACM To Be Removed	Nonfriable Asbestos Material				Units of Measurement
		Not To Be Removed		To Be Removed		
		Cat I	Cat II	Cat I	Cat II	Unit
Pipes						LnFt Ln m
Surface Area						SqFt Sq m
Vol RACM Off Facility Components						CuFt Cu m

VIII. Scheduled Dates Asbestos Removal Start: Complete:
Scheduled Dates of Preparation
Days of Week: (Circle) All Sun Mon Tue Wed Thu Fri Sat Hours of Day:

IX. Scheduled Dates Demo/Renovation Start: Complete:

X. Description of Planned Demolition or Renovation Work, Method(s) to be Used:

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NOTIFICATION OF ASBESTOS DEMOLITION OR RENOVATION (continued)

XI. Description of Work Practices and Engineering Controls to be used to Prevent Emissions of Asbestos at the Demolition and Renovation Site:

XII. Waste Transporter #1

Name:

Address:

City: State: Zip:

Contact Person: Telephone:

Waste Transporter #2

Name:

Address:

City: State: Zip:

Contact Person: Telephone:

XIII. Waste Disposal Site

Name:

Location:

City: State: Zip:

Telephone:

XIV. If Demolition Ordered by a Government Agency, Please Identify Below:

Name: Title:

Authority:

Date of Order (MM/DD/YY): Date Ordered to Begin (MM/DD/YY):

For Emergency Renovations

Date and Hour of Emergency (MM/DD/YY):

Description of the Sudden, Unexpected Event:

Explanation of How the Event Caused Unsafe Conditions or Would Cause Equipment Damage or an Unreasonable Financial Burden:

XVI. Description of Procedures to be Followed in the Event Asbestos is Found or Previously Nonfriable Asbestos Material Becomes Crumbled, Pulverized, or Reduced to Powder.

XVII. I Certify That an Individual Trained in the Provisions of This Regulation (40 CFR Part 61, Subpart M) Will be On-Site During the Demolition or Renovation Available for Inspection During Normal Business Hours. (REQUIRED AFTER NOVEMBER 20, 1991)

Signature of Owner/Operator (Date)

XVIII. I Certify That the Above Information is Correct.

Signature of Owner/Operator (Date)

Submit Completed Form by U.S. Postal Service/Commercial Delivery Service or Hand Deliver to:
Tennessee Air Pollution Control, 9th Floor, L & C Annex, 401 Church Street, Nashville, Tennessee 37243-1531.

F1071235

INSTRUCTIONS

Waste Generator Section (Items 1-9)

1. Enter the name of the facility at which asbestos waste is generated and the address where the facility is located. In the appropriate spaces, also enter the name of the owner of the facility and the owner's phone number.

2. If a demolition or renovation, enter the name and address of the company and authorized agent responsible for performing the asbestos removal. In the appropriate spaces, also enter the phone number of the operator.

3. Enter the name, address, and physical site location of the waste disposal site (WDS) that will be receiving the asbestos materials. In the appropriate spaces, also enter the phone number of the WDS. Enter "on-site" if the waste will be disposed of on the generator's property. Enter disposal facility permit number.

4. Provide the name and address of the local, State, or EPA Regional agency responsible for administering the asbestos NESHAP program.

5. Indicate the types of asbestos waste materials generated. If from a demolition or renovation, indicate the amount of asbestos that is

   - Friable Asbestos Material
   - Nonfriable Asbestos Material

6. Enter the number of containers used to transport the asbestos materials listed in item 4. Also enter one of the following container codes used in transporting each type of asbestos material (specify any other type of container used if not listed below):

   DM - Metal drums, barrels
   DP - Plastic drums, barrels
   BA - 6 mil plastic bags or wrapping

7. Enter the quantities of each type of asbestos material removed in units of cubic meters (cubic yards).

8. Use this space to indicate special transportation, treatment, storage or disposal of Bill of Lading information. If an alternate waste disposal site is designated, note it here. Emergency response telephone numbers or similar information may be included here.

9. The authorized agent of the waste generator must read and then sign and date this certification. The date is the date of receipt by transporter.

NOTE: The waste generator must retain a copy of this form.

Transporter Section (Items 10 & 11)

10. & 11.
Enter name, address, and telephone number of each transporter used, if applicable. Print or type the full name and title of person accepting responsibility and acknowledging receipt of materials as listed on this waste shipment record for transport. Enter date of receipt and signature.

NOTE: The transporter must retain a copy of this form.

Disposal Site Section (Items 12 & 13)

12. The authorized representative of the WDS must note in this space any discrepancy between waste described on this manifest and waste actually received as well as any improperly enclosed or contained waste. Any rejected materials should be listed and destination of those materials provided. A site that converts asbestos-containing waste material to nonasbestos material is considered a WDS.

13. The signature (by hand) of the authorized WDS agent indicates acceptance and agreement with statements on this manifest except as noted in Item 12. The date is the date of signature and receipt of shipment.

NOTE: The WDS must retain a completed copy of this form. The WDS must also send a completed copy to the operator listed in item 2.

RB/F1041235

Figure 4
WASTE SHIPMENT RECORD

GENERATOR		
1. Work site name and mailing address	Owner's name	Owner's telephone no.
2. Operator's name and address		Operator's telephone no.
3. Waste disposal site (WDS) name, mailing address, physical site location and disposal facility permit number.		WDS phone no. Permit No.
4. Name, and address of responsible agency		
5. Description of materials	6. Containers No. Type	7. Total quantity m3 (yd3)
8. Special handling instructions and additional information		
9. OPERATOR'S CERTIFICATION: I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and government regulations. Printed/type name & title _____ Signature _____ Month Day Year		

TRANSPORTER
10. Transporter 1 (Acknowledgment of receipt of materials) Printed/type name & title _____ Signature _____ Month Day Year Address and telephone no.
11. Transporter 2 (Acknowledgement of receipt of materials) Printed/type name & title _____ Signature _____ Month Day Year Address and telephone no.

DISPOSAL SITE
12. Discrepancy indication space
13. Waste disposal site Owner or operator: Certification of receipt of asbetos materials covered by this manifest except as noted in item 12. Printed/type name & title _____ Signature _____ Month Day Year

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Pages 47 through 51 are not missing. These pages are not included in this copy because they are not a part of the asbestos rule.

Further, I certify that these rules are properly presented for filing, a notice of rulemaking hearing having been filed in the Department of State on October 25, 1991, and such notice of rulemaking hearing having been published in the November 15, 1991, issue of the Tennessee Administrative Register, and such rulemaking hearing having been conducted pursuant thereto on December 16, 1991.

John W. Walton
John W. Walton, Technical Secretary
Tennessee Air Pollution Control Board

Subscribed and sworn to before me this the 28th day of October, 1992.

Gloria Ann Sloan
Notary Public

My commission expires on the 16th day of March, 1996.

All rulemaking hearing rules provided for herein have been examined by the Attorney General and Reporter of the State of Tennessee and are approved as to legality pursuant to the provisions of the Administrative Procedures Act, Tennessee Code Annotated, Title 4, Chapter 5.

Charles W. Burson
Attorney General and Reporter

The rulemaking hearing rules set out herein were properly filed in the Department of State and will become effective on the 19 day of April, 1993.

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SECRETARY OF STATE

Riley C. Darnell
~~Bryant Millsaps~~ Riley C. Darnell
Secretary of State

By: Richard Arnold

JP/F4072220

APPENDIX B

Occupational Safety and Health Administration (OSHA) Standards (29 CFR 1910.1001 and 1926.58)

1926.58 Asbestos, tremolite, anthophyllite, and actinolite.

[Sec. 1926.58 added by 51 FR 22756, June 20, 1986]

(a) *Scope and application.* This section applies to all construction work as defined in 29 CFR 1910.12(b), including but not limited to the following:

(1) Demolition or salvage of structures where asbestos, tremolite, anthophyllite, or actinolite is present;

(2) Removal or encapsulation of materials containing asbestos, tremolite, anthophyllite, or actinolite;

(3) Construction, alteration, repair, maintenance, or renovation of structures, substrates, or portions thereof, that contain asbestos, tremolite, anthophyllite, or actinolite;

(4) Installation of products containing asbestos, tremolite, anthophyllite, or actinolite;

(5) Asbestos, tremolite, anthophyllite, and actinolite spill/emergency cleanup; and

(6) Transportation, disposal, storage, or containment of asbestos, tremolite, anthophyllite, or actinolite or products containing asbestos, tremolite, anthophyllite, or actinolite on the site or location at which construction activities are performed.

(b) *Definitions.* "Action level" means an airborne concentration of asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals of 0.1 fiber per cubic centimeter (f/cc) of air calculated as an eight (8)-hour time-weighted average.

"Asbestos" includes chrysotile, amosite, crocidolite, tremolite asbestos, anthophyllite asbestos, actinolite asbestos, and any of these minerals that has been chemically treated and/or altered.

"Assistant Secretary" means the Assistant Secretary of Labor for Occupational Safety and Health, U.S. Department of Labor, or designee.

"Authorized person" means any person authorized by the employer and required by work duties to be present in regulated areas.

"Clean room" means an uncontaminated room having facilities for the storage of employees' street clothing and uncontaminated materials and equipment.

"Competent person" means one who is capable of identifying existing asbestos, tremolite, anthophyllite, or actinolite hazards in the workplace and who has the authority to take prompt corrective measures to eliminate them, as specified in 29 CFR 1926.32(f). The duties of the competent person include at least the following: establishing the negative-pressure enclosure, ensuring its integrity, and controlling entry to and exit from the enclosure; supervising any employee exposure monitoring required by the standard; ensuring that all employees working within such an enclosure wear the appropriate personal protective equipment, are trained in the use of appropriate methods of exposure control, and use the hygiene facilities and decontamination procedures specified in the standard; and ensuring that engineering controls in use are in proper operating condition and are functioning properly.

"Decontamination area" means an enclosed area adjacent and connected to the regulated area and consisting of an equipment room, shower area, and clean room, which is used for the decontamination of workers, materials, and equipment contaminated with asbestos, tremolite, anthophyllite, or actinolite.

"Demolition" means the wrecking or taking out of any load-supporting structural member and any related razing, removing, or stripping of asbestos, tremolite, anthophyllite, or actinolite products.

"Director" means the Director, National Institute for Occupational Safety and Health, U.S. Department of Health and Human Services, or designee.

"Employee exposure" means that exposure to airborne asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals, that would occur if the employee were not using respiratory protective equipment.

"Equipment room (change room)" means a contaminated room located within the decontamination area that is supplied with impermeable bags or containers for the disposal of contaminated protective clothing and equipment.

"Fiber" means a particulate form of asbestos, tremolite, anthophyllite, or actinolite, 5 micrometers or longer, with a length-to-diameter ratio of at least 3 to 1.

"High-efficiency particulate air (HEPA) filter" means a filter capable of trapping and retaining at least 99.97 percent of all monodispersed particles of 0.3 micrometers in diameter or larger.

"Regulated area" means an area established by the employer to demarcate areas where airborne concentrations of asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals exceed or can reasonably be expected to exceed the permissible exposure limit. The regulated area may take the form of (1) a temporary enclosure, as required by paragraph (e)(6) of this section, or (2) an area demarcated in any manner that minimizes the number of employees exposed to asbestos, tremolite, anthophyllite, or actinolite.

"Removal" means the taking out or stripping of asbestos, tremolite, anthophyllite, or actinolite or materials containing asbestos, tremolite, anthophyllite, or actinolite.

[Sec. 1926.58(b)]

"Renovation" means the modifying of any existing structure, or portion thereof, where exposure to airborne asbestos, tremolite, anthophyllite, actinolite may result.

"Repair" means overhauling, rebuilding, reconstructing, or reconditioning of structures or substrates where asbestos, tremolite, anthophyllite,or actinolite is present.

"Tremolite, anthophyllite and actinolite" means the non-asbestos form of these minerals, and any of these minerals that have been chemically treated and/or altered.

(c) *Permissible exposure limit (PEL).* The employer shall ensure that no employee is exposed to an airborne concentration of asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals in excess of 0.2 fiber per cubic centimeter of air as an eight (8) hour time-weighted average (TWA), as determined by the method prescribed in Appendix A of this section, or by an equivalent method.

(d) *Communication among employers.* On multi-employer worksites, an employer performing asbestos, tremolite, anthophyllite, or actinolite work requiring the establishment of a regulated area shall inform other employers on the site of the nature of the employer's work with asbestos, tremolite, anthophyllite, or actinolite and of the existence of and requirements pertaining to regulated areas.

(e) *Regulated areas*—(1) *General.* The employer shall establish a regulated area in work areas where airborne concentrations of asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals exceed or can reasonably be expected to exceed the permissible exposure limit prescribed in paragraph (c) of this section.

(2) *Demarcation.* The regulated area shall be demarcated in any manner that minimizes the number of persons within the area and protects persons outside the area from exposure to airborne concentrations of asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals in excess of the permissible exposure limit.

(3) *Access.* Access to regulated areas shall be limited to authorized persons or to persons authorized by the Act or regulations issued pursuant thereto.

(4) *Respirators.* All persons entering a regulated area shall be supplied with a respirator, selected in accordance with paragraph (h)(2) of this section.

(5) *Prohibited activities.* The employer shall ensure that employees do not eat, drink, smoke, chew tobacco or gum, or apply cosmetics in the regulated area.

(6) *Requirements for asbestos removal, demolition, and renovation operations.* (i) Wherever feasible, the employer shall establish negative-pressure enclosures before commencing removal, demolition, and renovation operations.

(ii) The employer shall designate a competent person to perform or supervise the following duties:

(A) Set up the enclosure;

(B) Ensure the integrity of the enclosure;

(C) Control entry to and exit from the enclosure;

(D) Supervise all employee exposure monitoring required by this section;

(E) Ensure that employees working within the enclosure wear protective clothing and respirators as required by paragraphs (i) and (h) of this section and;

(F) Ensure that employees are trained in the use of engineering controls, work practices, and personal protective equipment;

(G) Ensure that employees use the hygiene facilities and observe the decontamination procedures specified in paragraph (j) of this section; and

(H) Ensure that engineering controls are functioning properly.

(iii) In addition to the qualifications specified in paragraph (b) of this section, the competent person shall be trained in all aspects of asbestos, tremolite, anthophyllite, or actinolite abatement, the contents of this standard, the identification of asbestos, tremolite, anthophyllite, or actinolite and their removal procedures, and other practices for reducing the hazard. Such training shall be obtained in a comprehensive course, such as a course conducted by an EPA Asbestos Training Center, or an equivalent course.

(iv) *Exception:* For small-scale, short-duration operations, such as pipe repair, valve replacement, installing electrical conduits, installing or removing drywall, roofing, and other general building maintenance or renovation, the employer is not required to comply with the requirements of paragraph (e)(6) of this section.

(f) *Exposure monitoring*—(1) *General.* (i) Each employer who has a workplace or work operation covered by this standard shall perform monitoring to determine accurately the airborne concentrations of asbestos, tremolite, anthophyllite, actinolite or a combination of these minerals to which employees may be exposed.

(ii) Determinations of employee exposure shall be made from breathing zone air samples that are representative of the 8-hour TWA of each employee.

(iii) Representative 8-hour TWA employee exposure shall be determined on the basis of one or more samples representing full-shift exposure for employees in each work area.

(2) *Initial monitoring.* (i) Each employer who has a workplace or work operation covered by this standard, except as provided for in paragraph (f)(2)(ii) and (f)(2)(iii) of this section, shall perform initial monitoring at the initiation of each asbestos, tremolite, anthophyllite, actinolite job to accurately determine the airborne concentrations of asbestos, tremolite, anthophyllite, or actinolite to which employees may be exposed.

(ii) The employer may demonstrate that employee exposures are below the action level by means of objective data demonstrating that the product or material containing asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals cannot release airborne fibers in concentrations exceeding the action level under those work conditions having the greatest potential for releasing asbestos, tremolite, anthophyllite, or actinolite.

(iii) Where the employer has monitored each asbestos, tremolite, anthophyllite, or actinolite job, and the data were obtained during work operations conducted under workplace conditions closely resembling the processes, type of material, control methods, work practices, and environmental conditions used and prevailing in the employer's current operations, the employer may rely on such earlier monitoring results to satisfy the requirements of paragraph (f)(2)(i) of this section.

(3) *Periodic monitoring within regulated areas.* The employer shall conduct daily monitoring that is representative of the exposure of each employee who is assigned to work within a regulated area. *Exception:* When all employees within a regulated area are equipped with supplied-air respirators operated in the positive-pressure mode, the employer may dispense with the daily monitoring required by this paragraph.

(4) *Termination of monitoring.* If the periodic monitoring required by paragraph (f)(3) of this section reveals that employee exposures, as indicated by statistically reliable measurements, are below the action level, the employer may discontinue monitoring for those employees whose exposures are represented by such monitoring.

(5) *Method of monitoring.* (i) All samples taken to satisfy the monitoring requirements of paragraph (f) of this section shall be personal samples

[Sec. 1926.58(f)(5)(i)]

collected following the porocedures specified in Appendix A.

(ii) All samples taken to satisfy the monitoring requirements of paragraph (f) of this section shall be evaluated using the OSHA Reference Method (ORM) specified in Appendix A, or an equivalent counting method.

(iii) If an equivalent method to the ORM is used, the employer shall ensure that the method meets the following criteria:

(A) Replicate exposure data used to establish equivalency are collected in side-by-side field and laboratory comparisons;

(B) The comparison indicates that 90 percent of the samples collected in the range 0.5 to 2.0 times the permissible limit have an accuracy range of plus or minus 25 percent of the ORM results with a 95 percent confidence level as demonstrated by a statistically valid protocol; and

(C) The equivalent method is documented and the results of the comparison testing are maintained.

(iv) To satisfy the monitoring requirements of paragraph (f), employers shall rely on the results of monitoring analysis performed by laboratories that have instituted quality assurance programs that include the elements prescribed in Appendix A.

(6) *Employee notification of monitoring results.* (i) The employer shall notify affected employees of the monitoring results that represent that employee's exposure as soon as possible following receipt of monitoring results.

(ii) The employer shall notify affected employees of the results of monitoring representing the employee's exposure in writing either individually or by posting at a centrally located place that is accessible to affected employees.

(7) *Observation of monitoring.* (i) The employer shall provide affected employees or their designated representatives an opportunity to observe any monitoring of employee exposure to asbestos, tremolite, anthophyllite, or actinolite conducted in accordance with this section.

(ii) When observation of the monitoring of employee exposure to asbestos, tremolite, anthophyllite, or actinolite requires entry into an area where the use of protective clothing or equipment is required, the observer shall be provided with and be required to use such clothing and equipment and shall comply with all other applicable safety and health procedures.

(g) *Methods of compliance.*—(1) *Engineering controls and work practices.* (i) The employer shall use one or any combination of the following control methods to achieve compliance with the permissible exposure limit prescribed by paragraph (c) of this section:

(A) Local exhaust ventilation equipped with HEPA filter dust collection systems;

(B) General ventilation systems;

(C) Vacuum cleaners equipped with HEPA filters;

(D) Enclosure or isolation of processes producing asbestos, tremolite, anthophyllite, or actinolite dust;

(E) Use of wet methods, wetting agents, or removal encapsulants to control employee exposures during asbestos, tremolite, anthophyllite, or actinolite handling, mixing, removal, cutting, application, and cleanup;

(F) Prompt disposal of wastes contaminated with asbestos, tremolite, anthophyllite, or actinolite in leak-tight containers; or

(G) Use of work practices or other engineering controls that the Assistant Secretary can show to be feasible.

(ii) Wherever the feasible engineering and work practice controls described above are not sufficient to reduce employee exposure to or below the limit prescribed in paragraph (c), the employer shall use them to reduce employee exposure to the lowest levels attainable by these controls and shall supplement them by the use of respiratory protection that complies with the requirements of paragraph (h) of this section.

(2) *Prohibitions.* (i) High-speed abrasive disc saws that are not equipped with appropriate engineering controls shall not be used for work related to asbestos, tremolite, anthophyllite, or actinolite.

(ii) Compressed air shall not be used to remove asbestos, tremolite, anthophyllite, or actinolite or materials containing asbestos, tremolite, anthophyllite, or actinolite unless the compressed air is used in conjunction with an enclosed ventilation system designed to capture the dust cloud created by the compressed air.

(iii) Materials containing asbestos, tremolite, anthophyllite, or actinolite shall not be applied by spray methods.

(3) *Employee rotation.* The employer shall not use employee rotation as a means of compliance with the exposure limit prescribed in paragraph (c) of this section.

(h) *Respiratory protection.*—(1) *General.* The employer shall provide respirators, and ensure that they are used, where required by this section. Respirators shall be used in the following circumstances:

(i) During the interval necessary to install or implement feasible engineering and work practice controls;

(ii) In work operations such as maintenance and repair activities, or other activities for which engineering and work practice controls are not feasible;

(iii) In work situations where feasible engineering and work practice controls are not yet sufficient to reduce exposure to or below the exposure limit; and

(iv) In emergencies.

(2) *Respirator selection.* (i) Where respirators are used, the employer shall select and provide, at no cost to the employee, the appropriate respirator as specified in Table D–4, and shall ensure that the employee uses the respirator provided.

(ii) The employer shall select respirators from among those jointly approved as being acceptable for protection by the Mine Safety and Health Administration (MSHA) and the National Institute for Occupational Safety and Health (NIOSH) under the provisions of 30 CFR Part 11.

(iii) The employer shall provide a powered, air-purifying respirator in lieu of any negative-pressure respirator specified in Table D–4 whenever:

(A) An employee chooses to use this type of respirator; and

(B) This respirator will provide adequate protection to the employee.

TABLE D–4.—RESPIRATORY PROTECTION FOR ASBESTOS, TREMOLITE, ANTHOPHYLLITE, AND ACTINOLITE FIBERS

Airborne concentration of asbestos, tremolite, anthophyllite, actinolite, or a combination of these materials	Required respirator
Not in excess of 2 f/cc (10 X PEL).	1. Half-mask air-purifying respirator equipped with high-efficiency filters.
Not in excess of 10 f/cc (50 X PEL).	1. Full facepiece air-purifying respirator equipped with high-efficiency filters.
Not in excess of 20 f/cc (100 X PEL).	1. Any powered air purifying respirator equipped with high efficiency filters. 2. Any supplied-air respirator operated in continuous flow mode.
Not in excess of 200 f/cc (1000 X PEL).	1. Full facepiece supplied-air respirator operated in pressure demand mode.
Greater than 200 f/cc (>1,000 X PEL) or unknown concentration.	1. Full facepiece supplied air respirator operated in pressure demand mode equipped with an auxiliary positive pressure self-contained breathing apparatus.

NOTE: a. Respirators assigned for higher environmental concentrations may be used at lower concentrations.

b. A high-efficiency filter means a filter that is at least 99.97 percent efficient against mono-dispersed particles of 0.3 micrometers in diameter or larger.

(3) *Respirator program.* (i) Where respiratory protection is used, the employer shall institute a respirator program in accordance with 29 CFR 1910.134(b), (d), (e), and (f).

(ii) The employer shall permit each employee who uses a filter respirator to

[Sec. 1926.58(h)(3)(ii)]

change the filter elements whenever an increase in breathing resistance is detected and shall maintain an adequate supply of filter elements for this purpose.

(iii) Employees who wear respirators shall be permitted to leave work areas to wash their faces and respirator facepieces whenever necessary to prevent skin irritation associated with respirator use.

(iv) No employee shall be assigned to tasks requiring the use of respirators if, based on his or her 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 of other employees will be impaired by the use of a respirator. Such employee shall be assigned to another job or given the opportunity to transfer to a different position the duties of which he or she is able to perform with the same employer, in the same geographical area, and with the same seniority, status, and rate of pay he or she had just prior to such transfer, if such a different position is available.

(4) *Respirator fit testing.* (i) The employer shall ensure that the respirator issued to the employee exhibits the least possible facepiece leakage and that the respirator is fitted properly.

(ii) Employers shall perform either quantitative or qualitative face fit tests at the time of initial fitting and at least every 6 months thereafter for each employee wearing a negative-pressure respirator. The qualitative fit tests may be used only for testing the fit of half-mask respirators where they are permited to be worn, and shall be conducted in accordance with Appendix C. The tests shall be used to select facepieces that provide the required protection as prescribed in Table 1.

(l) *Protective clothing*—(1) *General.* The employer shall provide and require the use of protective clothing, such as coveralls or similar whole-body clothing, head coverings, gloves, and foot coverings for any employee exposed to airborne concentrations of asbestos, tremolite, anthophyllite, actinolite or a combination of these minerals that exceed the permissible exposure limit prescribed in paragraph (c) of this section.

(2) *Laundering.* (i) The employer shall ensure that laundering of contaminated clothing is done so as to prevent the release of airborne asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals in excess of the exposure limit prescribed in paragraph (c) of this section.

(ii) Any employer who gives contaminated clothing to another person for laundering shall inform such person of the requirement in paragraph (l)(2)(i) of this section to effectively prevent the release of airborne asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals in excess of the exposure limit prescribed in paragraph (c) of this section.

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

(4) *Protective clothing for removal, demolition, and renovation operations.* (i) The competent person shall periodically examine worksuits worn by employees for rips or tears that may occur during performance of work.

(ii) When rips or tears are detected while an employee is working within a negative-pressure enclosure, rips and tears shall be immediately mended, or the worksuit shall be immediately replaced.

(j) *Hygiene facilities and practices*—(1) *General.* (i) The employer shall provide clean change areas for employees required to work in regulated areas or required by paragraph (l)(1) of this section to wear protective clothing. *Exception:* In lieu of the change area requirement specified in paragraph (j)(1)(i), the employer may permit employees engaged in small scale, short duration operations, as described in paragraph (e)(6) of this section, to clean their protective clothing with a portable HEPA-equipped vacuum before such employees leave the area where maintenance was performed.

(ii) The employer shall ensure that change areas are equipped with separate storage facilities for protective clothing and street clothing, in accordance with section 1910.141(e).

(iii) Whenever food or beverages are consumed at the worksite and employees are exposed to airborne concentrations of asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals in excess of the permissible exposure limit, the employer shall provide lunch areas in which the airborne concentrations of asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals are below the action level.

(2) *Requirements for removal, demolition, and renovation operations*—(i) *Decontamination area.* Except for small scale, short duration operations, as described in paragraph (e)(6) of this section, the employer shall establish a decontamination area that is adjacent and connected to the regulated area for the decontamination of employees contaminated with asbestos, tremolite, anthophyllite, or actinolite. The decontamination area shall consist of an equipment room, shower area, and clean room in series. The employer shall ensure that employees enter and exit the regulated area through the decontamination area.

(ii) *Clean room.* The clean room shall be equipped with a locker or appropriate storage container for each employee's use.

(iii) *Shower area.* Where feasible, shower facilities shall be provided which comply with 29 CFR 1910.141(d)(3). The showers shall be contiguous both to the equipment room and the clean change room, unless the employer can demonstrate that this location is not feasible. Where the employer can demonstrate that it is not feasible to locate the shower between the equipment room and the clean change room, the employer shall ensure that employees:

(A) Remove asbestos, tremolite, anthophyllite, or actinolite contamination from their worksuits using a HEPA vacuum before proceeding to a shower that is not contiguous to the work area; or

(B) Remove their contaminated worksuits, don clean worksuits, and proceed to a shower that is not contiguous to the work area.

(iv) *Equipment room.* The equipment room shall be supplied with impermeable, labeled bags and containers for the containment and disposal of contaminated protective clothing and equipment.

(v) *Decontamination area entry procedures.* (A) the employer shall ensure that employees:

(*1*) Enter the decontamination area through the clean room;

(*2*) Remove and deposit street clothing within a locker provided for their use; and

(*3*) Put on protective clothing and respiratory protection before leaving the clean room.

(B) Before entering the enclosure, the employer shall ensure that employees pass through the equipment room.

(vi) *Decontamination area exit procedures.* (A) Before leaving the regulated area, the employer shall ensure that employees remove all gross contamination and debris from their protective clothing.

(B) The employer shall ensure that employees remove their protective clothing in the equipment room and deposit the clothing in labeled impermeable bags or containers.

(C) The employer shall ensure that employees do not remove their respirators in the equipment room.

[Sec. 1926.58(j)(2)(vi)(C)]

(D) The employer shall ensure that employees shower prior to entering the clean room.

(E) The employer shall ensure that, after showering, employees enter the clean room before changing into street clothes.

(k) *Communication of hazards to employees*—(1) *Signs.* (i) Warning signs that demarcate the regulated area shall be provided and displayed at each location where airborne concentrations of asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals may be in excess of the exposure limit prescribed in paragraph (c) of this section. Signs shall be posted at such a distance from such a location that an employee may read the signs and take necessary protective steps before entering the area marked by the signs.

(ii) The warning signs required by paragraph (k)(1)(i) of this section shall bear the following information:

DANGER

ASBESTOS

CANCER AND LUNG DISEASE HAZARD

AUTHORIZED PERSONNEL ONLY

RESPIRATORS AND PROTECTIVE CLOTHING ARE REQUIRED IN THIS AREA

(iii) Where minerals in the regulated area are only tremolite, anthophyllite or actinolite, the employer may replace the term "asbestos" with the appropriate mineral name.

(2) *Labels.* (i) Labels shall be affixed to all products containing asbestos, tremolite, anthophyllite, or actinolite and to all containers containing such products, including waste containers. Where feasible, installed asbestos, tremolite, anthophyllite, or actinolite products shall contain a visible label.

(ii) Labels shall be printed in large, bold letters on a contrasting background.

(iii) Labels shall be used in accordance with the requirements of 29 CFR 1910.1200(f) of OSHA's Hazard Communication standard, and shall contain the folowing information:

DANGER

CONTAINS ASBESTOS FIBERS

AVOID CREATING DUST

CANCER AND LUNG DISEASE HAZARD

(iv) Where minerals to be labeled are only tremolite, anthophyllite and actinolite, the employer may replace the term "asbestos" with the appropriate mineral name.

(v) Labels shall contain a warning statement against breathing airborne asbestos, tremolite, anthophyllite, or actinolite fibers.

(vi) The provisions for labels required by paragraphs (k)(2)(i)–(k)(2)(iv) do not apply where:

(A) asbestos, tremolite, anthophyllite, or actinolite fibers have been modified by a bonding agent, coating, binder, or other material, provided that the manufacturer can demonstrate that, during any reasonably foreseeable use, handling, storage, disposal, processing, or transportation, no airborne concentrations of asbestos, tremolite, anthophyllite, actinolite, or a combination of these mineral fibers in excess of the action level will be released, or

(B) asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals is present in a product in concentrations less than 0.1 percent by weight.

(3) *Employee information and training.* (i) The employer shall institute a training program for all employees exposed to airborne concentrations of asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals in excess of the action level and shall ensure their participation in the program.

(ii) Training shall be provided prior to or at the time of initial assignment, unless the employee has received equivalent training within the previous 12 months, and at least annually thereafter.

(iii) The training program shall be conducted in a manner that the employee is able to understand. The employer shall ensure that each such employee is informed of the following:

(A) Methods of recognizing asbestos, tremolite, anthophyllite, and actinolite;

(B) The health effects associated with asbestos, tremolite, anthophyllite, or actinolite exposure;

(C) The relationship between smoking and asbestos, tremolite, anthophyllite, and actinolite in producing lung cancer;

(D) The nature of operations that could result in exposure to asbestos, tremolite, anthophyllite, and actinolite, the importance of necessary protective controls to minimize exposure including, as applicable, engineering controls, work practices, respirators, housekeeping procedures, hygiene facilities, protective clothing, decontamination procedures, emergency procedures, and waste disposal procedures, and any necessary instruction in the use of these controls and procedures;

(E) The purpose, proper use, fitting instructions, and limitations of respirators as required by 29 CFR 1910.134;

(F) The appropriate work practices for performing the asbestos, tremolite, anthophyllite, or actinolite job; and

(G) Medical surveillance program requirements.

(H) A review of this standard, including appendices.

(4) *Access to training materials.* (i) The employer shall make readily available to all affected employees without cost all written materials relating to the employee training program, including a copy of this regulation.

(ii) The employer shall provide to the Assistant Secretary and the Director, upon request, all information and training materials relating to the employee information and training program.

(l) *Housekeeping*—(1) *Vacuuming.* Where vacuuming methods are selected, HEPA filtered vacuuming equipment must be used. The equipment shall be used and emptied in a manner that minimizes the reentry of asbestos, tremolite, anthophyllite, or actinolite into the workplace.

(2) *Waste disposal.* Asbestos waste, scrap, debris, bags, containers, equipment, and contaminated clothing consigned for disposal shall be collected and disposed of in sealed, labeled, impermeable bags or other closed, labeled, impermeable containers.

(m) *Medical surveillance*—(1) *General*—(i) *Employees covered.* The employer shall institute a medical surveillance program for all employees engaged in work involving levels of asbestos, tremolite, anthophyllite, actinolite or a combination of these minerals, at or above the action level for 30 or more days per year, or who are required by this section to wear negative pressure respirators.

(ii) *Examination by a physician.* (A) The employer shall ensure that all medical examinations and procedures are performed by or under the supervision of a licensed physician, and are provided at no cost to the employee and at a reasonable time and place.

(B) Persons other than such licensed physicians who administer the pulmonary function testing required by this section shall complete a training course in spirometry sponsored by an appropriate academic or professional institution.

(2) *Medical examinations and consultations*—(i) *Frequency.* The employer shall make available medical examinations and consultations to each employee covered under paragraph

[Sec. 1926.58(m)(2)(i)]

(m)(1)(i) of this section on the following schedules:

(A) Prior to assignment of the employee to an area where negative-pressure respirators are worn;

(B) When the employee is assigned to an area where exposure to asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals may be at or above the action level for 30 or more days per year, a medical examination must be given within 10 working days following the thirtieth day of exposure;

(C) And at least annually thereafter.

(D) If the examining physician determines that any of the examinations should be provided more frequently than specified, the employer shall provide such examinations to affected employees at the frequencies specified by the physician.

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

(ii) *Content.* Medical examinations made available pursuant to paragraphs (m)(2)(i)(A)–(m)(2)(i)(C) of this section shall include:

(A) A medical and work history with special emphasis directed to the pulmonary, cardiovascular, and gastrointestinal systems.

(B) On initial examination, the standardized questionnaire contained in Appendix D, Part 1, and, on annual examination, the abbreviated standardized questionnaire contained in Appendix D, Part 2.

(C) A physical examination directed to the pulmonary and gastrointestinal systems, including a chest roentgenogram to be administered at the discretion of the physician, and pulmonary function tests of forced vital capacity (FVC) and forced expiratory volume at one second (FEV_1). Interpretation and classification of chest roentgenograms shall be conducted in accordance with Appendix E.

(D) Any other examinations or tests deemed necessary by the examining physician.

(3) *Information provided to the physician.* The employer shall provide the following information to the examining physician:

(i) A copy of this standard and Appendices D, E, and I;

(ii) A description of the affected employee's duties as they relate to the employee's exposure;

(iii) The employee's representative exposure level or anticipated exposure level;

(iv) A description of any personal protective and respiratory equipment used or to be used; and

(v) Information from previous medical examinations of the affected employee that is not otherwise available to the examining physician.

(4) *Physician's written opinion.* (i) The employer shall obtain a written opinion from the examining physician. This written opinion shall contain the results of the medical examination and shall include:

(A) The physician's opinion as to whether the employee has any detected medical conditions that would place the employee at an increased risk of material health impairment from exposure to asbestos, tremolite, anthophyllite, or actinolite;

(B) Any recommended limitations on the employee or on the use of personal protective equipment such as respirators; and

(C) A statement that the employee has been informed by the physician of the results of the medical examination and of any medical conditions that may result from asbestos, tremolite, anthophyllite, or actinolite exposure.

(ii) The employer shall instruct the physician not to reveal in the written opinion given to the employer specific findings or diagnoses unrelated to occupational exposure to asbestos, tremolite, anthophyllite, or actinolite.

(iii) The employer shall provide a copy of the physician's written opinion to the affected employee within 30 days from its receipt.

(n) *Recordkeeping*—(1) *Objective data for exempted operations.* (i) Where the employer has relied on objective data that demonstrate that products made from or containing asbestos, tremolite, anthophyllite, or actinolite are not capable of releasing fibers of asbestos, tremolite, anthophyllite, or actinolite or a combination of these minerals, in concentrations at or above the action level under the expected conditions of processing, use, or handling to exempt such operations from the initial monitoring requirements under paragraph (f)(2) of this section, the employer shall establish and maintain an accurate record of objective data reasonably relied upon in support of the exemption.

(ii) The record shall include at least the following information:

(A) The product qualifying for exemption;

(B) The source of the objective data;

(C) The testing protocol, results of testing, and/or analysis of the material for the release of asbestos, tremolite, anthophyllite, or actinolite;

(D) A description of the operation exempted and how the data support the exemption; and

(E) Other data relevant to the operations, materials, processing, or employee exposures covered by the exemption.

(iii) The employer shall maintain this record for the duration of the employer's reliance upon such objective data.

(2) *Exposure measurements.* (i) The employer shall keep an accurate record of all measurements taken to monitor employee exposure to asbestos, tremolite, anthophyllite, or actinolite as prescribed in paragraph (f) of this section.

Note: The employer may utilize the services of competent organizations such as industry trade associations and employee associations to maintain the records required by this section.

(ii) This record shall include at least the following information:

(A) The date of measurement;

(B) The operation involving exposure to asbestos, tremolite, anthophyllite, or actinolite that is being monitored;

(C) Sampling and analytical methods used and evidence of their accuracy;

(D) Number, duration, and results of samples taken;

(E) Type of protective devices worn, if any; and

(F) Name, social security number, and exposure of the employees whose exposures are represented.

(iii) The employer shall maintain this record for at least thirty (30) years, in accordance with 29 CFR 1910.20.

(3) *Medical surveillance.* (i) The employer shall establish and maintain an accurate record for each employee subject to medical surveillance by paragraph (m) of this section, in accordance with 29 CFR 1910.20.

(ii) The record shall include at least the following information:

(A) The name and social security number of the employee;

(B) A copy of the employee's medical examination results, including the medical history, questionnaire responses, results of any tests, and physician's recommendations.

(C) Physician's written opinions;

(D) Any employee medical complaints related to exposure to asbestos, tremolite, anthophyllite, or actinolite; and

(E) A copy of the information provided to the physician as required by paragraph (m) of this section.

(iii) The employer shall ensure that this record is maintained for the duration of employment plus thirty (30) years, in accordance with 29 CFR 1910.20.

[Sec. 1926.58(n)(3)(iii)]

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(4) *Training records.* The employer shall maintain all employee training records for one 1 year beyond the last date of employment by that employer.

(5) *Availability.* (i) The employer, upon written request, shall make all records required to be maintained by this section available to the Assistant Secretary and the Director for examination and copying.

(ii) The employer, upon request, shall make any exposure records required by paragraphs (f) and (n) of this section available for examination and copying to affected employees, former employees, designated representatives, and the Assistant Secretary, in accordance with 29 CFR 1910.20(a)–(e) and (g)–(i).

(iii) The employer, upon request, shall make employee medical records required by paragraphs (m) and (n) of this section available for examination and copying to the subject employee, anyone having the specific written consent of the subject employee, and the Assistant Secretary, in accordance with 29 CFR 1910.20.

(6) *Transfer of records.* (i) The employer shall comply with the requirements concerning transfer of records set forth in 29 CFR 1910.20 (h).

(ii) Whenever the employer ceases to do business and there is no successor employer to receive and retain the records for the prescribed period, the employer shall notify the Director at least 90 days prior to disposal and, upon request, transmit them to the Director.

(o) *Dates*—(1) *Effective date.* This section shall become effective [insert date 30 days from publication in the Federal Register]. The requirements of the asbestos standard issued in June 1972 (37 FR 11318), as amended, and published in 29 CFR 1910.1001-(1985) remain in effect until compliance is achieved with the parallel provisions of this standard.

(2) *Start-up dates.* (i) The requirements of paragraphs (c) through (n) of this section, including the engineering controls specified in paragraph (g)(1) of this section, shall be complied with by [insert date 210 days from publication in the Federal Register].

(p) *Appendices.* (1) Appendices A, C, D, and E to this section are incorporated as part of this section and the contents of these appendices are mandatory.

(2) Appendices B, F, G, H, and I to this section are informational and are not intended to create any additional obligations not otherwise imposed or to detract from any existing obligations.

Appendix A to § 1926.58—OSHA Reference Method—Mandatory

This mandatory appendix specifies the procedure for analyzing air samples for asbestos, tremolite, anthophyllite, and actinolite and specifies quality control procedures that must be implemented by laboratories performing the analysis. The sampling and analytical methods described below represent the elements of the available monitoring methods [such as the NIOSH P&CAM 239 method] which OSHA considers to be essential to achieve adequate employee exposure monitoring while allowing employers to use methods that are already established within their organizations. All employers who are required to conduct air monitoring under paragraph (f) of the standard are required to utilize analytical laboratories that use this procedure, or an equivalent method, for collecting and analyzing samples.

Sampling and Analytical Procedure

1. The sampling medium for air samples shall be mixed cellulose ester filter membranes. These shall be designated by the manufacturer as suitable for asbestos, tremolite, anthophyllite, and actinolite counting. See below for rejection of blanks.

2. The preferred collection device shall be the 25-mm diameter cassette with an open-faced 50-mm extension cowl. The 37-mm cassette may be used if necessary but only if written justification for the need to use the 37-mm filter cassette accompanies the sample results in the employee's exposure monitoring record.

3. Air flow rate between 0.5 liter/min and 2.5 liters/min shall be selected for the 25/mm cassette. If the 37-mm cassette is used, an air flow rate between 1 liter/min and 2.5 liters/min shall be selected.

4. Where possible, a sufficient air volume for each air sample shall be collected to yield between 100 and 1,300 fibers per square millimeter on the membrane filter. If a filter darkens in appearance or if loose dust is seen on the filter, a second sample shall be started.

5. Ship the samples in a rigid container with sufficient packing material to prevent dislodging the collected fibers. Packing material that has a high electrostatic charge on its surface [e.g., expanded polystyrene] cannot be used because such material can cause loss of fibers to the sides of the cassette.

6. Calibrate each personal sampling pump before and after use with a representative filter cassette installed between the pump and the calibration devices.

7. Personal samples shall be taken in the "breathing zone" of the employee (i.e., attached to or near the collar or lapel near the worker's face).

8. Fiber counts shall be made by positive phase contrast using a microscope with an 8 to 10 X eyepiece and a 40 to 45 X objective for a total magnification of approximately 400 X and a numerical aperture of 0.65 to 0.75. The microscope shall also be fitted with a green or blue filter.

9. The microscope shall be fitted with a Walton-Beckett eyepiece graticule calibrated for a field diameter of 100 micrometers (+/− 2 micrometers).

10. The phase-shift detection limit of the microscope shall be about 3 degrees measured using the HSE phase shift test slide as outlined below.

a. Place the test slide on the microscope stage and center it under the phase objective.

b. Bring the blocks of grooved lines into focus.

Note.—The slide consists of seven sets of grooved lines (ca. 20 grooves to each block) in descending order of visibility from sets 1 to 7, seven being the least visible. The requirements for asbestos, tremolite, anthophyllite, and actinolite counting are that the microscope optics must resolve the grooved lines in set 3 completely, although they may appear somewhat faint, and that the grooved lines in sets 6 and 7 must be invisible. Sets 4 and 5 must be at least partially visible but may vary slightly in visibility between microscopes. A microscope that fails to meet these requirements has either too low or too high a resolution to be used for asbestos, tremolite, anthophyllite, and actinolite counting.

c. If the image deteriorates, clean and adjust the microscope optics. If the problem persists, consult the microscope manufacturer.

11. Each set of samples taken will include 10 percent blanks or a minimum of 2 blanks. The blank results shall be averaged and subtracted from the analytical results before reporting. Any samples represented by a blank having a fiber count in excess of 7 fibers/100 fields shall be rejected.

12. The samples shall be mounted by the acetone/triacetin method or a method with an equivalent index of refraction and similar clarity.

13. Observe the following counting rules.

a. Count only fibers equal to or longer than 5 micrometers. Measure the length of curved fibers along the curve.

b. Count all particles as asbestos, tremolite, anthophyllite, and actinolite that have a length-to-width ratio (aspect ratio) of 3:1 or greater.

c. Fibers lying entirely within the boundary of the Walton-Beckett graticule field shall receive a count of 1. Fibers crossing the boundary once, having one end within the circle, shall receive the count of one half (½). Do not count any fiber that crosses the graticule boundary more than once. Reject and do not count any other fibers even though they may be visible outside the graticule area.

d. Count bundles of fibers as one fiber unless individual fibers can be identified by observing both ends of an individual fiber.

e. Count enough graticule fields to yield 100 fibers. Count a minimum of 20 fields; stop counting at 100 fields regardless of fiber count.

14. Blind recounts shall be conducted at the rate of 10 percent.

Quality Control Procedures

1. Intralaboratory program. Each laboratory and/or each company with more than one microscopist counting slides shall establish a statistically designed quality assurance program involving blind recounts and

[Sec. 1926.58, Appendix A]

Calibration and Quality Control

11. Calibration of the Walton-Beckett graticule. The diameter, d_c (mm), of the circular counting area and the disc diameter must be specified when ordering the graticule.

a. Insert any available graticule into the eyepiece and focus so that the graticule lines are sharp and clear.

b. Set the appropriate interpupillary distance and, if applicable, reset the binocular head adjustment so that the magnification remains constant.

c. Install the 40 to 45 × phase objective.

d. Place a stage micrometer on the microscope object stage and focus the microscope on the graduate lines.

e. Measure the magnified grid length, L_s (mm), using the stage micrometer.

f. Remove the graticule from the microscope and measure its actual grid length, L_g (mm). This can best be accomplished by using a stage fitted with verniers.

g. Calculate the circle diameter, d_c (mm), for the Walton-Beckett graticule:

$$d_c = \frac{L_g \times D}{L_s}$$

Example.—If L_s = 108 um, L_g = 2.93 mm and D = 100 um, then d_c = 2.71 mm.

h. Check the field diameter, D (acceptable range 100 mm ± 2 mm) with a stage micrometer upon receipt of the graticule from the manufacturer. Determine field area (mm²).

12. Microscope adjustments. Follow the manufacturer's instructions and also the following:

a. Adjust the light source for even illumination across the field of view at the condenser iris.

Note.—Kohler illumination is preferred, where available.

b. Focus on the particulate material to be examined.

c. Make sure that the field iris is in focus, centered on the sample, and open only enough to fully illuminate the field of view.

d. Use the telescope ocular supplied by the manufacturer to ensure that the phase rings (annular diaphragm and phase-shifting elements) are concentric.

13. Check the phase-shift detection limit of the microscope periodically.

a. Remove the HSE/NPL phase-contrast test slide from its shipping container and center it under the phase objective.

b. Bring the blocks of grooved lines into focus.

Note.—The slide consists of seven sets of grooves (ca. 20 grooves to each block) in descending order of visibility from sets 1 to 7. The requirements for counting are that the microscope optics must resolve the grooved lines in set 3 completely, although they may appear somewhat faint, and that the grooved lines in sets 6 to 7 must be invisible. Sets 4 and 5 must be at least partially visible but may vary slightly in visibility between microscopes. A microscope which fails to meet these requirements has either too low or too high a resolution to be used for asbestos, tremolite, anthophyllite, and actinolite counting.

c. If the image quality deteriorates, clean the microscope optics and, if the problem persists, consult the microscope manufacturer.

14. Quality control of fiber counts.

a. Prepare and count field blanks along with the field samples. Report the counts on each blank. Calculate the mean of the field blank counts and subtract this value from each sample count before reporting the results.

Note 1.—The identity of the blank filters should be unknown to the counter until all counts have been completed.

Note 2: If a field blank yields fiber counts greater than 7 fibers/100 fields, report possible contamination of the samples.

b. Perform blind recounts by the same counter on 10 percent of filters counted (slides relabeled by a person other than the counter).

15. Use the following test to determine whether a pair of counts on the same filter should be rejected because of possible bias. This statistic estimates the counting repeatability at the 95% confidence level. Discard the sample if the difference between the two counts exceeds $2.77(F)s_r$, where F = average of the two fiber counts and s_r = relative standard deviation, which should be derived by each laboratory based on historical in-house data.

Note.—If a pair of counts is rejected as a result of this test, recount the remaining samples in the set and test the new counts against the first counts. Discard all rejected paired counts.

16. Enroll each new counter in a training course that compares performance of counters on a variety of samples using this procedure.

Note.—To ensure good reproducibility, all laboratories engaged in asbestos, tremolite, anthophyllite, and actinolite counting are required to participate in the Proficiency Analytical Testing (PAT) Program and should routinely participate with other asbestos, tremolite, anthophyllite, and actinolite fiber counting laboratories in the exchange of field samples to compare performance of counters.

Measurement

17. Place the slide on the mechanical stage of the calibrated microscope with the center of the filter under the objective lens. Focus the microscope on the plane of the filter.

18. Regularly check phase-ring alignment and Kohler illumination.

19. The following are the counting rules:

a. Count only fibers longer than 5 um. Measure the length of curved fibers along the curve.

b. Count only fibers with a length-to-width ratio equal to or greater than 3:1.

c. For fibers that cross the boundary of the graticule field, do the following:

1. Count any fiber longer than 5 um that lies entirely within the graticule area.

2. Count as ½ fiber any fiber with only one end lying within the graticule area.

3. Do not count any fiber that crosses the graticule boundary more than once.

4. Reject and do not count all other fibers.

d. Count bundles of fibers as one fiber unless individual fibers can be identified by observing both ends of a fiber.

e. Count enough graticule fields to yield 100 fibers. Count a minimum of 20 fields. Stop at 100 fields regardless of fiber count.

20. Start counting from one end of the filter and progress along a radial line to the other end, shift either up or down on the filter, and continue in the reverse direction. Select fields randomly by looking away from the eyepiece briefly while advancing the mechanical stage. When an agglomerate covers ca. ⅛ or more of the field of view, reject the field and select another. Do not report rejected fields in the number of total fields counted.

Note.—When counting a field, continuously scan a range of focal planes by moving the fine focus knob to detect very fine fibers which have become embedded in the filter. The small-diameter fibers will be very faint but are an important contribution to the total count.

Calculations

21. Calculate and report fiber density on the filter, E (fibers/mm²); by dividing the total fiber count, F; minus the mean field blank count, B, by the number of fields, n; and the field area, A_f (0.00785 mm² for a properly calibrated Walton-Beckett graticule):

$$E = \frac{F - B}{(n)(A_f)} \text{ fibers/mm}^2$$

[Sec. 1910.1001, Appendix B]

permitted to be used for asbestos, tremolite, anthophyllite, and actinolite work. For effective protection, respirators must fit your face and head snugly. Your employer is required to conduct fit tests when you are first assigned a respirator and every 6 months thereafter. Respirators should not be loosened or removed in work situations where their use is required.

B. Protective Clothing: You are required to wear protective clothing in work areas where asbestos, tremolite, anthophyllite, and actinolite fiber concentrations exceed the permissible exposure limit (PEL) of 0.2 f/cc to prevent contamination of the skin. Where protective clothing is required, your employer must provide you with clean garments. Unless you are working on a large asbestos, tremolite, anthophyllite, and actinolite removal or demolition project, your employer must also provide a change room and separate lockers for your street clothes and contaminated work clothes. If you are working on a large asbestos, tremolite, anthophyllite, and actinolite removal or demolition project, and where it is feasible to do so, your employer must provide a clean room, shower, and decontamination room contiguous to the work area. When leaving the work area, you must remove contaminated clothing before proceeding to the shower. If the shower is not adjacent to the work area, you must vacuum your clothing before proceeding to the change room and shower. To prevent inhaling fibers in contaminated change rooms and showers, leave your respirator on until you leave the shower and enter the clean change room.

IV. Disposal Procedures and Cleanup

A. Wastes that are generated by processes where asbestos, tremolite, anthophyllite, and actinolite is present include:

1. Empty asbestos, tremolite, anthophyllite, and actinolite shipping containers.

2. Process wastes such as cuttings, trimmings, or reject material.

3. Housekeeping waste from sweeping or vacuuming.

4. Asbestos, tremolite, anthophyllite, and actinolite fireproofing or insulating material that is removed from buildings.

5. Building products that contain asbestos, tremolite, anthophyllite, and actinolite removed during building renovation or demolition.

6. Contaminated disposable protective clothing.

B. Empty shipping bags can be flattened under exhaust hoods and packed into airtight containers for disposal. Empty shipping drums are difficult to clean and should be sealed.

C. Vacuum logs or disposable paper filters should not be cleaned, but should be sprayed with a fine water mist and placed into a labeled waste container.

D. Process waste and housekeeping waste should be wetted with water or a mixture of water and surfactant prior to packaging in disposable containers.

E. Material containing asbestos, tremolite, anthophyllite, and actinolite that is removed from buildings must be disposed of in leak-tight 6-mil thick plastic bags, plastic-lined cardboard containers, or plastic-lined metal containers. These wastes, which are removed while wet, should be sealed in containers before they dry out to minimize the release of asbestos, tremolite, anthophyllite, and actinolite fibers during handling.

V. Access to Information

A. Each year, your employer is required to inform you of the information contained in this standard and appendices for asbestos, tremolite, anthophyllite, and actinolite. In addition, your employer must instruct you in the proper work practices for handling materials containing asbestos, tremolite, anthophyllite, and actinolite, and the correct use of protective equipment.

B. Your employer is required to determine whether you are being exposed to asbestos, tremolite, anthophyllite, and actinolite. You or your representative has the right to observe employee measurements and to record the results obtained. Your employer is required to inform you of your exposure, and, if you are exposed above the permissible limit, he or she is required to inform you of the actions that are being taken to reduce your exposure to within the permissible limit.

C. Your employer is required to keep records of your exposures and medical examinations. These exposure records must be kept for at least thirty (30) years. Medical records must be kept for the period of your employment plus thirty (30) years.

D. Your employer is required to release your exposure and medical records to your physician or designated representative upon your written request.

Appendix H to § 1910.1001—Medical Surveillance Guidelines for Asbestos Tremolite, Anthophyllite, and Actinolite Non-Mandatory

I. Route of Entry Inhalation, Ingestion

II. Toxicology

Clinical evidence of the adverse effects associated with exposure to asbestos, tremolite, anthophyllite, and actinolite, is present in the form of several well-conducted epidemiological studies of occupationally exposed workers, family contacts of workers, and persons living near asbestos, tremolite, anthophyllite, and actinolite mines. These studies have shown a definite association between exposure to asbestos, tremolite, anthophyllite, and actinolite and an increased incidence of lung cancer, pleural and peritoneal mesothelioma, gastrointestinal cancer, and asbestosis. The latter is a disabling fibrotic lung disease that is caused only by exposure to asbestos. Exposure to asbestos, tremolite, anthophyllite, and actinolite has also been associated with an increased incidence of esophageal, kidney, laryngeal, pharyngeal, and buccal cavity cancers. As with other known chronic occupational diseases, disease associated with asbestos, tremolite, anthophyllite, and actinolite generally appears about 20 years following the first occurrence of exposure. There are no known acute effects associated with exposure to asbestos, tremolite, anthophyllite, and actinolite.

Epidemiological studies indicate that the risk of lung cancer among exposed workers who smoke cigarettes is greatly increased over the risk of lung cancer among non-exposed smokers or exposed nonsmokers. These studies suggest that cessation of smoking will reduce the risk of lung cancer for a person exposed to asbestos, tremolite, anthophyllite, and actinolite but will not reduce it to the same level of risk as that existing for an exposed worker who has never smoked.

III. Signs and Symptoms of Exposure-Related Disease

The signs and symptoms of lung cancer or gastrointestinal cancer induced by exposure to asbestos, tremolite, anthophyllite, and actinolite are not unique, except that a chest X-ray of an exposed patient with lung cancer may show pleural plaques, pleural calcification, or pleural fibrosis. Symptoms characteristic of mesothelioma include shortness of breath, pain in the walls of the chest, or abdominal pain. Mesothelioma has a much longer latency period compared with lung cancer (40 years versus 15–20 years), and mesothelioma is therefore more likely to be found among workers who were first exposed to asbestos at an early age. Mesothelioma is always fatal.

Asbestosis is pulmonary fibrosis caused by the accumulation of asbestos fibers in the lungs. Symptoms include shortness of breath, coughing, fatigue, and vague feelings of sickness. When the fibrosis worsens, shortness of breath occurs even at rest. The diagnosis of asbestosis is based on a history of exposure to asbestos, the presence of characteristic radiologic changes, end-inspiratory crackles (rales), and other clinical features of fibrosing lung disease. Pleural plaques and thickening are observed on X-rays taken during the early stages of the disease. Asbestosis is often a progressive disease even in the absence of continued exposure, although this appears to be a highly individualized characteristic. In severe cases, death may be caused by respiratory or cardiac failure.

[Sec. 1910.1001, Appendix H]

IV. Surveillance and Preventive Considerations

As noted above, exposure to asbestos, tremolite, anthophyllite, and actinolite has been linked to an increased risk of lung cancer, mesothelioma, gastrointestinal cancer, and asbestosis among occupationally exposed workers. Adequate screening tests to determine an employee's potential for developing serious chronic diseases, such as cancer, from exposure to asbestos, tremolite, anthophyllite, and actinolite do not presently exist. However, some tests, particularly chest X-rays and pulmonary function tests, may indicate that an employee has been overexposed to asbestos, tremolite, anthophyllite, and actinolite, increasing his or her risk of developing exposure-related chronic diseases. It is important for the physician to become familiar with the operating conditions in which occupational exposure to asbestos, tremolite, anthophyllite, and actinolite is likely to occur. This is particularly important in evaluating medical and work histories and in conducting physical examinations. When an active employee has been identified as having been overexposed to asbestos, tremolite, anthophyllite, and actinolite, measures taken by the employer to eliminate or mitigate further exposure should also lower the risk of serious long-term consequences.

The employer is required to institute a medical surveillance program for all employees who are or will be exposed to asbestos, tremolite, anthophyllite, and actinolite at or above the action level (0.1 fiber per cubic centimeter of air) for 30 or more days per year and for all employees who are assigned to wear a negative-pressure respirator. All examinations and procedures must be performed by or under the supervision of a licensed physician, at a reasonable time and place, and at no cost to the employee.

Although broad latitude is given to the physician in prescribing specific tests to be included in the medical surveillance program, OSHA requires inclusion of the following elements in the routine examination:

(i) Medical and work histories with special emphasis directed to symptoms of the respiratory system, cardiovascular system, and digestive tract.

(ii) Completion of the respiratory disease questionnaire contained in Appendix D.

(iii) A physical examination including a chest roentgenogram and pulmonary function test that includes measurement of the employee's forced vital capacity (FVC) and forced expiratory volume at one second (FEV_1).

(iv) Any laboratory or other test that the examining physician deems by sound medical practice to be necessary.

The employer is required to make the prescribed tests available at least annually to those employees covered; more often than specified if recommended by the examining physician; and upon termination of employment.

The employer is required to provide the physician with the following information: A copy of this standard and appendices; a description of the employee's duties as they relate to asbestos exposure; the employee's representative level of exposure to asbestos tremolite, anthophyllite, and actinolite; a description of any personal protective and respiratory equipment used; and information from previous medical examinations of the affected employee that is not otherwise available to the physician. Making this information available to the physician will aid in the evaluation of the employee's health in relation to assigned duties and fitness to wear personal protective equipment, if required.

The employer is required to obtain a written opinion from the examining physician containing the results of the medical examination; the physician's opinion as to whether the employee has any detected medical conditions that would place the employee at an increased risk of exposure-related disease; any recommended limitations on the employee or on the use of personal protective equipment; and a statement that the employee has been informed by the physician of the results of the medical examination and of any medical conditions related to asbestos, tremolite, anthophyllite, and actinolite exposure that require further explanation or treatment. This written opinion must not reveal specific findings or diagnoses unrelated to exposure to asbestos, tremolite, anthophyllite, and actinolite, and a copy of the opinion must be provided to the affected employee.

[Sec. 1910.1001, Appendix H]

1926.58 Asbestos, tremolite, anthophyllite, and actinolite.

[Sec. 1926.58 added by 51 FR 22756, June 20, 1986]

(a) *Scope and application.* This section applies to all construction work as defined in 29 CFR 1910.12(b), including but not limited to the following:

(1) Demolition or salvage of structures where asbestos, tremolite, anthophyllite, or actinolite is present;

(2) Removal or encapsulation of materials containing asbestos, tremolite, anthophyllite, or actinolite;

(3) Construction, alteration, repair, maintenance, or renovation of structures, substrates, or portions thereof, that contain asbestos, tremolite, anthophyllite, or actinolite;

(4) Installation of products containing asbestos, tremolite, anthophyllite, or actinolite;

(5) Asbestos, tremolite, anthophyllite, and actinolite spill/emergency cleanup; and

(6) Transportation, disposal, storage, or containment of asbestos, tremolite, anthophyllite, or actinolite or products containing asbestos, tremolite, anthophyllite, or actinolite on the site or location at which construction activities are performed.

(b) *Definitions.* "Action level" means an airborne concentration of asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals of 0.1 fiber per cubic centimeter (f/cc) of air calculated as an eight (8)-hour time-weighted average.

"Asbestos" includes chrysotile, amosite, crocidolite, tremolite asbestos, anthophyllite asbestos, actinolite asbestos, and any of these minerals that has been chemically treated and/or altered.

"Assistant Secretary" means the Assistant Secretary of Labor for Occupational Safety and Health, U.S. Department of Labor, or designee.

"Authorized person" means any person authorized by the employer and required by work duties to be present in regulated areas.

"Clean room" means an uncontaminated room having facilities for the storage of employees' street clothing and uncontaminated materials and equipment.

"Competent person" means one who is capable of identifying existing asbestos, tremolite, anthophyllite, or actinolite hazards in the workplace and who has the authority to take prompt corrective measures to eliminate them, as specified in 29 CFR 1926.32(f). The duties of the competent person include at least the following: establishing the negative-pressure enclosure, ensuring its integrity, and controlling entry to and exit from the enclosure; supervising any employee exposure monitoring required by the standard; ensuring that all employees working within such an enclosure wear the appropriate personal protective equipment, are trained in the use of appropriate methods of exposure control, and use the hygiene facilities and decontamination procedures specified in the standard; and ensuring that engineering controls in use are in proper operating condition and are functioning properly.

"Decontamination area" means an enclosed area adjacent and connected to the regulated area and consisting of an equipment room, shower area, and clean room, which is used for the decontamination of workers, materials, and equipment contaminated with asbestos, tremolite, anthophyllite, or actinolite.

"Demolition" means the wrecking or taking out of any load-supporting structural member and any related razing, removing, or stripping of asbestos, tremolite, anthophyllite, or actinolite products.

"Director" means the Director, National Institute for Occupational Safety and Health, U.S. Department of Health and Human Services, or designee.

"Employee exposure" means that exposure to airborne asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals, that would occur if the employee were not using respiratory protective equipment.

"Equipment room (change room)" means a contaminated room located within the decontamination area that is supplied with impermeable bags or containers for the disposal of contaminated protective clothing and equipment.

"Fiber" means a particulate form of asbestos, tremolite, anthophyllite, or actinolite, 5 micrometers or longer, with a length-to-diameter ratio of at least 3 to 1.

"High-efficiency particulate air (HEPA) filter" means a filter capable of trapping and retaining at least 99.97 percent of all monodispersed particles of 0.3 micrometers in diameter or larger.

"Regulated area" means an area established by the employer to demarcate areas where airborne concentrations of asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals exceed or can reasonably be expected to exceed the permissible exposure limit. The regulated area may take the form of (1) a temporary enclosure, as required by paragraph (e)(6) of this section, or (2) an area demarcated in any manner that minimizes the number of employees exposed to asbestos, tremolite, anthophyllite, or actinolite.

"Removal" means the taking out or stripping of asbestos, tremolite, anthophyllite, or actinolite or materials containing asbestos, tremolite, anthophyllite, or actinolite.

[Sec. 1926.58(b)]

"Renovation" means the modifying of any existing structure, or portion thereof, where exposure to airborne asbestos, tremolite, anthophyllite, actinolite may result.

"Repair" means overhauling, rebuilding, reconstructing, or reconditioning of structures or substrates where asbestos, tremolite, anthophyllite,or actinolite is present.

"Tremolite, anthophyllite and actinolite" means the non-asbestos form of these minerals, and any of these minerals that have been chemically treated and/or altered.

(c) *Permissible exposure limit (PEL).* The employer shall ensure that no employee is exposed to an airborne concentration of asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals in excess of 0.2 fiber per cubic centimeter of air as an eight (8) hour time-weighted average (TWA), as determined by the method prescribed in Appendix A of this section, or by an equivalent method.

(d) *Communication among employers.* On multi-employer worksites, an employer performing asbestos, tremolite, anthophyllite, or actinolite work requiring the establishment of a regulated area shall inform other employers on the site of the nature of the employer's work with asbestos, tremolite, anthophyllite, or actinolite and of the existence of and requirements pertaining to regulated areas.

(e) *Regulated areas*—(1) *General.* The employer shall establish a regulated area in work areas where airborne concentrations of asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals exceed or can reasonably be expected to exceed the permissible exposure limit prescribed in paragraph (c) of this section.

(2) *Demarcation.* The regulated area shall be demarcated in any manner that minimizes the number of persons within the area and protects persons outside the area from exposure to airborne concentrations of asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals in excess of the permissible exposure limit.

(3) *Access.* Access to regulated areas shall be limited to authorized persons or to persons authorized by the Act or regulations issued pursuant thereto.

(4) *Respirators.* All persons entering a regulated area shall be supplied with a respirator, selected in accordance with paragraph (h)(2) of this section.

(5) *Prohibited activities.* The employer shall ensure that employees do not eat, drink, smoke, chew tobacco or gum, or apply cosmetics in the regulated area.

(6) *Requirements for asbestos removal, demolition, and renovation operations.* (i) Wherever feasible, the employer shall establish negative-pressure enclosures before commencing removal, demolition, and renovation operations.

(ii) The employer shall designate a competent person to perform or supervise the following duties:

(A) Set up the enclosure;

(B) Ensure the integrity of the enclosure;

(C) Control entry to and exit from the enclosure;

(D) Supervise all employee exposure monitoring required by this section;

(E) Ensure that employees working within the enclosure wear protective clothing and respirators as required by paragraphs (i) and (h) of this section and;

(F) Ensure that employees are trained in the use of engineering controls, work practices, and personal protective equipment;

(G) Ensure that employees use the hygiene facilities and observe the decontamination procedures specified in paragraph (j) of this section; and

(H) Ensure that engineering controls are functioning properly.

(iii) In addition to the qualifications specified in paragraph (b) of this section, the competent person shall be trained in all aspects of asbestos, tremolite, anthophyllite, or actinolite abatement, the contents of this standard, the identification of asbestos, tremolite, anthophyllite, or actinolite and their removal procedures, and other practices for reducing the hazard. Such training shall be obtained in a comprehensive course, such as a course conducted by an EPA Asbestos Training Center, or an equivalent course.

(iv) *Exception:* For small-scale, short-duration operations, such as pipe repair, valve replacement, installing electrical conduits, installing or removing drywall, roofing, and other general building maintenance or renovation, the employer is not required to comply with the requirements of paragraph (e)(6) of this section.

(f) *Exposure monitoring*—(1) *General.* (i) Each employer who has a workplace or work operation covered by this standard shall perform monitoring to determine accurately the airborne concentrations of asbestos, tremolite, anthophyllite, actinolite or a combination of these minerals to which employees may be exposed.

(ii) Determinations of employee exposure shall be made from breathing zone air samples that are representative of the 8-hour TWA of each employee.

(iii) Representative 8-hour TWA employee exposure shall be determined on the basis of one or more samples representing full-shift exposure for employees in each work area.

(2) *Initial monitoring.* (i) Each employer who has a workplace or work operation covered by this standard, except as provided for in paragraph (f)(2)(ii) and (f)(2)(iii) of this section, shall perform initial monitoring at the initiation of each asbestos, tremolite, anthophyllite, actinolite job to accurately determine the airborne concentrations of asbestos, tremolite, anthophyllite, or actinolite to which employees may be exposed.

(ii) The employer may demonstrate that employee exposures are below the action level by means of objective data demonstrating that the product or material containing asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals cannot release airborne fibers in concentrations exceeding the action level under those work conditions having the greatest potential for releasing asbestos, tremolite, anthophyllite, or actinolite.

(iii) Where the employer has monitored each asbestos, tremolite, anthophyllite, or actinolite job, and the data were obtained during work operations conducted under workplace conditions closely resembling the processes, type of material, control methods, work practices, and environmental conditions used and prevailing in the employer's current operations, the employer may rely on such earlier monitoring results to satisfy the requirements of paragraph (f)(2)(i) of this section.

(3) *Periodic monitoring within regulated areas.* The employer shall conduct daily monitoring that is representative of the exposure of each employee who is assigned to work within a regulated area. *Exception:* When all employees within a regulated area are equipped with supplied-air respirators operated in the positive-pressure mode, the employer may dispense with the daily monitoring required by this paragraph.

(4) *Termination of monitoring.* If the periodic monitoring required by paragraph (f)(3) of this section reveals that employee exposures, as indicated by statistically reliable measurements, are below the action level, the employer may discontinue monitoring for those employees whose exposures are represented by such monitoring.

(5) *Method of monitoring.* (i) All samples taken to satisfy the monitoring requirements of paragraph (f) of this section shall be personal samples

[Sec. 1926.58(f)(5)(i)]

collected following the porocedures specified in Appendix A.

(ii) All samples taken to satisfy the monitoring requirements of paragraph (f) of this section shall be evaluated using the OSHA Reference Method (ORM) specified in Appendix A, or an equivalent counting method.

(iii) If an equivalent method to the ORM is used, the employer shall ensure that the method meets the following criteria:

(A) Replicate exposure data used to establish equivalency are collected in side-by-side field and laboratory comparisons;

(B) The comparison indicates that 90 percent of the samples collected in the range 0.5 to 2.0 times the permissible limit have an accuracy range of plus or minus 25 percent of the ORM results with a 95 percent confidence level as demonstrated by a statistically valid protocol; and

(C) The equivalent method is documented and the results of the comparison testing are maintained.

(iv) To satisfy the monitoring requirements of paragraph (f), employers shall rely on the results of monitoring analysis performed by laboratories that have instituted quality assurance programs that include the elements prescribed in Appendix A.

(6) *Employee notification of monitoring results.* (i) The employer shall notify affected employees of the monitoring results that represent that employee's exposure as soon as possible following receipt of monitoring results.

(ii) The employer shall notify affected employees of the results of monitoring representing the employee's exposure in writing either individually or by posting at a centrally located place that is accessible to affected employees.

(7) *Observation of monitoring.* (i) The employer shall provide affected employees or their designated representatives an opportunity to observe any monitoring of employee exposure to asbestos, tremolite, anthophyllite, or actinolite conducted in accordance with this section.

(ii) When observation of the monitoring of employee exposure to asbestos, tremolite, anthophyllite, or actinolite requires entry into an area where the use of protective clothing or equipment is required, the observer shall be provided with and be required to use such clothing and equipment and shall comply with all other applicable safety and health procedures.

(g) *Methods of compliance.*—(1) *Engineering controls and work practices.* (i) The employer shall use one or any combination of the following control methods to achieve compliance with the permissible exposure limit prescribed by paragraph (c) of this section:

(A) Local exhaust ventilation equipped with HEPA filter dust collection systems;

(B) General ventilation systems;

(C) Vacuum cleaners equipped with HEPA filters;

(D) Enclosure or isolation of processes producing asbestos, tremolite, anthophyllite, or actinolite dust;

(E) Use of wet methods, wetting agents, or removal encapsulants to control employee exposures during asbestos, tremolite, anthophyllite, or actinolite handling, mixing, removal, cutting, application, and cleanup;

(F) Prompt disposal of wastes contaminated with asbestos, tremolite, anthophyllite, or actinolite in leak-tight containers; or

(G) Use of work practices or other engineering controls that the Assistant Secretary can show to be feasible.

(ii) Wherever the feasible engineering and work practice controls described above are not sufficient to reduce employee exposure to or below the limit prescribed in paragraph (c), the employer shall use them to reduce employee exposure to the lowest levels attainable by these controls and shall supplement them by the use of respiratory protection that complies with the requirements of paragraph (h) of this section.

(2) *Prohibitions.* (i) High-speed abrasive disc saws that are not equipped with appropriate engineering controls shall not be used for work related to asbestos, tremolite, anthophyllite, or actinolite.

(ii) Compressed air shall not be used to remove asbestos, tremolite, anthophyllite, or actinolite or materials containing asbestos, tremolite, anthophyllite, or actinolite unless the compressed air is used in conjunction with an enclosed ventilation system designed to capture the dust cloud created by the compressed air.

(iii) Materials containing asbestos, tremolite, anthophyllite, or actinolite shall not be applied by spray methods.

(3) *Employee rotation.* The employer shall not use employee rotation as a means of compliance with the exposure limit prescribed in paragraph (c) of this section.

(h) *Respiratory protection.*—(1) *General.* The employer shall provide respirators, and ensure that they are used, where required by this section. Respirators shall be used in the following circumstances:

(i) During the interval necessary to install or implement feasible engineering and work practice controls;

(ii) In work operations such as maintenance and repair activities, or other activities for which engineering and work practice controls are not feasible;

(iii) In work situations where feasible engineering and work practice controls are not yet sufficient to reduce exposure to or below the exposure limit; and

(iv) In emergencies.

(2) *Respirator selection.* (i) Where respirators are used, the employer shall select and provide, at no cost to the employee, the appropriate respirator as specified in Table D–4, and shall ensure that the employee uses the respirator provided.

(ii) The employer shall select respirators from among those jointly approved as being acceptable for protection by the Mine Safety and Health Administration (MSHA) and the National Institute for Occupational Safety and Health (NIOSH) under the provisions of 30 CFR Part 11.

(iii) The employer shall provide a powered, air-purifying respirator in lieu of any negative-pressure respirator specified in Table D–4 whenever:

(A) An employee chooses to use this type of respirator; and

(B) This respirator will provide adequate protection to the employee.

TABLE D–4.—RESPIRATORY PROTECTION FOR ASBESTOS, TREMOLITE, ANTHOPHYLLITE, AND ACTINOLITE FIBERS

Airborne concentration of asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals	Required respirator
Not in excess of 2 f/cc (10 X PEL).	1. Half-mask air-purifying respirator equipped with high-efficiency filters.
Not in excess of 10 f/cc (50 X PEL).	1. Full facepiece air-purifying respirator equipped with high-efficiency filters.
Not in excess of 20 f/cc (100 X PEL).	1. Any powered air purifying respirator equipped with high efficiency filters. 2. Any supplied-air respirator operated in continuous flow mode.
Not in excess of 200 f/cc (1000 X PEL).	1. Full facepiece supplied-air respirator operated in pressure demand mode.
Greater than 200 f/cc (>1,000 X PEL) or unknown concentration.	1. Full facepiece supplied air respirator operated in pressure demand mode equipped with an auxiliary positive pressure self-contained breathing apparatus.

NOTE: a. Respirators assigned for higher environmental concentrations may be used at lower concentrations.

b. A high-efficiency filter means a filter that is at least 99.97 percent efficient against mono-dispersed particles of 0.3 micrometers in diameter or larger.

(3) *Respirator program.* (i) Where respiratory protection is used, the employer shall institute a respirator program in accordance with 29 CFR 1910.134(b), (d), (e), and (f).

(ii) The employer shall permit each employee who uses a filter respirator to

[Sec. 1926.58(h)(3)(ii)]

change the filter elements whenever an increase in breathing resistance is detected and shall maintain an adequate supply of filter elements for this purpose.

(iii) Employees who wear respirators shall be permitted to leave work areas to wash their faces and respirator facepieces whenever necessary to prevent skin irritation associated with respirator use.

(iv) No employee shall be assigned to tasks requiring the use of respirators if, based on his or her 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 of other employees will be impaired by the use of a respirator. Such employee shall be assigned to another job or given the opportunity to transfer to a different position the duties of which he or she is able to perform with the same employer, in the same geographical area, and with the same seniority, status, and rate of pay he or she had just prior to such transfer, if such a different position is available.

(4) *Respirator fit testing.* (i) The employer shall ensure that the respirator issued to the employee exhibits the least possible facepiece leakage and that the respirator is fitted properly.

(ii) Employers shall perform either quantitative or qualitative face fit tests at the time of initial fitting and at least every 6 months thereafter for each employee wearing a negative-pressure respirator. The qualitative fit tests may be used only for testing the fit of half-mask respirators where they are permited to be worn, and shall be conducted in accordance with Appendix C. The tests shall be used to select facepieces that provide the required protection as prescribed in Table 1.

(l) *Protective clothing*—(1) *General.* The employer shall provide and require the use of protective clothing, such as coveralls or similar whole-body clothing, head coverings, gloves, and foot coverings for any employee exposed to airborne concentrations of asbestos, tremolite, anthophyllite, actinolite or a combination of these minerals that exceed the permissible exposure limit prescribed in paragraph (c) of this section.

(2) *Laundering.* (i) The employer shall ensure that laundering of contaminated clothing is done so as to prevent the release of airborne asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals in excess of the exposure limit prescribed in paragraph (c) of this section.

(ii) Any employer who gives contaminated clothing to another person for laundering shall inform such person of the requirement in paragraph (l)(2)(i) of this section to effectively prevent the release of airborne asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals in excess of the exposure limit prescribed in paragraph (c) of this section.

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

(4) *Protective clothing for removal, demolition, and renovation operations.* (i) The competent person shall periodically examine worksuits worn by employees for rips or tears that may occur during performance of work.

(ii) When rips or tears are detected while an employee is working within a negative-pressure enclosure, rips and tears shall be immediately mended, or the worksuit shall be immediately replaced.

(j) *Hygiene facilities and practices*—(1) *General.* (i) The employer shall provide clean change areas for employees required to work in regulated areas or required by paragraph (l)(1) of this section to wear protective clothing. *Exception:* In lieu of the change area requirement specified in paragraph (j)(1)(i), the employer may permit employees engaged in small scale, short duration operations, as described in paragraph (e)(6) of this section, to clean their protective clothing with a portable HEPA-equipped vacuum before such employees leave the area where maintenance was performed.

(ii) The employer shall ensure that change areas are equipped with separate storage facilities for protective clothing and street clothing, in accordance with section 1910.141(e).

(iii) Whenever food or beverages are consumed at the worksite and employees are exposed to airborne concentrations of asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals in excess of the permissible exposure limit, the employer shall provide lunch areas in which the airborne concentrations of asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals are below the action level.

(2) *Requirements for removal, demolition, and renovation operations*—(i) *Decontamination area.* Except for small scale, short duration operations, as described in paragraph (e)(6) of this section, the employer shall establish a decontamination area that is adjacent and connected to the regulated area for the decontamination of employees contaminated with asbestos, tremolite, anthophyllite, or actinolite. The decontamination area shall consist of an equipment room, shower area, and clean room in series. The employer shall ensure that employees enter and exit the regulated area through the decontamination area.

(ii) *Clean room.* The clean room shall be equipped with a locker or appropriate storage container for each employee's use.

(iii) *Shower area.* Where feasible, shower facilities shall be provided which comply with 29 CFR 1910.141(d)(3). The showers shall be contiguous both to the equipment room and the clean change room, unless the employer can demonstrate that this location is not feasible. Where the employer can demonstrate that it is not feasible to locate the shower between the equipment room and the clean change room, the employer shall ensure that employees:

(A) Remove asbestos, tremolite, anthophyllite, or actinolite contamination from their worksuits using a HEPA vacuum before proceeding to a shower that is not contiguous to the work area; or

(B) Remove their contaminated worksuits, don clean worksuits, and proceed to a shower that is not contiguous to the work area.

(iv) *Equipment room.* The equipment room shall be supplied with impermeable, labeled bags and containers for the containment and disposal of contaminated protective clothing and equipment.

(v) *Decontamination area entry procedures.* (A) the employer shall ensure that employees:

(*1*) Enter the decontamination area through the clean room;

(*2*) Remove and deposit street clothing within a locker provided for their use; and

(*3*) Put on protective clothing and respiratory protection before leaving the clean room.

(B) Before entering the enclosure, the employer shall ensure that employees pass through the equipment room.

(vi) *Decontamination area exit procedures.* (A) Before leaving the regulated area, the employer shall ensure that employees remove all gross contamination and debris from their protective clothing.

(B) The employer shall ensure that employees remove their protective clothing in the equipment room and deposit the clothing in labeled impermeable bags or containers.

(C) The employer shall ensure that employees do not remove their respirators in the equipment room.

[Sec. 1926.58(j)(2)(vi)(C)]

(D) The employer shall ensure that employees shower prior to entering the clean room.

(E) The employer shall ensure that, after showering, employees enter the clean room before changing into street clothes.

(k) *Communication of hazards to employees*—(1) *Signs.* (i) Warning signs that demarcate the regulated area shall be provided and displayed at each location where airborne concentrations of asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals may be in excess of the exposure limit prescribed in paragraph (c) of this section. Signs shall be posted at such a distance from such a location that an employee may read the signs and take necessary protective steps before entering the area marked by the signs.

(ii) The warning signs required by paragraph (k)(1)(i) of this section shall bear the following information:

DANGER

ASBESTOS

CANCER AND LUNG DISEASE HAZARD

AUTHORIZED PERSONNEL ONLY

RESPIRATORS AND PROTECTIVE CLOTHING ARE REQUIRED IN THIS AREA

(iii) Where minerals in the regulated area are only tremolite, anthophyllite or actinolite, the employer may replace the term "asbestos" with the appropriate mineral name.

(2) *Labels.* (i) Labels shall be affixed to all products containing asbestos, tremolite, anthophyllite, or actinolite and to all containers containing such products, including waste containers. Where feasible, installed asbestos, tremolite, anthophyllite, or actinolite products shall contain a visible label.

(ii) Labels shall be printed in large, bold letters on a contrasting background.

(iii) Labels shall be used in accordance with the requirements of 29 CFR 1910.1200(f) of OSHA's Hazard Communication standard, and shall contain the folowing information:

DANGER

CONTAINS ASBESTOS FIBERS

AVOID CREATING DUST

CANCER AND LUNG DISEASE HAZARD

(iv) Where minerals to be labeled are only tremolite, anthophyllite and actinolite, the employer may replace the term "asbestos" with the appropriate mineral name.

(v) Labels shall contain a warning statement against breathing airborne asbestos, tremolite, anthophyllite, or actinolite fibers.

(vi) The provisions for labels required by paragraphs (k)(2)(i)–(k)(2)(iv) do not apply where:

(A) asbestos, tremolite, anthophyllite, or actinolite fibers have been modified by a bonding agent, coating, binder, or other material, provided that the manufacturer can demonstrate that, during any reasonably foreseeable use, handling, storage, disposal, processing, or transportation, no airborne concentrations of asbestos, tremolite, anthophyllite, actinolite, or a combination of these mineral fibers in excess of the action level will be released, or

(B) asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals is present in a product in concentrations less than 0.1 percent by weight.

(3) *Employee information and training.* (i) The employer shall institute a training program for all employees exposed to airborne concentrations of asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals in excess of the action level and shall ensure their participation in the program.

(ii) Training shall be provided prior to or at the time of initial assignment, unless the employee has received equivalent training within the previous 12 months, and at least annually thereafter.

(iii) The training program shall be conducted in a manner that the employee is able to understand. The employer shall ensure that each such employee is informed of the following:

(A) Methods of recognizing asbestos, tremolite, anthophyllite, and actinolite;

(B) The health effects associated with asbestos, tremolite, anthophyllite, or actinolite exposure;

(C) The relationship between smoking and asbestos, tremolite, anthophyllite, and actinolite in producing lung cancer;

(D) The nature of operations that could result in exposure to asbestos, tremolite, anthophyllite, and actinolite, the importance of necessary protective controls to minimize exposure including, as applicable, engineering controls, work practices, respirators, housekeeping procedures, hygiene facilities, protective clothing, decontamination procedures, emergency procedures, and waste disposal procedures, and any necessary instruction in the use of these controls and procedures;

(E) The purpose, proper use, fitting instructions, and limitations of respirators as required by 29 CFR 1910.134;

(F) The appropriate work practices for performing the asbestos, tremolite, anthophyllite, or actinolite job; and

(G) Medical surveillance program requirements.

(H) A review of this standard, including appendices.

(4) *Access to training materials.* (i) The employer shall make readily available to all affected employees without cost all written materials relating to the employee training program, including a copy of this regulation.

(ii) The employer shall provide to the Assistant Secretary and the Director, upon request, all information and training materials relating to the employee information and training program.

(l) *Housekeeping*—(1) *Vacuuming.* Where vacuuming methods are selected, HEPA filtered vacuuming equipment must be used. The equipment shall be used and emptied in a manner that minimizes the reentry of asbestos, tremolite, anthophyllite, or actinolite into the workplace.

(2) *Waste disposal.* Asbestos waste, scrap, debris, bags, containers, equipment, and contaminated clothing consigned for disposal shall be collected and disposed of in sealed, labeled, impermeable bags or other closed, labeled, impermeable containers.

(m) *Medical surveillance*—(1) *General*—(i) *Employees covered.* The employer shall institute a medical surveillance program for all employees engaged in work involving levels of asbestos, tremolite, anthophyllite, actinolite or a combination of these minerals, at or above the action level for 30 or more days per year, or who are required by this section to wear negative pressure respirators.

(ii) *Examination by a physician.* (A) The employer shall ensure that all medical examinations and procedures are performed by or under the supervision of a licensed physician, and are provided at no cost to the employee and at a reasonable time and place.

(B) Persons other than such licensed physicians who administer the pulmonary function testing required by this section shall complete a training course in spirometry sponsored by an appropriate academic or professional institution.

(2) *Medical examinations and consultations*—(i) *Frequency.* The employer shall make available medical examinations and consultations to each employee covered under paragraph

(m)(1)(i) of this section on the following schedules:

(A) Prior to assignment of the employee to an area where negative-pressure respirators are worn;

(B) When the employee is assigned to an area where exposure to asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals may be at or above the action level for 30 or more days per year, a medical examination must be given within 10 working days following the thirtieth day of exposure;

(C) And at least annually thereafter.

(D) If the examining physician determines that any of the examinations should be provided more frequently than specified, the employer shall provide such examinations to affected employees at the frequencies specified by the physician.

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

(ii) *Content.* Medical examinations made available pursuant to paragraphs (m)(2)(i)(A)–(m)(2)(i)(C) of this section shall include:

(A) A medical and work history with special emphasis directed to the pulmonary, cardiovascular, and gastrointestinal systems.

(B) On initial examination, the standardized questionnaire contained in Appendix D, Part 1, and, on annual examination, the abbreviated standardized questionnaire contained in Appendix D, Part 2.

(C) A physical examination directed to the pulmonary and gastrointestinal systems, including a chest roentgenogram to be administered at the discretion of the physician, and pulmonary function tests of forced vital capacity (FVC) and forced expiratory volume at one second (FEV_1). Interpretation and classification of chest roentgenograms shall be conducted in accordance with Appendix E.

(D) Any other examinations or tests deemed necessary by the examining physician.

(3) *Information provided to the physician.* The employer shall provide the following information to the examining physician:

(i) A copy of this standard and Appendices D, E, and I;

(ii) A description of the affected employee's duties as they relate to the employee's exposure;

(iii) The employee's representative exposure level or anticipated exposure level;

(iv) A description of any personal protective and respiratory equipment used or to be used; and

(v) Information from previous medical examinations of the affected employee that is not otherwise available to the examining physician.

(4) *Physician's written opinion.* (i) The employer shall obtain a written opinion from the examining physician. This written opinion shall contain the results of the medical examination and shall include:

(A) The physician's opinion as to whether the employee has any detected medical conditions that would place the employee at an increased risk of material health impairment from exposure to asbestos, tremolite, anthophyllite, or actinolite;

(B) Any recommended limitations on the employee or on the use of personal protective equipment such as respirators; and

(C) A statement that the employee has been informed by the physician of the results of the medical examination and of any medical conditions that may result from asbestos, tremolite, anthophyllite, or actinolite exposure.

(ii) The employer shall instruct the physician not to reveal in the written opinion given to the employer specific findings or diagnoses unrelated to occupational exposure to asbestos, tremolite, anthophyllite, or actinolite.

(iii) The employer shall provide a copy of the physician's written opinion to the affected employee within 30 days from its receipt.

(n) *Recordkeeping*—(1) *Objective data for exempted operations.* (i) Where the employer has relied on objective data that demonstrate that products made from or containing asbestos, tremolite, anthophyllite, or actinolite are not capable of releasing fibers of asbestos, tremolite, anthophyllite, or actinolite or a combination of these minerals, in concentrations at or above the action level under the expected conditions of processing, use, or handling to exempt such operations from the initial monitoring requirements under paragraph (f)(2) of this section, the employer shall establish and maintain an accurate record of objective data reasonably relied upon in support of the exemption.

(ii) The record shall include at least the following information:

(A) The product qualifying for exemption;

(B) The source of the objective data;

(C) The testing protocol, results of testing, and/or analysis of the material for the release of asbestos, tremolite, anthophyllite, or actinolite;

(D) A description of the operation exempted and how the data support the exemption; and

(E) Other data relevant to the operations, materials, processing, or employee exposures covered by the exemption.

(iii) The employer shall maintain this record for the duration of the employer's reliance upon such objective data.

(2) *Exposure measurements.* (i) The employer shall keep an accurate record of all measurements taken to monitor employee exposure to asbestos, tremolite, anthophyllite, or actinolite as prescribed in paragraph (f) of this section.

Note: The employer may utilize the services of competent organizations such as industry trade associations and employee associations to maintain the records required by this section.

(ii) This record shall include at least the following information:

(A) The date of measurement;

(B) The operation involving exposure to asbestos, tremolite, anthophyllite, or actinolite that is being monitored;

(C) Sampling and analytical methods used and evidence of their accuracy;

(D) Number, duration, and results of samples taken;

(E) Type of protective devices worn, if any; and

(F) Name, social security number, and exposure of the employees whose exposures are represented.

(iii) The employer shall maintain this record for at least thirty (30) years, in accordance with 29 CFR 1910.20.

(3) *Medical surveillance.* (i) The employer shall establish and maintain an accurate record for each employee subject to medical surveillance by paragraph (m) of this section, in accordance with 29 CFR 1910.20.

(ii) The record shall include at least the following information:

(A) The name and social security number of the employee;

(B) A copy of the employee's medical examination results, including the medical history, questionnaire responses, results of any tests, and physician's recommendations.

(C) Physician's written opinions;

(D) Any employee medical complaints related to exposure to asbestos, tremolite, anthophyllite, or actinolite; and

(E) A copy of the information provided to the physician as required by paragraph (m) of this section.

(iii) The employer shall ensure that this record is maintained for the duration of employment plus thirty (30) years, in accordance with 29 CFR 1910.20.

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(4) *Training records.* The employer shall maintain all employee training records for one 1 year beyond the last date of employment by that employer.

(5) *Availability.* (i) The employer, upon written request, shall make all records required to be maintained by this section available to the Assistant Secretary and the Director for examination and copying.

(ii) The employer, upon request, shall make any exposure records required by paragraphs (f) and (n) of this section available for examination and copying to affected employees, former employees, designated representatives, and the Assistant Secretary, in accordance with 29 CFR 1910.20(a)–(e) and (g)–(i).

(iii) The employer, upon request, shall make employee medical records required by paragraphs (m) and (n) of this section available for examination and copying to the subject employee, anyone having the specific written consent of the subject employee, and the Assistant Secretary, in accordance with 29 CFR 1910.20.

(6) *Transfer of records.* (i) The employer shall comply with the requirements concerning transfer of records set forth in 29 CFR 1910.20 (h).

(ii) Whenever the employer ceases to do business and there is no successor employer to receive and retain the records for the prescribed period, the employer shall notify the Director at least 90 days prior to disposal and, upon request, transmit them to the Director.

(o) *Dates*—(1) *Effective date.* This section shall become effective [insert date 30 days from publication in the Federal Register]. The requirements of the asbestos standard issued in June 1972 (37 FR 11318), as amended, and published in 29 CFR 1910.1001 (1985) remain in effect until compliance is achieved with the parallel provisions of this standard.

(2) *Start-up dates.* (i) The requirements of paragraphs (c) through (n) of this section, including the engineering controls specified in paragraph (g)(1) of this section, shall be complied with by [insert date 210 days from publication in the Federal Register].

(p) *Appendices.* (1) Appendices A, C, D, and E to this section are incorporated as part of this section and the contents of these appendices are mandatory.

(2) Appendices B, F, G, H, and I to this section are informational and are not intended to create any additional obligations not otherwise imposed or to detract from any existing obligations.

Appendix A to § 1926.58—OSHA Reference Method—Mandatory

This mandatory appendix specifies the procedure for analyzing air samples for asbestos, tremolite, anthophyllite, and actinolite and specifies quality control procedures that must be implemented by laboratories performing the analysis. The sampling and analytical methods described below represent the elements of the available monitoring methods (such as the NIOSH P&CAM 239 method) which OSHA considers to be essential to achieve adequate employee exposure monitoring while allowing employers to use methods that are already established within their organizations. All employers who are required to conduct air monitoring under paragraph (f) of the standard are required to utilize analytical laboratories that use this procedure, or an equivalent method, for collecting and analyzing samples.

Sampling and Analytical Procedure

1. The sampling medium for air samples shall be mixed cellulose ester filter membranes. These shall be designated by the manufacturer as suitable for asbestos, tremolite, anthophyllite, and actinolite counting. See below for rejection of blanks.

2. The preferred collection device shall be the 25-mm diameter cassette with an open-faced 50-mm extension cowl. The 37-mm cassette may be used if necessary but only if written justification for the need to use the 37-mm filter cassette accompanies the sample results in the employee's exposure monitoring record.

3. An air flow rate between 0.5 liter/min and 2.5 liters/min shall be selected for the 25/mm cassette. If the 37-mm cassette is used, an air flow rate between 1 liter/min and 2.5 liters/min shall be selected.

4. Where possible, a sufficient air volume for each air sample shall be collected to yield between 100 and 1,300 fibers per square millimeter on the membrane filter. If a filter darkens in appearance or if loose dust is seen on the filter, a second sample shall be started.

5. Ship the samples in a rigid container with sufficient packing material to prevent dislodging the collected fibers. Packing material that has a high electrostatic charge on its surface (e.g., expanded polystyrene) cannot be used because such material can cause loss of fibers to the sides of the cassette.

6. Calibrate each personal sampling pump before and after use with a representative filter cassette installed between the pump and the calibration devices.

7. Personal samples shall be taken in the "breathing zone" of the employee (i.e., attached to or near the collar or lapel near the worker's face).

8. Fiber counts shall be made by positive phase contrast using a microscope with an 8 to 10 X eyepiece and a 40 to 45 X objective for a total magnification of approximately 400 X and a numerical aperture of 0.65 to 0.75. The microscope shall also be fitted with a green or blue filter.

9. The microscope shall be fitted with a Walton-Beckett eyepiece graticule calibrated for a field diameter of 100 micrometers (+/− 2 micrometers).

10. The phase-shift detection limit of the microscope shall be about 3 degrees measured using the HSE phase shift test slide as outlined below.

a. Place the test slide on the microscope stage and center it under the phase objective.

b. Bring the blocks of grooved lines into focus.

Note.—The slide consists of seven sets of grooved lines (ca. 20 grooves to each block) in descending order of visibility from sets 1 to 7, seven being the least visible. The requirements for asbestos, tremolite, anthophyllite, and actinolite counting are that the microscope optics must resolve the grooved lines in set 3 completely, although they may appear somewhat faint, and that the grooved lines in sets 6 and 7 must be invisible. Sets 4 and 5 must be at least partially visible but may vary slightly in visibility between microscopes. A microscope that fails to meet these requirements has either too low or too high a resolution to be used for asbestos, tremolite, anthophyllite, and actinolite counting.

c. If the image deteriorates, clean and adjust the microscope optics. If the problem persists, consult the microscope manufacturer.

11. Each set of samples taken will include 10 percent blanks or a minimum of 2 blanks. The blank results shall be averaged and subtracted from the analytical results before reporting. Any samples represented by a blank having a fiber count in excess of 7 fibers/100 fields shall be rejected.

12. The samples shall be mounted by the acetone/triacetin method or a method with an equivalent index of refraction and similar clarity.

13. Observe the following counting rules.

a. Count only fibers equal to or longer than 5 micrometers. Measure the length of curved fibers along the curve.

b. Count all particles as asbestos, tremolite, anthophyllite, and actinolite that have a length-to-width ratio (aspect ratio) of 3:1 or greater.

c. Fibers lying entirely within the boundary of the Walton-Beckett graticule field shall receive a count of 1. Fibers crossing the boundary once, having one end within the circle, shall receive the count of one half (½). Do not count any fiber that crosses the graticule boundary more than once. Reject and do not count any other fibers even though they may be visible outside the graticule area.

d. Count bundles of fibers as one fiber unless individual fibers can be identified by observing both ends of an individual fiber.

e. Count enough graticule fields to yield 100 fibers. Count a minimum of 20 fields; stop counting at 100 fields regardless of fiber count.

14. Blind recounts shall be conducted at the rate of 10 percent.

Quality Control Procedures

1. Intralaboratory program. Each laboratory and/or each company with more than one microscopist counting slides shall establish a statistically designed quality assurance program involving blind recounts and

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comparisons between microscopists to monitor the variability of counting by each microscopist and between microscopists. In a company with more than one laboratory, the program shall include all laboratories, and shall also evaluate the laboratory-to-laboratory variability.

2. Interlaboratory program. Each laboratory analyzing asbestos, tremolite, anthophyllite, and actinolite samples for compliance determination shall implement an interlaboratory quality assurance program that as a minimum includes participation of at least two other independent laboratories. Each laboratory shall participate in round robin testing at least once every 6 months with at least all the other laboratories in its interlaboratory quality assurance group. Each laboratory shall submit slides typical of its own workload for use in this program. The round robin shall be designed and results analyzed using appropriate statistical methodology.

3. All individuals performing asbestos, tremolite, anthophyllite, and actinolite analysis must have taken the NIOSH course for sampling and evaluating airborne asbestos, tremolite, anthophyllite, and actinolite dust or an equivalent course.

4. When the use of different microscopes contributes to differences between counters and laboratories, the effect of the different microscope shall be evaluated and the microscope shall be replaced, as necessary.

5. Current results of these quality assurance programs shall be posted in each laboratory to keep the microscopists informed.

Appendix B to § 1926.58—Detailed Procedure for Asbestos Tremolite, Anthophyllite, and Actinolite Sampling and Analysis—Non-Mandatory

This appendix contains a detailed procedure for sampling and analysis and includes those critical elements specified in Appendix A. Employers are not required to use this procedure, but they are required to use Appendix A. The purpose of Appendix B is to provide a detailed step-by-step sampling and analysis procedure that conforms to the elements specified in Appendix A. Since this procedure may also standardize the analysis and reduce variability, OSHA encourages employers to use this appendix.

Asbestos, Tremolite, Anthophyllite, and Actinolite Sampling and Analysis Method

Technique: Microscopy, Phase Contrast.

Analyte: Fibers (Manual count).

Sample Preparation: Acetone/triacetin method.

Calibration: Phase-shift detection limit about 3 degrees.

Range: 100 to 1300 fibers/mm² filter area.

Estimated Limit of Detection: 7 fibers/mm² filter area.

Sampler: Filter (0.8–1.2 um mixed cellulose ester membrane, 25-mm diameter).

Flow Rate: 0.5 l/min to 2.5 l/min (25-mm cassette); 1.0 l/min to 2.5 l/min (37-mm cassette).

Sample Volume: Adjust to obtain 100 to 1300 fibers/mm².

Shipment: Routine.

Sample Stability: Indefinite.

Blanks: 10% of samples (minimum 2).

Standard Analytical Error: 0.25.

Applicability: The working range is 0.02 f/cc (1920–L air sample) to 1.25 f/cc (400–L air sample). The method gives an index of airborne asbestos, tremolite, anthophyllite, and actinolite fibers but may be used for other materials such as fibrous glass by inserting suitable parameters into the counting rules. The method does not differentiate between asbestos, tremolite, anthophyllite, and actinolite and other fibers. Asbestos, tremolite, anthophyllite, and actinolite fibers less than ca. 0.25 um diameter will not be detected by this method.

Interferences: Any other airborne fiber may interfere since all particles meeting the counting criteria are counted. Chain-like particles may appear fibrous. High levels of nonfibrous dust particles may obscure fibers in the field of view and raise the detection limit.

Reagents

1. Acetone.

2. Triacetin (glycerol triacetate), reagent grade.

Special Precautions

Acetone is an extremely flammable liquid and precautions must be taken not to ignite it. Heating of acetone must be done in a ventilated laboratory fume hood using a flameless, spark-free heat source.

Equipment

1. Collection device: 25-mm cassette with 50-mm extension cowl with cellulose ester filter, 0.8 to 1.2 mm pore size and backup pad.

Note.—Analyze representative filters for fiber background before use and discard the filter lot if more than 5 fibers/100 fields are found.

2. Personal sampling pump, greater than or equal to 0.5 L/min, with flexible connecting tubing.

3. Microscope, phase contrast, with green or blue filter, 8 to 10X eyepiece, and 40 to 45X phase objective (total magnification ca 400X); numerical aperture = 0.65 to 0.75.

4. Slides, glass, single-frosted, pre-cleaned, 25 × 75 mm.

5. Cover slips, 25 × 25 mm, no. 1½ unless otherwise specified by microscope manufacturer.

6. Knife, #1 surgical steel, curved blade.

7. Tweezers.

8. Flask, Guth-type, insulated neck, 250 to 500 mL (with single-holed rubber stopper and elbow-jointed glass tubing, 16 to 22 cm long).

9. Hotplate, spark-free, stirring type; heating mantle; or infrared lamp and magnetic stirrer.

10. Syringe, hypodermic, with 22-gauge needle.

11. Graticule, Walton-Beckett type with 100 um diameter circular field at the specimen plane (area = 0.00785 mm²), (Type G–22).

Note.—The graticule is custom-made for each microscope.

12. HSE/NPL phase contrast test slide, Mark II.

13. Telescope, ocular phase-ring centering.

14. Stage micrometer (0.01 mm divisions).

Sampling

1. Calibrate each personal sampling pump with a representative sampler in line.

2. Fasten the sampler to the worker's lapel as close as possible to the worker's mouth. Remove the top cover from the end of the cowl extension (open face) and orient face down. Wrap the joint between the extender and the monitor's body with shrink tape to prevent air leaks.

3. Submit at least two blanks (or 10% of the total samples, whichever is greater) for each set of samples. Remove the caps from the field blank cassettes and store the caps and cassettes in a clean area (bag or box) during the sampling period. Replace the caps in the cassettes when sampling is completed.

4. Sample at 0.5 L/min or greater. Do not exceed 1 mg total dust loading on the filter. Adjust sampling flow rate, Q (L/min), and time to produce a fiber density, E (fibers/mm²), of 100 to 1300 fibers/mm² (3.85×10^4 to 5×10^4 fibers per 25-mm filter with effective collection area ($A_c = 385$ mm²)) for optimum counting precision (see step 21 below). Calculate the minimum sampling time, t_{min} (min) at the action level (one-half of the current standard), L (f/cc) of the fibrous aerosol being sampled:

$$t_{min} = \frac{(Ac)(E)}{(Q)(L)(10^3)}$$

5. Remove the field monitor at the end of sampling, replace the plastic top cover and small end caps, and store the monitor.

6. Ship the samples in a rigid container with sufficient packing material to prevent jostling or damage. NOTE: Do not use polystyrene foam in the shipping container because of electrostatic forces which may cause fiber loss from the sampler filter.

Sample Preparation

Note.—The object is to produce samples with a smooth (non-grainy) background in a medium with a refractive index equal to or less than 1.46. The method below collapses the filter for easier focusing and produces permanent mounts which are useful for quality control and interlaboratory comparison. Other mounting techniques meeting the above criteria may also be used, e.g., the nonpermanent field mounting technique used in P & CAM 239.

7. Ensure that the glass slides and cover slips are free of dust and fibers.

8. Place 40 to 60 ml of acetone into a Guth-type flask. Stopper the flask with a single-hole rubber stopper through which a glass tube extends 5 to 8 cm into the flask. The portion of the glass tube that exits the top of the stopper (5 to 10 cm) is bent downward in an elbow that makes an angle of 20 to 30 degrees with the horizontal.

9. Place the flask in a stirring hotplate or wrap in a heating mantle. Heat the acetone gradually to its boiling temperature (ca. 56°C).

Caution.—The acetone vapor must be generated in a ventilated fume hood away from all open flames and spark sources. Alternate heating methods can be used, providing no open flame or sparks are present.

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10. Mount either the whole sample filter or a wedge cut from the sample filter on a clean glass slide.

a. Cut wedges of ca. 25 percent of the filter area with a curved-blade steel surgical knife using a rocking motion to prevent tearing.

b. Place the filter or wedge, dust side up, on the slide. Static electricity will usually keep the filter on the slide until it is cleared.

c. Hold the glass slide supporting the filter approximately 1 to 2 cm from the glass tube part where the acetone vapor is escaping from the heated flask. The acetone vapor stream should cause a condensation spot on the glass slide ca. 2 to 3 cm in diameter. Move the glass slide gently in the vapor stream. The filter should clear in 2 to 5 sec. If the filter curls, distorts, or is otherwise rendered unusable, the vapor stream is probably not strong enough. Periodically wipe the outlet part with tissue to prevent liquid acetone dripping onto the filter.

d. Using the hypodermic syringe with a 22-gauge needle, place 1 to 2 drops of triacetin on the filter. Gently lower a clean 25-mm square cover slip down onto the filter at a slight angle to reduce the possibility of forming bubbles. If too many bubbles form or the amount of triacetin is insufficient, the cover slip may become detached within a few hours.

e. Glue the edges of the cover slip to the glass slide using a lacquer or nail polish.

Note.—If clearing is slow, the slide preparation may be heated on a hotplate (surface temperature 50°C) for 15 min to hasten clearing. Counting may proceed immediately after clearing and mounting are completed.

Calibration and Quality Control

11. Calibration of the Walton-Beckett graticule. The diameter, d_c (mm), of the circular counting area and the disc diameter must be specified when ordering the graticule.

a. Insert any available graticule into the eyepiece and focus so that the graticule lines are sharp and clear.

b. Set the appropriate interpupillary distance and, if applicable, reset the binocular head adjustment so that the magnification remains constant.

c. Install the 40 to 45 X phase objective.

d. Place a stage micrometer on the microscope object stage and focus the microscope on the graduated lines.

e. Measure the magnified grid length, L_u (um), using the stage micrometer.

f. Remove the graticule from the microscope and measure its actual grid length, L_a (mm). This can best be accomplished by using a stage fitted with verniers.

g. Calculate the circle diameter, d_c (mm), for the Walton-Beckett graticule:

$$d_c = \frac{L_a \times D}{L_u}$$

Example: If $L_u = 108$ um, $L_a = 2.93$ mm and $D = 100$ um, then $d_c = 2.71$ mm.

h. Check the field diameter. D(acceptable range 100 mm ± 2 mm) with a stage micrometer upon receipt of the graticule from the manufacturer. Determine field area (mm²).

12. Microscope adjustments. Follow the manufacturer's instructions and also the following:

a. Adjust the light source for even illumination across the field of view at the condenser iris.

Note.—Kohler illumination is preferred, where available.

b. Focus on the particulate material to be examined.

c. Make sure that the field iris is in focus, centered on the sample, and open only enough to fully illuminate the field of view.

d. Use the telescope ocular supplied by the manufacturer to ensure that the phase rings (annular diaphragm and phase-shifting elements) are concentric.

13. Check the phase-shift detection limit of the microscope periodically.

a. Remove the HSE/NPL phase-contrast test slide from its shipping container and center it under the phase objective.

b. Bring the blocks of grooved lines into focus.

Note.—The slide consists of seven sets of grooves (ca. 20 grooves to each block) in descending order of visibility from sets 1 to 7. The requirements for counting are that the microscope optics must resolve the grooved lines in set 3 completely, although they may appear somewhat faint, and that the grooved lines in sets 6 to 7 must be invisible. Sets 4 and 5 must be at least partially visible but may vary slightly in visibility between microscopes. A microscope which fails to meet these requirements has either too low or too high a resolution to be used for asbestos, tremolite, anthophyllite, and actinolite counting.

c. If the image quality deteriorates, clean the microscope optics and, if the problem persists, consult the microscope manufacturer.

14. Quality control of filter counts.

a. Prepare and count field blanks along with the field samples. Report the counts on each blank. Calculate the mean of the field blank counts and subtract this value from each sample count before reporting the results.

Note 1.—The identity of the blank filters should be unknown to the counter until all counts have been completed.

Note 2.—If a field blank yields fiber counts greater than 7 fibers/100 fields, report possible contamination of the samples.

b. Perform blind recounts by the same counter on 10 percent of filters counted (slides relabeled by a person other than the counter).

15. Use the following test to determine whether a pair of counts on the same filter should be rejected because of possible bias. This statistic estimates the counting repeatability at the 95% confidence level. Discard the sample if the difference between the two counts exceeds 2.77 (F)s_r, where F = average of the two fiber counts and S_r = relative standard deviation, which should be derived by each laboratory based on historical in-house data.

Note.—If a pair of counts is rejected as a result of this test, recount the remaining samples in the set and test the new counts against the first counts. Discard all rejected paired counts.

16. Enroll each new counter in a training course that compares performance of counters on a variety of samples using this procedure.

Note.—To ensure good reproducibility, all laboratories engaged in asbestos, tremolite, anthophyllite, and actinolite counting are required to participate in the Proficiency Analytical Testing (PAT) Program and should routinely participate with other asbestos, tremolite, anthophyllite, and actinolite fiber counting laboratories in the exchange of field samples to compare performance of counters.

Measurement

17. Place the slide on the mechanical stage of the calibrated microscope with the center of the filter under the objective lens. Focus the microscope on the plane of the filter.

18. Regularly check phase-ring alignment and Kohler illumination.

19. The following are the counting rules:

a. Count only fibers longer than 5 um. Measure the length of curved fibers along the curve.

b. Count only fibers with a length-to-width ratio equal to or greater than 3:1.

c. For fibers that cross the boundary of the graticule field, do the following:

1. Count any fiber longer than 5 um that lies entirely within the graticule area.

2. Count as ½ fiber any fiber with only one end lying within the graticule area.

3. Do not count any fiber that crosses the graticule boundary more than once.

4. Reject and do not count all other fibers.

d. Count bundles of fibers as one fiber unless individual fibers can be identified by observing both ends of a fiber.

e. Count enough graticule fields to yield 100 fibers. Count a minimum of 20 fields. Stop at 100 fields regardless of fiber count.

20. Start counting from one end of the filter and progress along a radial line to the other end, shift either up or down on the filter, and continue in the reverse direction. Select fields randomly by looking away from the eyepiece briefly while advancing the mechanical stage. When an agglomerate covers ca. ¼ or more of the field of view, reject the field and select another. Do not report rejected fields in the number of total fields counted.

Note.—When counting a field, continuously scan a range of focal planes by moving the fine focus knob to detect very fine fibers which have become embedded in the filter. The small-diameter fibers will be very faint but are an important contribution to the total count.

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Calculations

21. Calculate and report fiber density on the filter, E (fibers/mm²); by dividing the total fiber count, F; minus the mean field blank count, B, by the number of fields, n; and the field area, A_f (0.00785mm² for a properly calibrated Walton-Beckett graticule):

$$E = \frac{F - B}{(n)(A_f)} \text{ fibers/mm}^2$$

22. Calculate the concentration, C (f/cc), of fibers in the air volume sampled, V (L), using the effective collection area of the filter, A_c (385 mm² for a 25-mm filter):

$$C = \frac{(E)(Ac)}{V(10^3)}$$

Note.—Periodically check and adjust the value of A_c if necessary.

Appendix C to § 1926.58—Qualitative and Quantitative Fit Testing Procedures—Mandatory

Qualitative Fit Test Protocols

I. Isoamyl Acetate Protocol

A. Odor threshold screening.

1. Three 1-liter glass jars with metal lids (e.g. Mason or Bell jars) are required.

2. Odor-free water (e.g. distilled or spring water) at approximately 25 °C shall be used for the solutions.

3. The isoamyl acetate (IAA) (also known as isopentyl acetate) stock solution is prepared by adding 1 cc of pure IAA to 800 cc of odor free water in a 1-liter jar and shaking for 30 seconds. This solution shall be prepared new at least weekly.

4. The screening test shall be conducted in a room separate from the room used for actual fit testing. The two rooms shall be well ventilated but shall not be connected to the same recirculating ventilation system.

5. The odor test solution is prepared in a second jar by placing 0.4 cc of the stock solution into 500 cc of odor free water using a clean dropper or pipette. Shake for 30 seconds and allow to stand for two to three minutes so that the IAA concentration above the liquid may reach equilibrium. This solution may be used for only one day.

6. A test blank is prepared in a third jar by adding 500 cc of odor free water.

7. The odor test and test blank jars shall be labelled 1 and 2 for jar identification. If the labels are put on the lids they can be periodically peeled, dried off and switched to maintain the integrity of the test.

8. The following instructions shall be typed on a card and placed on the table in front of the two test jars (i.e. 1 and 2): "The purpose of this test is to determine if you can smell banana oil at a low concentration. The two bottles in front of you contain water. One of these bottles also contains a small amount of banana oil. Be sure the covers are on tight, then shake each bottle for two seconds. Unscrew the lid of each bottle, one at a time, and sniff at the mouth of the bottle. Indicate to the test conductor which bottle contains banana oil."

9. The mixtures used in the IAA odor detection test shall be prepared in an area separate from where the test is performed, in order to prevent olfactory fatigue in the subject.

10. If the test subject is unable to correctly identify the jar containing the odor test solution, the IAA qualitative fit test may not be used.

11. If the test subject correctly identifies the jar containing the odor test solution, the test subject may proceed to respirator selection and fit testing.

B. Respirator Selection.

1. The test subject shall be allowed to pick the most comfortable respirator from a selection including respirators of various sizes from different manufacturers. The selection shall include at least five sizes of elastomeric half facepieces, from at least two manufacturers.

2. The selection process shall be conducted in a room separate from the fit-test chamber to prevent odor fatigue. Prior to the selection process, the test subject shall be shown how to put on a respirator, how it should be positioned on the face, how to set strap tension and how to determine a "comfortable" respirator. A mirror shall be available to assist the subject in evaluating the fit and positioning of the respirator. This instruction may not constitute the subject's formal training on respirator use, as it is only a review.

3. The test subject should understand that the employee is being asked to select the respirator which provides the most comfortable fit. Each respirator represents a different size and shape and, if fit properly and used properly will provide adequate protection.

4. The test subject holds each facepiece up to the face and eliminates those which obviously do not give a comfortable fit. Normally, selection will begin with a half-mask and if a good fit cannot be found, the subject will be asked to test the full facepiece respirators. (A small percentage of users will not be able to wear any half-mask.)

5. The more comfortable facepieces are noted; the most comfortable mask is donned and *worn at least five minutes* to assess comfort. All donning and adjustments of the facepiece shall be performed by the test subject without assistance from the test conductor or other person. Assistance in assessing comfort can be given by discussing the points in #6 below. If the test subject is not familiar with using a particular respirator, the test subject shall be directed to don the mask several times and to adjust the straps each time to become adept at setting proper tension on the straps.

6. Assessment of comfort shall include reviewing the following points with the test subject and allowing the test subject adequate time to determine the comfort of the respirator:

- Positioning of mask on nose.
- Room for eye protection.
- Room to talk.
- Positioning mask on face and cheeks.

7. The following criteria shall be used to help determine the adequacy of the respirator fit:

- Chin properly placed.
- Strap tension.
- Fit across nose bridge.
- Distance from nose to chin.
- Tendency to slip.
- Self-observation in mirror.

8. The test subject shall conduct the conventional negative and positive-pressure fit checks before conducting the negative- or positive-pressure test the subject shall be told to "seal" the mask by rapidly moving the head from side-to-side and up and down, while taking a few deep breaths.

9. The test subject is now ready for fit testing.

10. After passing the fit test, the test subject shall be questioned again regarding the comfort of the respirator. If it has become uncomfortable, another model of respirator shall be tried.

11. The employee shall be given the opportunity to select a different facepiece and be retested if the chosen facepiece becomes increasingly uncomfortable at any time.

C. Fit test.

1. The fit test chamber shall be similar to a clear 55 gal drum liner suspended inverted over a 2 foot diameter frame, so that the top of the chamber is about 6 inches above the test subject's head. The inside top center of the chamber shall have a small hook attached.

2. Each respirator used for the fitting and fit testing shall be equipped with organic vapor cartridges or offer protection against organic vapors. The cartridges or masks shall be changed at least weekly.

3. After selecting, donning, and properly adjusting a respirator, the test subject shall wear it to the fit testing room. This room shall be separate from the room used for odor threshold screening and respirator selection, and shall be well ventilated, as by an exhaust fan or lab hood, to prevent general room contamination.

4. A copy of the following test exercises and rainbow passage shall be taped to the inside of the test chamber:

Test Exercises

i. Breathe normally.

ii. Breathe deeply. Be certain breaths are *deep* and *regular*.

iii. Turn head all the way from one side to the other. Inhale on each side. Be certain movement is complete. Do not bump the respirator against the shoulders.

iv. Nod head up-and-down. Inhale when head is in the full up position (looking toward ceiling). Be certain motions are complete and made about every second. Do not bump the respirator on the chest.

v. Talking. Talk aloud and slowly for several minutes. The following paragraph is called the Rainbow Passage. Reading it will result in a wide range of facial movements, and thus be useful to satisfy this requirement.

[Sec. 1926.58, Appendix C]

Alternative passages which serve the same purpose may also be used.

vi. Jogging in place.

vii. Breathe normally.

Rainbow Passage

When the sunlight strikes raindrops in the air, they act like a prism and form a rainbow. The rainbow is a division of white light into many beautiful colors. These take the shape of a long round arch, with its path high above, and its two ends apparently beyond the horizon. There is, according to legend, a boiling pot of gold at one end. People look, but no one ever finds it. When a man looks for something beyond reach, his friends say he is looking for the pot of gold at the end of the rainbow.

5. Each test subject shall wear the respirator for at least 10 minutes before starting the fit test.

6. Upon entering the test chamber, the test subject shall be given a 6 inch by 5 inch piece of paper towel or other porous absorbent single ply material, folded in half and wetted with three-quarters of one cc of pure IAA. The test subject shall hang the wet towel on the hook at the top of the chamber.

7. Allow two minutes for the IAA test concentration to be reached before starting the fit-test exercises. This would be an appropriate time to talk with the test subject, to explain the fit test, the importance of cooperation, the purpose for the head exercises, or to demonstrate some of the exercises.

8. Each exercise described in #4 above shall be performed for at least one minute.

9. If at any time during the test, the subject detects the banana-like odor of IAA, the test has failed. The subject shall quickly exit from the test chamber and leave the test area to avoid olfactory fatigue.

10. If the test is failed, the subject shall return to the selection room and remove the respirator, repeat the odor sensitivity test, select and put on another respirator, return to the test chamber, and again begin the procedure described in the c(4) through c(8) above. The process continues until a respirator that fits well has been found. Should the odor sensitivity test be failed, the subject shall wait about 5 minutes before retesting. Odor sensitivity will usually have returned by this time.

11. If a person cannot pass the fit test described above wearing a half-mask respirator from the available selection, full facepiece models must be used.

12. When a respirator is found that passes the test, the subject breaks the faceseal and takes a breath before exiting the chamber. This is to assure that the reason the test subject is not smelling the IAA is the good fit of the respirator facepiece seal and not olfactory fatigue.

13. When the test subject leaves the chamber, the subject shall remove the saturated towel and return it to the person conducting the test. To keep the area from becoming contaminated, the used towels shall be kept in a self-sealing bag so there is no significant IAA concentration buildup in the test chamber during subsequent tests.

14. At least two facepieces shall be selected for the IAA test protocol. The test subject shall be given the opportunity to wear them for one week to choose the one which is more comfortable to wear.

15. Persons who have successfully passed this fit test with a half-mask respirator may be assigned the use of the test respirator in atmospheres with up to 10 times the PEL of airborne asbestos. In atmospheres greater than 10 times, and less than 100 times the PEL (up to 100 ppm), the subject must pass the IAA test using a full face negative pressure respirator. (The concentration of the IAA inside the test chamber must be increased by ten times for QLFT of the full facepiece.)

16. The test shall not be conducted if there is any hair growth between the skin and the facepiece sealing surface.

17. If hair growth or apparel interfere with a satisfactory fit, then they shall be altered or removed so as to eliminate interference and allow a satisfactory fit. If a satisfactory fit is still not attained, the test subject must use a positive-pressure respirator such as powered air-purifying respirators, supplied air respirator, or self-contained breathing apparatus.

18. If a test subject exhibits difficulty in breathing during the tests, she or he shall be referred to a physician trained in respirator diseases or pulmonary medicine to determine whether the test subject can wear a respirator while performing her or his duties.

19. Qualitative fit testing shall be repeated at least every six months.

20. In addition, because the sealing of the respirator may be affected, qualitative fit testing shall be repeated immediately when the test subject has a:

(1) Weight change of 20 pounds or more,

(2) Significant facial scarring in the area of the facepiece seal,

(3) Significant dental changes; i.e.; multiple extractions without prothesis, or acquiring dentures,

(4) Reconstructive or cosmetic surgery, or

(5) Any other condition that may interfere with facepiece sealing.

D. Recordkeeping.

A summary of all test results shall be maintained in each office for 3 years. The summary shall include:

(1) Name of test subject.

(2) Date of testing.

(3) Name of the test conductor.

(4) Respirators selected (indicate manufacturer, model, size and approval number).

(5) Testing agent.

II. Saccharin Solution Aerosol Protocol

A. Respirator Selection.

Respirators shall be selected as described in section IB (respirator selection) above, except that each respirator shall be equipped with a particulate filter.

B. Taste Threshold Screening.

1. An enclosure about head and shoulders shall be used for threshold screening (to determine if the individual can taste saccharin) and for fit testing. The enclosure shall be approximately 12 inches in diameter by 14 inches tall with at least the front clear to allow free movement of the head when a respirator is worn.

2. The test enclosure shall have a three-quarter inch hole in front of the test subject's nose and mouth area to accommodate the nebulizer nozzle.

3. The entire screening and testing procedure shall be explained to the test subject prior to conducting the screening test.

4. During the threshold screening test, the test subject shall don the test enclosure and breathe with open mouth with tongue extended.

5. Using a DeVilbiss Model 40 Inhalation Medication Nebulizer or equivalent, the test conductor shall spray the threshold check solution into the enclosure. This nebulizer shall be clearly marked to distinguish it from the fit test solution nebulizer.

6. The threshold check solution consists of 0.83 grams of sodium saccharin, USP in water. It can be prepared by putting 1 cc of the test solution (see C 7 below) in 100 cc of water.

7. To produce the aerosol, the nebulizer bulb is firmly squeezed so that it collapses completely, then is released and allowed to fully expand.

8. Ten squeezes of the nebulizer bulb are repeated rapidly and then the test subject is asked whether the saccharin can be tasted.

9. If the first response is negative, ten more squeezes of the nebulizer bulb are repeated rapidly and the test subject is again asked whether the saccharin can be tasted.

10. If the second response is negative ten more squeezes are repeated rapidly and the test subject is again asked whether the saccharin can be tasted.

11. The test conductor will take note of the number of squeezes required to elicit a taste response.

12. If the saccharin is not tasted after 30 squeezes (Step 10), the saccharin fit test cannot be performed on the test subject.

13. If a taste response is elicited, the test subject shall be asked to take note of the taste for reference in the fit test.

14. Correct use of the nebulizer means that approximately 1 cc of liquid is used at a time in the nebulizer body.

15. The nebulizer shall be thoroughly rinsed in water, shaken dry, and refilled at least every four hours.

C. Fit test.

1. The test subject shall don and adjust the respirator without the assistance from any person.

2. The fit test uses the same enclosure described in IIB above.

3. Each test subject shall wear the respirator for at least 10 minutes before starting the fit test.

4. The test subject shall don the enclosure while wearing the respirator selected in section IB above. This respirator shall be properly adjusted and equipped with a particulate filter.

5. The test subject may not eat, drink (except plain water), or chew gum for 15 minutes before the test.

6. A second DeVilbiss Model 40 Inhalation Medication Nebulizer is used to spray the fit test solution into the enclosure. This nebulizer shall be clearly marked to distinguish it from the screening test solution nebulizer.

[Sec. 1926.58, Appendix C]

7. The fit test solution is prepared by adding 83 grams of sodium saccharin to 100 cc of warm water.

8. As before, the test subject shall breathe with mouth open and tongue extended.

9. The nebulizer is inserted into the hole in the front of the enclosure and the fit test solution is sprayed into the enclosure using the same technique as for the taste threshold screening and the same number of squeezes required to elicit a taste response in the screening. (See B8 through B10 above.)

10. After generation of the aerosol read the following instructions to the test subject. The test subject shall perform the exercises for one minute each.

i. Breathe normally.

ii. Breathe deeply. Be certain breaths are *deep* and *regular*.

iii. Turn head all the way from one side to the other. Be certain movement is complete. Inhale on each side. Do not bump the respirator against the shoulders.

iv. Nod head up-and-down. Be certain motions are complete. Inhale when head is in the full up position (when looking toward the ceiling). Do not bump the respirator on the chest.

v. Talking. Talk aloud and slowly for several minutes. The following paragraph is called the Rainbow Passage. Reading it will result in a wide range of facial movements, and thus be useful to satisfy this requirement. Alternative passages which serve the same purpose may also be used.

vi. Jogging in place.

vii. Breathe normally.

Rainbow Passage

When the sunlight strikes raindrops in the air, they act like a prism and form a rainbow. The rainbow is a division of white light into many beautiful colors. These take the shape of a long round arch, with its path high above, and its two ends apparently beyond the horizon. There is, according to legend, a boiling pot of gold at one end. People look, but no one ever finds it. When a man looks for something beyond his reach, his friends say he is looking for the pot of gold at the end of the rainbow.

11. At the beginning of each exercise, the aerosol concentration shall be replenished using one-half the number of squeezes as initially described in C8.

12. The test subject shall indicate to the test conductor if at any time during the fit test the taste of saccharin is detected.

13. If the saccharin is detected the fit is deemed unsatisfactory and a different respirator shall be tried.

14. At least two facepieces shall be selected by the IAA test protocol. The test subject shall be given the opportunity to wear them for one week to choose the one which is more comfortable to wear.

15. Successful completion of the test protocol shall allow the use of the half mask tested respirator in contaminated atmospheres up to 10 times the PEL of asbestos. In other words this protocol may be used to assign protection factors no higher than ten.

16. The test shall not be conducted if there is any hair growth between the skin and the facepiece sealing surface.

17. If hair growth or apparel interfere with a satisfactory fit, then they shall be altered or removed so as to eliminate interference and allow a satisfactory fit. If a satisfactory fit is still not attained, the test subject must use a positive-pressure respirator such as powered air-purifying respirators, supplied air respirator, or self-contained breathing apparatus.

18. If a test subject exhibits difficulty in breathing during the tests, she or he shall be referred to a physician trained in respirator diseases or pulmonary medicine to determine whether the test subject can wear a respirator while performing her or his duties.

19. Qualitative fit testing shall be repeated at least every six months.

20. In addition, because the sealing of the respirator may be affected, qualitative fit testing shall be repeated immediately when the test subject has a:

(1) Weight change of 20 pounds or more,

(2) Significant facial scarring in the area of the facepiece seal,

(3) Significant dental change; i.e.; multiple extractions without prothesis, or acquiring dentures,

(4) Reconstructive or cosmetic surgery, or

(5) Any other condition that may interfere with facepiece sealing.

D. Recordkeeping.

A summary of all test results shall be maintained in each office for 3 years. The summary shall include:

(1) Name of test subject.

(2) Date of testing.

(3) Name of test conductor.

(4) Respirators selected (indicate manufacturer, model, size and approval number).

(5) Testing agent.

III. Irritant Fume Protocol

A. Respirator selection:

Respirators shall be selected as described in section IB above, except that each respirator shall be equipped with a combination of high-efficiency and acid-gas cartridges.

B. Fit test.

1. The test subject shall be allowed to smell a weak concentration of the irritant smoke to familiarize the subject with the characteristic odor.

2. The test subject shall properly don the respirator selected as above, and wear it for at least 10 minutes before starting the fit test.

3. The test conductor shall review this protocol with the test subject before testing.

4. The test subject shall perform the coaventional positive pressure and negative pressure fit checks (see ANSI Z88.2 1980). Failure of either check shall be cause to select an alternate respirator.

5. Break both ends of a ventilation smoke tube containing stannic oxychloride, such as the MSA part #5645, or equivalent. Attach a short length of tubing to one end of the smoke tude. Attach the other end of the smoke tube to a low pressure air pump set to deliver 200 milliliters per minute.

6. Advise the test subject that the smoke can be irritating to the eyes and instruct the subject to keep the eyes closed while the test is performed.

7. The test conductor shall direct the stream of irritant smoke from the tube towards the faceseal area of the test subject. The person conducting the test shall begin with the tube at least 12 inches from the facepiece and gradually move to within one inch, moving around the whole perimeter of the mask.

8. The test subject shall be instructed to do the following exercises while the respirator is being challenged by the smoke. Each exercise shall be performed for one minute.

i. Breathe normally.

ii. Breathe deeply. Be certain breaths are *deep* and *regular*.

iii. Turn head all the way from one side to the other. Be certain movement is complete. Inhale on each side. Do not bump the respirator against the shoulders.

iv. Nod head up-and-down. Be certain motions are complete and made every second. Inhale when head is in the full up position (looking toward ceiling). Do not bump the respirator against the chest.

v. Talking. Talk aloud and slowly for several minutes. The following paragraph is called the Rainbow Passage. Reading it will result in a wide range of facial movements, and thus be useful to satisfy this requirement. Alternative passages which serve the same purpose may also be used.

Rainbow Passage

When the sunlight strikes raindrops in the air, they act like a prism and form a rainbow. The rainbow is a division of white light into many beautiful colors. These take the shape of a long round arch, with its path high above, and its two end apparently beyond the horizon. There is, according to legend, a boiling pot of gold at one end. People look, but no one ever finds it. When a man looks for something beyond his reach, his friends say he is looking for the pot of gold at the end of the rainbow.

vi. Jogging in Place.

vii. Breathe normally.

9. The test subject shall indicate to the test conductor if the irritant smoke is detected. If smoke is detected, the test conductor shall stop the test. In this case, the tested respirator is rejected and another respirator shall be selected.

10. Each test subject passing the smoke test (i.e., without detecting the smoke) shall be given a sensitivity check of smoke from the same tube to determine if the test subject reacts to the smoke. Failure to evoke a response shall void the fit test.

11. Steps B4, B9, B10 of this fit test protocol shall be performed in a location with exhaust ventilation sufficient to prevent general contamination of the testing area by the test agents.

12. At least two facepieces shall be selected by the IAA test protocol. The test subject shall be given the opportunity to wear them for one week to choose the one which is more comfortable to wear.

13. Respirators successfully tested by the protocol may be used in contaminated atmospheres up to ten times the PEL of asbestos.

14. The test shall not be conducted if there is any hair growth between the skin and the facepiece sealing surface.

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15. If hair growth or apparel interfere with a satisfactory fit, then they shall be altered or removed so as to eliminate interference and allow a satisfactory fit. If a satisfactory fit is still not attained, the test subject must use a positive-pressure respirator such as powered air-purifying respirators, supplied air respirator, or self-contained breathing apparatus.

16. If a test subject exhibits difficulty in breathing during the tests, she or he shall be referred to a physician trained in respirator diseases or pulmonary medicine to determine whether the test subject can wear a respirator while performing her or his duties.

17. Qualitative fit testing shall be repeated at least every six months.

18. In addition, because the sealing of the respirator may be affected, qualitative fit testing shall be repeated immediately when the test subject has a:

(1) Weight change of 20 pounds or more.

(2) Significant facial scarring in the area of the facepiece seal.

(3) Significant dental changes: i.e., multiple extractions without prothesis, or acquiring dentures.

(4) Reconstructive or cosmetic surgery, or

(5) Any other condition that may interfere with facepiece sealing.

C. Recordkeeping.

A summary of all test results shall be maintained in each office for 3 years. The summary shall include:

(1) Name of test subject.

(2) Date of testing.

(3) Name of test conductor.

(4) Respirators selected (indicate manufacturer, model, size and approval number).

(5) Testing agent.

Quantitative Fit Test Procedures

1. *General.*

a. The method applies to the negative-pressure nonpowered air-purifying respirators only.

b. The employer shall assign one individual who shall assume the full responsibility for implementing the respirator quantitative fit test program.

2. *Definition.*

a. "Quantitative Fit Test" means the measurement of the effectiveness of a respirator seal in excluding the ambient atmosphere. The test is performed by dividing the measured concentration of challenge agent in a test chamber by the measured concentration of the challenge agent inside the respirator facepiece when the normal air purifying element has been replaced by an essentially perfect purifying element.

b. "Challenge Agent" means the air contaminant introduced into a test chamber so that its concentration inside and outside the respirator may be compared.

c. "Test Subject" means the person wearing the respirator for quantitative fit testing.

d. "Normal Standing Position" means standing erect and straight with arms down along the sides and looking straight ahead.

e. "Fit Factor" means the ratio of challenge agent concentration outside with respect to inside of a respirator inlet covering (facepiece or enclosure).

3. *Apparatus.*

a. *Instrumentation.* Corn oil, sodium chloride or other appropriate aerosol generation, dilution, and measurement systems shall be used for quantitative fit test.

b. *Test chamber.* The test chamber shall be large enough to permit all test subjects to freely perform all required exercises without distributing the challenge agent concentration or the measurement apparatus. The test chamber shall be equipped and constructed so that the challenge agent is effectively isolated from the ambient air yet uniform in concentration throughout the chamber.

c. When testing air-purifying respirators, the normal filter or cartridge element shall be replaced with a high-efficiency particular filter supplied by the same manufacturer.

d. The sampling instrument shall be selected so that a strip chart record may be made of the test showing the rise and fall of challenge agent concentration with each inspiration and expiration at fit factors of at least 2,000.

e. The combination of substitute air-purifying elements (if any), challenge agent, and challenge agent concentration in the test chamber shall be such that the test subject is not exposed in excess of PEL to the challenge agent at any time during the testing process.

f. The sampling port on the test specimen respirator shall be placed and constructed so that there is no detectable leak around the port, a free air flow is allowed into the sampling line at all times and so there is no interference with the fit or performance of the respirator.

g. The test chamber and test set-up shall permit the person administering the test to observe one test subject inside the chamber during the test.

h. The equipment generating the challenge atmosphere shall maintain the concentration of challenge agent constant within a 10 percent variation for the duration of the test.

i. The time lag (interval between an event and its being recorded on the strip chart) of the instrumentation may not exceed 2 seconds.

j. The tubing for the test chamber atmosphere and for the respirator sampling port shall be the same diameter, length and material. It shall be kept as short as possible. The smallest diameter tubing recommended by the manufacturer shall be used.

k. The exhaust flow from the test chamber shall pass through a high-efficiency filter before release to the room.

l. When sodium chloride aerosol is used, the relative humidity inside the test chamber shall not exceed 50 percent.

4. *Procedural Requirements*

a. The fitting of half-mask respirators should be started with those having multiple sizes and a variety of interchangeable cartridges and canisters such as the MSA Comfo II–M, Norton M, Survivair M, A–O M, or Scott–M. Use either of the tests outlined below to assure that the facepiece is properly adjusted.

(1) *Positive pressure test.* With the exhaust port(s) blocked, the negative pressure of slight inhalation should remain constant for several seconds.

(2) *Negative pressure test.* With the intake port(s) blocked, the negative pressure slight inhalation should remain constant for several seconds.

b. After a facepiece is adjusted, the test subject shall wear the facepiece for at least a minutes before conducting a qualitative test by using either of the methods described below and using the exercise regime described in 5.a., b., c., d. and e.

(1) *Isoamyl acetate test.* When using organic vapor cartridges, the test subject who can smell the odor should be unable to detect the odor of isoamyl acetate squirted into the air near the most vulnerable portions of the facepiece seal, in a location which is separated from the test area, the test subject shall be instructed to close her/his eyes during the test period. A combination cartridge or canister with organic vapor and high-efficiency filters shall be used when available for the particular mask being tested. The test subject shall be given an opportunity to smell the odor of isoamyl acetate before the test is conducted.

(2) *Irritant fume test.* When using high-efficiency filters, the test subject should be unable to detect the odor of irritant fume (stannic chloride or titanium tetrachloride ventilation smoke tubes) squirted into the air near the most vulnerable portions of the facepiece seal. The test subject shall be instructed to close her/his eyes during the test period.

c. The test subject may enter the quantitative testing chamber only if she or he has obtained a satisfactory fit as stated in 4.b. of this Appendix.

d. Before the subject enters the test chamber, a reasonably stable challenge agent concentration shall be measured in the test chamber.

e. Immediately after the subject enters the test chamber, the challenge agent concentration inside the respirator shall be measured to ensure that the peak penetration does not exceed 5 percent for a half-mask and 1 percent for a full facepiece.

f. A stable challenge agent concentration shall be obtained prior to the actual start of testing.

(1) Respirator restraining straps may not be overtightened for testing. The straps shall be adjusted by the wearer to give a reasonably comfortable fit typical of normal use.

5. *Exercise Regime.* Prior to entering the test chamber, the test subject shall be given complete instructions as to her/his part in the test procedures. The test subject shall perform the following exercises, in the order given, for each independent test.

a. *Normal Breathing (NB).* In the normal standing position, without talking, the subject shall breathe normally for at least one minute.

b. *Deep Breathing (DB).* In the normal standing position the subject shall do deep breathing for at least one minute pausing so as not to hyperventilate.

c. *Turning head side to side. (SS).* Standing in place the subject shall slowly turn his/her head from side between the extreme positions to each side. The head shall be held at each extreme position for at least 5 seconds. Perform for at least three complete cycles.

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d. *Moving head up and down (UD).* Standing in place, the subject shall slowly move his/her head up and down between the extreme position straight up and the extreme position straight down. The head shall be held at each extreme position for at least 5 seconds. Perform for at least three complete cycles.

e. *Reading (R).* The subject shall read out slowly and loud so as to be heard clearly by the test conductor or monitor. The test subject shall read the "rainbow passage" at the end of this section.

f. *Grimace (G).* The test subject shall grimace, smile, frown, and generally contort the face using the facial muscles. Continue for at least 15 seconds.

g. *Bend over and touch toes (B).* The test subject shall bend at the waist and touch toes and return to upright position. Repeat for at least 30 seconds.

h. *Jogging in place (J).* The test subject shall perform jog in place for at least 30 seconds.

i. *Normal Breathing (NB).* Same as exercise a.

Rainbow Passage

When the sunlight strikes raindrops in the air, they act like a prism and form a rainbow. The rainbow is a division of white light into many beautiful colors. These take the shape of a long round arch, with its path high above, and its two ends apparently beyond the horizon. There is, according to legend, a boiling pot of gold at one end. People look, but no one ever finds it. When a man looks for something beyond reach, his friends say he is looking for the pot of gold at the end of the rainbow.

6. The test shall be terminated whenever any single peak penetration exceeds 5 percent for half-masks and 1 percent for full facepieces. The test subject may be refitted and retested. If two of the three required tests are terminated, the fit shall be deemed inadequate. (See paragraph 4.h.).

7. *Calculation of Fit Factors.*

a. The fit factor determined by the quantitative fit test equals the average concentration inside the respirator.

b. The average test chamber concentration is the arithmetic average of the test chamber concentration at the beginning and of the end of the test.

c. The average peak concentration of the challenge agent inside the respirator shall be the arithmetic average peak concentrations for each of the nine exercises of the test which are computed as the arithmetic average of the peak concentrations found for each breath during the exercise.

d. The average peak concentration for an exercise may be determined graphically if there is not a great variation in the peak concentrations during a single exercise.

8. *Interpretation of Test Results.* The fit factor measured by the quantitative fit testing shall be the lowest of the three protection factors resulting from three independent tests.

9. *Other Requirements.*

a. The test subject shall not be permitted to wear a half-mask or full facepiece mask if the minimum fit factor of 100 or 1,000, respectively, cannot be obtained. If hair growth or apparel interfere with a satisfactory fit, then they shall be altered or removed so as to eliminate interference and allow a satisfactory fit. If a satisfactory fit is still not attained, the test subject must use a positive-pressure respirator such as powered air-purifying respirators, supplied air respirator, or self-contained breathing apparatus.

b. The test shall not be conducted if there is any hair growth between the skin and the facepiece sealing surface.

c. If a test subject exhibits difficulty in breathing during the tests, she or he shall be referred to a physician trained in respirator diseases or pulmonary medicine to determine whether the test subject can wear a respirator while performing her or his duties.

d. The test subject shall be given the opportunity to wear the assigned respirator for one week. If the respirator does not provide a satisfactory fit during actual use, the test subject may request another QNFT which shall be performed immediately.

e. A respirator fit factor card shall be issued to the test subject with the following information:

(1) Name.

(2) Date of fit test.

(3) Protection factors obtained through each manufacturer, model and approval number of respirator tested.

(4) Name and signature of the person that conducted the test.

f. Filters used for qualitative or quantitative fit testing shall be replaced weekly, whenever increased breathing resistance is encountered, or when the test agent has altered the integrity of the filter media. Organic vapor cartridges/canisters shall be replaced daily or sooner if there is any indication of breakthrough by the test agent.

10. In addition, because the sealing of the respirator may be affected, quantitative fit testing shall be repeated immediately when the test subject has a:

(1) Weight change of 20 pounds or more,

(2) Significant facial scarring in the area of the facepiece seal,

(3) Significant dental changes; i.e.; multiple extractions without prothesis, or acquiring dentures,

(4) Reconstructive or cosmetic surgery, or

(5) Any other condition that may interfere with facepiece sealing.

11. *Recordkeeping.*

A summary of all test results shall be maintained for 3 years. The summary shall include:

(1) Name of test subject.

(2) Date of testing.

(3) Name of the test conductor.

(4) Fit factors obtained from every respirator tested (indicate manufacturer, model, size and approval number).

Appendix D to § 1926.58—Medical Questionnaires; Mandatory

This mandatory appendix contains the medical questionnaires that must be administered to all employees who are exposed to asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals above the action level, and who will therefore be included in their employer's medical surveillance program. Part 1 of the appendix contains the Initial Medical Questionnaire, which must be obtained for all new hires who will be covered by the medical surveillance requirements. Part 2 includes the abbreviated Periodical Medical Questionnaire, which must be administered to all employees who are provided periodic medical examinations under the medical surveillance provisions of the standard.

[Sec. 1926.58, Appendix D]

Part 1
INITIAL MEDICAL QUESTIONNAIRE

1. NAME _____

2. SOCIAL SECURITY # ___ ___ ___ ___ ___ ___ ___ ___ ___
(1 2 3 4 5 6 7 8 9)

3. CLOCK NUMBER ___ ___ ___ ___ ___ ___
(10 11 12 13 14 15)

4. PRESENT OCCUPATION _____

5. PLANT _____

6. ADDRESS _____

7. _____
(Zip Code)

8. TELEPHONE NUMBER _____

9. INTERVIEWER _____

10. DATE _____ ___ ___ ___ ___ ___ ___
(16 17 18 19 20 21)

11. Date of Birth _____ ___ ___ ___ ___ ___ ___
Month Day Year (22 23 24 25 26 27)

12. Place of Birth _____

13. Sex
1. Male ___
2. Female ___

14. What is your marital status?
1. Single ___
2. Married ___
3. Widowed ___
4. Separated/ Divorced ___

15. Race
1. White ___
2. Black ___
3. Asian ___
4. Hispanic ___
5. Indian ___
6. Other ___

16. What is the highest grade completed in school? _____
(For example 12 years is completion of high school)

OCCUPATIONAL HISTORY

17A. Have you ever worked full time (30 hours per week or more) for 6 months or more?
1. Yes ___ 2. No ___

IF YES TO 17A:

B. Have you ever worked for a year or more in any dusty job?
1. Yes ___ 2. No ___
3. Does Not Apply ___

Specify . Industry _____ Total Years Worked ___

Was dust exposure: 1. Mild ___ 2. Moderate ___ 3. Severe ___

C. Have you ever been exposed to gas or chemical fumes in your work? 1. Yes ___ 2. No ___
Specify job/industry _____ Total Years Worked ___

Was exposure: 1. Mild ___ 2. Moderate ___ 3. Severe ___

D. What has been your usual occupation or job--the one you have worked at the longest?

1. Job occupation _____

2. Number of years employed in this occupation _____

3. Position/job title _____

4. Business, field or industry _____

(Record on lines the years in which you have worked in any of these industries, e.g. 1960-1969)

Have you ever worked:

		YES	NO
E.	In a mine?.....	( )	( )
F.	In a quarry?.....	( )	( )
G.	In a foundry?.....	( )	( )
H.	In a pottery?.....	( )	( )
I.	In a cotton, flax or hemp mill?.....	( )	( )
J.	With asbestos?.....	( )	( )

18. PAST MEDICAL HISTORY

		YES	NO
A.	Do you consider yourself to be in good health?	( )	( )
	If "NO" state reason _____		
B.	Have you any defect of vision?.....	( )	( )
	If "YES" state nature of defect _____		
C.	Have you any hearing defect?.....	( )	( )
	If "YES" state nature of defect _____		

3A. Hay fever? 1. Yes __ 2. No __

IF YES TO 3A:
B. Was it confirmed by a doctor? 1. Yes __ 2. No __ 3. Does Not Apply __

C. At what age did it start? Age in Years __ Does Not Apply __

23A. Have you ever had chronic bronchitis? 1. Yes __ 2. No __

IF YES TO 23A:
B. Do you still have it? 1. Yes __ 2. No __ 3. Does Not Apply __

C. Was it confirmed by a doctor? 1. Yes __ 2. No __ 3. Does Not Apply __

D. At what age did it start? Age in Years __ Does Not Apply __

24A. Have you ever had emphysema? 1. Yes __ 2. No __

IF YES TO 24A:
B. Do you still have it? 1. Yes __ 2. No __ 3. Does Not Apply __

C. Was it confirmed by a doctor? 1. Yes __ 2. No __ 3. Does Not Apply __

D. At what age did it start? Age in Years __ Does Not Apply __

25A. Have you ever had asthma? 1. Yes __ 2. No __

IF YES TO 25A:
B. Do you still have it? 1. Yes __ 2. No __ 3. Does Not Apply __

C. Was it confirmed by a doctor? 1. Yes __ 2. No __ 3. Does Not Apply __

D. At what age did it start? Age in Years __ Does Not Apply __

E. If you no longer have it, at what age did it stop? Age stopped __ Does Not Apply __

26. Have you ever had:

A. Any other chest illness? 1. Yes __ 2. No __

If yes, please specify _____

D. Are you suffering from or have you ever suffered from:

a. Epilepsy (or fits, seizures, convulsions)?	[ ]	[ ]
b. Rheumatic fever?	[ ]	[ ]
c. Kidney disease?	[ ]	[ ]
d. Bladder disease?	[ ]	[ ]
e. Diabetes?	[ ]	[ ]
f. Jaundice?	[ ]	[ ]

19. CHEST COLDS AND CHEST ILLNESSES

19A. If you get a cold, does it usually go to your chest? (Usually means more than 1/2 the time) 1. Yes __ 2. No __ 3. Don't get colds __

20A. During the past 3 years, have you had any chest illnesses that have kept you off work, indoors at home, or in bed? 1. Yes __ 2. No __

IF YES TO 20A:
B. Did you produce phlegm with any of these chest illnesses? 1. Yes __ 2. No __ 3. Does Not Apply __

C. In the last 3 years, how many such illnesses with (increased) phlegm did you have which lasted a week or more? Number of illnesses __ No such illnesses __

21. Did you have any lung trouble before the age of 16? 1. Yes __ 2. No __

22. Have you ever had any of the following?

1A. Attacks of bronchitis? 1. Yes __ 2. No __

IF YES TO 1A:
B. Was it confirmed by a doctor? 1. Yes __ 2. No __ 3. Does Not Apply __

C. At what age was your first attack? Age in Years __ Does Not Apply __

2A. Pneumonia (include bronchopneumonia)? 1. Yes __ 2. No __

IF YES TO 2A:
B. Was it confirmed by a doctor? 1. Yes __ 2. No __ 3. Does Not Apply __

C. At what age did you first have it? Age in Years __ Does Not Apply __

B. Any chest operations? 1. Yes __ 2. No __

If yes, please specify _____

C. Any chest injuries? 1. Yes __ 2. No __

If yes, please specify _____

27A. Has a doctor ever told you that you had heart trouble? 1. Yes __ 2. No __

IF YES TO 27A:

B. Have you ever had treatment for heart trouble in the past 10 years? 1. Yes __ 2. No __ 3. Does Not Apply __

28A. Has a doctor ever told you that you had high blood pressure? 1. Yes __ 2. No __

IF YES TO 28A:

B. Have you had any treatment for high blood pressure (hypertension) in the past 10 years? 1. Yes __ 2. No __ 3. Does Not Apply __

29. When did you last have your chest X-rayed? (Year) __ __ __ __ (25 26 27 28)

30. Where did you last have your chest X-rayed (if known)? _____

What was the outcome? _____

FAMILY HISTORY

31. Were either of your natural parents ever told by a doctor that they had a chronic lung condition such as:

	FATHER			MOTHER		
	1. Yes	2. No	3. Don't Know	1. Yes	2. No	3. Don't Know
A. Chronic Bronchitis?	__	__	__	__	__	__
B. Emphysema?	__	__	__	__	__	__
C. Asthma?	__	__	__	__	__	__
D. Lung cancer?	__	__	__	__	__	__
E. Other chest conditions	__	__	__	__	__	__
F. Is parent currently alive?	__	__	__	__	__	__
G. Please Specify	__ Age if Living __ Age at Death __ Don't Know			__ Age if Living __ Age at Death __ Don't Know		

H. Please specify cause of death

_____

COUGH

32A. Do you usually have a cough? (Count a cough with first smoke or on first going out of doors. Exclude clearing of throat.) (If no, skip to question 33C.) 1. Yes __ 2. No __

B. Do you usually cough as much as 4 to 6 times a day 4 or more days out of the week? 1. Yes __ 2. No __

C. Do you usually cough at all on getting up or first thing in the morning? 1. Yes __ 2. No __

D. Do you usually cough at all during the rest of the day or at night? 1. Yes __ 2. No __

IF YES TO ANY OF ABOVE (32A, B, C, or D), ANSWER THE FOLLOWING. IF NO TO ALL, CHECK DOES NOT APPLY AND SKIP TO NEXT PAGE

E. Do you usually cough like this on most days for 3 consecutive months or more during the year? 1. Yes __ 2. No __ 3. Does not apply __

F. For how many years have you had the cough? Number of years __ Does not apply __

33A. Do you usually bring up phlegm from your chest? (Count phlegm with the first smoke or on first going out of doors. Exclude phlegm from the nose. Count swallowed phlegm.) (If no, skip to 33C) 1. Yes __ 2. No __

B. Do you usually bring up phlegm like this as much as twice a day 4 or more days out of the week? 1. Yes __ 2. No __

C. Do you usually bring up phlegm at all on getting up or first thing in the morning? 1. Yes __ 2. No __

D. Do you usually bring up phlegm at all during the rest of the day or at night? 1. Yes __ 2. No __

IF YES TO ANY OF THE ABOVE (33A, B, C, or D), ANSWER THE FOLLOWING: IF NO TO ALL, CHECK DOES NOT APPLY AND SKIP TO 34A.

E. Do you bring up phlegm like this on most days for 3 consecutive months or more during the year? 1. Yes __ 2. No __ 3. Does not apply __

F. For how many years have you had trouble with phlegm? — Number of years __ Does not apply __

EPISODES OF COUGH AND PHLEGM

34A. Have you had periods or episodes of (increased*) cough and phlegm lasting for 3 weeks or more each year? *(For persons who usually have cough and/or phlegm) — 1. Yes __ 2. No __

IF YES TO 34A

B. For how long have you had at least 1 such episode per year? — Number of years __ Does not apply __

WHEEZING

35A. Does your chest ever sound wheezy or whistling

1. When you have a cold? — 1. Yes __ 2. No __
2. Occasionally apart from colds? — 1. Yes __ 2. No __
3. Most days or nights? — 1. Yes __ 2. No __

IF YES TO 1, 2, or 3 in 35A

B. For how many years has this been present? — Number of years __ Does not apply __

36A. Have you ever had an attack of wheezing that has made you feel short of breath? — 1. Yes __ 2. No __

IF YES TO 36A

B. How old were you when you had your first such attack? — Age in years __ Does not apply __

C. Have you had 2 or more such episodes? — 1. Yes __ 2. No __ 3. Does not apply __

D. Have you ever required medicine or treatment for the(se) attack(s)? — 1. Yes __ 2. No __ 3. Does not apply __

BREATHLESSNESS

37. If disabled from walking by any condition other than heart or lung disease, please describe and proceed to question 38A. Nature of condition(s)_____

38A. Are you troubled by shortness of breath when hurrying on the level or walking up a slight hill? — 1. Yes __ 2. No __

IF YES TO 38A

B. Do you have to walk slower than people of your age on the level because of breathlessness? — 1. Yes __ 2. No __ 3. Does not apply __

C. Do you ever have to stop for breath when walking at your own pace on the level? — 1. Yes __ 2. No __ 3. Does not apply __

D. Do you ever have to stop for breath after walking about 100 yards (or after a few minutes) on the level? — 1. Yes __ 2. No __ 3. Does not apply __

E. Are you too breathless to leave the house or breathless on dressing or climbing one flight of stairs? — 1. Yes __ 2. No __ 3. Does not apply __

TOBACCO SMOKING

39A. Have you ever smoked cigarettes? (No means less than 20 packs of cigarettes or 12 oz. of tobacco in a lifetime or less than 1 cigarette a day for 1 year.) — 1. Yes __ 2. No __

IF YES TO 39A

B. Do you now smoke cigarettes (as of one month ago) — 1. Yes __ 2. No __ 3. Does not apply __

C. How old were you when you first started regular cigarette smoking? — Age in years __ Does not apply __

D. If you have stopped smoking cigarettes completely, how old were you when you stopped? — Age stopped __ Check if still smoking __ Does not apply __

E. How many cigarettes do you smoke per day now? — Cigarettes per day __ Does not apply __

F. On the average of the entire time you smoked, how many cigarettes did you smoke per day? — Cigarettes per day __ Does not apply __

G. Do or did you inhale the cigarette smoke? — 1. Does not apply 2. Not at all 3. Slightly 4. Moderately 5. Deeply __

40A. Have you ever smoked a pipe regularly? (Yes means more than 12 oz. of tobacco in a lifetime.) — 1. Yes __ 2. No __

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[Sec. 1926.64, Appendix D]

IF YES TO 40A:
FOR PERSONS WHO HAVE EVER SMOKED A PIPE

8. 1. How old were you when you started to smoke a pipe regularly? — Age __

2. If you have stopped smoking a pipe completely, how old were you when you stopped? — Age stopped __ / Check if still smoking pipe __ / Does not apply __

C. On the average over the entire time you smoked a pipe, how much pipe tobacco did you smoke per week? — __ oz. per week (a standard pouch of tobacco contains 1 1/2 oz.) / __ Does not apply

D. How much pipe tobacco are you smoking now? — oz. per week __ / Not currently smoking a pipe __

E. Do you or did you inhale the pipe smoke? — 1. Never smoked __ / 2. Not at all __ / 3. Slightly __ / 4. Moderately __ / 5. Deeply __

41A. Have you ever smoked cigars regularly? (Yes means more than 1 cigar a week for a year) — 1. Yes __ 2. No __

IF YES TO 41A
FOR PERSONS WHO HAVE EVER SMOKED CIGARS

8. 1. How old were you when you started smoking cigars regularly? — Age __

2. If you have stopped smoking cigars completely, how old were you when you stopped. — Age stopped __ / Check if still smoking cigars __ / Does not apply __

C. On the average over the entire time you smoked cigars, how many cigars did you smoke per week? — Cigars per week __ / Does not apply __

D. How many cigars are you smoking per week now? — Cigars per week __ / Check if not smoking cigars currently __

E. Do or did you inhale the cigar smoke? — 1. Never smoked __ / 2. Not at all __ / 3. Slightly __ / 4. Moderately __ / 5. Deeply __

Signature _____ Date _____

Part 2
PERIODIC MEDICAL QUESTIONNAIRE

1. NAME _____

2. SOCIAL SECURITY # [1] [2] [3] [4] [5] [6] [7] # [8] [9] __

3. CLOCK NUMBER [10] [11] [12] [13] [14] [15] __

4. PRESENT OCCUPATION _____

5. PLANT _____

6. ADDRESS _____

7. _____ (Zip Code)

8. TELEPHONE NUMBER _____

9. INTERVIEWER _____

10. DATE _____ [16] [17] [18] [19] [20] [21] __

11. What is your marital status? — 1. Single __ / 2. Married __ / 3. Widowed __ / 4. Separated/Divorced __

12. OCCUPATIONAL HISTORY

12A. In the past year, did you work full time (30 hours per week or more) for 6 months or more? — 1. Yes __ 2. No __

IF YES TO 12A:

12B. In the past year, did you work in a dusty job? — 1. Yes __ 2. No __ 3. Does Not Apply __

12C. Was dust exposure: — 1. Mild __ 2. Moderate __ 3. Severe __

12D. In the past year, were you exposed to gas or chemical fumes in your work? — 1. Yes __ 2. No __

12E. Was exposure: — 1. Mild __ 2. Moderate __ 3. Severe __

12F. In the past year, what was your: — 1. Job/occupation? _____ / 2. Position/job title? _____

[Sec. 1926.64, Appendix D]

13. RECENT MEDICAL HISTORY

13A. Do you consider yourself to be in good health? Yes ___ No ___

If NO, state reason ______________________________

13B. In the past year, have you developed:

	Yes	No
Epilepsy?	___	___
Rheumatic fever?	___	___
Kidney disease?	___	___
Bladder disease?	___	___
Diabetes?	___	___
Jaundice?	___	___
Cancer?	___	___

14. CHEST COLDS AND CHEST ILLNESSES

14A. If you get a cold, does it usually go to your chest? (Usually means more than 1/2 the time)

1. Yes ___ 2. No ___
3. Don't get colds ___

15A. During the past year, have you had any chest illnesses that have kept you off work, indoors at home, or in bed?

1. Yes ___ 2. No ___
3. Does Not Apply ___

IF YES TO 15A:

15B. Did you produce phlegm with any of these chest illnesses?

1. Yes ___ 2. No ___
3. Does Not Apply ___

15C. In the past year, how many such illnesses with (increased) phlegm did you have which lasted a week or more?

Number of illnesses ___
No such illnesses ___

16. RESPIRATORY SYSTEM

In the past year have you had:

	Yes or No	Further Comment on Positive Answers
Asthma	___	
Bronchitis	___	
Hay Fever	___	
Other Allergies	___	

	Yes or No	Further Comment on Positive Answers
Pneumonia	___	
Tuberculosis	___	
Chest Surgery	___	
Other Lung Problems	___	
Heart Disease	___	

Do you have:

	Yes or No	Further Comment on Positive Answers
Frequent colds	___	
Chronic cough	___	
Shortness of breath when walking or climbing one flight or stairs	___	

Do you:

Wheeze	___	
Cough up phlegm	___	
Smoke cigarettes	___	Packs per day ___ How many years ___

Date ______________ Signature ______________

[Sec. 1926.58, Appendix D]

Appendix E to § 1926.58—Interpretation and Classification of Chest Roentgenograms—Mandatory

(a) Chest roentgenograms shall be interpreted and classified in accordance with a professionally accepted classification system and recorded on a Roentgenographic Interpretation Form. "Form CSD/NIOSH (M) 2.8.

(b) [illegible] roentgenograms shall be interpreted and classified only by a B-reader, a board eligible/certified radiologist, or an experienced physician with known expertise in pneumoconioses.

(c) All interpreters, whenever interpreting chest roentgenograms made under this section, shall have immediately available for reference a complete set of the ILO–U/C International Classification of Radiographs for Pneumoconioses, 1980.

Appendix F to 1926.58—Work Practices and Engineering Controls for Major Asbestos Removal, Renovation, and Demolition Operations—Non-Mandatory

This is a non-mandatory appendix designed to provide guidelines to assist employers in complying with the requirements of 29 CFR 1926.58. Specifically, this appendix describes the equipment, methods, and procedures that should be used in major asbestos removal projects conducted to abate a recognized asbestos hazard or in preparation for building renovation or demolition. These projects require the construction of negative-pressure temporary enclosures to contain the asbestos material and to prevent the exposure of bystanders and other employees at the worksite. Paragraph (e)(6) of the standard requires that "... [W]henever feasible, the employer shall establish negative-pressure enclosures before commencing asbestos removal, demolition, or renovation operations." Employers should also be aware that, when conducting asbestos removal projects, they may be required under the National Emissions Standards for Hazardous Air Pollutants (NESHAPS), 40 CFR Part 61, Subpart M, or EPA regulations under the Clear Water Act.

Construction of a negative-pressure enclosure is a simple but time-consuming process that requires careful preparation and execution; however, if the procedures below are followed, contractors should be assured of achieving a temporary barricade that will protect employees and others outside the enclosure from exposure to asbestos and minimize to the extent possible the exposure of asbestos workers inside the barrier as well.

The equipment and materials required to construct these barriers are readily available and easily installed and used. In addition to an enclosure around the removal site, the standard requires employers to provide hygiene facilities that ensure that their asbestos contaminated employees do not leave the work site with asbestos on their persons or clothing; the construction of these facilities is also described below. The steps in the process of preparing the asbestos removal site, building the enclosure, constructing hygiene facilities, removing the asbestos-containing material, and restoring the site include:

(1) Planning the removal project;
(2) Procuring the necessary materials and equipment;
(3) Preparing the work area;
(4) Removing the asbestos-containing material;
(5) Cleaning the work area; and
(6) Disposing of the asbestos-containing waste.

Planning the Removal Project

The planning of an asbestos removal project is critical to completing the project safely and cost-effectively. A written asbestos removal plan should be prepared that describes the equipment and procedures that will be used throughout the project. The asbestos abatement plan will aid not only in executing the project but also in complying with the reporting requirements of the USEPA asbestos regulations (40 CFR 61, Subpart M), which call for specific information such as a description of control methods and control equipment to be used and the disposal sites the contractor proposes to use to dispose of the asbestos containing materials.

The asbestos abatement plan should contain the following information:

- A physical description of the work area;
- A description of the approximate amount of material to be removed;
- A schedule for turning off and sealing existing ventilation systems;
- Personnel hygiene procedures;
- Labeling procedures;
- A description of personal protective equipment and clothing to be worn by employees;
- A description of the local exhaust ventilation systems to be used;
- A description of work practices to be observed by employees;
- A description of the methods to be used to remove the asbestos-containing material;
- The wetting agent to be used;
- A description of the sealant to be used at the end of the project;
- An air monitoring plan;
- A description of the method to be used to transport waste material; and
- The location of the dump site.

Materials and Equipment Necessary for Asbestos Removal

Although individual asbestos removal projects vary in terms of the equipment required to accomplish the removal of the material, some equipment and materials are common to most asbestos removal operations. Equipment and materials that should be available at the beginning of each project are: (1) rolls of polyethylene sheeting; (2) rolls of gray duct tape or clear plastic tape; (3) HEPA filtered vacuum(s); (4) HEPA-filtered portable ventilation system(s); (5) a wetting agent; (6) an airless sprayer; (7) a portable shower unit; (8) appropriate respirators; (9) disposable coveralls; (10) signs and labels; (11) pre-printed disposal bags; and (12) a manometer or pressure gauge.

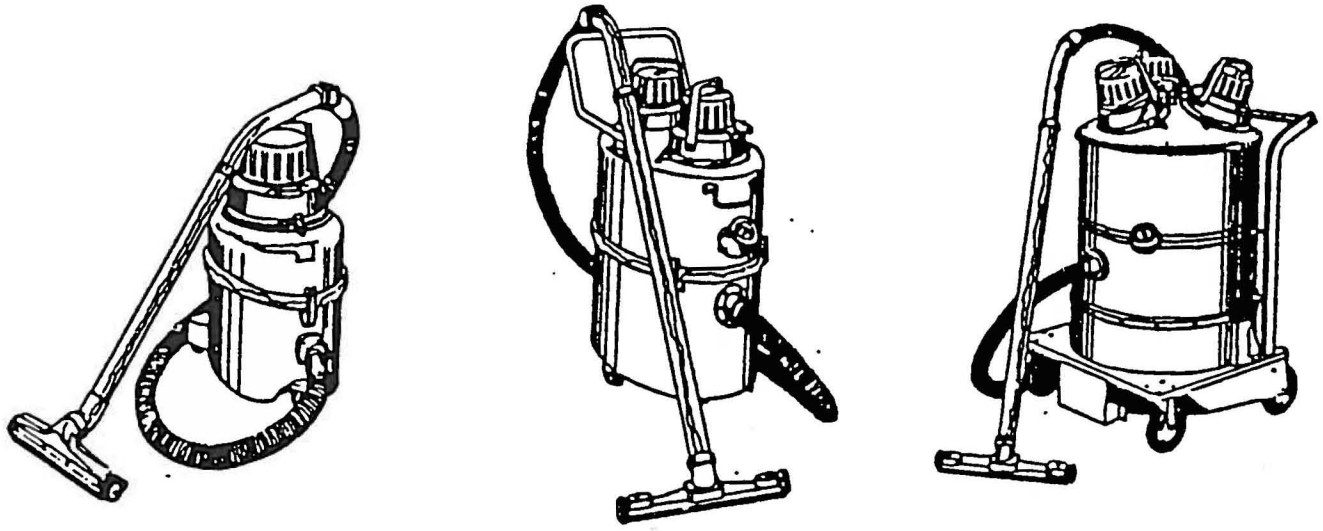
Rolls of Polyethylene Plastic and Tape. Rolls of polyethylene plastic (6 mil in thickness) should be available to construct the asbestos removal enclosure and to seal windows, doors, ventilation systems, wall penetrations, and ceilings and floors in the work area. Gray duct tape or clear plastic tape should be used to seal the edges of the plastic and to seal any holes in the plastic enclosure. Polyethylene plastic sheeting can be purchased in rolls up to 12–20 feet in width and up to 100 feet in length.

HEPA-Filtered Vacuum. A HEPA-filtered vacuum is essential for cleaning the work area after the asbestos has been removed. Such vacuums are designed to be used with a HEPA (High Efficiency Particulate Air) filter, which is capable of removing 99.97 percent of the asbestos particles from the air. Various sizes and capacities of HEPA vacuums are available. One manufacturer, Nilfisk of America, Inc.*, produces three models that range in capacity from 5.25 gallons to 17 gallons (see Figure F–1). All of these models are portable, and all have long hoses capable of reaching out-of-the-way places, such as areas above ceiling tiles, behind pipes, etc.

Exhaust Air Filtration System. A portable ventilation system is necessary to create a negative pressure within the asbestos removal enclosure. Such units are equipped with a HEPA filter and are designed to exhaust and clean the air inside the enclosure before exhausting it to the outside of the enclosure (See Figure F–2). Systems are available from several manufacturers. One supplier, Micro-Trap, Inc.,* has two ventilation units that range in capacity from 600 cubic feet per minute (CFM) to 1,700 CFM. According to the manufacturer's literature, Micro-Trap * units filter particles of 0.3 micron in size with an efficiency of 99.99 percent. The number and capacity of units required to ventilate an enclosure depend on the size of the area to be ventilated.

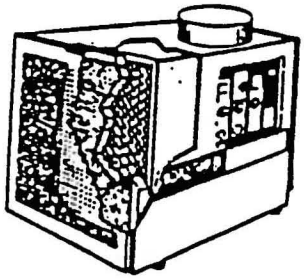
* Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

[Sec. 1926.58, Appendix F]



Source: Product Catalog, Asbestos Control Technologies, Inc., Maple Shade, N.J., 1986.

Figure F-1. HEPA Filtered Vacuums



Source: Product Catalog, Asbestos Control Technologies, Inc., Maple Shade, N.J., 1986.

Figure F-2. Portable Exhaust Ventilation System with HEPA Filter

Wetting Agents. Wetting agents (surfactants) are added to water (which is then called amended water) and used to soak asbestos-containing materials; amended water penetrates more effectively than plain water and permits more thorough soaking of the asbestos-containing materials. Wetting the asbestos-containing material reduces the number of fibers that will break free and become airborne when the asbestos-containing material is handled or otherwise disturbed. Asbestos-containing materials should be thoroughly soaked before removal is attempted; the dislodged material should feel spongy to the touch. Wetting agents are generally prepared by mixing 1 to 3 ounces of wetting agent to 5 gallons of water.

One type of asbestos, amosite, is relatively resistant to soaking, either with plain or amended water. The work practices of choice when working with amosite containing material are to soak the material as much as possible and then to bag it for disposal immediately after removal, so that the material has no time to dry and be ground into smaller particles that are more likely to liberate airborne asbestos.

In a very limited number of situations, it may not be possible to wet the asbestos-containing material before removing it. Examples of such rare situations are: (1) Removal of asbestos material from a "live" electrical box that was oversprayed with the material when the rest of the area was sprayed with asbestos-containing coating; and (2) removing asbestos-containing insulation from a live steam pipe. In both of these situations, the preferred approach would be to turn off the electricity or steam, respectively, to permit wet removal methods to be used. However, where removal work must be performed during working hours, i.e., when normal operations cannot be disrupted, the asbestos-containing material must be removed dry. Immediate bagging is then the only method of minimizing the amount of airborne asbestos generated.

Airless Sprayer. Airless sprayers are used to apply amended water to asbestos-containing materials. Airless sprayers allow the amended water to be applied in a fine spray that minimizes the release of asbestos fibers by reducing the impact of the spray on the material to be removed. Airless sprayers are inexpensive and readily available.

Portable Shower. Unless the site has available a permanent shower facility that is contiguous to the removal area, a portable shower system is necessary to permit employees to clean themselves after exposure to asbestos and to remove any asbestos contamination from their hair and bodies. Taking a shower prevents employees from leaving the work area with asbestos on their clothes and thus prevents the spread of asbestos contamination to areas outside the asbestos removal area. This measure also protects members of the families of asbestos workers from possible exposure to asbestos. Showers should be supplied with warm water and a drain. A shower water filtration system to filter asbestos fibers from the shower water is recommended. Portable shower units are readily available, inexpensive, and easy to install and transport.

Respirators. Employees involved in asbestos removal projects should be provided with appropriate NIOSH-approved respirators. Selection of the appropriate respirator should be based on the concentration of asbestos fibers in the work area. If the concentration of asbestos fibers is unknown, employees should be provided with respirators that will provide protection against the highest concentration of asbestos fibers that can reasonably be expected to exist in the work area. For most work within an enclosure, employees should wear half-mask dual-filter cartridge respirators. Disposable face mask respirators (single-use) should not be used to protect employers from exposure to asbestos fibers.

Disposable Coveralls. Employees involved in asbestos removal operations should be provided with disposable impervious coveralls that are equipped with head and foot covers. Such coveralls are typically made of Tyvek.[1] The coverall has a zipper front and elastic wrists and ankles.

Signs and Labels. Before work begins, a supply of signs to demarcate the entrance to the work area should be obtained. Signs are available that have the wording required by the final OSHA standard. The required labels are also commercially available as press-on labels and pre-printed on the 6-mil polyethylene plastic bags used to dispose of asbestos-containing waste material.

Preparing the Work Area

Preparation for constructing negative-pressure enclosures should begin with the removal of all movable objects from the work

[1] Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

[Sec. 1926.58, Appendix F]

area, e.g., desks, chairs, rugs, and light fixtures, to ensure that these objects do not become contaminated with asbestos. When movable objects are contaminated or are suspected of being contaminated, they should be vacuumed with a HEPA vacuum and cleaned with amended water, unless they are made of material that will be damaged by the wetting agent; wiping with plain water is recommend in those cases where amended water will damage the object. Before the asbestos removal work begins, objects that cannot be removed from the work area should be covered with a 6-mil-thick polyethylene plastic sheeting that is securely taped with duct tape or plastic tape to achieve an air-tight seal around the object.

Constructing the Enclosure

When all objects have either been removed from the work area or covered with plastic, all penetrations of the floor, walls, and ceiling should be sealed with 6-mil polyethylene plastic and tape to prevent airborne asbestos from escaping into areas outside the work area of from lodging in cracks around the penetrations. Penetrations that require sealing are typically found around electrical conduits, telephone wires, and water supply and drain pipes. A single entrance to be used for access and egress to the work area should be selected, and all other doors and windows should be sealed with tape or be covered with 6-mil polyethylene plastic sheeting and securely taped. Covering windows and unnecessary doors with a layer of polyethylene before covering the walls provides a second layer of protection and saves time in installation because it reduces the number of edges that must be cut and taped. All other surfaces such as support columns, ledges, pipes, and other surfaces should also be covered with polyethylene plastic sheeting and taped before the walls themselves are completely covered with sheeting.

Next a thin layer of spray adhesive should be sprayed along the top of all walls surrounding the enclosed work area, close to the wall-ceiling interface, and a layer of polyethylene plastic sheeting should be stuck to this adhesive and taped. The entire inside surfaces of all wall areas are covered in this manner, and the sheeting over the walls is extended across the floor area until it meets in the center of the area, where it is taped to form a single layer of material encasing the entire room except for the ceiling. A final layer of plastic sheeting is then laid across the plastic-covered floor area and up the walls to a level of 2 feet or so; this layer provides a second protective layer of plastic sheeting over the floor, which can then be removed and disposed of easily after the asbestos-containing material that has dropped to the floor has been bagged and removed.

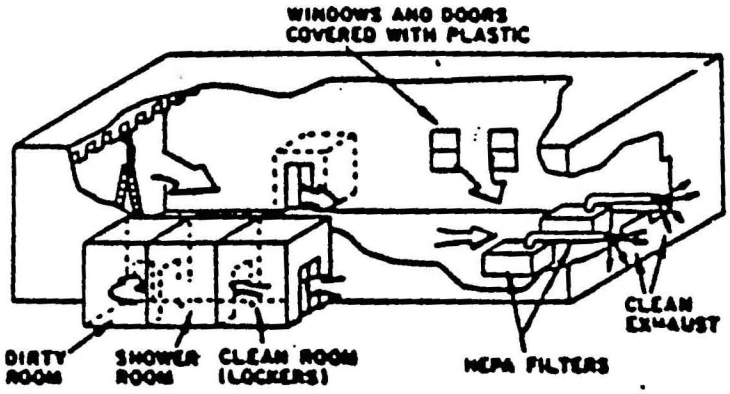
Building Hygiene Facilities

Paragraph (j) of the final standard mandates that employers involved in asbestos removal, demolition, or renovation operations provide their employees with hygiene facilities to be used to decontaminate asbestos-exposed workers, equipment, and clothing before such employees leave the work area. These decontamination facilities consist of:

(1) A clean change room;
(2) A shower; and
(3) An equipment room.

The clean change room is an area in which employees remove their street clothes and don their respirators and disposable protective clothing. The clean room should have hooks on the wall or be equipped with lockers for the storage of workers' clothing and personal articles. Extra disposable coveralls and towels can also be stored in the clean change room.

The shower should be contiguous with both the clean and dirty change room (see Figure F-3) and should be used by all workers leaving the work area. The shower should also be used to clean asbestos-contaminated equipment and materials, such as the outsides of asbestos waste bags and hand tools used in the removal process.



Source: EPA 1985. Asbestos Waste Management Guidance (EPA/530-SW-85-027).

Figure F-3. Cutaway View of Enclosure and Hygiene Facilities

The equipment room (also called the dirty change room) is the area where workers remove their protective coveralls and where equipment that is to be used in the work area can be stored. The equipment room should be lined with 6-mil-thick polyethylene plastic sheeting in the same way as was done in the work area enclosure. Two layers of 6-mil polyethylene plastic sheeting that are not taped together from a double flap or barrier between the equipment room and the work area and between the shower and the clean change room (see Figure F-4).

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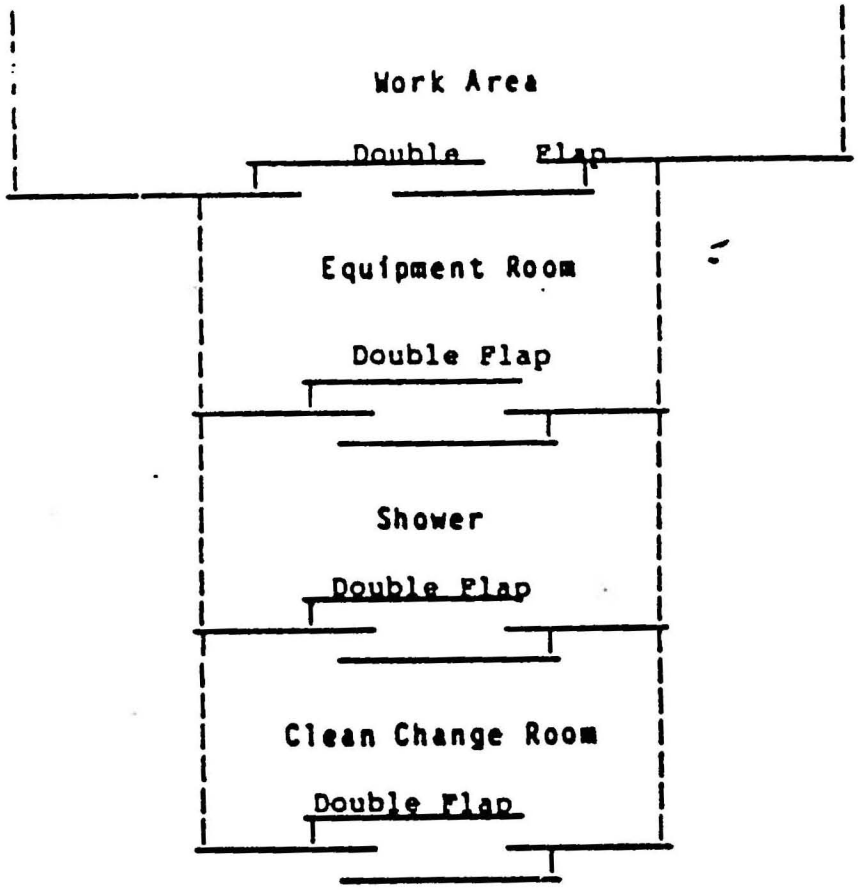

Figure F-4. Typical Hygiene Facility Layout

When feasible, the clean change room, shower, and equipment room should be contiguous and adjacent to the negative-pressure enclosure surrounding the removal area. In the overwhelming number of cases, hygiene facilities can be built contiguous to the negative-pressure enclosure. In some cases, however, hygiene facilities may have to be located on another floor of the building where removal of asbestos-containing materials is taking place. In these instances, the hygiene facilities can in effect be made to be contiguous to the work area by constructing a polyethylene plastic "tunnel" from the work area to the hygiene facilities. Such a tunnel can be made even in cases where the hygiene facilities are located several floors above or below the work area; the tunnel begins with a double flap door at the enclosure, extends through the exit from the floor, continues down the necessary number of flights of stairs and goes through a double-flap entrance to the hygiene facilities, which have been prepared as described above. The tunnel is constructed of 2-inch by 4-inch lumber or aluminum struts and covered with 6-mil-thick polyethylene plastic sheeting.

In the rare instances when there is not enough space to permit any hygiene facilities to be built at the work site, employees should be directed to change into a clean disposable worksuit immediately after exiting the enclosure (without removing their respirators) and to proceed immediately to the shower. Alternatively, employees could be directed to vacuum their disposable coveralls with a HEPA-filtered vacuum before proceeding to a shower located a distance from the enclosure.

The clean room, shower, and equipment room must be sealed completely to ensure that the sole source of air flow through these areas originates from uncontaminated areas outside the asbestos removal, demolition, or renovation enclosure. The shower must be drained properly after each use to ensure that contaminated water is not released to uncontaminated areas. If waste water is inadvertently released, it should be cleaned up as soon as possible to prevent any asbestos in the water from drying and becoming airborne in areas outside the work area.

Establishing Negative Pressure Within the Enclosure

After construction of the enclosure is completed, a ventilation system(s) should be installed to create a negative pressure within the enclosure with respect to the area outside the enclosure. Such ventilation systems must be equipped with HEPA filters to prevent the release of asbestos fibers to the environment outside the enclosure and should be operated 24 hours per day during the entire project until the final cleanup is completed and the results of final air samples are received from the laboratory. A sufficient amount of air should be exhausted to create a pressure of −0.02 inches of water within the enclosure with respect to the area outside the enclosure.

These ventilation systems should exhaust the HEPA-filtered clean air outside the building in which the asbestos removal, demolition, or renovation is taking place (see Figure F-6). If access to the outside is not available, the ventilation system can exhaust the HEPA-filtered asbestos-free air to an area within the building that is as far away as possible from the enclosure. Care should be taken to ensure that the clean air is released either to an asbestos-free area or in such a way as not to disturb any asbestos-containing materials.

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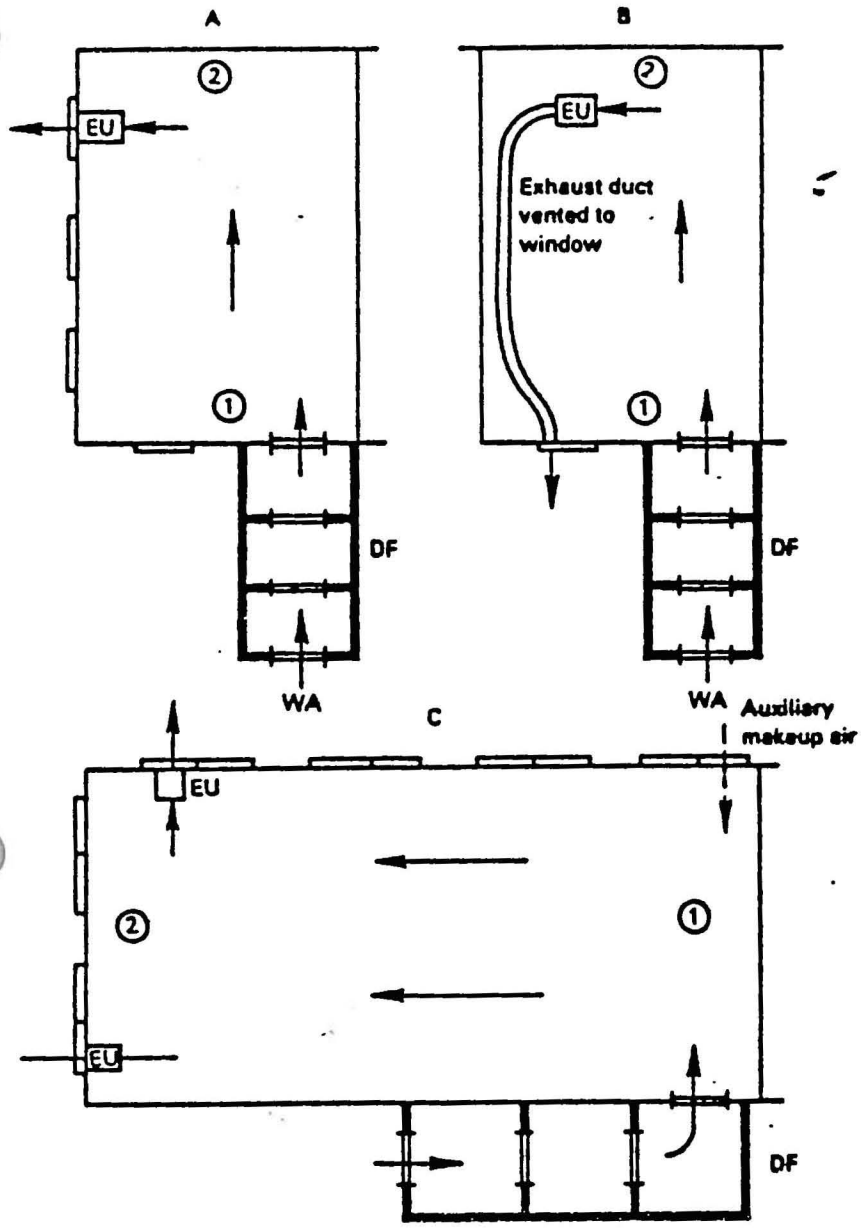

Source: EPA 1985. Guidance for Controlling Asbestos-Containing materials in Buildings (EPA 560/5-85-024).

Figure F-6. Examples of Negative Pressure Systems. DF, Decontamination Facility; EU, Exhaust Unit; WA, Worker Access; A, Single-room work area with multiple windows; B, Single-room work area with single window near entrance; C, Large single-room work area with windows and auxiliary makeup air source (dotted arrow). Arrows denote direction of air flow. Circled numbers indicate progression of removal sequence.

A manometer or pressure gauge for measuring the negative pressure within the enclosure should be installed and should be monitored frequently throughout all work shifts during which asbestos removal, demolition, or renovation takes place. Several types of manometers and pressure gauges are available for this purpose.

All asbestos removal, renovation, and demolition operations should have a program for monitoring the concentration of airborne asbestos and employee exposures to asbestos. Area samples should be collected inside the enclosure (approximately four samples for 5000 square feet of enclosure area). At least two samples should be collected outside the work area, one at the entrance to the clean change room and one at the exhaust of the portable ventilation system. In addition, several breathing zone samples should be collected from those workers who can reasonably be expected to have the highest potential exposure to asbestos.

Removing Asbestos Materials

Paragraph (e)(6)(ii) requires that employers involved in asbestos removal, demolition, or renovation operations designate a competent person to:

(1) Set up the enclosure;
(2) Ensure the integrity of the enclosure;
(3) Control entry to and exit from the enclosure;
(4) Supervise all employee exposure monitoring required by this section;
(5) Ensure the use of protective clothing and equipment;
(6) Ensure that employees are trained in the use of engineering controls, work practices, and personal protective equipment;
(7) Ensure the use of hygiene facilities and the observance of proper decontamination procedures; and
(8) Ensure that engineering controls are functioning properly.

The competent person will generally be a Certified Industrial Hygienist, an industrial hygienist with training and experience in the handling of asbestos, or a person who has such training and experience as a result of on-the-job training and experience.

Ensuring the integrity of the enclosure is accomplished by inspecting the enclosure before asbestos removal work begins and prior to each work shift throughout the entire period work is being conducted in the enclosure. The inspection should be conducted by locating all areas where air might escape from the enclosure; this is best accomplished by running a hand over all seams in the plastic enclosure to ensure that no seams are ripped and the tape is securely in place.

The competent person should also ensure that all unauthorized personnel do not enter the enclosure and that all employees and other personnel who enter the enclosure have the proper protective clothing and equipment. He or she should also ensure that all employees and other personnel who enter the enclosure use the hygiene facilities and observe the proper decontamination procedures (described below).

Proper work practices are necessary during asbestos removal, demolition, and renovation to ensure that the concentration of asbestos fibers inside the enclosure remains as low as possible. One of the most important work practices is to wet the asbestos-containing material before it is disturbed. After the asbestos-containing material is thoroughly wetted, it should be removed by scraping (as in the case of sprayed-on or troweled-on ceiling material) or removed by cutting the metal bands or wire mesh that support the asbestos-containing material on boilers or pipes. Any residue that remains on the surface of the object from which asbestos is being removed should be wire brushed and wet wiped.

Bagging asbestos waste material promptly after its removal is another work practice control that is effective in reducing the airborne concentration of asbestos within the

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- Appropriate work practices are used;
- Necessary protective clothing and equipment are used; and
- Appropriate decontamination procedures are being followed.

Cleaning the Work Area

After all of the asbestos-containing material is removed and bagged, the entire work area should be cleaned until it is free of all visible asbestos dust. All surfaces from which asbestos has been removed should be cleaned by wire brushing the surfaces, HEPA vacuuming these surfaces, and wiping them with amended water. The inside of the plastic enclosure should be vacuumed with a HEPA vacuum and wet wiped until there is no visible dust in the enclosure. Particular attention should be given to small horizontal surfaces such as pipes, electrical conduits, lights, and support tracks for drop ceilings. All such surfaces should be free of visible dust before the final air samples are collected.

Additional sampling should be conducted inside the enclosure after the cleanup of the work area has been completed. Approximately four area samples should be collected for each 5000 square feet of enclosure area. The enclosure should not be dismantled unless the final samples show asbestos concentrations of less than the final standard's action level. EPA recommends that a clearance level of 0.01 f/cc be achieved before cleanup is considered complete.

A clearance checklist is an effective method of ensuring that all surfaces are adequately cleaned and the enclosure is ready to be dismantled. Figure F-7 shows a checklist that can be used during the final inspection phase of asbestos abatement, removal, or renovation operations.

Final Inspection of Asbestos Removal, Renovation, and Demolition Projects

Date: _____
Project: _____
Location: _____
Building: _____

CHECKLIST:

Residual dust on:	Yes	No		Yes	No
a. Floor	____	____	e. Horizontal surfaces	____	____
b. Horizontal surfaces	____	____	f. Pipes	____	____
c. Pipes	____	____	g. Ducts	____	____
d. Ventilation equipment	____	____	h. Register	____	____
			i. Lights	____	____

FIELD NOTES:
Record any problems encountered here.

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

FINAL AIR SAMPLE RESULTS: _____
_____
_____

Figure F-7. Clearance Checklist

[Sec. 1926.58, Appendix F]

enclosure. Whenever possible, the asbestos should be removed and placed directly into bags for disposal rather than dropping the material to the floor and picking up all of the material when the removal is complete. If a significant amount of time elapses between the time that the material is removed and the time it is bagged, the asbestos material is likely to dry out and generate asbestos-laden dust when it is disturbed by people working within the enclosure. Any asbestos-contaminated supplies and equipment that cannot be decontaminated should be disposed of in pre-labeled bags; items in this category include plastic sheeting, disposable work clothing, respirator cartridges, and contaminated wash water.

A checklist is one of the most effective methods of ensuring adequate surveillance of the integrity of the asbestos removal enclosure. Such a checklist is shown in Figure F-6. Filling out the checklist at the beginning of each shift in which asbestos removal is being performed will serve to document that all the necessary precautions will be taken during the asbestos removal work. The checklist contains entries for ensuring that:

- The work area enclosure is complete;
- The negative-pressure system is in operation;
- Necessary signs and labels are used;

Asbestos Removal, Renovation, and Demolition Checklist

Date: _____ Location: _____

Supervisor _____ Project # _____

Work Area (sq. ft.) _____

		Yes	No
I.	Work site barrier		
	Floor covered	____	____
	Walls covered	____	____
	Area ventilation off	____	____
	All edges sealed	____	____
	Penetrations sealed	____	____
	Entry curtains	____	____
II.	Negative Air Pressure		
	HEPA Vac _____ Ventilation system _____		
	Constant operation	____	____
	Negative pressure achieved	____	____
III.	Signs		
	Work area entrance	____	____
	Bags labeled	____	____
IV.	Work Practices		
	Removed material promptly bagged	____	____
	Material worked wet	____	____
	HEPA vacuum used	____	____
	No smoking	____	____
	No eating, drinking	____	____
	Work area cleaned after completion	____	____
	Personnel decontaminated each departure	____	____
V.	Protective Equipment		
	Disposable clothing used one time	____	____
	Proper NIOSH-approved respirators	____	____
VII.	Showers		
	On site	____	____
	Functioning	____	____
	Soap and towels	____	____
	Used by all personnel	____	____

Figure F-6. Checklist

[Sec. 1926.58, Appendix F]

Appendix G to § 1926.58—Work Practices and Engineering Controls for Small-Scale, Short-Duration Asbestos Renovation and Maintenance Activities—Non-Mandatory

This appendix is not mandatory. In that construction industry employers may choose to comply with all of the requirements of OSHA's final rule for occupational exposure to asbestos in the construction industry, § 1926.58. However, employers wishing to be exempted from the requirements of paragraphs (e)(6) and (f)(2)(ii)(*B*) of § 1926.58 shall comply with the provisions of this appendix when performing small-scale, short-duration renovation or maintenance activities. OSHA anticipates that employers in the electrical, carpentry, utility, plumbing, and interior construction trades may wish to avail themselves of the final standard's exemptions for small-scale, short-duration renovation and maintenance operations.

Definition of Small-Scale, Short-Duration Activities

For the purposes of this appendix, small-scale, short-duration renovation and maintenance activities are tasks such as, but not limited to:

- Removal of asbestos-containing insulation on pipes;
- Removal of small quantities of asbestos-containing insulation on beams or above ceilings;
- Replacement of an asbestos-containing gasket on a valve;
- Installation or removal of a small section of drywall;
- Installation of electrical conduits through or proximate to asbestos-containing materials.

Evidence in the record (see the Summary and Explanation section of the preamble for paragraph (g), Methods of Compliance, for specific citations) suggests that the use of certain engineering and work practice controls is capable of reducing employee exposures to asbestos to levels below the final standard's action level (0.1 f/cc). Several controls and work practices, used either singly or in combination, can be employed effectively to reduce asbestos exposures during small maintenance and renovation operations. These include:

- Wet methods;
- Removal methods
  - —Use of Glove bags
  - —Removal of entire asbestos insulated pipes or structures
  - —Use of mini-enclosures
- Enclosure of asbestos materials; and
- Maintenance programs.

This appendix describes these controls and work practices in detail.

Preparation of the Area Before Renovation or Maintenance Activities

The first step in preparing to perform a small-scale, short-duration asbestos renovation or maintenance task, regardless of the abatement method that will be used, is the removal from the work area of all objects that are movable to protect them from asbestos contamination. Objects that cannot be removed must be covered completely with a 6-mil-thick polyethylene plastic sheeting before the task begins. If objects have already been contaminated, they should be thoroughly cleaned with a High Efficiency Particulate Air [(HEPA] filtered vacuum or be wet wiped before they are removed from the work area or completely encased in the plastic.

Wet Methods

Whenever feasible, and regardless of the abatement method to be used (e.g., removal, enclosure, use of glove bags), wet methods must be used during small-scale, short duration maintenance and renovation activities that involve disturbing asbestos-containing materials. Handling asbestos materials wet is one of the most reliable methods of ensuring that asbestos fibers do not become airborne, and this practice should therefore be used whenever feasible. As discussed in the Summary and Explanation section of the preamble for paragraph (g), Methods of Compliance, wet methods can be used in the great majority of workplace situations. Only in cases where asbestos work must be performed on live electrical equipment, on live steam lines, or in other areas where water will seriously damage materials or equipment may dry removal be performed. Amended water or another wetting agent should be applied by means of an airless sprayer to minimize the extent to which the asbestos-containing material is disturbed.

Asbestos-containing materials should be wetted from the initiation of the maintenance or renovation operation and wetting agents should be used continually throughout the work period to ensure that any dry asbestos-containing material exposed in the course of the work is wet and remains wet until final disposal.

Removal of Small Amount of Asbestos-Containing Materials

Several methods can be used to remove small amounts of asbestos-containing materials during small-scale, short-duration renovation or maintenance tasks. These include the use of glove bags, the removal of an entire asbestos-covered pipe or structure, and the construction of mini-enclosures. The procedures that employers must use for each of these operations if they wish to avail themselves of the final rule's exemptions are described in the following sections.

Glove Bags

As discussed in the Summary and Explanation section of the preamble for paragraph (g), Methods of Compliance, evidence in the record indicate that the use of glove bags to enclose the work area during small-scale, short-duration maintenance or renovation activities will result in employee exposures to asbestos that are below the final standard's action level of 0.1 f/cc. This appendix provides requirements for glove-bag procedures to be followed by employers wishing to avail themselves of the standard's exemptions for such activities. OSHA has determined that the use of these procedures will reduce the 8 hour time weighted average (TWA) exposures of employees involved in these work operations to levels below the action level and will thus provide a degree of employee protection equivalent to that provided by compliance with all provisions of the final rule.

Glove Bag Installation. Glove bags are approximately 40-inch-wide times 64-inch-long bags fitted with arms through which the work can be performed (see Figure C–1(A)). When properly installed and used, they permit workers to remain completely isolated from the asbestos material removed or replaced inside the bag. Glove bags can thus provide a flexible, easily installed, and quickly dismantled temporary small work area enclosure that is ideal for small-scale asbestos renovation or maintenance jobs.

[Sec. 1926.58, Appendix G]

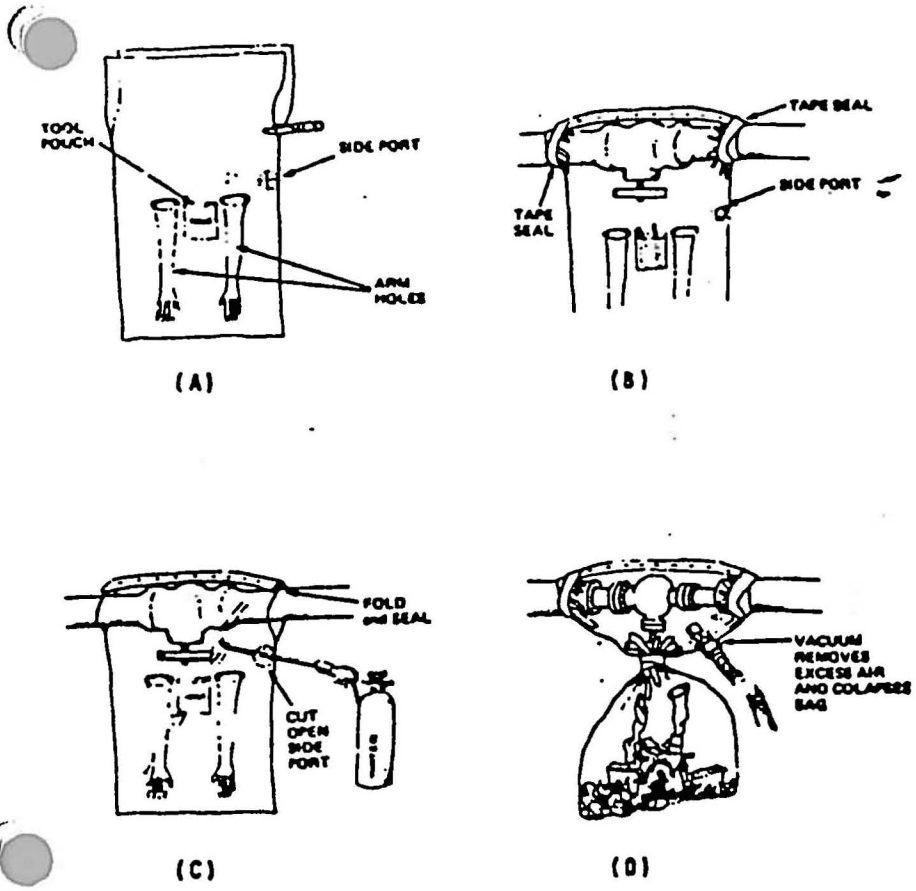

Figure G–1. Diagrams Showing Proper Use of Glove Bags in Small-Scale, Short-Duration Maintenance and Renovation Operations.

These bags are single use control devices that are disposed of at the end of each job. The bags are made of transparent 6-mil-thick polyethylene plastic with arms of Tyvek * material (the same material used to make the disposable protective suits used in major asbestos removal, renovation, and demolition operations and in protective gloves). Glove bags are readily available from safety supply stores or specialty asbestos removal supply houses. Glove bags come pre-labeled with the asbestos warning label prescribed by OSHA and EPA for bags used to dispose of asbestos waste.

Glove Bag Equipment and Supplies. Supplies and materials that are necessary to use glove bags effectively include:

(1) Tape to seal the glove bag to the area from which abebestos is to be removed;

(2) Amended water or other wetting agents;

(3) An airless sprayer for the application of the wetting agent;

(4) Bridging encapsulant (a paste-like substance for coating asbestos) to seal the rough edges of any asbestos-containing materials that remain within the glove bag at the points of attachment after the rest of the asbestos has be removed;

(5) Tools such as razor knives, nips, and wire brushes (or other tools suitable for cutting wire, etc.);

(6) A HEPA filter-equipped vacuum for evacuating the glove bag (to minimize the release of asbestos fibers) during removal of the bag from the work area and for cleaning any material that may have escaped during the installation of the glove bag; and

(7) HEPA-equipped dust cartridge respirators for use by the employees involved in the removal of asbestos with the glove bag.

Glove Bag Work Practices. The proper use of glove bags requires the following steps:

(1) Glove bags must be installed so that they completely cover the pipe or other structure where asbestos work is to be done. Glove bags are installed by cutting the sides of the glove bag to fit the size of the pipe from which asbestos is to be removed. The glove bag is attached to the pipe by folding the open edges together and securely sealing them with tape. All openings in the glove bag must be sealed with duct tape or equivalent material. The bottom seam of the glove bag must also be sealed with duct tape or equivalent to prevent any leakage from the bag that may result from a defect in the bottom seam (Figure G–1(B)).

(2) The employee who is performing the asbestos removal with the glove bag must don a half mask dual-cartridge HEPA-equipped respirator; respirators should be worn by employees who are in close contact with the glove bag and who may thus be exposed as a result of small gaps in the seams of the bag or holes punched through the bag by a razor knife or a piece of wire mesh.

(3) The removed asbestos material from the pipe or other surface that has fallen into the enclosed bag must be thoroughly wetted with a wetting agent (applied with an airless sprayer through the pre-cut port provided in most gloves bags or applied through a small hole cut in the bag) (Figure G–1(C)).

(4) Once the asbestos material has been thoroughly wetted, it can be removed from the pipe, beam or other surface. The choice of tool to use to remove the asbestos-containing material depends on the type of material to be removed. Asbestos-containing materials are generally covered with painted canvas and/or wire mesh. Painted canvas can be cut with a razor knife and peeled away from the asbestos-containing material underneath. Once the canvas has been peeled away, the asbestos-containing material underneath may be dry, in which case it should be re-sprayed with a wetting agent to ensure that it generates as little dust as possible when removed. If the asbestos-containing material is covered with wire mesh, the mesh should be cut with nips, tin snips, or other appropriate tool and removed.

A wetting agent must then be used to spray any layer of dry material that is exposed beneath the mesh, the surface of the stripped underlying structure, and the inside of the glove bag.

(5) After removal of the layer of asbestos-containing material, the pipe or surface from which asbestos has been removed must be thoroughly cleaned with a wire brush and wet wiped with a wetting agent until no traces of the asbestos containing material can be seen.

(6) Any asbestos containing insulation edges that have been exposed as a result of the removal or maintenance activity must be encapsulated with bridging encapsulant to ensure that the edges do not release asbestos fibers to the atmosphere after the glove bag has been removed.

(7) When the asbestos removal and encapsulation have been completed, a vacuum hose from a HEPA filtered vacuum must be inserted into the glove bag through the port to remove any air in the bag that may contain asbestos fibers. When the air has been removed from the bag, the bag should be squeezed tightly (as close to the top as possible), twisted, and sealed with tape, to keep the asbestos materials safely in the bottom of the bag. The HEPA vacuum can

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* Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

then be removed from the bag and the glove bag itself can be removed from the work area to be disposed of properly (Figure C–1(D)).

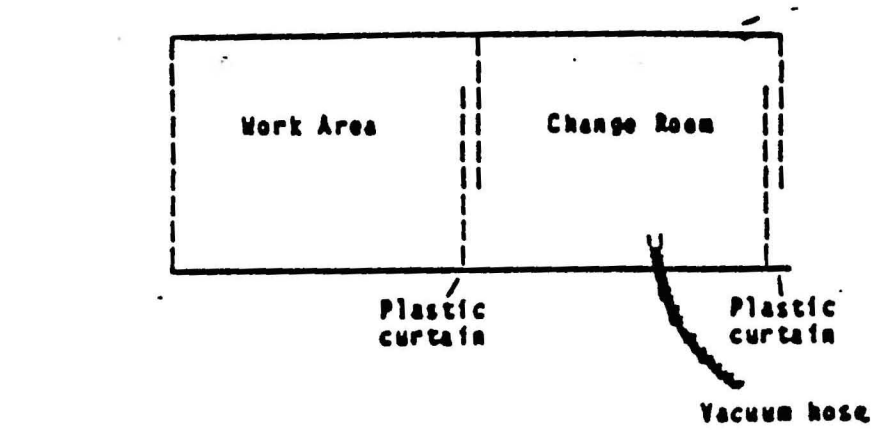

Figure C–2. Schematic of Mini-enclosure

Mini-Enclosures

In some instances, such as removal of asbestos from a small ventilation system or from a short length of duct, a glove bag may not be either large enough or of the proper shape to enclose the work area. In such cases, a mini-enclosure can be built around the area where small-scale, short-duration asbestos maintenance or renovation work is to be performed (Figure C–2). Such an enclosure should be constructed of 6-mil-thick polyethylene plastic sheeting and can be small enough to restrict entry to the asbestos work area to one worker.

For example, a mini-enclosure can be built in a small utility closet when asbestos-containing duct covering is to be removed. The enclosure is constructed by:

(1) Affixing plastic sheeting to the walls with spray adhesive and tape;

(2) Covering the floor with plastic and sealing the plastic covering the floor to the plastic on the walls.

(3) Sealing any penetrations such as pipes or electrical conduits with tape; and

(4) Constructing a small change room (approximately 3 feet square) made of 6-mil-thick polyethylene plastic supported by 2-inch by 4-inch lumber (the plastic should be attached to the lumber supports with staples or spray adhesive and tape).

The change room should be contiguous to the mini enclosure, and is necessary to allow the worker to vacuum off his protective coveralls and remove them before leaving the work area. While inside the enclosure, the worker should wear Tyvek[1] disposable coveralls and use the appropriate (EPA filtered dual cartridge respiratory protection.

The advantages of mini-enclosures are that they limit the spread of asbestos contamination, reduce the potential exposure of bystanders and other workers who may be working in adjacent areas, and are quick and easy to install. The disadvantage of mini-enclosures is that they may be too small to contain the equipment necessary to create a negative pressure within the enclosure; however, the double layer of plastic sheeting will serve to restrict the release of asbestos fibers to the area outside the enclosure.

Removal of Entire Structures

When pipes are insulated with asbestos-containing materials, removal of the entire pipe may be more protective, easier, and more cost-effective than stripping the asbestos insulation from the pipe. Before such a pipe is cut, the asbestos-containing insulation must be wrapped with 6-mil polyethylene plastic and securely sealed with duct tape or equivalent. This plastic covering will prevent asbestos fibers from becoming airborne as a result of the vibration created by the power saws used to cut the pipe. If possible, the pipes should be cut at locations that are not insulated to avoid disturbing the asbestos. If a pipe is completely insulated with asbestos-containing materials, small sections should be stripped using the glove-bag method described above before the pipe is cut at the stripped sections.

Enclosure

The decision to enclose rather than remove asbestos-containing material from an area depends on the building owner's preference, i.e., for removal or containment. Owners consider such factors as cost effectiveness, the physical configuration of the work area, and the amount of traffic in the area when determining which abatement method to use.

If the owner chooses to enclose the structure rather than to remove the asbestos-containing material insulating it, a solid structure (airtight walls and ceilings) must be built around the asbestos covered pipe or structure to prevent the release of asbestos-containing materials into the area beyond the enclosure and to prevent disturbing these

[1] Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

[Sec. 1926.58, Appendix G]

materials by casual contact during future maintenance operations.

Such a permanent [i.e., for the life of the building] enclosure should be built of new construction materials and should be impact resistant and airtight. Enclosure walls should be made of tongue-and-groove boards, boards with spine joints, or gypsum boards having taped seams. The underlying structure must be able to support the weight of the enclosure. [Suspended ceilings with laid in panels do not provide airtight enclosures and should not be used to enclose structures covered with asbestos-containing materials.] All joints between the walls and ceiling of the enclosure should be caulked to prevent the escape of asbestos fibers. During the installation of enclosures, tools that are used [such as drills or rivet tools] should be equipped with HEPA-filtered vacuums. Before constructing the enclosure, all electrical conduits, telephone lines, recessed lights, and pipes in the area to be enclosed should be moved to ensure that the enclosure will not have to be re-opened later for routine or emergency maintenance. If such lights or other equipment cannot be moved to a new location for logistic reasons, or if moving them will disturb the asbestos-containing materials, removal rather than enclosure of the asbestos-containing materials is the appropriate control method to use.

Maintenance Program

An asbestos maintenance program must be initiated in all facilities that have asbestos-containing materials. Such a program should include:

- Development of an inventory of all asbestos-containing materials in the facility;
- Periodic examination of all asbestos-containing materials to detect deterioration;
- Written procedures for handling asbestos materials during the performance of small-scale, short-duration maintenance and renovation activities;
- Written procedures for asbestos disposal; and
- Written procedures for dealing with asbestos-related emergencies.

Members of the building's maintenance engineering staff [electricians, heating/air conditioning engineers, plumbers, etc.] who may be required to handle asbestos-containing materials should be trained in safe procedures. Such training should include at a minimum:

- Information regarding types of asbestos and its various uses and forms;
- Information on the health effects associated with asbestos exposure;
- Descriptions of the proper methods of handling asbestos-containing materials; and
- Information on the use of HEPA-equipped dual cartridge respiratory and other personal protection during maintenance activities.

Prohibited Activities

The training program for the maintenance engineering staff should describe methods of handling asbestos-containing materials as well as routine maintenance activities that are prohibited when asbestos-containing materials are involved. For example, maintenance staff employees should be instructed:

- *Not* to drill holes in asbestos-containing materials;
- *Not* to hang plants or pictures on structures covered with asbestos-containing materials;
- *Not* to sand asbestos-containing floor tile;
- *Not* to damage asbestos-containing materials while moving furniture or other objects;
- *Not* to install curtains, drapes, or dividers in such a way that they damage asbestos-containing materials;
- *Not* to dust floors, ceilings, moldings or other surfaces in asbestos-contaminated environments with a dry brush or sweep with a dry broom;
- *Not* to use an ordinary vacuum to clean up asbestos-containing debris;
- *Not* to remove ceiling tiles below asbestos-containing materials without wearing the proper respiratory protection, clearing the area of other people, and observing asbestos removal waste disposal procedures;
- *Not* to remove ventilation system filters dry; and
- *Not* to shake ventilation system filters.

Appendix H to § 1926.58—Substance Technical Information for Asbestos, Non-Mandatory

I. Substance Identification

A. Substance: "Asbestos" is the name of a class of magnesium-silicate minerals that occur in fibrous form. Minerals that are included in this group are chrysotile, crocidolite, amosite, anthophyllite asbestos, tremolite asbestos, and actinolite asbestos.

B. Asbestos, tremolite, anthophyllite, and actinolite are used in the manufacture of heat-resistant clothing, automotive brake and clutch linings, and a variety of building materials including floor tiles, roofing felts, ceiling tiles, asbestos-cement pipe and sheet, and fire-resistant drywall. Asbestos, tremolite, anthophyllite and actinolite are also present in pipe and boiler insulation materials, and in sprayed-on materials located on beams, in crawlspaces, and between walls.

C. The potential for an asbestos-containing product to release breathable fibers depends on its degree of friability. Friable means that the material can be crumbled with hand pressure and is therefore likely to emit fibers. The fibrous or fluffy sprayed-on materials used for fireproofing, insulation, or sound proofing are considered to be friable, and they readily release airborne fibers if disturbed. Materials such as vinyl-asbestos floor tile or roofing felts are considered nonfriable and generally do not emit airborne fibers unless subjected to sanding or sawing operations. Asbestos-cement pipe or sheet can emit airborne fibers if the materials are cut or sawed, or if they are broken during demolition operations.

D. Permissible exposure: Exposure to airborne asbestos, tremolite, anthophyllite, and actinolite fibers may not exceed 0.2 fibers per cubic centimeter of air (0.2 f/cc) averaged over the 8-hour workday.

II. Health Hazard Data

A. Asbestos, tremolite, anthophyllite, and actinolite can cause disabling respiratory disease and various types of cancers if the fibers are inhaled. Inhaling or ingesting fibers from contaminated clothing or skin can also result in these diseases. The symptoms of these diseases generally do not appear for 20 or more years after initial exposure.

B. Exposure to asbestos, tremolite, anthophyllite and actinolite has been shown to cause lung cancer, mesothelioma, and cancer of the stomach and colon. Mesothelioma is a rare cancer of the thin membrane lining of the chest and abdomen. Symptoms of mesothelioma include shortness of breath, pain in the walls of the chest, and/or abdominal pain.

III. Respirators and Protective Clothing

A. Respirators: You are required to wear a respirator when performing tasks that result in asbestos, tremolite, anthophyllite and actinolite exposure that exceeds the permissible exposure limit (PEL) of 0.2 f/cc. These conditions can occur while your employer is in the process of installing engineering controls to reduce asbestos, tremolite, anthophyllite and actinolite exposure, or where engineering controls are not feasible to reduce asbestos, tremolite, anthophyllite and actinolite exposure. Air-purifying respirators equipped with a high-efficiency particulate air (HEPA) filter can be used where airborne asbestos, tremolite, anthophyllite and actinolite fiber concentrations do not exceed 2 f/cc; otherwise, air-supplied, positive-pressure, full facepiece respirators must be used. Disposable respirators or dust masks are not permitted to be used for asbestos, tremolite, anthophyllite and actinolite work. For effective protection, respirators must fit your face and head snugly. Your employer is required to conduct fit tests when you are first assigned a respirator and every 6 months thereafter. Respirators should not be loosened or removed in work situations where their use is required.

B. Protective Clothing: You are required to wear protective clothing in work areas where asbestos, tremolite, anthophyllite, and actinolite fiber concentrations exceed the permissible exposure limit (PEL) of 0.2 f/cc to prevent contamination of the skin. Where protective clothing is required, your employer must provide you with clean garments. Unless you are working on a large asbestos, tremolite, anthophyllite, and actinolite removal or demolition project, your employer must also provide a change room and separate lockers for your street clothes and contaminated work clothes. If you are working on a large asbestos, tremolite, anthophyllite, and actinolite removal or demolition project, and where it is feasible to do so, your employer must provide a clean room, shower, and decontamination room contiguous to the work area. When leaving the work area, you must remove contaminated clothing before proceeding to the shower. If the shower is not adjacent to the work area, you must vacuum your clothing before proceeding to change the room and shower. To prevent inhaling fibers in contaminated change rooms and showers, leave your respirator on until you have the shower and enter the clean changeroom.

[Sec. 1926.58, Appendix H]

IV. Disposal Procedures and Cleanup

A. Wastes that are generated by processes where asbestos, tremolite, anthophyllite, and actinolite is present include:

1. Empty asbestos, tremolite, anthophyllite, and actinolite shipping containers.

2. Process wastes such as cuttings, trimmings, or reject materials.

3. Housekeeping waste from sweeping or vacuuming.

4. Asbestos fireproofing or insulating material that is removed from buildings.

5. Asbestos-containing building products removed during building renovation or demolition.

6. Contaminated disposable protective clothing.

B. Empty shipping bags can be flattened under exhaust hoods and packed into airtight containers for disposal. Empty shipping drums are difficult to clean and should be sealed.

C. Vacuum logs or disposable paper filters should not be cleaned, but should be sprayed with a fine water mist and placed into a labeled waste container.

D. Process waste and housekeeping waste should be wetted with water or a mixture of water and surfactant prior to packaging in disposable containers.

E. Asbestos-containing material that is removed from buildings must be disposed of in leak-tight 6-mil thick plastic bags, plastic-lined cardboard containers, or plastic-lined metal containers. These wastes, which are removed while wet, should be sealed in containers before they dry out to minimize the release of asbestos, tremolite, anthophyllite, and actinolite fibers during handling.

V. Access to Information

A. Each year, your employer is required to inform you of the information contained in this standard and appendices for asbestos. In addition, your employer must instruct you in the proper work practices for handling asbestos-containing materials, and the correct use of protective equipment.

B. Your employer is required to determine whether you are being exposed to asbestos. You or your representative has the right to observe employee measurements and to record the results obtained. Your employer is required to inform you of your exposure, and, if you are exposed above the permissible limit, he or she is required to inform you of the actions that are being taken to reduce your exposure to within the permissible limit.

C. Your employer is required to keep records of your exposures and medical examinations. These exposure records must be kept for at least thirty [30] years. Medical records must be kept for the period of your employment plus thirty [30] years.

D. Your employer is required to release your exposure and medical records to your physician or designated representative upon your written request.

Appendix I to § 1926.58—Medical Surveillance Guidelines for Asbestos, Tremolite, Anthophyllite, and Actinolite, Non-Mandatory

I. Route of Entry

Inhalation ingestion.

II. Toxicology

Clinical evidence of the adverse effects associated with exposure to asbestos, tremolite, anthophyllite, and actinolite, is present in the form of several well-conducted epidemiological studies of occupationally exposed workers, family contacts of workers, and persons living near asbestos, tremolite, anthophyllite, and actinolite mines. These studies have shown a definite association between exposure to asbestos, tremolite, anthophyllite, and actinolite and an increased incidence of lung cancer, pleural and peritoneal mesothelioma, gastrointestinal cancer, and asbestosis. The latter is a disabling fibrotic lung disease that is caused only by exposure to asbestos. Exposure to asbestos, tremolite, anthophyllite, and actinolite has also been associated with an increased incidence of esophageal, kidney, laryngeal, pharyngeal, and buccal cavity cancers. As with other known chronic occupational diseases, disease associated with asbestos, tremolite, anthophyllite, and actinolite generally appears about 20 years following the first occurrence of exposure. There are no known acute effects associated with exposure to asbestos, tremolite, anthophyllite, and actinolite.

Epidemiological studies indicate that the risk of lung cancer among exposed workers who smoke cigarettes is greatly increased over the risk of lung cancer among non-exposed smokers or exposed nonsmokers. These studies suggest that cessation of smoking will reduce the risk of lung cancer for a person exposed to asbestos, tremolite, anthophyllite, and actinolite but will not reduce it to the same level of risk as that existing for an exposed worker who has never smoked.

III. Signs and Symptoms of Exposure-Related Disease

The signs and symptoms of lung cancer or gastrointestinal cancer induced by exposure to asbestos, tremolite, anthophyllite, and actinolite are not unique, except that a chest X-ray of an exposed patient with lung cancer may show pleural plaques, pleural calcification, or pleural fibrosis. Symptoms characteristic of mesothelioma include shortness of breath, pain in the walls of the chest, or abdominal pain. Mesothelioma has a much longer latency period compared with lung cancer (40 years versus 15–20 years), and mesothelioma is therefore more likely to be found among workers who were first exposed to asbestos at an early age. Mesothelioma is always fatal.

Asbestosis is pulmonary fibrosis caused by the accumulation of asbestos fibers in the lungs. Symptoms include shortness of breath, coughing, fatigue, and vague feelings of sickness. When the fibrosis worsens, shortness of breath occurs even at rest. The diagnosis of asbestosis is based on a history of exposure to asbestos, the presence of characteristics radiologic changes, end-inspiratory crackles (rales), and other clinical features of fibrosing lung disease. Pleural plaques and thickening are observed on X-rays taken during the early stages of the disease. Asbestosis is often a progressive disease even in the absence of continued exposure, although this appears to be a highly individualized characteristic. In severe cases, death may be caused by respiratory or cardiac failure.

IV. Surveillance and Preventive Considerations

As noted above, exposure to asbestos, tremolite, anthophyllite, and actinolite has been linked to an increased risk of lung cancer, mesothelioma, gastrointestinal cancer, and asbestosis among occupationally exposed workers. Adequate screening tests to determine an employee's potential for developing serious chronic diseases, such as a cancer, from exposure to asbestos, tremolite, anthophyllite, and actinolite do not presently exist. However, some tests, particularly chest X-rays and pulmonary function tests, may indicate that an employee has been overexposed to asbestos, tremolite, anthophyllite, and actinolite, increasing his or her risk of developing exposure related chronic diseases. It is important for the physician to become familiar with the operating conditions in which occupational exposure to asbestos, tremolite, anthophyllite, and actinolite is likely to occur. This is particularly important in evaluating medical and work histories and in conducting physical examinations. When an active employee has been identified as having been overexposed to asbestos, tremolite, anthophyllite, and actinolite, measures taken by the employer to eliminate or mitigate further exposure should also lower the risk of serious long-term consequences.

The employer is required to institute a medical surveillance program for all employees who are or will be exposed to asbestos, tremolite, anthophyllite, and actinolite at or above the action level (0.1 fiber per cubic centimeter of air) for 30 or more days per year and for all employees who are assigned to wear a negative-pressure respirator. All examinations and procedures must be performed by or under the supervision of a licensed physician, at a reasonable time and place, and at no cost to the employee.

Although broad latitude is given to the physician in prescribing specific tests to be included in the medical surveillance program, OSHA requires inclusion of the following elements in the routine examination:

(i) Medical and work histories with special emphasis directed to symptoms of the respiratory system, cardiovascular system, and digestive tract.

(ii) Completion of the respiratory disease questionnaire contained in Appendix D.

(iii) A physical examination including a chest roentgenogram and pulmonary function test that includes measurement of the employee's forced vital capacity (FVC) and forced expiratory volume at one second (FEV_{1}).

(iv) Any laboratory or other test that the examining physician deems by sound medical practice to be necessary.

The employer is required to make the prescribed tests available at least annually to those employees covered; more often than specified if recommended by the examining physician; and upon termination of employment.

[Sec. 1926.58, Appendix I]

The employer is required to provide the physician with the following information: A copy of this standard and appendices; a description of the employee's duties as they relate to asbestos exposure; the employee's representative level of exposure to asbestos, tremolite, anthophyllite, and actinolite; a description of any personal protective and respiratory equipment used; and information from previous medical examinations of the affected employee that is not otherwise available to the physician. Making this information available to the physician will aid in the evaluation of the employee's health in relation to assigned duties and fitness to wear personal protective equipment, if required.

The employer is required to obtain a written opinion from the examining physician containing the results of the medical examination; the physician's opinion as to whether the employee has any detected medical conditions that would place the employee at an increased risk of exposure-related disease; any recommended limitations on the employee or on the use of personal protective equipment; and a statement that the employee has been informed by the physician of the results of the medical examination and of any medical conditions related to asbestos, tremolite, anthophyllite, and actinolite exposure that require further explanation or treatment. This written opinion must not reveal specific findings or diagnoses unrelated to exposure to asbestos, tremolite, anthophyllite, and actinolite, and a copy of the opinion must be provided to the affected employee.

Subpart E—Personal Protective and Life Saving Equipment [1]

Sec.

1926.100 Head protection.
1926.101 Hearing protection.
1926.102 Eye and face protection.
1926.103 Respiratory protection.
1910.94 Ventilation.
1910.134 Respiratory protection.
1926.104 Safety belts, lifelines, and lanyards.
1926.105 Safety nets.
1926.106 Working over or near water.
1926.107 Definitions applicable to this subpart.

[1] Portions of the listed Part 1910 standards have been identified as applicable to construction.

§ 1926.100 Head protection.

(a) Employees working in areas where there is a possible danger of head injury from impact, or from falling or flying objects, or from electrical shock and burns, shall be protected by protective helmets.

(b) Helmets for the protection of employees against impact and penetration of falling and flying objects shall meet the specifications contained in American National Standards Institute, Z89.1-1969, Safety Requirements for Industrial Head Protection.

(c) Helmets for the head protection of employees exposed to high voltage electrical shock and burns shall meet the specifications contained in American National Standards Institute, Z89.2-1971.

§ 1926.101 Hearing protection.

(a) Wherever it is not feasible to reduce the noise levels or duration of exposures to those specified in Table D-2, Permissible Noise Exposures, in

§1910.1001 ASBESTOS, TREMOLITE, ANTHOPHYLLITE, AND ACTINOLITE.
[Sec. 1910.1001 revised by 51 FR 22733, June 20, 1986]

(a) *Scope and application.* (1) This section applies to all occupational exposures to asbestos, tremolite, anthophyllite, and actinolite, in all industries covered by the Occupational Safety and Health Act, except as provided in paragraph (a)(2) of this section.

(2) This section does not apply to construction work as defined in 29 CFR 1910.12(b). [Exposure to asbestos, tremolite, anthophyllite, and actinolite in construction work is covered by 29 CFR 1926.58.]

(b) *Definitions.* "Action level" means an airborne concentration of asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals, of 0.1 fiber per cubic centimeter (f/cc) of air calculated as an eight (8)—hour time-weighted average.

"Asbestos" includes chrysotile, amosite, crocidolite, tremolite asbestos, anthophyllite asbestos, actinolite asbestos, and any of these minerals that have been chemically treated and/or altered.

"Assistant Secretary" means the Assistant Secretary of Labor for Occupational Safety and Health, U.S. Department of Labor, or designee.

"Authorized person" means any person authorized by the employer and required by work duties to be present in regulated areas.

"Director" means the Director of the National Institute for Occupational Safety and Health, U.S. Department of Health and Human Services, or designee.

"Employee exposure" means that exposure to airborne asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals that would occur if the employee were not using respiratory protective equipment.

"Fiber" means a particulate form of asbestos, tremolite, anthophyllite, or actinolite, 5 micrometers or longer, with a length-to-diameter ratio of at lease 3 to 1.

"High-efficiency particulate air (HEPA) filter" means a filter capable of trapping and retaining at least 99.97 percent of 0.3 micrometer diameter mono-disperse particles.

"Regulated area" means an area established by the employer to demarcate areas where airborne concentrations of asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals exceed, or can reasonably be expected to exceed, the permissible exposure limit.

"Tremolite, anthophyllite, or actinolite" means the non-asbestos form of these minerals, and any of these minerals that have been chemically treated and/or altered.

(c) *Permissible exposure limit (PEL).* The employer shall ensure that no employee is exposed to an airborne concentration of asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals in excess of 0.2 fiber per cubic centimeter of air as an eight (8)-hour time-weighted average (TWA) as determined by the method prescribed in Appendix A of this section, or by an equivalent method

(d) *Exposure monitoring.*—(1) *General.* (i) Determinations of employee exposure shall be made from breathing zone air samples that are representative of the 8-hour TWA of each employee.

(ii) Representative 8-hour TWA employee exposures shall be determined on the basis of one or more samples representing full-shift exposures for each shift for each employee in each job classification in each work area.

(2) *Initial monitoring.* (i) Each employer who has a workplace or work operation covered by this standard, except as provided for in paragraphs (d)(2)(ii) and (d)(2)(iii) of this section, shall perform initial monitoring of employees who are, or may reasonably be expected to be exposed to airborne concentrations at or above the action level.

(ii) Where the employer has monitored after December 20, 1985, and the monitoring satisfies all other requirements of this section, the employer may rely on such earlier monitoring results to satisfy the requirements of paragraph (d)(2)(i) of this section.

(iii) Where the employer has relied upon objective data that demonstrates that asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals is not capable of being released in airborne concentrations at or above the action level under the expected conditions of processing, use, or handling, then no initial monitoring is required.

(3) *Monitoring frequency (periodic monitoring) and patterns.* After the initial determinations required by paragraph (d)(2)(i) of this section, 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 six months for employees whose exposures may reasonably be foreseen to exceed the action level.

(4) *Changes in monitoring frequency.* If either the initial or the periodic monitoring required by paragraphs (d)(2) and (d)(3) of this section statistically indicates that employee exposures are below the action level, the employer may discontinue the monitoring for those employees whose exposures are represented by such monitoring.

(5) *Additional monitoring.* Notwithstanding the provisions of paragraphs (d)(2)(ii) and (d)(4) of this section, the employer shall institute the exposure monitoring required under paragraphs (d)(2)(i) and (d)(3) of this section whenever there has been a change in the production, process, control equipment, personnel or work practices that may result in new or additional exposures above the action level or when the employer has any reason to suspect that a change may result in new or additional exposures above the action level.

(6) *Method of monitoring.* (i) All samples taken to satisfy the monitoring requirements of paragraph (d) shall be personal samples collected following the procedures specified in Appendix A.

(ii) All samples taken to satisfy the monitoring requirements of paragraph (d) shall be evaluated using the OSHA Reference Method (ORM) specified in Appendix A of this section, or an equivalent counting method.

(iii) If an equivalent method to the ORM is used, the employer shall ensure that the method meets the following criteria:

[Sec. 1910.1001(d)(6)(iii)]

(A) Replicate exposure data used to establish equivalency are collected in side-by-side field and laboratory comparisons; and

(B) The comparison indicates that 90% of the samples collected in the range 0.5 to 2.0 times the permissible limit have an accuracy range of plus or minus 25 percent of the ORM results with a 95% confidence level as demonstrated by a statistically valid protocol; and

(C) The equivalent method is documented and the results of the comparison testing are maintained.

(iv) To satisfy the monitoring requirements of paragraph (d) of this section, employers must use the results of monitoring analysis performed by laboratories which have instituted quality assurance programs that include the elements as prescribed in Appendix A.

(7) *Employee notification of monitoring results.* (i) The employer shall, within 15 working days after the receipt of the results of any monitoring performed under the standard, notify the affected employees of these results in writing either individually or by posting of results in an appropriate location that is accessible to affected employees.

(ii) The written notification required by paragraph (d)(7)(i) of this section shall contain the corrective action being taken by the employer to reduce employee exposure to or below the PEL, wherever monitoring results indicated that the PEL had been exceeded.

(e) *Regulated Areas.*—(1) *Establishment.* The employer shall establish regulated areas wherever airborne concentrations of asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals are in excess of the permissible exposure limit prescribed in paragraph (c) of this section.

(2) *Demarcation.* Regulated areas shall be demarcated from the rest of the workplace in any manner that minimizes the number of persons who will be exposed to asbestos, tremolite, anthophyllite, or actinolite.

(3) *Access.* Access to regulated areas shall be limited to authorized persons or to persons authorized by the Act or regulations issued pursuant thereto.

(4) *Provision of respirators.* Each person entering a regulated area shall be supplied with and required to use a respirator, selected in accordance with paragraph (g)(2) of this section.

(5) *Prohibited activities.* The employer shall ensure that employees do not eat, drink, smoke, chew tobacco or gum, or apply cosmetics in the regulated areas.

(f) *Methods of compliance.*—(1) *Engineering controls and work practices.* (i) The employer shall institute engineering controls and work practices to reduce and maintain employee exposure to or below the exposure limit prescribed in paragraph (c) of this section, except to the extent that such controls are not feasible.

(ii) Wherever the feasible engineering controls and work practices that can be instituted are not sufficient to reduce employee exposure to or below the permissible exposure limit prescribed in paragraph (c) of this section, the employer shall use them to reduce employee exposure to the lowest levels achievable by these controls and shall supplement them by the use of respiratory protection that complies with the requirements of paragraph (g) of this section.

(iii) For the following operations, wherever feasible engineering controls and work practices that can be instituted are not sufficient to reduce the employee exposure to or below the permissible exposure limit prescribed in paragraph (c) of this section, the employer shall use them to reduce employee exposure to or below 0.5 fiber per cubic centimeter of air (as an eight-hour time-weighted average) and shall supplement them by the use of any combination of respiratory protection that complies with the requirements of paragraph (g) of this section, work practices and feasible engineering controls that will reduce employee exposure to or below the permissible exposure limit prescribed in paragraph (c) of this section: Coupling cutoff in primary asbestos cement pipe manufacturing; sanding in primary and secondary asbestos cement sheet manufacturing; grinding in primary and secondary friction product manufacturing; carding and spinning in dry textile processes; and grinding and sanding in primary plastics manufacturing.

(iv) Local exhaust ventilation. Local exhaust ventilation and dust collection systems shall be designed, constructed, installed, and maintained in accordance with good practices such as those found in the American National Standard Fundamentals Governing the Design and Operation of Local Exhaust Systems, ANSI Z9.2–1979.

(v) Particular tools. All hand-operated and power-operated tools which would produce or release fibers of asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals so as to expose employees to levels in excess of the exposure limit prescribed in paragraph (c) of this section, such as, but not limited to, saws, scorers, abrasive wheels, and drills, shall be provided with local exhaust ventilation systems which comply with paragraph (f)(1)(iv) of this section.

(vi) Wet methods. Insofar as practicable, asbestos, tremolite, anthophyllite, or actinolite shall be handled, mixed, applied, removed, cut, scored, or otherwise worked in a wet state sufficient to prevent the emission of airborne fibers so as to expose employees to levels in excess of the exposure limit prescribed in paragraph (c) of this section, unless the usefulness of the product would be diminished thereby.

(vii) Materials containing asbestos, tremolite, anthophyllite, or actinolite shall not be applied by spray methods.

(viii) Particular products and operations. No asbestos cement, mortar, coating, grout, plaster, or similar material containing asbestos, tremolite, anthophyllite, or actinolite 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 fibers of asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals so as to expose employees to levels in excess of the limit prescribed in paragraph (c) of this section.

(ix) Compressed air. Compressed air shall not be used to remove asbestos, tremolite, anthophyllite, or actinolite or materials containing asbestos, tremolite, anthophyllite, or actinolite, unless the compressed air is used in conjunction with a ventilation system designed to capture the dust cloud created by the compressed air.

[Sec. 1910.1001(f)(1)(ix)]

(2) *Compliance program.* (i) Where the PEL is exceeded, the employer shall establish and implement a written program to reduce employee exposure to or below the limit by means of engineering and work practice controls as required by paragraph (f)(1) of this section, and by the use of respiratory protection where required or permitted under this section.

(ii) Such programs shall be reviewed and updated as necessary to reflect significant changes in the status of the employer's compliance program.

(iii) Written programs shall be submitted upon request for examination and copying to the Assistant Secretary, the Director, affected employees and designated employee representatives.

(iv) The employer shall not use employee rotation as a means of compliance with the PEL.

(g) *Respiratory protection*—(1) *General.* The employer shall provide respirators, and ensure that they are used, where required by this section. Respirators shall be used in the following circumstances:

(i) During the interval necessary to install or implement feasible engineering and work practice controls;

(ii) In work operations, such as maintenance and repair activities, or other activities for which engineering and work practice controls are not feasible;

(iii) In work situations where feasible engineering and work practice controls are not yet sufficient to reduce exposure to or below the exposure limit; and

(iv) In emergencies.

(2) *Respirator selection.* (i) Where respirators are required under this section, the employer shall select and provide, at no cost to the employee, the appropriate respirator as specified in Table 1. The employer shall select respirators from among those jointly approved as being acceptable for protection by the Mine Safety and Health Administration (MSHA) and by the National Institute for Occupational Safety and Health (NIOSH) under the provisions of 30 CFR Part 11.

(ii) The employer shall provide a powered, air-purifying respirator in lieu of any negative pressure respirator specified in Table 1 whenever:

(A) An employee chooses to use this type of respirator; and

(B) This respirator will provide adequate protection to the employee.

TABLE 1.—RESPIRATORY PROTECTION FOR ASBESTOS, TREMOLITE, ANTHOPHYLLITE, AND ACTINOLITE FIBERS

Airborne concentration of asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals	Required respirator
Not in excess of 2 f/cc (10 X PEL).	1. Half-mask air-purifying respirator equipped with high-efficiency filters.
Not in excess of 10 f/cc (50 X PEL).	1. Full facepiece air-purifying respirator equipped with high-efficiency filters. 2. Any powered air-purifying respirator equipped with high-efficiency filters. 3. Any supplied-air respirator operated in continuous flow mode.
Not in excess of 200 f/cc (1000 X PEL).	1. Full facepiece supplied-air respirator operated in pressure demand mode.
Greater than 200 f/cc (> 1 000 X PEL) or unknown concentration.	1. Full facepiece supplied air respirator operated in pressure demand mode equipped with an auxiliary positive pressure self-contained breathing apparatus.

Note: a. Respirators assigned for higher environmental concentrations may be used at lower concentrations.

b. A high-efficiency filter means a filter that is at least 99.97 percent efficient against mono-dispersed particles of 0.3 micrometers or larger.

(3) *Respirator program.* (i) Where respiratory protection is required, the employer shall institute a respirator program in accordance with 29 CFR 1910.134(b), (d), (e), and (f).

(ii) The employer shall permit each employee who uses a filter respirator to change the filter elements whenever an increase in breathing resistance is detected and shall maintain an adequate supply of filter elements for this purpose.

(iii) Employees who wear respirators shall be permitted to leave the regulated area to wash their faces and respirator facepieces whenever necessary to prevent skin irritation associated with respirator use.

(iv) No employee shall be assigned to tasks requiring the use of respirators if, based upon his or her 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 the use of a respirator. Such employee shall be assigned to another job or given the opportunity to transfer to a different position whose duties he or she is able to perform with the same employer, in the same geographical area and with the same seniority, status, and rate of pay the employee had just prior to such transfer, if such a different position is available.

(4) *Respirator fit testing.* (i) The employer shall ensure that the respirator issued to the employee exhibits the least possible facepiece leakage and that the respirator is fitted properly.

(ii) For each employee wearing negative pressure respirators, employers shall perform either quantitative or qualitative face fit tests at the time of initial fitting and at least every six months thereafter. The qualitative fit tests may be used only for testing the fit of half-mask respirators where they are permitted to be worn, and shall be conducted in accordance with Appendix C. The tests shall be used to select facepieces that provide the required protection as prescribed in Table 1.

(h) *Protective work clothing and equipment*—(1) *Provision and use.* If an employee is exposed to asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals above the PEL, or where the possibility of eye irritation exists, the employer shall provide at no cost to the employee and ensure that the employee uses appropriate protective work clothing and equipment such as, but not limited to:

(i) Coveralls or similar full-body work clothing;

(ii) Gloves, head coverings, and foot coverings; and

(iii) Face shields, vented goggles, or other appropriate protective equipment which complies with § 1910.133 of this Part.

(2) *Removal and storage.* (i) The employer shall ensure that employees remove work clothing contaminated with asbestos, tremolite, anthophyllite, or actinolite only in change rooms provided in accordance with paragraph (i)(1) of this section.

(ii) The employer shall ensure that no employee takes contaminated work clothing out of the change room, except those employees authorized to do so for the purpose of laundering, maintenance, or disposal.

(iii) Contaminated work clothing shall be placed and stored in closed containers which prevent dispersion of the asbestos, tremolite, anthophyllite, and actinolite outside the container.

(iv) Containers of contaminated protective devices or work clothing

[Sec. 1910.1001(h)(2)(iv)]

which are to be taken out of change rooms or the workplace for cleaning, maintenance or disposal, shall bear labels in accordance with paragraph (j)(2) of this section.

(3) *Cleaning and replacement.* (i) The employer shall clean, launder, repair, or replace protective clothing and equipment required by this paragraph to maintain their effectiveness. The employer shall provide clean protective clothing and equipment at least weekly to each affected employee.

(ii) The employer shall prohibit the removal of asbestos, tremolite, anthophyllite, and actinolite from protective clothing and equipment by blowing or shaking.

(iii) Laundering of contaminated clothing shall be done so as to prevent the release of airborne fibers of asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals in excess of the permissible exposure limit prescribed in paragraph (c) of this section.

(iv) Any employer who gives contaminated clothing to another person for laundering shall inform such person of the requirement in paragraph (h)(3)(iii) of this section to effectively prevent the release of airborne fibers of asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals in excess of the permissible exposure limit.

(v) The employer shall inform any person who launders or cleans protective clothing or equipment contaminated with asbestos, tremolite, anthophyllite, or actinolite, of the potentially harmful effects of exposure to asbestos, tremolite, anthophyllite, or actinolite.

(vi) Contaminated clothing shall be transported in sealed impermeable bags, or other closed, impermeable containers, and labeled in accordance with paragraph (j) of this seciton.

(i) *Hygiene facilities and practices*—(1) *Change rooms.* (i) The employer shall provide clean change rooms for employees who work in areas where their airborne exposure to asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals is above the permissible exposure limit.

(ii) The employer shall ensure that change rooms are in accordance with § 1910.141(e) of this part, and are equipped with two separate lockers or storage facilities, so separated as to prevent contamination of the employee's street clothes from his protective work clothing and equipment.

(2) *Showers.* (i) The employer shall ensure that employees who work in areas where their airborne exposure is above the permissible exposure limit shower at the end of the work shift.

(ii) The employer shall provide shower facilities which comply with § 1910.141(d)(3) of this part.

(iii) The employer shall ensure that employees who are required to shower pursuant to paragraph (i)(2)(i) of this section do not leave the workplace wearing any clothing or equipment worn during the work shift.

(3) *Lunchrooms.* (i) The employer shall provide lunchroom facilities for employees who work in areas where their airborne exposure is above the permissible exposure limit.

(ii) The employer shall ensure that lunchroom facilities have a positive pressure, filtered air supply, and are readily accessible to employees.

(iii) The employer shall ensure that employees who work in areas where their airborne exposure is above the permissible exposure limit wash their hands and faces prior to eating, drinking or smoking.

(iv) The employer shall ensure that employees do not enter lunchroom facilities with protective work clothing or equipment unless surface asbestos, tremolite, anthophyllite, and actinolite fibers have been removed from the clothing or equipment by vaccuming or other method that removes dust without causing the asbestos, tremolite, anthophyllite, or actinolite to become airborne.

(j) *Communication of hazards to employees*—(1) *Warning signs.* (i) Posting. Warning signs shall be provided and displayed at each regulated area. In addition, warning signs shall be posted at all approaches to regulated areas so that an employee may read the signs and take necessary protective steps before entering the area.

(ii) Sign specifications. The warning signs required by paragraph (j)(1)(i) of this section shall bear the following information:

DANGER
ASBESTOS
CANCER AND LUNG DISEASE
HAZARD
AUTHORIZED PERSONNEL ONLY
RESPIRATORS AND PROTECTIVE
CLOTHING
ARE REQUIRED IN THIS AREA

(iii) Where minerals in the regulated area are only tremolite, anthophyllite or actinolite, the employer may replace the term "asbestos" with the appropriate mineral name.

(2) *Warning labels.* (i) Labeling. Warning labels shall be affixed to all raw materials, mixtures, scrap, waste, debris, and other products containing asbestos, tremolite, anthophyllite, or actinolite fibers, or to their containers.

(ii) Label specifications. The labels shall comply with the requirements of 29 CFR 1910.1200(f) of OSHA's Hazard Communication standard, and shall include the following information:

DANGER
CONTAINS ASBESTOS FIBERS
AVOID CREATING DUST
CANCER AND LUNG DISEASE
HAZARD

(iii) Where minerals to be labeled are only tremolite, anthophyllite, or actinolite, the employer may replace the term "asbestos" with the appropriate mineral name.

(3) *Material safety data sheets.* Employers who are manufacturers or importers of asbestos, tremolite, anthophyllite, or actinolite or asbestos, tremolite, anthophyllite, or actionlite products shall comply with the requirements regarding development of material safety data sheets as specified in 29 CFR 1910.1200(g) of OSHA's Hazard Communication standard, except as provided by paragraph (j)(4) of this section.

(4) The provisions for labels required by paragraph (j)(2) or for material safety data sheets required by paragraph (j)(3) do not apply where:

(i) Asbestos, tremolite, anthophyllite, or actinolite fibers have been modified by a bonding agent, coating, binder, or other material provided that the manufacturer can demonstrate that during any reasonably foreseeable use,

[Sec. 1910.1001(j)(4)(i)]

handling, storage, disposal, processing, or transportation, no airborne concentrations of fibers of asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals in excess of the action level will be released or

(ii) Asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals is present in a product in concentrations less than 0.1%.

(5) *Employee information and training.* (i) The employer shall institute a training program for all employees who are exposed to airborne concentrations of asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals at or above the action level ensure their participation in the program.

(ii) Training shall be provided prior to or at the time of initial assignment and at least annually thereafter.

(iii) The training program shall be conducted in a manner which the employee is able to understand. The employer shall ensure that each employee is informed of the following:

(A) The health effect associated with asbestos, tremolite, anthophyllite, or actinolite exposure;

(B) The relationship between smoking and exposure to asbestos, tremolite, anthophyllite, and actinolite in producing lung cancer;

(C) The quantity, location, manner of use, release, and storage of asbestos, tremolite, anthophyllite, or actinolite, and the specific nature of operations which could result in exposure to asbestos, tremolite, anthophyllite,or actinolite;

(D) The engineering controls and work practices associated with the employee's job assignment;

(E) The specific procedures implemented to protect employees from exposure to asbestos, tremolite, anthophyllite, or actinolite, such as appropriate work practices, emergency and clean-up procedures, and personal protective equipment to be used;

(F) The purpose, proper use, and limitations of respirators and protective clothing;

(G) The purpose and a description of the medical surveillance program required by paragraph (1) of this section;

(H) A review of this standard, including appendices.

(iv) Access to information and training materials.

(A) The employer shall make a copy of this standard and its appendices readily available without cost to all affected employees.

(B) The employer shall provide, upon request, all materials relating to the employee information and training program to the Assistant Secretary and the training program to the Assistant Secretary and the Director.

(k) *Housekeeping.* (1) All surfaces shall be maintained as free as practicable of accumulations of dusts and waste containing asbestos, tremolite, anthophyllite, or actinolite.

(2) All spills and sudden releases of material containing asbestos, tremolite, anthophyllite, or actinolite shall be cleaned up as soon as possible.

(3) Surfaces contaminated with asbestos, tremolite, anthophyllite, or actinolite may not be cleaned by the use of compressed air.

(4) Vacuuming. HEPA-filtered vacuuming equipment shall be used for vacuuming. The equipment shall be used and emptied in a manner which minimizes the reentry of asbestos, tremolite, anthophyllite, or actinolite into the workplace.

(5) Shoveling, dry sweeping and dry clean-up of asbestos, tremolite, anthophyllite, or actinolite may be used only where vacuuming and/or wet cleaning are not feasible.

(6) Waste disposal. Waste, scrap, debris, bags, containers, equipment, and clothing contaminated with asbestos, tremolite, anthophyllite, or actinolite consigned for disposal, shall be collected and disposed of in sealed impermeable bags, or other closed, impermeable containers.

(l) *Medical surveillance*—(1) *General.—(i) Employees covered.* The employer shall institute a medical surveillance program for all employees who are or will be exposed to airborne concentrations of fibers of asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals at or above the action level.

(ii) *Examination by a physician.* (A) The employer shall ensure that all medical examinations and procedures are performed by or under the supervision of a licensed physician, and shall be provided without cost to the employee and at a reasonable time and place.

(B) Persons other than licensed physicians, who administer the pulmonary function testing required by this section, shall complete a training course in spirometry sponsored by an appropriate academic or professional institution.

(2) *Preplacement examinations.* (i) Before an employee is assigned to an occupation exposed to airborne concentrations of asbestos, tremolite, anthophyllite, or actinolite fibers, a preplacement medical examination shall be provided or made available by the employer.

(ii) Such examination shall include, as a minimum, a medical and work history; A complete physical examination of all systems with emphasis on the respiratory system, the cardiovascular system and digestive tract; completion of the respiratory disease standardized questionnaire in Appendix D, Part 1; a chest roentgenogram (posterior-anterior 14x17 inches); pulmonary function tests to include forced vital capacity (FVC) and forced expiratory volume at 1 second ($FEV_{1.0}$); and any additional tests deemed appropriate by the examining physician. Interpretation and classification of chest roentgenograms shall be conducted in accordance with Appendix E.

(3) *Periodic examinations.* (i) Periodic medical examinations shall be made available annually.

(ii) The scope of the medical examination shall be in conformance with the protocol established in paragraph (1)(2)(ii), except that the frequency of chest roentgenograms shall be conducted in accordance with Table 2, and the abbreviated standardized questionnaire contained in Appendix D, Part 2, shall be administered to the employee

[Sec. 1910.1001(l)(3)(ii)]

TABLE 2.—FREQUENCY OF CHEST ROENTGENOGRAMS

Years since first exposure	Age of employee		
	15 to 35	35+ to 45	45+
0 to 10	Every 5 years	Every 5 years	Every 5 years.
10+	Every 5 years	Every 2 years	Every 1 year.

(4) *Termination of employment examinations.* (i) The employer shall provide, or make available, a termination of employment medical examination for any employee who has been exposed to airborne concentrations of fibers of asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals at or above the action level.

(ii) The medical examination shall be in accordance with the requirements of the periodic examinations stipulated in paragraph (l)(3) of this section, and shall be given within 30 calendar days before or after the date of termination of employment.

(5) *Recent examinations.* No medical examination is required of any employee, if adequate records show that the employee has been examined in accordance with any of the preceding paragraphs [(l)(2)–(l)(4)] within the past 1 year period.

(6) *Information provided to the physician.* The employer shall provide the following information to the examining physician:

(i) A copy of this standard and Appendices D and E.

(ii) A description of the affected employee's duties as they relate to the employee's exposure.

(iii) The employee's representative exposure level or anticipated exposure level.

(iv) A description of any personal protective and respiratory equipment used or to be used.

(v) Information from previous medical examinations of the affected employee that is not otherwise available to the examining physician.

(7) *Physician's written opinion.* (i) The employer shall obtain a written signed opinion from the examining physician. This written opinion shall contain the results of the medical examination and shall include:

(A) The physician's opinion as to whether the employee has any detected medical conditions that would place the employee at an increased risk of material health impairment from exposure to asbestos, tremolite, anthophyllite, or actinolite;

(B) Any recommended limitations on the employee or upon the use of personal protective equipment such as clothing or respirators; and

(C) A statement that the employee has been informed by the physician of the results of the medical examination and of any medical conditions resulting from asbestos, tremolite, anthophyllite, or actinolite exposure that require further explanation or treatment.

(ii) The employer shall instruct the physician not to reveal in the written opinion given to the employer specific findings or diagnoses unrelated to occupational exposure to asbestos, tremolite, anthophyllite, or actinolite.

(iii) The employer shall provide a copy of the physician's written opinion to the affected employee within 30 days from its receipt.

(m) *Recordkeeping.*—(1) *Exposure measurements.* (i) The employer shall keep an accurate record of all measurements taken to monitor employee exposure to asbestos, tremolite, anthophyllite, or actinolite as prescribed in paragraph (d) of this section.

(ii) This record shall include at least the following information:

(A) The date of measurement;

(B) The operation involving exposure to asbestos, tremolite, anthophyllite, or actinolite which is being monitored;

(C) Sampling and analytical methods used and evidence of their accuracy;

(D) Number, duration, and results of samples taken;

(E) Type of respiratory protective devices worn, if any; and

(F) Name, social security number and exposure of the employees whose exposure are represented.

(iii) The employer shall maintain this record for at least thirty (30) years, in accordance with 29 CFR 1910.20.

(2) *Objective data for exempted operations.* (i) Where the processing, use, or handling of products made from or containing asbestos, tremolite, anthophyllite, or actinolite is exempted from other requirements of this section under paragraph (d)(2)(iii) of this section, the employer shall establish and maintain an accurate record of objective data reasonably relied upon in support of the exemption.

(ii) The record shall include at least the following:

(A) The product qualifying for exemption;

(B) The source of the objective data;

(C) The testing protocol, results of testing, and/or analysis of the material for the release of asbestos, tremolite, anthophyllite, or actinolite;

(D) A description of the operation exempted and how the data support the exemption; and

(E) Other data relevant to the operations, materials, processing, or employee exposures covered by the exemption.

(iii) The employer shall maintain this record for the duration of the employer's reliance upon such objective data.

Note.—The employer may utilize the services of competent organizations such as industry trade associations and employee associations to maintain the records required by this section.

(3) *Medical surveillance.* (i) The employer shall establish and maintain an accurate record for each employee subject to medical surveillance by paragraph (l)(1)(i) of this section, in accordance with 29 CFR 1910.20.

(ii) The record shall include at least the following information:

(A) The name and social security number of the employee;

(B) Physician's written opinions;

(C) Any employee medical complaints related to exposure to asbestos, tremolite, anthophyllite, or actinolite; and

(D) A copy of the information provided to the physician as required by paragraph (l)(6) of this section.

(iii) The employer shall ensure that this record is maintained for the

[Sec. 1910.1001(m)(3)(iii)]

duration of employment plus thirty (30) years, in accordance with 29 CFR 1910.20.

(4) *Training.* The employer shall maintain all employee training records for one (1) year beyond the last date of employment of that employee.

(5) *Availability.* (i) The employer, upon written request, shall make all records required to be maintained by this section available to the Assistant Secretary and the Director for examination and copying.

(ii) The employer, upon request shall make any exposure records required by paragraph (m)(1) of this section available for examination and copying to affected employees, former employees, designated representatives and the Assistant Secretary, in accordance with 29 CFR 1910.20 (a)–(e) and (g)–(i).

(iii) The employer, upon request, shall make employee medical records required by paragraph (m)(2) of this section available for examination and copying to the subject employee, to anyone having the specific written consent of the subject employee, and the Assistant Secretary, in accordance with 29 CFR 1910.20.

(6) *Transfer of records.* (i) The employer shall comply with the requirements concerning transfer of records set forth in 29 CFR 1910.20(h).

(ii) Whenever the employer ceases to do business and there is no successor employer to receive and retain the records for the prescribed period, the employer shall notify the Director at least 90 days prior to disposal of records and, upon request, transmit them to the Director.

(n) *Observation of monitoring*—(1) *Employee observation.* The employer shall provide affected employees or their designated representatives an opportunity to observe any monitoring of employee exposure to asbestos, tremolite, anthophyllite, or actinolite conducted in accordance with paragraph (d) of this section.

(2) *Observation procedures.* When observation of the monitoring of employee exposure to asbestos, tremolite, anthophyllite, or actinolite requires entry into an area where the use of protective clothing or equipment is required, the observer shall be provided with and be required to use such clothing and equipment and shall comply with all other applicable safety and health procedures.

(o) *Dates*—(1) *Effective date.* This standard shall become effective July 21, 1986. The requirements of the asbestos standard issued in June 1972 (37 FR 11318), as amended, and published in 29 CFR 1910.1001 (1985) remain in effect until compliance is achieved with the parallel provisions of this standard.

(2) *Start-up dates.* All obligations of this standard commence on the effective date except as follows:

(i) *Exposure monitoring.* Initial monitoring required by paragraph (d)(2) of this section shall be completed as soon as possible but no later than October 20, 1986.

(ii) *Regulated areas.* Regulated areas required to be established by paragraph (e) of this section as a result of initial monitoring shall be set up as soon as possible after the results of that monitoring are known and not later than November 17, 1986.

(iii) *Respiratory protection.* Respiratory protection required by paragraph (g) of this section shall be provided as soon as possible but no later than the following schedule:

(A) Employees whose 8-hour TWA exposure exceeds 2 fibers/cc—July 21, 1986.

(B) Employees whose 8-hour TWA exposure exceeds the PEL but is less than 2 fibers/cc—November 17, 1986.

(C) Powered air-purifying respirators provided under paragraph (g)(2)(ii)—January 16, 1987.

(iv) *Hygiene and lunchroom facilities.* Construction plans for changerooms, showers, lavatories, and lunchroom facilities shall be completed no later than January 16, 1987; and these facilities shall be constructed and in use no later than July 20, 1987. However, if as part of the compliance plan it is predicted by an independent engineering firm that engineering controls and work practices will reduce exposures below the permissible exposure limit by July 20, 1986, for affected employees, then such facilities need not be completed until 1 year after the engineering controls are completed, if such controls have not in fact succeeded in reducing exposure to below the permissible exposure limit.

(v) *Employee information and training.* Employee information and training required by paragraph (j)(5) of this section shall be provided as soon as possible but no later than October 20, 1986.

(vi) *Medical surveillance.* Medical examinations required by paragraph (l) of this section shall be provided as soon as possible but no later than November 17, 1986.

(vii) *Compliance program.* Written compliance programs required by paragraph (f)(2) of this section as a result of initial monitoring shall be completed and available for inspection and copying as soon as possible but no later than July 20, 1987.

(viii) *Methods of compliance.* The engineering and work practice controls as required by paragraph (f)(1) shall be implemented as soon as possible but no later than July 20, 1986.

(p) *Appendices.* (1) Appendices A, C, D, and E to this section are incorporated as part of this section and the contents of these Appendices are mandatory

(2) Appendices B, F, G and H to this section are informational and are not intended to create any additional obligations not otherwise imposed or to detract from any existing obligations.

Appendix A to § 1910.1001—Osha Reference Method—Mandatory

This mandatory appendix specifies the procedure for analyzing air samples for asbestos, tremolite, anthophyllite, and actinolite and specifies quality control procedures that must be implemented by laboratories performing the analysis. The sampling and analytical methods described below represent the elements of the available monitoring methods (such as the NIOSH 7400 method) which OSHA considers to be essential to achieve adequate employee exposure monitoring while allowing employers to use methods that are already established within their organizations. All employers who are required to conduct air monitoring under paragraph (f) of the standard are required to utilize analytical laboratories that use this procedure, or an equivalent method, for collecting and analyzing samples.

Sampling and Analytical Procedure

1. The sampling medium for air samples shall be mixed cellulose ester filter membranes. These shall be designated by the manufacturer as suitable for asbestos, tremolite, anthophyllite, and actinolite counting. See below for rejection of blanks.

[Sec. 1910.1001, Appendix A]

duration of employment plus thirty (30) years, in accordance with 29 CFR 1910.20.

(4) *Training.* The employer shall maintain all employee training records for one (1) year beyond the last date of employment of that employee.

(5) *Availability.* (i) The employer, upon written request, shall make all records required to be maintained by this section available to the Assistant Secretary and the Director for examination and copying.

(ii) The employer, upon request shall make any exposure records required by paragraph (m)(1) of this section available for examination and copying to affected employees, former employees, designated representatives and the Assistant Secretary, in accordance with 29 CFR 1910.20 (a)–(e) and (g)–(i).

(iii) The employer, upon request, shall make employee medical records required by paragraph (m)(2) of this section available for examination and copying to the subject employee, to anyone having the specific written consent of the subject employee, and the Assistant Secretary, in accordance with 29 CFR 1910.20.

(6) *Transfer of records.* (i) The employer shall comply with the requirements concerning transfer of records set forth in 29 CFR 1910.20(h).

(ii) Whenever the employer ceases to do business and there is no successor employer to receive and retain the records for the prescribed period, the employer shall notify the Director at least 90 days prior to disposal of records and, upon request, transmit them to the Director.

(n) *Observation of monitoring*—(1) *Employee observation.* The employer shall provide affected employees or their designated representatives an opportunity to observe any monitoring of employee exposure to asbestos, tremolite, anthophyllite, or actinolite conducted in accordance with paragraph (d) of this section.

(2) *Observation procedures.* When observation of the monitoring of employee exposure to asbestos, tremolite, anthophyllite, or actinolite requires entry into an area where the use of protective clothing or equipment is required, the observer shall be provided with and be required to use such clothing and equipment and shall comply with all other applicable safety and health procedures.

(o) *Dates*—(1) *Effective date.* This standard shall become effective July 21, 1986. The requirements of the asbestos standard issued in June 1972 (37 FR 11318), as amended, and published in 29 CFR 1910.1001 (1985) remain in effect until compliance is achieved with the parallel provisions of this standard.

(2) *Start-up dates.* All obligations of this standard commence on the effective date except as follows:

(i) *Exposure monitoring.* Initial monitoring required by paragraph (d)(2) of this section shall be completed as soon as possible but no later than October 20, 1986.

(ii) *Regulated areas.* Regulated areas required to be established by paragraph (e) of this section as a result of initial monitoring shall be set up as soon as possible after the results of that monitoring are known and not later than November 17, 1986.

(iii) *Respiratory protection.* Respiratory protection required by paragraph (g) of this section shall be provided as soon as possible but no later than the following schedule:

(A) Employees whose 8-hour TWA exposure exceeds 2 fibers/cc—July 21, 1986.

(B) Employees whose 8-hour TWA exposure exceeds the PEL but is less than 2 fibers/cc—November 17, 1986.

(C) Powered air-purifying respirators provided under paragraph (g)(2)(ii)—January 16, 1987.

(iv) *Hygiene and lunchroom facilities.* Construction plans for changerooms, showers, lavatories, and lunchroom facilities shall be completed no later than January 16, 1987; and these facilities shall be constructed and in use no later than July 20, 1987. However, if as part of the compliance plan it is predicted by an independent engineering firm that engineering controls and work practices will reduce exposures below the permissible exposure limit by July 20, 1986, for affected employees, then such facilities need not be completed until 1 year after the engineering controls are completed, if such controls have not in fact succeeded in reducing exposure to below the permissible exposure limit.

(v) *Employee information and training.* Employee information and training required by paragraph (j)(5) of this section shall be provided as soon as possible but no later than October 20, 1986.

(vi) *Medical surveillance.* Medical examinations required by paragraph (i) of this section shall be provided as soon as possible but no later than November 17, 1986.

(vii) *Compliance program.* Written compliance programs required by paragraph (f)(2) of this section as a result of initial monitoring shall be completed and available for inspection and copying as soon as possible but no later than July 20, 1987.

(viii) *Methods of compliance.* The engineering and work practice controls as required by paragraph (f)(1) shall be implemented as soon as possible but no later than July 20, 1986.

(p) *Appendices.* (1) Appendices A, C, D, and E to this section are incorporated as part of this section and the contents of these Appendices are mandatory

(2) Appendices B, F, G and H to this section are informational and are not intended to create any additional obligations not otherwise imposed or to detract from any existing obligations.

Appendix A to § 1910.1001—Osha Reference Method—Mandatory

This mandatory appendix specifies the procedure for analyzing air samples for asbestos, tremolite, anthophyllite, and actinolite and specifies quality control procedures that must be implemented by laboratories performing the analysis. The sampling and analytical methods described below represent the elements of the available monitoring methods (such as the NIOSH 7400 method) which OSHA considers to be essential to achieve adequate employee exposure monitoring while allowing employers to use methods that are already established within their organizations. All employers who are required to conduct air monitoring under paragraph (f) of the standard are required to utilize analytical laboratories that use this procedure, or an equivalent method, for collecting and analyzing samples.

Sampling and Analytical Procedure

1. The sampling medium for air samples shall be mixed cellulose ester filter membranes. These shall be designated by the manufacturer as suitable for asbestos, tremolite, anthophyllite, and actinolite counting. See below for rejection of blanks.

[Sec. 1910.1001, Appendix A]

2. The preferred collection device shall be the 25-mm diameter cassette with an open-faced 50-mm extension cowl. The 37-mm cassette may be used if necessary but only if written justification for the need to use the 37-mm filter cassette accompanies the sample results in the employee's exposure monitoring record.

3. An air flow rate between 0.5 liter/min and 2.5 liters/min shall be selected for the 25-mm cassette. If the 37-mm cassette is used, an air flow rate between 1 liter/min and 2.5 liters/min shall be selected.

4. Where possible, a sufficient air volume for each air sample shall be collected to yield between 100 and 1,300 fibers per square millimeter on the membrane filter. If a filter darkens in appearance or if loose dust is seen on the filter, a second sample shall be started.

5. Ship the samples in a rigid container with sufficient packing material to prevent dislodging the collected fibers. Packing material that has a high electrostatic charge on its surface (e.g., expanded polystyrene) cannot be used because such material can cause loss of fibers to the sides of the cassette.

6. Calibrate each personal sampling pump before and after use with a representative filter cassette installed between the pump and the calibration devices.

7. Personal samples shall be taken in the "breathing zone" of the employee (i.e., attached to or near the collar or lapel near the worker's face).

8. Fiber counts shall be made by positive phase contrast using a microscope with an 8 to 10 X eyepiece and a 40 to 45 X objective for a total magnification of approximately 400 X and a numerical aperture of 0.65 to 0.75. The microscope shall also be fitted with a green or blue filter.

9. The microscope shall be fitted with a Walton-Beckett eyepiece graticule calibrated for a field diameter of 100 micrometers (+/−2 micrometers).

10. The phase-shift detection limit of the microscope shall be about 3 degrees measured using the HSE phase shift test slide as outlined below.

a. Place the test slide on the microscope stage and center it under the phase objective.

b. Bring the blocks of grooved lines into focus.

Note.—The slide consists of seven sets of grooved lines (ca. 20 grooves to each block) in descending order of visibility from sets 1 to 7, seven being the least visible. The requirements for asbestos, tremolite, anthophyllite, and actinolite counting are that the microscope optics must resolve the grooved lines in set 3 completely, although they may appear somewhat faint, and that the grooved lines in sets 6 and 7 must be invisible. Sets 4 and 5 must be at least partially visible but may vary slightly in visibility between microscopes. A microscope that fails to meet these requirements has either too low or too high a resolution to be used for asbestos, tremolite, anthophyllite, and actinolite counting.

c. If the image deteriorates, clean and adjust the microscope optics. If the problem persists, consult the microscope manufacturer.

11. Each set of samples taken will include 10 percent blanks or a minimum of 2 blanks. The blank results shall be averaged and subtracted from the analytical results before reporting. Any samples represented by a blank having a fiber count in excess of 7 fibers/100 fields shall be rejected.

12. The samples shall be mounted by the acetone/triacetin method or a method with an equivalent index of refraction and similar clarity.

13. Observe the following counting rules.

a. Count only fibers equal to or longer than 5 micrometers. Measure the length of curved fibers along the curve.

b. Count all particles as asbestos, tremolite, anthophyllite, and actinolite that have a length-to-width ratio (aspect ratio) of 3:1 or greater.

c. Fibers lying entirely within the boundary of the Walton-Beckett graticule field shall receive a count of 1. Fibers crossing the boundary once, having one end within the circle, shall receive the count of one half (½). Do not count any fiber that crosses the graticule boundary more than once. Reject and do not count any other fibers even though they may be visible outside the graticule area.

d. Count bundles of fibers as one fiber unless individual fibers can be identified by observing both ends of an individual fiber.

e. Count enough graticule fields to yield 100 fibers. Count a minimum of 20 fields; stop counting at 100 fields regardless of fiber count.

14. Blind recounts shall be conducted at the rate of 10 percent.

Quality Control Procedures

1. Intralaboratory program. Each laboratory and/or each company with more than one microscopist counting slides shall establish a statistically designed quality assurance program involving blind recounts and comparisons between microscopists to monitor the variability of counting by each microscopist and between microscopists. In a company with more than one laboratory, the program shall include all laboratories and shall also evaluate the laboratory-to-laboratory variability.

2. Interlaboratory program. Each laboratory analyzing asbestos, tremolite, anthophyllite, and actinolite samples for compliance determination shall implement an interlaboratory quality assurance program that as a minimum includes participation of at least two other independent laboratories. Each laboratory shall participate in round robin testing at least once every 6 months with at least all the other laboratories in its interlaboratory quality assurance group. Each laboratory shall submit slides typical of its own work load for use in this program. The round robin shall be designed and results analyzed using appropriate statistical methodology.

3. All individuals performing asbestos, tremolite, anthophyllite, and actinolite analysis must have taken the NIOSH course for sampling and evaluating airborne asbestos, tremolite, anthophyllite, and actinolite dust or an equivalent course.

4. When the use of different microscopes contributes to differences between counters and laboratories, the effect of the different microscope shall be evaluated and the microscope shall be replaced, as necessary.

5. Current results of these quality assurance programs shall be posted in each laboratory to keep the microscopists informed.

Appendix B to § 1910.1001—Detailed Procedure for Asbestos Tremolite, Anthophyllite, and Actinolite Sampling and Analysis—Non-Mandatory

This appendix contains a detailed procedure for sampling and analysis and includes those critical elements specified in Appendix A. Employers are not required to use this procedure, but they are required to use Appendix A. The purpose of Appendix B is to provide a detailed step-by-step sampling and analysis procedure that conforms to the elements specified in Appendix A. Since this procedure may also standardize the analysis and reduce variability, OSHA encourages employers to use this appendix.

Asbestos, Tremolite, Anthophyllite, and Actinolite Sampling and Analysis Method

Technique: Microscopy, Phase Contrast
Analyte: Fibers (manual count)
Sample Preparation: Acetone/triacetin method
Calibration: Phase-shift detection limit about 3 degrees
Range: 100 to 1300 fibers/mm ^{2} filter area
Estimated limit of detection: 7 fibers/mm ^{2} filter area
Sampler: Filter (0.8–1.2 um mixed cellulose ester membrane, 25-mm diameter)
Flow rate: 0.5 l/min to 2.5 l/min (25-mm cassette) 1.0 l/min to 2.5 l/min (37-mm cassette)

[Sec. 1910.1001, Appendix B]

Sample volume: Adjust to obtain 100 to 1300 fibers/mm ^{2}
Shipment: Routine
Sample stability: Indefinite
Blanks: 10% of samples (minimum 2)
Standard analytical error: 0.25.

Applicability: The working range is 0.02 f/cc (1920-L air sample) to 1.25 f/cc (400-L air sample). The method gives an index of airborne asbestos, tremolite, anthophyllite, and actinolite fibers but may be used for other materials such as fibrous glass by inserting suitable parameters into the counting rules. The method does not differentiate between asbestos, tremolite, anthophyllite, and actinolite and other fibers. Asbestos, tremolite, anthophyllite, and actinolite fibers less than ca. 0.25 um diameter will not be detected by this method.

Interferences: Any other airborne fiber may interfere since all particles meeting the counting criteria are counted. Chainlike particles may appear fibrous. High levels of nonfibrous dust particles may obscure fibers in the field of view and raise the detection limit.

Reagents: 1. Acetone. 2. Triacetin (glycerol triacetate), reagent grade

Special precautions: Acetone is an extremely flammable liquid and precautions must be taken not to ignite it. Heating of acetone must be done in a ventilated laboratory fume hood using a flameless, spark-free heat source.

Equipment: 1. Collection device: 25-mm cassette with 50-mm extension cowl with cellulose ester filter, 0.8 to 1.2 mm pore size and backup pad.

Note: Analyze representative filters for fiber background before use and discard the filter lot if more than 5 fibers/100 fields are found.

2. Personal sampling pump, greater than or equal to 0.5 L/min. with flexible connecting tubing.

3. Microscope, phase contrast, with green or blue filter, 8 to 10X eyepiece, and 40 to 45X phase objective (total magnification ca 400X; numerical aperture = 0.65 to 0.75.

4. Slides, glass, single-frosted, pre-cleaned, 25 x 75 mm.

5. Cover slips, 25 x 25 mm, no. 1½ unless otherwise specified by microscope manufacturer.

6. Knife, No. 1 surgical steel, curved blade.

7. Tweezers.

8. Flask, Guth-type, insulated neck, 250 to 500 mL (with single-holed rubber stopper and elbow-jointed glass tubing, 18 to 22 cm long).

9. Hotplate, spark-free, stirring type; heating mantle; or infrared lamp and magnetic stirrer.

10. Syringe, hypodermic, with 22-gauge needle.

11. Graticule, Walton-Beckett type with 100 um diameter circular field at the specimen plane (area = 0.00785 mm ^{2}). (Type G-22).

Note.—the graticule is custom-made for each microscope.

12. HSE/NPL phase contrast test slide, Mark II.

13. Telescope, ocular phase-ring centering.

14. Stage micrometer (0.01 mm divisions).

Sampling

1. Calibrate each personal sampling pump with a representative sampler in line.

2. Fasten the sampler to the worker's lapel as close as possible to the worker's mouth. Remove the top cover from the end of the cowl extension (open face) and orient face down. Wrap the joint between the extender and the monitor's body with shrink tape to prevent air leaks.

3. Submit at least two blanks (or 10% of the total samples, whichever is greater) for each set of samples. Remove the caps from the field blank cassettes and store the caps and cassettes in a clean area (bag or box) during the sampling period. Replace the caps in the cassettes when sampling is completed.

4. Sample at 0.5 L/min or greater. Do not exceed 1 mg total dust loading on the filter. Adjust sampling flow rate, Q (L/min), and time to produce a fiber density, E (fibers/mm^2), of 100 to 1300 fibers/mm^2 [3.85×10^4 to 5×10^4 fibers per 25-mm filter with effective collection area (A_c=385 mm^2)] for optimum counting precision (see step 21 below). Calculate the minimum sampling time, t_{min} (min) at the action level (one-half of the current standard), L (f/cc) of the fibrous aerosol being sampled:

$$t_{min} = \frac{(Ac)(E)}{(Q)(L)10^6}$$

5. Remove the field monitor at the end of sampling, replace the plastic top cover and small end caps, and store the monitor.

6. Ship the samples in a rigid container with sufficient packing material to prevent jostling or damage.

Note.—Do not use polystyrene foam in the shipping container because of electrostatic forces which may cause fiber loss from the sampler filter.

Sample Preparation

Note.—The object is to produce samples with a smooth (non-grainy) background in a medium with a refractive index equal to or less than 1.46. The method below collapses the filter for easier focusing and produces permanent mounts which are useful for quality control and interlaboratory comparison. Other mounting techniques meeting the above criteria may also be used, e.g., the nonpermanent field mounting technique used in P & CAM 239.

7. Ensure that the glass slides and cover slips are free of dust and fibers.

8. Place 40 to 60 ml of acetone into a Guth-type flask. Stopper the flask with a single-hole rubber stopper through which a glass tube extends 5 to 8 cm into the flask. The portion of the glass tube that exits the top of the stopper (8 to 10 cm) is bent downward in an elbow that makes an angle of 20 to 30 degrees with the horizontal.

9. Place the flask in a stirring hotplate or wrap in a heating mantle. Heat the acetone gradually to its boiling temperature (ca. 58 °C).

Caution.—The acetone vapor must be generated in a ventilated fume hood away from all open flames and spark sources. Alternate heating methods can be used, providing no open flame or sparks are present.

10. Mount either the whole sample filter or a wedge cut from the sample filter on a clean glass slide.

a. Cut wedges of ca. 25 percent of the filter area with a curved-blade steel surgical knife using a rocking motion to prevent tearing.

b. Place the filter or wedge, dust side up, on the slide. Static electricity will usually keep the filter on the slide until it is cleared.

c. Hold the glass slide supporting the filter approximately 1 to 2 cm from the glass tube part where the acetone vapor is escaping from the heated flask. The acetone vapor stream should cause a condensation spot on the glass slide ca. 2 to 3 cm in diameter. Move the glass slide gently in the vapor stream. The filter should clear in 2 to 5 sec. If the filter curls, distorts, or is otherwise rendered unusable, the vapor stream is probably not strong enough. Periodically wipe the outlet port with tissue to prevent liquid acetone dripping onto the filter.

d. Using the hypodermic syringe with a 22-gauge needle, place 1 to 2 drops of triacetin on the filter. Gently lower a clean 25-mm square cover slip down onto the filter at a slight angle to reduce the possibility of forming bubbles. If too many bubbles form or the amount of triacetin is insufficient, the cover slip may become detached within a few hours.

e. Glue the edges of the cover slip to the glass slide using a lacquer or nail polish.

Note.—If clearing is slow, the slide preparation may be heated on a hotplate (surface temperature 50 °C) for 15 min to hasten clearing. Counting may proceed immediately after clearing and mounting are completed.

[Sec. 1910.1001, Appendix B]

Calibration and Quality Control

11. Calibration of the Walton-Beckett graticule. The diameter, d_c(mm), of the circular counting area and the disc diameter must be specified when ordering the graticule.

a. Insert any available graticule into the eyepiece and focus so that the graticule lines are sharp and clear.

b. Set the appropriate interpupillary distance and, if applicable, reset the binocular head adjustment so that the magnification remains constant.

c. Install the 40 to 45 × phase objective.

d. Place a stage micrometer on the microscope object stage and focus the microscope on the graduate lines.

e. Measure the magnified grid length, L_m(mm), using the stage micrometer.

f. Remove the graticule from the microscope and measure its actual grid length, L_o(mm). This can best be accomplished by using a stage fitted with verniers.

g. Calculate the circle diameter, d_c(mm), for the Walton-Beckett graticule:

$$d_c = \frac{L_o \times D}{L_m}$$

Example.—If L_o = 108 um, L_m = 2.93 mm and D = 100 um, then d_c = 2.71 mm.

h. Check the field diameter, D(acceptable range 100 mm ± 2 mm) with a stage micrometer upon receipt of the graticule from the manufacturer. Determine field area (mm²).

12. Microscope adjustments. Follow the manufacturer's instructions and also the following:

a. Adjust the light source for even illumination across the field of view at the condenser iris.

Note.—Kohler illumination is preferred, where available.

b. Focus on the particulate material to be examined.

c. Make sure that the field iris is in focus, centered on the sample, and open only enough to fully illuminate the field of view.

d. Use the telescope ocular supplied by the manufacturer to ensure that the phase rings (annular diaphragm and phase-shifting elements) are concentric.

13. Check the phase-shift detection limit of the microscope periodically.

a. Remove the HSE/NPL phase-contrast test slide from its shipping container and center it under the phase objective.

b. Bring the blocks of grooved lines into focus.

Note.—The slide consists of seven sets of grooves (ca. 20 grooves to each block) in descending order of visibility from sets 1 to 7. The requirements for counting are that the microscope optics must resolve the grooved lines in set 3 completely, although they may appear somewhat faint, and that the grooved lines in sets 6 to 7 must be invisible. Sets 4 and 5 must be at least partially visible but may vary slightly in visibility between microscopes. A microscope which fails to meet these requirements has either too low or too high a resolution to be used for asbestos, tremolite, anthophyllite, and actinolite counting.

c. If the image quality deteriorates, clean the microscope optics and, if the problem persists, consult the microscope manufacturer.

14. Quality control of fiber counts.

a. Prepare and count field blanks along with the field samples. Report the counts on each blank. Calculate the mean of the field blank counts and subtract this value from each sample count before reporting the results.

Note 1.—The identity of the blank filters should be unknown to the counter until all counts have been completed.

Note 2: If a field blank yields fiber counts greater than 7 fibers/100 fields, report possible contamination of the samples.

b. Perform blind recounts by the same counter on 10 percent of filters counted (slides relabeled by a person other than the counter).

15. Use the following test to determine whether a pair of counts on the same filter should be rejected because of possible bias. This statistic estimates the counting repeatability at the 95% confidence level. Discard the sample if the difference between the two counts exceeds 2.77(F)s_r, where F = average of the two fiber counts and s_r = relative standard deviation, which should be derived by each laboratory based on historical in-house data.

Note.—If a pair of counts is rejected as a result of this test, recount the remaining samples in the set and test the new counts against the first counts. Discard all rejected paired counts.

16. Enroll each new counter in a training course that compares performance of counters on a variety of samples using this procedure.

Note.—To ensure good reproducibility, all laboratories engaged in asbestos, tremolite, anthophyllite, and actinolite counting are required to participate in the Proficiency Analytical Testing (PAT) Program and should routinely participate with other asbestos, tremolite, anthophyllite, and actinolite fiber counting laboratories in the exchange of field samples to compare performance of counters.

Measurement

17. Place the slide on the mechanical stage of the calibrated microscope with the center of the filter under the objective lens. Focus the microscope on the plane of the filter.

18. Regularly check phase-ring alignment and Kohler illumination.

19. The following are the counting rules:

a. Count only fibers longer than 5 um. Measure the length of curved fibers along the curve.

b. Count only fibers with a length-to-width ratio equal to or greater than 3:1.

c. For fibers that cross the boundary of the graticule field, do the following:

1. Count any fiber longer than 5 um that lies entirely within the graticule area.

2. Count as ½ fiber any fiber with only one end lying within the graticule area.

3. Do not count any fiber that crosses the graticule boundary more than once.

4. Reject and do not count all other fibers.

d. Count bundles of fibers as one fiber unless individual fibers can be identified by observing both ends of a fiber.

e. Count enough graticule fields to yield 100 fibers. Count a minimum of 20 fields. Stop at 100 fields regardless of fiber count.

20. Start counting from one end of the filter and progress along a radial line to the other end, shift either up or down on the filter, and continue in the reverse direction. Select fields randomly by looking away from the eyepiece briefly while advancing the mechanical stage. When an agglomerate covers ca. ⅛ or more of the field of view, reject the field and select another. Do not report rejected fields in the number of total fields counted.

Note.—When counting a field, continuously scan a range of focal planes by moving the fine focus knob to detect very fine fibers which have become embedded in the filter. The small-diameter fibers will be very faint but are an important contribution to the total count.

Calculations

21. Calculate and report fiber density on the filter, E (fibers/mm²); by dividing the total fiber count, F; minus the mean field blank count, B, by the number of fields, n; and the field area, A_f (0.00785 mm² for a properly calibrated Walton-Beckett graticule):

$$E = \frac{F - B}{(n)(A_f)} \text{ fibers/mm}^2$$

[Sec. 1910.1001, Appendix B]

22. Calculate the concentration, C (f/cc), of fibers in the air volume sampled, V (L), using the effective collection area of the filter, A_c (335 mm^2 for a 25-mm filter):

$$C = \frac{[E][A_c]}{V[10^3]}$$

Note.—Periodically check and adjust the value of A_c, if necessary.

Appendix C to § 1910.1001—Qualitative and Quantitative Fit Testing Procedures—Mandatory

Qualitative Fit Test Protocols

I. Isoamyl Acetate Protocol.

A. Odor Threshold Screening

1. Three 1-liter glass jars with metal lids [e.g. Mason or Bell jars] are required.

2. Odor-free water (e.g. distilled or spring water) at approximately 25° C shall be used for the solutions.

3. The isoamyl acetate (IAA) (also known as isopentyl acetate) stock solution is prepared by adding 1 cc of pure IAA to 800 cc of odor free water in a 1-liter jar and shaking for 30 seconds. This solution shall be prepared new at least weekly.

4. The screening test shall be conducted in a room separate from the room used for actual fit testing. The two rooms shall be well ventilated but shall not be connected to the same recirculating ventilation system.

5. The odor test solution is prepared in a second jar by placing 0.4 cc of the stock solution into 500 cc of odor free water using a clean dropper or pipette. Shake for 30 seconds and allow to stand for two to three minutes so that the IAA concentration above the liquid may reach equilibrium. This solution may be used for only one day.

6. A test blank is prepared in a third jar by adding 500 cc of odor free water.

7. The odor test and test blank jars shall be labelled 1 and 2 for jar identification. If the labels are put on the lids they can be periodically peeled, dried off and switched to maintain the integrity of the test.

8. The following instructions shall be typed on a card and placed on the table in front of the two test jars (i.e. 1 and 2): "The purpose of this test is to determine if you can smell banana oil at a low concentration. The two bottles in front of you contain water. One of these bottles also contains a small amount of banana oil. Be sure the covers are on tight, then shake each bottle for two seconds. Unscrew the lid of each bottle, one at a time, and sniff at the mouth of the bottle. Indicate to the test conductor which bottle contains banana oil."

9. The mixtures used in the IAA odor detection test shall be prepared in an area separate from where the test is performed, in order to prevent olfactory fatigue in the subject.

10. If the test subject is unable to correctly identify the jar containing the odor test solution, the IAA qualitative fit test may not be used.

11. If the test subject correctly identifies the jar containing the odor test solution, the test subject may proceed to respirator selection and fit testing.

B. Respirator Selection

1. The test subject shall be allowed to pick the most comfortable respirator from a selection including respirators of various sizes from different manufacturers. The selection shall include at least five sizes of elastomeric half facepieces, from at least two manufacturers.

2. The selection process shall be conducted in a room separate from the fit-test chamber to prevent odor fatigue. Prior to the selection process, the test subject shall be shown how to put on a respirator, how it should be positioned on the face, how to set strap tension and how to determine a "comfortable" respirator. A mirror shall be available to assist the subject in evaluating the fit and positioning of the respirator. This instruction may not constitute the subject's formal training on respirator use, as it is only a review.

3. The test subject should understand that the employee is being asked to select the respirator which provides the most comfortable fit. Each respirator represents a different size and shape and, if fit properly and used properly will provide adequate protection.

4. The test subject holds each facepiece up to the face and eliminates those which obviously do not give a comfortable fit. Normally, selection will begin with a half-mask and if a good fit cannot be found, the subject will be asked to test the full facepiece respirators. (A small percentage of users will not be able to wear any half-mask.)

5. The more comfortable facepieces are noted; the most comfortable mask is donned and *worn at least five minutes* to assess comfort. All donning and adjustments of the facepiece shall be performed by the test subject without assistance from the test conductor or other person. Assistance in assessing comfort can be given by discussing the points in #6 below. If the test subject is not familiar with using a particular respirator, the test subject shall be directed to don the mask several times and to adjust the straps each time to become adept at setting proper tension on the straps.

6. Assessment of comfort shall include reviewing the following points with the test subject and allowing the test subject adequate time to determine the comfort of the respirator:

- Positioning of mask on nose.
- Room for eye protection.
- Room to talk.
- Positioning mask on face and cheeks.

7. The following criteria shall be used to help determine the adequacy of the respirator fit:

- Chin properly placed.
- Strap tension.
- Fit across nose bridge.
- Distance from nose to chin.
- Tendency to slip.
- Self-observation in mirror.

8. The test subject shall conduct the conventional negative and positive-pressure fit checks (e.g. see ANSI Z88.2–1980). Before conducting the negative- or positive-pressure test the subject shall be told to "seat" the mask by rapidly moving the head from side-to-side and up and down, while taking a few deep breaths.

9. The test subject is now ready for fit testing.

10. After passing the fit test, the test subject shall be questioned again regarding the comfort of the respirator. If it has become uncomfortable, another model of respirator shall be tried.

11. The employee shall be given the opportunity to select a different facepiece and be retested if the chosen facepiece becomes increasingly uncomfortable at any time.

C. Fit Test

1. The fit test chamber shall be similar to a clear 55 gal drum liner suspended inverted over a 2 foot diameter frame, so that the top of the chamber is about 6 inches above the test subject's head. The inside top center of the chamber shall have a small hook attached.

2. Each respirator used for the fitting and fit testing shall be equipped with organic vapor cartridges or offer protection against organic vapors. The cartridges or masks shall be changed at least weekly.

3. After selecting, donning, and properly adjusting a respirator, the test subject shall wear it to the fit testing room. This room shall be separate from the room used for odor threshold screening and respirator selection, and shall be well ventilated, as by an exhaust fan or lab hood, to prevent general room contamination.

4. A copy of the following test exercises and rainbow passage shall be taped to the inside of the test chamber:

Test Exercises

i. Breathe normally.

ii. Breathe deeply. Be certain breaths are *deep* and *regular*.

iii. Turn head all the way from one side to the other. Inhale on each side. Be certain movement is complete. Do not bump the respirator against the shoulders.

iv. Nod head up-and-down. Inhale when head is in the full up position (looking toward ceiling). Be certain motions are complete and made about every second. Do not bump the respirator on the chest.

v. Talking. Talk aloud and slowly for several minutes. The following paragraph is called the Rainbow Passage. Reading it will

result in a wide range of facial movements, and thus be useful to satisfy this requirement. Alternative passages which serve the same purpose may also be used.

vi. Jogging in place.

vii. Breathe normally.

Rainbow Passage

When the sunlight strikes raindrops in the air, they act like a prism and form a rainbow. The rainbow is a division of white light into many beautiful colors. These take the shape of a long round arch, with its path high above, and its two ends apparently beyond the horizon. There is, according to legend, a boiling pot of gold at one end. People look but no one ever finds it. When a man looks for something beyond reach, his friends say he is looking for the pot of gold at the end of the rainbow.

5. Each test subject shall wear the respirator for at least 10 minutes before starting the fit test.

6. Upon entering the test chamber, the test subject shall be given a 6 inch by 6 inch piece of paper towel or other porous absorbent single ply material, folded in half and wetted with three-quarters of one cc of pure IAA. The test subject shall hang the wet towel on the hook at the top of the chamber.

7. Allow two minutes for the IAA test concentration to be reached before starting the fit-test exercises. This would be an appropriate time to talk with the test subject, to explain the fit test, the importance of cooperation, the purpose for the head exercises, or to demonstrate some of the exercises.

8. Each exercise described in #4 above shall be performed for at least one minute.

9. If at any time during the test, the subject detects the banana-like odor of IAA, the test has failed. The subject shall quickly exit from the test chamber and leave the test area to avoid olfactory fatigue.

10. If the test is failed, the subject shall return to the selection room and remove the respirator, repeat the odor sensitivity test, select and put on another respirator, return to the test chamber, and again begin the procedure described in the c(4) through c(8) above. The process continues until a respirator that fits well has been found. Should the odor sensitivity test be failed, the subject shall wait about 5 minutes before retesting. Odor sensitivity will usually have returned by this time.

11. If a person cannot pass the fit test described above wearing a half-mask respirator from the available selection, full facepiece models must be used.

12. When a respirator is found that passes the test, the subject breaks the faceseal and takes a breath before exiting the chamber. This is to assure that the reason the test subject is not smelling the IAA is the good fit of the respirator facepiece seal and not olfactory fatigue.

13. When the test subject leaves the chamber, the subject shall remove the saturated towel and return it to the person conducting the test. To keep the area from becoming contaminated, the used towels shall be kept in a self-sealing bag so there is no significant IAA concentration buildup in the test chamber during subsequent tests.

14. At least two facepieces shall be selected for the IAA test protocol. The test subject shall be given the opportunity to wear them for one week to choose the one which is more comfortable to wear.

15. Persons who have successfully passed this fit test with a half-mask respirator may be assigned the use of the test respirator in atmospheres with up to 10 times the PEL of airborne asbestos. In atmospheres greater than 10 times, and less than 100 times the PEL (up to 100 ppm), the subject must pass the IAA test using a full face negative pressure respirator. (The concentration of the IAA inside the test chamber must be increased by ten times for QLFT of the full facepiece.)

16. The test shall not be conducted if there is any hair growth between the skin the facepiece sealing surface.

17. If hair growth or apparel interfere with a satisfactory fit, then they shall be altered or removed so as to eliminate interference and allow a satisfactory fit. If a satisfactory fit is still not attained, the test subject must use a positive-pressure respirator such as powered air-purifying respirators, supplied air respirator, or self-contained breathing apparatus.

18. If a test subject exhibits difficulty in breathing during the tests, she or he shall be referred to a physician trained in respirator diseases or pulmonary medicine to determine whether the test subject can wear a respirator while performing her or his duties.

19. Qualitative fit testing shall be repeated at least every six months.

20. In addition, because the sealing of the respirator may be affected, qualitative fit testing shall be repeated immediately when the test subject has a:

(1) Weight change of 20 pounds or more,

(2) Significant facial scarring in the area of the facepiece seal,

(3) Significant dental change; i.e., multiple extractions without prothesis, or acquiring dentures,

(4) Reconstructive or cosmetic surgery, or

(5) Any other condition that may interfere with facepiece sealing.

D. Recordkeeping

A summary of all test results shall be maintained in each office for 3 years. The summary shall include:

(1) Name of test subject.

(2) Date of testing.

(3) Name of the test conductor.

(4) Respirators selected (indicate manufacturer, model, size and approval number).

(5) Testing agent.

II. Saccharin Solution Aerosol Protocol

A. Respirator Selection

Respirators shall be selected as described in section IB (respirator selection) above, except that each respirator shall be equipped with a particulate filter.

B. Taste Threshold Screening

1. An enclosure about head and shoulders shall be used for threshold screening (to determine if the individual can taste saccharin) and for fit testing. The enclosure shall be approximately 12 inches in diameter by 14 inches tall with at least the front clear to allow free movement of the head when a respirator is worn.

2. The test enclosure shall have a three-quarter inch hole in front of the test subject's nose and mouth area to accommodate the nebulizer nozzle.

3. The entire screening and testing procedure shall be explained to the test subject prior to conducting the screening test.

4. During the threshold screening test, the test subject shall don the test enclosure and breathe with open mouth with tongue extended.

5. Using a DeVilbiss Model 40 Inhalation Medication Nebulizer or equivalent, the test conductor shall spray the threshold check solution into the enclosure. This nebulizer shall be clearly marked to distinguish it from the fit test solution nebulizer.

6. The threshold check solution consists of 0.83 grams of sodium saccharin, USP in water. It can be prepared by putting 1 cc of the test solution (see C 7 below) in 100 cc. of water.

7. To produce the aerosol, the nebulizer bulb is firmly squeezed so that it collapses completely, then is released and allowed to fully expand.

8. Ten squeezes of the nebulizer bulb are repeated rapidly and then the test subject is asked whether the saccharin can be tasted.

9. If the first response is negative, ten more squeezes of the nebulizer bulb are repeated rapidly and the test subject is again asked whether the saccharin can be tasted.

10. If the second response is negative ten more squeezes are repeated rapidly and the test subject is again asked whether the saccharin can be tasted.

11. The test conductor will take note of the number of squeezes required to elicit a taste response.

12. If the saccharin is not tasted after 30 squeezes (Step 10), the saccharin fit test cannot be performed on the test subject.

13. If a taste response is elicited, the test subject shall be asked to take note of the taste for reference in the fit test.

14. Correct use of the nebulizer means that approximately 1 cc of liquid is used at a time in the nebulizer body.

15. The nebulizer shall be thoroughly rinsed in water, shaken dry, and refilled at least every four hours.

[Sec. 1910.1001, Appendix C]

C. Fit Test

1. The test subject shall don and adjust the respirator without the assistance from any person.

2. The fit test uses the same enclosure described in IIB above.

3. Each test subject shall wear the respirator for at least 10 minutes before starting the fit test.

4. The test subject shall don the enclosure while wearing the respirator selected in section 1B above. This respirator shall be properly adjusted and equipped with a particulate filter.

5. The test subject may not eat, drink (except plain water), or chew gum for 15 minutes before the test.

6. A second DeVilbiss Model 40 Inhalation Medication Nebulizer is used to spray the fit test solution into the enclosure. This nebulizer shall be clearly marked to distinguish it from the screening test solution nebulizer.

7. The fit test solution is prepared by adding 83 grams of sodium saccharin to 100 cc of warm water.

8. As before, the test subject shall breathe with mouth open and tongue extended.

9. The nebulizer is inserted into the hole in the front of the enclosure and the fit test solution is sprayed into the enclosure using the same technique as for the taste threshold screening and the same number of squeezes required to elicit a taste response in the screening. (See B8 through B10 above).

10. After generation of the aerosol read the following instructions to the test subject. The test subject shall perform the exercises for one minute each.

i. Breathe normally.

ii. Breathe deeply. Be certain breaths are *deep* and *regular*.

iii. Turn head all the way from one side *to the other*. Be certain movement is complete. Inhale on each side. Do not bump the respirator against the shoulders.

iv. Nod head up-and-down. Be certain motions are complete. Inhale when head is in the full up position (when looking toward the ceiling). Do not bump the respirator on the chest.

v. Talking. Talk loudly and slowly for several minutes. The following paragraph is called the Rainbow Passage. Reading it will result in a wide range of facial movements, and thus be useful to satisfy this requirement. Alternative passages which serve the same purpose may also be used.

vi. Jogging in place.

vii. Breathe normally.

Rainbow Passage

When the sunlight strikes raindrops in the air, they act like a prism and form a rainbow. The rainbow is a division of white light into many beautiful colors. These take the shape of a long round arch, with its path high above, and its two ends apparently beyond the horizon. There is, according to legend, a boiling pot of gold at one end. People look, but no one ever finds it. When a man looks for something beyond his reach, his friends say he is looking for the pot of gold at the end of the rainbow.

11. At the beginning of each exercise, the aerosol concentration shall be replenished using one-half the number of squeezes as initially described in C9.

12. The test subject shall indicate to the test conductor if at any time during the fit test the taste of saccharin is detected.

13. If the saccharin is detected the fit is deemed unsatisfactory and a different respirator shall be tried.

14. At least two facepieces shall be selected by the IAA test protocol. The test subject shall be given the opportunity to wear them for one week to choose the one which is more comfortable to wear.

15. Successful completion of the test protocol shall allow the use of the half mask tested respirator in contaminated atmospheres up to 10 times the PEL of asbestos. In other words this protocol may be used to assign protection factors no higher than ten.

16. The test shall not be conducted if there is any hair growth between the skin and the facepiece sealing surface.

17. If hair growth or apparel interfere with a satisfactory fit, then they shall be altered or removed so as to eliminate interference and allow a satisfactory fit. If a satisfactory fit is still not attained, the test subject must use a positive-pressure respirator such as powered air-purifying respirators, supplied air respirator, or self-contained breathing apparatus.

18. If a test subject exhibits difficulty in breathing during the tests, she or he shall be referred to a physician trained in respirator diseases or pulmonary medicine to determine whether the test subject can wear a respirator while performing her or his duties.

19. Qualitative fit testing shall be repeated at least every six months.

20. In addition, because the sealing of the respirator may be affected, qualitative fit testing shall be repeated immediately when the test subject has a:

(1) Weight change of 20 pounds or more,

(2) Significant facial scarring in the area of the facepiece seal,

(3) Significant dental change; i.e.: multiple extractions without prothesis, or acquiring dentures,

(4) Reconstructive or cosmetic surgery, or

(5) Any other condition that may interfere with facepiece sealing.

D. Recordkeeping

A summary of all test results shall be maintained in each office for 3 years. The summary shall include:

(1) Name of test subject.

(2) Date of testing.

(3) Name of test conductor.

(4) Respirators selected (indicate manufacturer, model, size and approval number).

(5) Testing agent.

III. Irritant Fume Protocol

A. Respirator selection

Respirators shall be selected as described in section 1B above, except that each respirator shall be equipped with a combination of high-efficiency and acid-gas cartridges.

B. Fit test

1. The test subject shall be allowed to smell a weak concentration of the irritant smoke to familiarize the subject with the characteristic odor.

2. The test subject shall properly don the respirator selected as above, and wear it for at least 10 minutes before starting the fit test.

3. The test conductor shall review this protocol with the test subject before testing.

4. The test subject shall perform the conventional positive pressure and negative pressure fit checks (see ANSI Z88.2 1980). Failure of either check shall be cause to select an alternate respirator.

5. Break both ends of a ventillation smoke tube containing stannic oxychloride, such as the MSA part #5645, or equivalent. Attach a short length of tubing to one end of the smoke tube. Attach the other end of the smoke tube to a low pressure air pump set to deliver 200 milliliters per minute.

6. Advise the test subject that the smoke can be irritating to the eyes and instruct the subject to keep the eyes closed while the test is performed.

7. The test conductor shall direct the stream of irritant smoke from the tube towards the faceseal area of the test subject. The person conducting the test shall begin with the tube at least 12 inches from the facepiece and gradually move to within one inch, moving around the whole perimeter of the mask.

8. The test subject shall be instructed to do the following exercises while the respirator is being challenged by the smoke. Each exercise shall be performed for one minute.

i. Breathe normally.

ii. Breathe deeply. Be certain breaths are *deep* and *regular*.

iii. Turn head all the way from one side to the other. Be certain movement is complete. Inhale on each side. Do not bump the respirator against the shoulders.

iv. Nod head up-and-down. Be certain motions are complete and made every second. Inhale when head is in the full up position (looking toward ceiling). Do not bump the respirator against the chest.

v. Talking. Talk aloud and slowly for several minutes. The following paragraph is called the Rainbow Passage. Reading it will

result in a wide range of facial movements, and thus be useful to satisfy this requirement. Alternative passages which serve the same purpose may also be used.

Rainbow Passage

When the sunlight strikes raindrops in the air, they act like a prism and form a rainbow. The rainbow is a division of white light into many beautiful colors. These take the shape of a long round arch, with its path high above, and its two ends apparently beyond the horizon. There is, according to legend, a boiling pot of gold at one end. People look, but no one ever finds it. When a man looks for something beyond his reach, his friends say he is looking for the pot of gold at the end of the rainbow.

vi. Jogging in Place.

vii. Breathe normally.

9. The test subject shall indicate to the test conductor if the irritant smoke is detected. If smoke is detected, the test conductor shall stop the test. In this case, the tested respirator is rejected and another respirator shall be selected.

10. Each test subject passing the smoke test (i.e. without detecting the smoke) shall be given a sensitivity check of smoke from the same tube to determine if the test subject reacts to the smoke. Failure to evoke a response shall void the fit test.

11. Steps B4, B9, B10 of this fit test protocol shall be performed in a location with exhaust ventilation sufficient to prevent general contamination of the testing area by the test agents.

12. At least two facepieces shall be selected by the IAA test protocol. The test subject shall be given the opportunity to wear them for one week to choose the one which is more comfortable to wear.

13. Respirators successfully tested by the protocol may be used in contaminated atmospheres up to ten times the PEL of asbestos.

14. The test shall not be conducted if there is any hair growth between the skin and the facepiece sealing surface.

15. If hair growth or apparel interfere with a satisfactory fit, then they shall be altered or removed so as to eliminate interference and allow a satisfactory fit. If a satisfactory fit is still not attained, the test subject must use a positive-pressure respirator such as powered air-purifying respirators, supplied air respirator, or self-contained breathing apparatus.

16. If a test subject exhibits difficulty in breathing during the tests, she or he shall be referred to a physician trained in respirator diseases or pulmonary medicine to determine whether the test subject can wear a respirator while performing her or his duties.

17. Qualitative fit testing shall be repeated at least every six months.

18. In addition, because the sealing of the respirator may be affected, qualitative fit testing shall be repeated immediately when the test subject has a:

(1) Weight change of 20 pounds or more,

(2) Significant facial scarring in the area of the facepiece seal,

(3) Significant dental changes; i.e.; multiple extractions without prothesis, or acquiring dentures,

(4) Reconstructive or cosmestic surgery, or

(5) Any other condition that may interfere with facepiece sealing.

C. Recordkeeping

A summary of all test results shall be maintained in each office for 3 years. The summary shall include:

(1) Name of test subject.

(2) Date of testing.

(3) Name of test conductor.

(4) Respirators selected (indicate manufacturer, model, size and approval number).

(5) Testing agent

Quantitative Fit Test Procedures

1. General.

a. The method applies to the negative-pressure nonpowered air-purifying respirators only.

b. The employer shall assign one individual who shall assume the full responsibility for implementing the respirator quantitative fit test program.

2. *Definition.*

a. "Quantitative Fit Test" means the measurement of the effectiveness of a respirator seal in excluding the ambient atmosphere. The test is performed by dividing the measured concentration of challenge agent in a test chamber by the measured concentration of the challenge agent inside the respirator facepiece when the normal air purifying element has been replaced by an essentially perfect purifying element.

b. "Challenge Agent" means the air contaminant introduced into a test chamber so that its concentration inside and outside the respirator may be compared.

c. "Test Subject" means the person wearing the respirator for quantitative fit testing.

d. "Normal Standing Position" means standing erect and straight with arms down along the sides and looking straight ahead.

e. "Fit Factor" means the ratio of challenge agent concentration outside with respect to the inside of a respirator inlet covering (facepiece or enclosure).

3. *Apparatus.*

a. *Instrumentation.* Corn oil, sodium chloride or other appropriate aerosol generation, dilution, and measurement systems shall be used for quantitative fit test.

b. *Test chamber.* The test chamber shall be large enough to permit all test subjects to freely perform all required exercises without distributing the challenge agent concentration or the measurement apparatus. The test chamber shall be equipped and constructed so that the challenge agent is effectively isolated from the ambient air yet uniform in concentration throughout the chamber.

c. When testing air-purifying respirators, the normal filter or cartridge element shall be replaced with a high-efficiency particular filter supplied by the same manufacturer.

d. The sampling instrument shall be selected so that a strip chart record may be made of the test showing the rise and fall of challenge agent concentration with each inspiration and expiration at fit factors of at least 2,000.

e. The combination of substitute air-purifying elements (if any), challenge agent, and challenge agent concentration in the test chamber shall be such that the test subject is not exposed in excess of PEL to the challenge agent at any time during the testing process.

f. The sampling port on the test specimen respirator shall be placed and constructed so that there is no detectable leak around the port, a free air flow, is allowed into the sampling line at all times and so there is no interference with the fit or performance of the respirator.

g. The test chamber and test set-up shall permit the person administering the test to observe one test subject inside the chamber during the test.

h. The equipment generating the challenge atmosphere shall maintain the concentration of challenge agent constant within a 10 percent variation for the duration of the test.

i. The time lag (interval between an event and its being recorded on the strip chart) of the instrumentation may not exceed 2 seconds.

j. The tubing for the test chamber atmosphere and for the respirator sampling port shall be the same diameter, length and material. It shall be kept as short as possible. The smallest diameter tubing recommended by the manufacturer shall be used.

k. The exhaust flow from the test chamber shall pass through a high-efficiency filter before release to the room.

l. When sodium chloride aerosol is used, the relative humidity inside the test chamber shall not exceed 50 percent.

4. *Procedural Requirements.*

a. The fitting of half-mask respirators should be started with those having multiple sizes and a variety of interchangeable cartridges and canisters such as the MSA Comfo II-M, Norton M, Survivair M, A-O M, or Scott-M. Use either of the tests outlined below to assure that the facepiece is properly adjusted.

(1) *Positive pressure test.* With the exhaust port(s) blocked, the negative pressure of slight inhalation should remain constant for several seconds.

(2) *Negative pressure test.* With the intake port(s) blocked, the negative pressure slight

inhalation should remain constant for several seconds.

b. After a facepiece is adjusted, the test subject shall wear the facepiece for at least 5 minutes before conducting a qualitive test by using either of the methods described below and using the exercise regime described in 5.a., b., c., d. and e.

(1) *Isoamyl acetate test.* When using organic vapor cartridges, the test subject who can smell the odor should be unable to detect the odor of isoamyl acetate squirted into the air near the most vulnerable portions of the facepiece seal. In a location which is separated from the test area, the test subject shall be instructed to close her/his eyes during the test period. A combination cartridge or canister with organic vapor and high-efficiency filters shall be used when available for the particular mask being tested. The test subject shall be given an opportunity to smell the odor of isoamyl acetate before the test is conducted.

(2) *Irritant fume test.* When using high-efficiency filters, the test subject should be unable to detect the odor of irritant fume (stannic chloride or titanium tetrachloride ventilation smoke tubes) squirted into the air near the most vulnerable portions of the facepiece seal. The test subject shall be instructed to close her/his eyes during the test period.

c. The test subject may enter the quantitative testing chamber only if she or he has obtained a satisfactory fit as stated in 4.b. of this Appendix.

d. Before the subject enters the test chamber, a reasonably stable challenge agent concentration shall be measured in the test chamber.

e. Immediately after the subject enters the test chamber, the challenge agent concentration inside the respirator shall be measured to ensure that the peak penetration does not exceed 5 percent for a half-mask and 1 percent for a full facepiece.

f. A stable challenge agent concentration shall be obtained prior to the actual start of testing.

(1) Respirator restraining straps may not be overtightened for testing. The straps shall be adjusted by the wearer to give a reasonably comfortable fit typical of normal use.

5. *Exercise Regime.* Prior to entering the test chamber, the test subject shall be given complete instructions as to her/his part in the test procedures. The test subject shall perform the following exercises, in the order given, for each independent test.

a. *Normal Breathing (NB).* In the normal standing position, without talking, the subject shall breathe normally for at least one minute.

b. *Deep Breathing (DB).* In the normal standing position the subject shall do deep breathing for at least one minute pausing so as not to hyperventilate.

c. *Turning head side to side (SS).* Standing in place the subject shall slowly turn his/her head from side between the extreme positions to each side. The head shall be held at each extreme position for at least 5 seconds. Perform for at least three complete cycles.

d. *Moving head up and down (UD).* Standing in place, the subject shall slowly move his/her head up and down between the extreme position straight up and the extreme position straight down. The head shall be held at each extreme position for at least 5 seconds. Perform for at least three complete cycles.

e. *Reading (R).* The subject shall read out slowly and loud so as to be heard clearly by the test conductor or monitor. The test subject shall read the "rainbow passage" at the end of this section.

f. *Grimace (G).* The test subject shall grimace, smile, frown, and generally contort the face using the facial muscles. Continue for at least 15 seconds.

g. *Bend over and touch toes (B).* The test subject shall bend at the waist and touch toes and return to upright position. Repeat for at least 30 seconds.

h. *Jogging in place (J).* The test subject shall perform jog in place for at least 30 seconds.

i. *Normal Breathing (NB).* Same as exercise a.

Rainbow Passage

When the sunlight strikes raindrops in the air, they act like a prism and form a rainbow. The rainbow is a division of white light into many beautiful colors. These take the shape of a long round arch, with its path high above, and its two ends apparently beyond the horizon. There is, according to legend, a boiling pot of gold at one end. People look, but no one ever finds it. When a man looks for something beyond reach, his friends say he is looking for the pot of gold at the end of the rainbow.

6. The test shall be terminated whenever any single peak penetration exceeds 5 percent for half-masks and 1 percent for full facepieces. The test subject may be refitted and retested. If two of the three required tests are terminated, the fit shall be deemed inadequate. (See paragraph 4.h.)

7. *Calculation of Fit Factors.*

a. The fit factor determined by the quantitative fit test equals the average concentration inside the respirator.

b. The average test chamber concentration is the arithmetic average of the test chamber concentration at the beginning and of the end of the test.

c. The average peak concentration of the challenge agent inside the respirator shall be the arithmetic average peak concentrations for each of the nine exercises of the test which are computed as the arithmetic average of the peak concentrations found for each breath during the exercise.

d. The average peak concentration for an exercise may be determined graphically if there is not a great variation in the peak concentrations during a single exercise.

8. *Interpretation of Test Results.* The fit factor measured by the quantitative fit testing shall be the lowest of the three protection factors resulting from three independent tests.

9. *Other Requirements.*

a. The test subject shall not be permitted to wear a half-mask or full facepiece mask if the minimum fit factor of 100 or 1,000, respectively, cannot be obtained. If hair growth or apparel interfere with a satisfactory fit, then they shall be altered or removed so as to eliminate interference and allow a satisfactory fit. If a satisfactory fit is still not attained, the test subject must use a positive-pressure respirator such as powered air-purifying respirators, supplied air respirator, or self-contained breathing apparatus.

b. The test shall not be conducted if there is any hair growth between the skin and the facepiece sealing surface.

c. If a test subject exhibits difficulty in breathing during the tests, she or he shall be referred to a physician trained in respirator diseases or pulmonary medicine to determine whether the test subject can wear a respirator while performing her or his duties.

d. The test subject shall be given the opportunity to wear the assigned respirator for one week. If the respirator does not provide a satisfactory fit during actual use, the test subject may request another QNFT which shall be performed immediately.

e. A respirator fit factor card shall be issued to the test subject with the following information:

(1) Name.

(2) Date of fit test.

(3) Protection factors obtained through each manufacturer, model and approval number of respirator tested.

(4) Name and signature of the person that conducted the test.

f. Filters used for qualitative or quantitative fit testing shall be replaced weekly, whenever increased breathing resistance is encountered, or when the test agent has altered the integrity of the filter media.

Organic vapor cartridges/canisters shall be replaced daily or sooner if there is any indication of breakthrough by the test agent.

10. In addition, because the sealing of the respirator may be affected, quantitative fit testing shall be repeated immediately when the test subject has a:

(1) Weight change of 20 pounds or more,

(2) Significant facial scarring in the area of the facepiece seal,

(3) Significant dental change; i.e., multiple extractions without prothesis, or acquiring dentures,

(4) Reconstructive or cosmetic surgery, or

(5) Any other condition that may interfere with facepiece sealing.

[Sec. 1910.1001, Appendix C]

11. *Recordkeeping.*

A summary of all test results shall be maintained in for 3 years. The summary shall include:

(1) Name of test subject.

(2) Date of testing.

(3) Name of the test conductor.

(4) Fit factors obtained from every respirator tested (indicate manufacturer, model, size and approval number).

Appendix D to § 1910.1001—Medical Questionnaires; Mandatory

This mandatory appendix contains the medical questionnaires that must be administered to all employees who are exposed to asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals above the action level, and who will therefore be included in their employer's medical surveillance program. Part 1 of the appendix contains the Initial Medical Questionnaire, which must be obtained for all new hires who will be covered by the medical surveillance requirements. Part 2 includes the abbreviated Periodical Medical Questionnaire, which must be administered to all employees who are provided periodic medical examinations under the medical surveillance provisions of the standard.

Part 1
INITIAL MEDICAL QUESTIONNAIRE

1. NAME _____

2. SOCIAL SECURITY # ___ ___ ___ ___ ___ ___ ___ ___ ___
(1 2 3 4 5 6 7 8 9)

3. CLOCK NUMBER ___ ___ ___ ___ ___ ___
(10 11 12 13 14 15)

4. PRESENT OCCUPATION _____

5. PLANT _____ _____

6. ADDRESS _____

7. _____
(Zip Code)

8. TELEPHONE NUMBER _____

9. INTERVIEWER _____

10. DATE _____ ___ ___ ___ ___ ___ ___
(16 17 18 19 20 21)

11. Date of Birth _____ ___ ___ ___ ___ ___ ___
Month Day Year (22 23 24 25 26 27)

12. Place of Birth _____

13. Sex
1. Male ___
2. Female ___

14. What is your marital status?
1. Single ___
2. Married ___
3. Widowed ___
4. Separated/Divorced ___

15. Race
1. White ___
2. Black ___
3. Asian ___
4. Hispanic ___
5. Indian ___
6. Other ___

16. What is the highest grade completed in school? _____
(For example 12 years is completion of high school)

OCCUPATIONAL HISTORY

17A. Have you ever worked full time (30 hours per week or more) for 6 months or more? 1. Yes ___ 2. No ___

IF YES TO 17A:

B. Have you ever worked for a year or more in any dusty job? 1. Yes ___ 2. No ___ 3. Does Not Apply ___

Specify job/industry _____ Total Years Worked ___

Was dust exposure: 1. Mild ___ 2. Moderate ___ 3. Severe ___

C. Have you ever been exposed to gas or chemical fumes in your work? 1. Yes ___ 2. No ___

Specify job/industry _____ Total Years Worked ___

Was exposure: 1. Mild ___ 2. Moderate ___ 3. Severe ___

[Sec. 1910.1001, Appendix D]

D. What has been your usual occupation or job--the one you have worked at the longest?

1. Job occupation _____

2. Number of years employed in this occupation _____

3. Position/job title _____

4. Business, field or industry _____

(Record on lines the years in which you have worked in any of these industries, e.g. 1960-1969)

Have you ever worked:

		YES	NO
E.	In a mine?	[ ]	[ ]
F.	In a quarry?	[ ]	[ ]
G.	In a foundry?	[ ]	[ ]
H.	In a pottery?	[ ]	[ ]
I.	In a cotton, flax or hemp mill?	[ ]	[ ]
J.	With asbestos?	[ ]	[ ]

18. PAST MEDICAL HISTORY

	YES	NO
A. Do you consider yourself to be in good health?	[ ]	[ ]
If "NO" state reason _____		
B. Have you any defect of vision?	[ ]	[ ]
If "YES" state nature of defect _____		
C. Have you any hearing defect?	[ ]	[ ]
If "YES" state nature of defect _____		
D. Are you suffering from or have you ever suffered from:		
a. Epilepsy (or fits, seizures, convulsions)?	[ ]	[ ]
b. Rheumatic fever?	[ ]	[ ]
c. Kidney disease?	[ ]	[ ]
d. Bladder disease?	[ ]	[ ]
e. Diabetes?	[ ]	[ ]
f. Jaundice?	[ ]	[ ]

19. CHEST COLDS AND CHEST ILLNESSES

19A. If you get a cold, does it usually go to your chest? (Usually means more than 1/2 the time) 1. Yes __ 2. No __ 3. Don't get colds __

20A. During the past 3 years, have you had any chest illnesses that have kept you off work, indoors at home, or in bed? 1. Yes __ 2. No __

If YES TO 20A:

B. Did you produce phlegm with any of these chest illnesses? 1. Yes __ 2. No __ 3. Does Not Apply __

C. In the last 3 years, how many such illnesses with (increased) phlegm did you have which lasted a week or more? Number of illnesses __ No such illnesses __

21. Did you have any lung trouble before the age of 16? 1. Yes __ 2. No __

22. Have you ever had any of the following?

1A. Attacks of bronchitis? 1. Yes __ 2. No __

If YES TO 1A:

B. Was it confirmed by a doctor? 1. Yes __ 2. No __ 3. Does Not Apply __

C. At what age was your first attack? Age in Years __ Does Not Apply __

2A. Pneumonia (include bronchopneumonia)? 1. Yes __ 2. No __

If YES TO 2A:

B. Was it confirmed by a doctor? 1. Yes __ 2. No __ 3. Does Not Apply __

C. At what age did you first have it? Age in Years __ Does Not Apply __

3A. Hay Fever? 1. Yes __ 2. No __

If YES TO 3A:

B. Was it confirmed by a doctor? 1. Yes __ 2. No __ 3. Does Not Apply __

C. At what age did it start? Age in Years __ Does Not Apply __

23A. Have you ever had chronic bronchitis? 1. Yes __ 2. No __

If YES TO 23A:

B. Do you still have it? 1. Yes __ 2. No __ 3. Does Not Apply __

C. Was it confirmed by a doctor? 1. Yes __ 2. No __ 3. Does Not Apply __

D. At what age did it start? Age in Years __ Does Not Apply __

24A. Have you ever had emphysema? 1. Yes __ 2. No __

If YES TO 24A:

B. Do you still have it? 1. Yes __ 2. No __ 3. Does Not Apply __

C. Was it confirmed by a doctor? 1. Yes __ 2. No __ 3. Does Not Apply __

D. At what age did it start? Age in Years __ Does Not Apply __

25A. Have you ever had asthma? 1. Yes __ 2. No __

If YES TO 25A:

B. Do you still have it? 1. Yes __ 2. No __ 3. Does Not Apply __

C. Was it confirmed by a doctor? 1. Yes __ 2. No __ 3. Does Not Apply __

D. At what age did it start? Age in Years __ Does Not Apply __

E. If you no longer have it, at what age did it stop? Age stopped __ Does Not Apply __

26. Have you ever had:

A. Any other chest illness? 1. Yes __ 2. No __

If yes, please specify _____

B. Any chest operations? 1. Yes __ 2. No __

If yes, please specify _____

C. Any chest injuries? 1. Yes __ 2. No __

If yes, please specify _____

27A. Has a doctor ever told you that you had heart trouble? 1. Yes __ 2. No __

IF YES TO 27A:

B. Have you ever had treatment for heart trouble in the past 10 years? 1. Yes __ 2. No __ 3. Does Not Apply __

28A. Has a doctor ever told you that you had high blood pressure? 1. Yes __ 2. No __

IF YES TO 28A:

B. Have you had any treatment for high blood pressure (hypertension) in the past 10 years? 1. Yes __ 2. No __ 3. Does Not Apply __

29. When did you last have your chest X-rayed? (Year) __ __ __ __ (25 26 27 28)

30. Where did you last have your chest X-rayed (if known)? _____

What was the outcome? _____

FAMILY HISTORY

31. Were either of your natural parents ever told by a doctor that they had a chronic lung condition such as:

	FATHER 1. Yes	2. No	3. Don't Know	MOTHER 1. Yes	2. No	3. Don't Know
A. Chronic Bronchitis?	__	__	__	__	__	__
B. Emphysema?	__	__	__	__	__	__
C. Asthma?	__	__	__	__	__	__
D. Lung cancer?	__	__	__	__	__	__
E. Other chest conditions	__	__	__	__	__	__
F. Is parent currently alive?	__	__	__	__	__	__
G. Please Specify	__ Age if Living __ Age at Death __ Don't Know			__ Age if Living __ Age at Death __ Don't Know		
H. Please specify cause of death	_____			_____		

COUGH

32A. Do you usually have a cough? (Count a cough with first smoke or on first going out of doors. Exclude clearing of throat.) [If no, skip to question 32C.] 1. Yes __ 2. No __

B. Do you usually cough as much as 4 to 6 times a day 4 or more days out of the week? 1. Yes __

C. Do you usually cough at all on getting up or first thing in the morning? 1. Yes __ 2. No __

D. Do you usually cough at all during the rest of the day or at night? 1. Yes __ 2. No __

IF YES TO ANY OF ABOVE (32A, B, C, or D), ANSWER THE FOLLOWING. IF NO TO ALL, CHECK DOES NOT APPLY AND SKIP TO NEXT PAGE

E. Do you usually cough like this on most days for 3 consecutive months or more during the year? 1. Yes __ 2. No __ 3. Does not apply __

F. For how many years have you had the cough? Number of years __ Does not apply __

33A. Do you usually bring up phlegm from your chest? (Count phlegm with the first smoke or on first going out of doors. Exclude phlegm from the nose. Count swallowed phlegm.) (If no, skip to 33C) 1. Yes __ 2. No __

B. Do you usually bring up phlegm like this as much as twice a day 4 or more days out of the week? 1. Yes __ 2. No __

C. Do you usually bring up phlegm at all on getting up or first thing in the morning? 1. Yes __ 2. No __

D. Do you usually bring up phlegm at all during the rest of the day or at night? 1. Yes __ 2. No __

IF YES TO ANY OF THE ABOVE (33A, B, C, or D), ANSWER THE FOLLOWING: IF NO TO ALL, CHECK DOES NOT APPLY AND SKIP TO 34A.

E. Do you bring up phlegm like this on most days for 3 consecutive months or more during the year? 1. Yes __ 2. No __ 3. Does not apply __

F. For how many years have you had trouble with phlegm? Number of years __ Does not apply __

EPISODES OF COUGH AND PHLEGM

34A. Have you had periods or episodes of (increased*) cough and phlegm lasting for 3 weeks or more each year?
*(For persons who usually have cough and/or phlegm) 1. Yes __ 2. No __

IF YES TO 34A

B. For how long have you had at least 1 such episode per year? Number of years __ Does not apply __

WHEEZING

35A. Does your chest ever sound wheezy or whistling

1. When you have a cold? 1. Yes __ 2. No __
2. Occasionally apart from colds? 1. Yes __ 2. No __
3. Most days or nights? 1. Yes __ 2. No __

IF YES TO 1, 2, or 3 in 35A

B. For how many years has this been present? — Number of years ___ Does not apply ___

36A. Have you ever had an attack of wheezing that has made you feel short of breath? — 1. Yes ___ 2. No ___

IF YES TO 36A

B. How old were you when you had your first such attack? — Age in years ___ Does not apply ___

C. Have you had 2 or more such episodes? — 1. Yes ___ 2. No ___ 3. Does not apply ___

D. Have you ever required medicine or treatment for (his/her) attack(s)? — 1. Yes ___ 2. No ___ 3. Does not apply ___

BREATHLESSNESS

37. If disabled from walking by any condition other than heart or lung disease, please describe and proceed to question 38A. Return of condition(s)_____

38A. Are you troubled by shortness of breath when hurrying on the level or walking up a slight hill? — 1. Yes ___ 2. No ___

IF YES TO 38A

B. Do you have to walk slower than people of your age on the level because of breathlessness? — 1. Yes ___ 2. No ___ 3. Does not apply ___

C. Do you ever have to stop for breath when walking at your own pace on the level? — 1. Yes ___ 2. No ___ 3. Does not apply ___

D. Do you ever have to stop for breath after walking about 100 yards (or after a few minutes) on the level? — 1. Yes ___ 2. No ___ 4. Does not apply ___

E. Are you too breathless to leave the house or breathless on dressing or climbing one flight of stairs? — 1. Yes ___ 2. No ___ 3. Does not apply ___

TOBACCO SMOKING

39A. Have you ever smoked cigarettes? (No means less than 20 packs of cigarettes or 12 oz. of tobacco in a lifetime or less than 1 cigarette a day for 1 year.) — 1. Yes ___ 2. No ___

IF YES TO 39A

B. Do you now smoke cigarettes (as of one month ago) — 1. Yes ___ 2. No ___ 4. Does not apply ___

C. How old were you when you first started regular cigarette smoking? — Age in years ___ Does not apply ___

D. If you have stopped smoking cigarettes completely, how old were you when you stopped? — Age stopped ___ Check if still smoking ___ Does not apply ___

E. How many cigarettes do you smoke per day now? — Cigarettes per day ___ Does not apply ___

F. On the average of the entire time you smoked, how many cigarettes did you smoke per day? — Cigarettes per day ___ Does not apply ___

G. Do or did you inhale the cigarette smoke? — 1. Does not apply ___ 2. Not at all ___ 3. Slightly ___ 4. Moderately ___ 5. Deeply ___

40A. Have you ever smoked a pipe regularly? (Yes means more than 12 oz. of tobacco in a lifetime.) — 1. Yes ___ 2. No ___

IF YES TO 40A:

FOR PERSONS WHO HAVE EVER SMOKED A PIPE

B. 1. How old were you when you started to smoke a pipe regularly? — Age ___

2. If you have stopped smoking a pipe completely, how old were you when you stopped? — Age stopped ___ Check if still smoking pipe ___ Does not apply ___

C On the average over the entire time you smoked a pipe, how much pipe tobacco did you smoke per week? — ___ oz. per week (a standard pouch of tobacco contains 1 1/2 oz.) ___ Does not apply

D. How much pipe tobacco are you smoking now? — oz. per week ___ Not currently smoking a pipe ___

E. Do you or did you inhale the pipe smoke? — 1. Never smoked ___ 2. Not at all ___ 3. Slightly ___ 4. Moderately ___ 5. Deeply ___

41A. Have you ever smoked cigars regularly? (Yes means more than 1 cigar a week for a year) — 1. Yes ___ 2. No ___

IF YES TO 41A

FOR PERSONS WHO HAVE EVER SMOKED CIGARS

B. 1. How old were you when you started smoking cigars regularly? — Age ___

2. If you have stopped smoking cigars completely, how old were you when you stopped. — Age stopped ___ Check if still smoking cigars ___ Does not apply ___

C. On the average over the entire time you smoked cigars, how many cigars did you smoke per week? — Cigars per week ___ Does not apply ___

D. How many cigars are you smoking per week now? — Cigars per week ___ Check if not smoking cigars currently ___

E. Do or did you inhale the cigar smoke? — 1. Never smoked ___ 2. Not at all ___ 3. Slightly ___ 4. Moderately ___ 5. Deeply ___

Signature _____ Date _____

Part 2
PERIODIC MEDICAL QUESTIONNAIRE

1. NAME _____

2. SOCIAL SECURITY # ___ ___ ___ ___ ___ ___ ___ ___ ___ ___
1 2 3 4 5 6 7 8 9

3. CLOCK NUMBER ___ ___ ___ ___ ___ ___ ___
10 11 12 13 14 15

4. PRESENT OCCUPATION _____

5. PLANT _____

6. ADDRESS _____

7. _____
(Zip Code)

8. TELEPHONE NUMBER _____

9. INTERVIEWER _____

10. DATE _____ ___ ___ ___ ___ ___ ___
16 17 18 19 20 21

11. What is your marital status? 1. Single ___ 2. Married ___ 3. Widowed ___ 4. Separated/Divorced ___

12. OCCUPATIONAL HISTORY

12A. In the past year, did you work full time (30 hours per week or more) for 6 months or more? 1. Yes ___ 2. No ___

IF YES TO 12A:

12B. In the past year, did you work in a dusty job? 1. Yes ___ 2. No ___ 3. Does Not Apply ___

12C. Was dust exposure: 1. Mild ___ 2. Moderate ___ 3. Severe ___

12D. In the past year, were you exposed to gas or chemical fumes in your work? 1. Yes ___ 2. No ___

12E. Was exposure: 1. Mild ___ 2. Moderate ___ 3. Severe ___

12F. In the past year, what was your: 1. Job/occupation? _____ 2. Position/job title? _____

13. RECENT MEDICAL HISTORY

13A. Do you consider yourself to be in good health? Yes ___ No ___

If NO, state reason _____

13B. In the past year, have you developed:

	Yes	No
Epilepsy?	___	___
Rheumatic fever?	___	___
Kidney disease?	___	___
Bladder disease?	___	___
Diabetes?	___	___
Jaundice?	___	___
Cancer?	___	___

14. CHEST COLDS AND CHEST ILLNESSES

14A. If you get a cold, does it usually go to your chest? (Usually means more than 1/2 the time) 1. Yes ___ 2. No ___ 3. Don't get colds ___

15A. During the past year, have you had any chest illnesses that have kept you off work, indoors at home, or in bed? 1. Yes ___ 2. No ___ 3. Does Not Apply ___

IF YES TO 15A:

15B. Did you produce phlegm with any of these chest illnesses? 1. Yes ___ 2. No ___ 3. Does Not Apply ___

15C. In the past year, how many such illnesses with (increased) phlegm did you have which lasted a week or more? Number of illnesses ___ No such illnesses ___

16. RESPIRATORY SYSTEM

In the past year have you had:

	Yes or No	Further Comment on Positive Answers
Asthma	___	
Bronchitis	___	
Hay Fever	___	
Other Allergies	___	

	Yes or No	Further Comment on Positive Answers
Pneumonia	___	
Tuberculosis	___	
Chest Surgery	___	
Other Lung Problems	___	
Heart Disease	___	

Do you have:

	Yes or No	Further Comment on Positive Answers
Frequent colds	___	
Chronic cough	___	
Shortness of breath when walking or climbing one flight of stairs	___	
Do you:		
Wheeze	___	
Cough up phlegm	___	
Smoke cigarettes	___	Packs per day ___ How many years ___

Date _____ Signature _____

Appendix E to § 1910.1001—Interpretation and Classification of Chest Roentgenograms—Mandatory

(a) Chest roentgenograms shall be interpreted and classified in accordance with a professionally accepted classification system and recorded on a Roentgenographic Interpretation Form. "Form CSD/NIOSH (M) 2.8.

(b) Roentgenograms shall be interpreted and classified only by a B-reader, a board eligible/certified radiologist, or an experienced physician with known expertise in pneumoconioses.

(c) All interpreters, whenever interpreting chest roentgenograms made under this section, shall have immediately available for reference a complete set of the ILO–U/C International Classification of Radiographs for Pneumoconioses, 1980.

Appendix F to § 1910.1001—Work Practices and Engineering Controls for Automotive Brake Repair Operations—Non-Mandatory

This appendix is intended as guidance for employers in the automotive brake and clutch repair industry who wish to reduce their employees' asbestos exposures during repair operations to levels below the new standard's action level (0.1 f/cc). OSHA believes that employers in this industry sector are likely to be able to reduce their employees' exposures to asbestos by employing the engineering and work practice controls described in Sections A and B of this appendix. Those employers who choose to use these controls and who achieve exposures below the action level will thus be able to avoid any burden that might be imposed by complying with such requirements as medical surveillance, recordkeeping, training, respiratory protection, and regulated areas, which are triggered when employee exposures exceed the action level or PEL.

Asbestos exposure in the automotive brake and clutch repair industry occurs primarily during the replacement of clutch plates and brake pads, shoes, and linings. Asbestos fibers may become airborne when an automotive mechanic removes the asbestos-containing residue that has been deposited as brakes and clutches wear. Employee exposures to asbestos occur during the cleaning of the brake drum or clutch housing.

Based on evidence in the rulemaking record (Exs. 84–74, 84–263, 90–148), OSHA believes that employers engaged in brake repair operations who implement any of the work practices and engineering controls described in Sections A and B of this appendix may be able to reduce their employees' exposures to levels below the action level (0.1 fiber/cc). These control methods and the relevant record evidence on these and other methods are described in the following sections.

A. Enclosed Cylinder/HEPA Vacuum System Method

The enclosed cylinder-vacuum system used in one of the facilities visited by representatives of the National Institute for Occupational Safety and Health (NIOSH) during a health hazard evaluation of brake repair facilities (Ex. 84–263) consists of three components:

(1) A wheel-shaped cylinder designed to cover and enclose the wheel assembly;

(2) A compressed-air hose and nozzle that fits into a port in the cylinder; and

(3) A HEPA-filtered vacuum used to evacuate airborne dust generated within the cylinder by the compressed air.

To operate the system, the brake assembly is enclosed in a cylinder that has viewing ports to provide visibility and cotton sleeves through which the mechanic can handle the brake assembly parts. The cylinder effectively isolates asbestos dust in the drum from the mechanic's breathing zone. The brake assembly isolation cylinder is available from the Nilfisk Company [1] and comes in two sizes to fit brake drums in the 7-to-12-inch size range common to automobiles and light trucks and the 12-to-19-inch size range common to large commercial vehicles. The cylinder is equipped with built-in compressed-air guns and a connection for a vacuum cleaner equipped with a High Efficiency Particulate Air (HEPA) filter. This type of filter is capable of removing all particles greater than 0.3 microns from the air. When the vacuum cleaner's filter is full, it must be replaced according to the manufacturer's instruction, and appropriate HEPA-filtered dual cartridge respirators should be worn during the process. The filter of the vacuum cleaner is assumed to be contaminated with asbestos fibers and should be handled carefully, wetted with a fine mist of water, placed immediately in a labelled plastic bag, and disposed of properly. When the cylinder is in place around the brake assembly and the HEPA vacuum is connected, compressed air is blown into the cylinder to loosen the residue from the brake assembly parts. The vacuum then evacuates the loosened material from within the cylinder, capturing the airborne material on the HEPA filter.

The HEPA vacuum system can be disconnected from the brake assembly isolation cylinder when the cylinder is not being used. The HEPA vacuum can then be used for clutch facing work, grinding, or other routine cleaning.

B. Compressed Air/Solvent System Method

A compressed-air hose fitted at the end with a bottle of solvent can be used to loosen the asbestos-containing residue and to capture the resulting airborne particles in the solvent mist. The mechanic should begin spraying the asbestos-contaminated parts with the solvent at a sufficient distance to ensure that the asbestos particles are not dislodged by the velocity of the solvent spray. After the asbestos particles are thoroughly wetted, the spray may be brought closer to the parts and the parts may be sprayed as necessary to remove grease and other material. The automotive parts sprayed with the mist are then wiped with a rag, which must then be disposed of appropriately. Rags should be placed in a labelled plastic bag or other container while they are still wet. This ensures that the asbestos fibers will not become airborne after the brake and clutch parts have been cleaned. (If cleanup rags are laundered rather than disposed of, they must be washed using methods appropriate for the laundering of asbestos-contaminated materials.)

OSHA believes that a variant of this compressed-air/solvent mist process offers advantages over the compressed-air/solvent mist technique discussed above, both in terms of costs and employee protection. The variant involves the use of spray cans filled with any of several solvent cleaners commercially available from auto supply stores. Spray cans of solvent are inexpensive, readily available, and easy to use. These cans will also save time, because no solvent delivery system has to be assembled, i.e., no compressed-air hose/mister ensemble. OSHA believes that a spray can will deliver solvent to the parts to be cleaned with considerably less force than the alternative compressed-air delivery system described above, and will thus generate fewer airborne asbestos fibers than the compressed-air method. The Agency therefore believes that the exposure levels of automotive repair mechanics using the spray can/solvent mist process will be even lower than the exposures reported by NIOSH (Ex. 84–263) for the compressed-air/solvent mist system (0.06 f/cc).

C. Information on the Effectiveness of Various Control Measures

The amount of airborne asbestos generated during brake and clutch repair operations depends on the work practices and engineering controls used during the repair or removal activity. Data in the rulemaking record document the 8-hour time-weighted averages (TWA_8) asbestos exposure levels associated with various methods of brake and clutch repair and removal.

NIOSH submitted a report to the record entitled "Health Hazard Evaluation for Automotive Brake Repair" (Ex. 84–263). In addition, Exhibits 84–74 and 90–148 provided exposure data for comparing the airborne concentrations of asbestos generated by the use of various work practices during brake repair operations. These reports present

[1] Mention of tradenames or commercial products does not constitute endorsement or recommendation for use.

exposure data for brake repair operations involving a variety of controls and work practices, including:

- Use of compressed air to blow out the brake drums;
- Use of a brush, without a wetting agent, to remove the asbestos-containing residue;
- Use of a brush dipped in water or a solvent to remove the asbestos-containing residue;
- Use of an enclosed vacuum cleaning system to capture the asbestos-containing residue; and
- Use of a solvent mixture applied with compressed air to remove the residue.

Prohibited Methods

The use of compressed air to blow the asbestos-containing residue off the surface of the brake drum removes the residue effectively but simultaneously produces an airborne cloud of asbestos fibers. According to NIOSH (Ex. 84-263), the peak exposures of mechanics using this technique were as high as 15 fibers/cc, and 8-hour TWA exposures ranged from 0.03 to 0.19 f/cc.

Dr. William J. Nicholson of the Mount Sinai School of Medicine (Ex. 84-74) cited data from Knight and Hickish (1970) that indicated that the concentration of asbestos ranged from 0.84 to 5.35 f/cc over a 60-minute sampling period when compressed air was being used to blow out the asbestos-containing residue from the brake drum. In the same study, a peak concentration of 87 f/cc was measured for a few seconds during brake cleaning performed with compressed air. Rohl et al. (1976) (Ex. 90-148) measured area concentrations (of unspecified duration) within 3-5 feet of operations involving the cleaning of brakes with compressed air and obtained readings ranging from 6.6 to 29.8 f/cc. Because of the high exposure levels that result from cleaning brake and clutch parts using compressed air, OSHA has prohibited this practice in the revised standard.

Ineffective Methods

When dry brushing was used to remove the asbestos-containing residue from the brake drums and wheel assemblies, peak exposures measured by NIOSH ranged from 0.61 to 0.81 f/cc, while 8-hour TWA levels were at the new standard's permissible exposure limit (PEL) of 0.2 f/cc (Ex. 84-263). Rohl and his colleagues (Ex. 90-148) collected area samples 1-3 feet from a brake cleaning operation being performed with a dry brush, and measured concentrations ranging from 1.3 to 3.6 f/cc; however, sampling times and TWA concentrations were not presented in the Rohl et al. study.

When a brush wetted with water, gasoline, or Stoddart solvent was used to clean the asbestos-containing residue from the affected parts, exposure levels (8-hour TWAs) measured by NIOSH also exceeded the new 0.2 f/cc PEL, and peak exposures ranged as high as 2.62 f/cc (Ex. 84-263).

Preferred Methods

Use of an engineering control system involving a cylinder that completely encloses the brake shoe assembly and a High Efficiency Particulate Air (HEPA) filter-equipped vacuum produced 8-hour TWA employee exposures of 0.01 f/cc and peak exposures ranging from nondetectable to 0.07 f/cc (Ex. 84-263). (Because this system achieved exposure levels below the standard's action level, it is described in detail below.) Data collected by the Mount Sinai Medical Center (Ex. 90-148) for Nilfisk of America, Inc., the manufacturer of the brake assembly enclosure system, showed that for two of three operations sampled, the exposure of mechanics to airborne asbestos fibers was nondetectable. For the third operator sampled by Mt. Sinai researchers, the exposure was 0.5 f/cc, which the authors attributed to asbestos that had contaminated the operator's clothing in the course of previous brake repair operations performed without the enclosed cylinder/vacuum system.

Some automotive repair facilities use a compressed-air hose to apply a solvent mist to remove the asbestos-containing residue from the brake drums before repair. The NIOSH data (Ex. 84-263) indicated that mechanics employing this method experienced exposures (8-hour TWAs) of 0.8 f/cc, with peaks of 0.25 to 0.66 f/cc. This technique, and a variant of it that OSHA believes is both less costly and more effective in reducing employee exposures, is described in greater detail above in Sections A and B.

D. Summary

In conclusion, OSHA believes that it is likely that employers in the brake and clutch repair industry will be able to avail themselves of the action level trigger built into the revised standard if they conscientiously employ one of the three control methods described above: the enclosed cylinder/HEPA vacuum system, the compressed air/solvent method, or the spray can/solvent mist system.

Appendix G to § 1910.1001—Substance Technical Information for Asbestos—Non-Mandatory

I. Substance Identification

A. Substance: "Asbestos" is the name of a class of magnesium-silicate minerals that occur in fibrous form. Minerals that are included in this group are chrysotile, crocidolite, amosite, tremolite asbestos, anthophyllite asbestos, and actinolite asbestos.

B. Asbestos, tremolite, anthophyllite, and actinolite are used in the manufacture of heat-resistant clothing, automotive brake and clutch linings, and a variety of building materials including floor tiles, roofing felts, ceiling tiles, asbestos-cement pipe and sheet, and fire-resistant drywall. Asbestos is also present in pipe and boiler insulation materials, and in sprayed-on materials located on beams, in crawlspaces, and between walls.

C. The potential for a product containing asbestos, tremolite, anthophyllite, and actinolite to release breatheable fibers depends on its degree of friability. Friable means that the material can be crumbled with hand pressure and is therefore likely to emit fibers. The fibrous or fluffy sprayed-on materials used for fireproofing, insulation, or sound proofing are considered to be friable, and they readily release airborne fibers if disturbed. Materials such as vinyl-asbestos floor tile or roofing felts are considered nonfriable and generally do not emit airborne fibers unless subjected to sanding or sawing operations. Asbestos-cement pipe or sheet can emit airborne fibers if the materials are cut or sawed, or if they are broken during demolition operations.

D. Permissible exposure: Exposure to airborne asbestos, tremolite, anthophyllite, and actinolite fibers may not exceed 0.2 fibers per cubic centimeter of air (0.2 f/cc) averaged over the 8-hour workday.

II. Health Hazard Data

A. Asbestos, tremolite, anthophyllite, and actinolite can cause disabling respiratory disease and various types of cancers if the fibers are inhaled. Inhaling or ingesting fibers from contaminated clothing or skin can also result in these diseases. The symptoms of these diseases generally do not appear for 20 or more years after initial exposure.

B. Exposure to asbestos, tremolite, anthophyllite, and actinolite has been shown to cause lung cancer, mesothelioma, and cancer of the stomach and colon. Mesothelioma is a rare cancer of the thin membrane lining of the chest and abdomen. Symptoms of mesothelioma include shortness of breath, pain in the walls of the chest, and/or abdominal pain.

III. Respirators and Protective Clothing

A. Respirators: You are required to wear a respirator when performing tasks that result in asbestos, tremolite, anthophyllite, and actinolite exposure that exceeds the permissible exposure limit (PEL) of 0.2 f/cc. These conditions can occur while your employer is in the process of installing engineering controls to reduce asbestos, tremolite, anthophyllite, and actinolite exposure, or where engineering controls are not feasible to reduce asbestos, tremolite, anthophyllite, and actinolite exposure. Air-purifying respirators equipped with a high-efficiency particulate air (HEPA) filter can be used where airborne asbestos, tremolite, anthophyllite, and actinolite fiber concentrations do not exceed 2 f/cc; otherwise, air-supplied, positive-pressure, full facepiece respirators must be used. Disposable respirators or dust masks are not

[Sec. 1910.1001, Appendix G]

permitted to be used for asbestos, tremolite, anthophyllite, and actinolite work. For effective protection, respirators must fit your face and head snugly. Your employer is required to conduct fit tests when you are first assigned a respirator and every 6 months thereafter. Respirators should not be loosened or removed in work situations where their use is required.

B. Protective Clothing: You are required to wear protective clothing in work areas where asbestos, tremolite, anthophyllite, and actinolite fiber concentrations exceed the permissible exposure limit (PEL) of 0.2 f/cc to prevent contamination of the skin. Where protective clothing is required, your employer must provide you with clean garments. Unless you are working on a large asbestos, tremolite, anthophyllite, and actinolite removal or demolition project, your employer must also provide a change room and separate lockers for your street clothes and contaminated work clothes. If you are working on a large asbestos, tremolite, anthophyllite, and actinolite removal or demolition project, and where it is feasible to do so, your employer must provide a clean room, shower, and decontamination room contiguous to the work area. When leaving the work area, you must remove contaminated clothing before proceeding to the shower. If the shower is not adjacent to the work area, you must vacuum your clothing before proceeding to the change room and shower. To prevent inhaling fibers in contaminated change rooms and showers, leave your respirator on until you leave the shower and enter the clean change room.

IV. Disposal Procedures and Cleanup

A. Wastes that are generated by processes where asbestos, tremolite, anthophyllite, and actinolite is present include:

1. Empty asbestos, tremolite, anthophyllite, and actinolite shipping containers.

2. Process wastes such as cuttings, trimmings, or reject material.

3. Housekeeping waste from sweeping or vacuuming.

4. Asbestos, tremolite, anthophyllite, and actinolite fireproofing or insulating material that is removed from buildings.

5. Building products that contain asbestos, tremolite, anthophyllite, and actinolite removed during building renovation or demolition.

6. Contaminated disposable protective clothing.

B. Empty shipping bags can be flattened under exhaust hoods and packed into airtight containers for disposal. Empty shipping drums are difficult to clean and should be sealed.

C. Vacuum logs or disposable paper filters should not be cleaned, but should be sprayed with a fine water mist and placed into a labeled waste container.

D. Process waste and housekeeping waste should be wetted with water or a mixture of water and surfactant prior to packaging in disposable containers.

E. Material containing asbestos, tremolite, anthophyllite, and actinolite that is removed from buildings must be disposed of in leak-tight 6-mil thick plastic bags, plastic-lined cardboard containers, or plastic-lined metal containers. These wastes, which are removed while wet, should be sealed in containers before they dry out to minimize the release of asbestos, tremolite, anthophyllite, and actinolite fibers during handling.

V. Access to Information

A. Each year, your employer is required to inform you of the information contained in this standard and appendices for asbestos, tremolite, anthophyllite, and actinolite. In addition, your employer must instruct you in the proper work practices for handling materials containing asbestos, tremolite, anthophyllite, and actinolite, and the correct use of protective equipment.

B. Your employer is required to determine whether you are being exposed to asbestos, tremolite, anthophyllite, and actinolite. You or your representative has the right to observe employee measurements and to record the results obtained. Your employer is required to inform you of your exposure, and, if you are exposed above the permissible limit, he or she is required to inform you of the actions that are being taken to reduce your exposure to within the permissible limit.

C. Your employer is required to keep records of your exposures and medical examinations. These exposure records must be kept for at least thirty (30) years. Medical records must be kept for the period of your employment plus thirty (30) years.

D. Your employer is required to release your exposure and medical records to your physician or designated representative upon your written request.

Appendix H to § 1910.1001—Medical Surveillance Guidelines for Asbestos Tremolite, Anthophyllite, and Actinolite Non-Mandatory

I. Route of Entry Inhalation, Ingestion

II. Toxicology

Clinical evidence of the adverse effects associated with exposure to asbestos, tremolite, anthophyllite, and actinolite, is present in the form of several well-conducted epidemiological studies of occupationally exposed workers, family contacts of workers, and persons living near asbestos, tremolite, anthophyllite, and actinolite mines. These studies have shown a definite association between exposure to asbestos, tremolite, anthophyllite, and actinolite and an increased incidence of lung cancer, pleural and peritoneal mesothelioma, gastrointestinal cancer, and asbestosis. The latter is a disabling fibrotic lung disease that is caused only by exposure to asbestos. Exposure to asbestos, tremolite, anthophyllite, and actinolite has also been associated with an increased incidence of esophageal, kidney, laryngeal, pharyngeal, and buccal cavity cancers. As with other known chronic occupational diseases, disease associated with asbestos, tremolite, anthophyllite, and actinolite generally appears about 20 years following the first occurrence of exposure. There are no known acute effects associated with exposure to asbestos, tremolite, anthophyllite, and actinolite.

Epidemiological studies indicate that the risk of lung cancer among exposed workers who smoke cigarettes is greatly increased over the risk of lung cancer among non-exposed smokers or exposed nonsmokers. These studies suggest that cessation of smoking will reduce the risk of lung cancer for a person exposed to asbestos, tremolite, anthophyllite, and actinolite but will not reduce it to the same level of risk as that existing for an exposed worker who has never smoked.

III. Signs and Symptoms of Exposure-Related Disease

The signs and symptoms of lung cancer or gastrointestinal cancer induced by exposure to asbestos, tremolite, anthophyllite, and actinolite are not unique, except that a chest X-ray of an exposed patient with lung cancer may show pleural plaques, pleural calcification, or pleural fibrosis. Symptoms characteristic of mesothelioma include shortness of breath, pain in the walls of the chest, or abdominal pain. Mesothelioma has a much longer latency period compared with lung cancer (40 years versus 15–20 years), and mesothelioma is therefore more likely to be found among workers who were first exposed to asbestos at an early age. Mesothelioma is always fatal.

Asbestosis is pulmonary fibrosis caused by the accumulation of asbestos fibers in the lungs. Symptoms include shortness of breath, coughing, fatigue, and vague feelings of sickness. When the fibrosis worsens, shortness of breath occurs even at rest. The diagnosis of asbestosis is based on a history of exposure to asbestos, the presence of characteristic radiologic changes, end-inspiratory crackles (rales), and other clinical features of fibrosing lung disease. Pleural plaques and thickening are observed on X-rays taken during the early stages of the disease. Asbestosis is often a progressive disease even in the absence of continued exposure, although this appears to be a highly individualized characteristic. In severe cases, death may be caused by respiratory or cardiac failure.

[Sec. 1910.1001, Appendix H]

IV. Surveillance and Preventive Considerations

As noted above, exposure to asbestos, tremolite, anthophyllite, and actinolite has been linked to an increased risk of lung cancer, mesothelioma, gastrointestinal cancer, and asbestosis among occupationally exposed workers. Adequate screening tests to determine an employee's potential for developing serious chronic diseases, such as cancer, from exposure to asbestos, tremolite, anthophyllite, and actinolite do not presently exist. However, some tests, particularly chest X-rays and pulmonary function tests, may indicate that an employee has been overexposed to asbestos, tremolite, anthophyllite, and actinolite, increasing his or her risk of developing exposure-related chronic diseases. It is important for the physician to become familiar with the operating conditions in which occupational exposure to asbestos, tremolite, anthophyllite, and actinolite is likely to occur. This is particularly important in evaluating medical and work histories and in conducting physical examinations. When an active employee has been identified as having been overexposed to asbestos, tremolite, anthophyllite, and actinolite, measures taken by the employer to eliminate or mitigate further exposure should also lower the risk of serious long-term consequences.

The employer is required to institute a medical surveillance program for all employees who are or will be exposed to asbestos, tremolite, anthophyllite, and actinolite at or above the action level (0.1 fiber per cubic centimeter of air) for 30 or more days per year and for all employees who are assigned to wear a negative-pressure respirator. All examinations and procedures must be performed by or under the supervision of a licensed physician, at a reasonable time and place, and at no cost to the employee.

Although broad latitude is given to the physician in prescribing specific tests to be included in the medical surveillance program, OSHA requires inclusion of the following elements in the routine examination:

(i) Medical and work histories with special emphasis directed to symptoms of the respiratory system, cardiovascular system, and digestive tract.

(ii) Completion of the respiratory disease questionnaire contained in Appendix D.

(iii) A physical examination including a chest roentgenogram and pulmonary function test that includes measurement of the employee's forced vital capacity (FVC) and forced expiratory volume at one second (FEV_1).

(iv) Any laboratory or other test that the examining physician deems by sound medical practice to be necessary.

The employer is required to make the prescribed tests available at least annually to those employees covered; more often than specified if recommended by the examining physician; and upon termination of employment.

The employer is required to provide the physician with the following information: A copy of this standard and appendices; a description of the employee's duties as they relate to asbestos exposure; the employee's representative level of exposure to asbestos tremolite, anthophyllite, and actinolite; a description of any personal protective and respiratory equipment used; and information from previous medical examinations of the affected employee that is not otherwise available to the physician. Making this information available to the physician will aid in the evaluation of the employee's health in relation to assigned duties and fitness to wear personal protective equipment, if required.

The employer is required to obtain a written opinion from the examining physician containing the results of the medical examination; the physician's opinion as to whether the employee has any detected medical conditions that would place the employee at an increased risk of exposure-related disease; any recommended limitations on the employee or on the use of personal protective equipment; and a statement that the employee has been informed by the physician of the results of the medical examination and of any medical conditions related to asbestos, tremolite, anthophyllite, and actinolite exposure that require further explanation or treatment. This written opinion must not reveal specific findings or diagnoses unrelated to exposure to asbestos, tremolite, anthophyllite, and actinolite, and a copy of the opinion must be provided to the affected employee.

[Sec. 1910.1001, Appendix H]

§ 1926.58 Asbestos, tremolite, anthophyllite, and actinolite.

[Sec. 1926.58 added by 51 FR 22756, June 20, 1986]

(a) *Scope and application.* This section applies to all construction work as defined in 29 CFR 1910.12(b), including but not limited to the following:

(1) Demolition or salvage of structures where asbestos, tremolite, anthophyllite, or actinolite is present;

(2) Removal or encapsulation of materials containing asbestos, tremolite, anthophyllite, or actinolite;

(3) Construction, alteration, repair, maintenance, or renovation of structures, substrates, or portions thereof, that contain asbestos, tremolite, anthophyllite, or actinolite;

(4) Installation of products containing asbestos, tremolite, anthophyllite, or actinolite;

(5) Asbestos, tremolite, anthophyllite, and actinolite spill/emergency cleanup; and

(6) Transportation, disposal, storage, or containment of asbestos, tremolite, anthophyllite, or actinolite or products containing asbestos, tremolite, anthophyllite, or actinolite on the site or location at which construction activities are performed.

(b) *Definitions.* "Action level" means an airborne concentration of asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals of 0.1 fiber per cubic centimeter (f/cc) of air calculated as an eight (8)-hour time-weighted average.

"Asbestos" includes chrysotile, amosite, crocidolite, tremolite asbestos, anthophyllite asbestos, actinolite asbestos, and any of these minerals that has been chemically treated and/or altered.

"Assistant Secretary" means the Assistant Secretary of Labor for Occupational Safety and Health, U.S. Department of Labor, or designee.

"Authorized person" means any person authorized by the employer and required by work duties to be present in regulated areas.

"Clean room" means an uncontaminated room having facilities for the storage of employees' street clothing and uncontaminated materials and equipment.

"Competent person" means one who is capable of identifying existing asbestos, tremolite, anthophyllite, or actinolite hazards in the workplace and who has the authority to take prompt corrective measures to eliminate them, as specified in 29 CFR 1926.32(f). The duties of the competent person include at least the following: establishing the negative-pressure enclosure, ensuring its integrity, and controlling entry to and exit from the enclosure; supervising any employee exposure monitoring required by the standard; ensuring that all employees working within such an enclosure wear the appropriate personal protective equipment, are trained in the use of appropriate methods of exposure control, and use the hygiene facilities and decontamination procedures specified in the standard; and ensuring that engineering controls in use are in proper operating condition and are functioning properly.

"Decontamination area" means an enclosed area adjacent and connected to the regulated area and consisting of an equipment room, shower area, and clean room, which is used for the decontamination of workers, materials, and equipment contaminated with asbestos, tremolite, anthophyllite, or actinolite.

"Demolition" means the wrecking or taking out of any load-supporting structural member and any related razing, removing, or stripping of asbestos, tremolite, anthophyllite, or actinolite products.

"Director" means the Director, National Institute for Occupational Safety and Health, U.S. Department of Health and Human Services, or designee.

"Employee exposure" means that exposure to airborne asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals, that would occur if the employee were not using respiratory protective equipment.

"Equipment room (change room)" means a contaminated room located within the decontamination area that is supplied with impermeable bags or containers for the disposal of contaminated protective clothing and equipment.

"Fiber" means a particulate form of asbestos, tremolite, anthophyllite, or actinolite, 5 micrometers or longer, with a length-to-diameter ratio of at least 3 to 1.

"High-efficiency particulate air (HEPA) filter" means a filter capable of trapping and retaining at least 99.97 percent of all monodispersed particles of 0.3 micrometers in diameter or larger.

"Regulated area" means an area established by the employer to demarcate areas where airborne concentrations of asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals exceed or can reasonably be expected to exceed the permissible exposure limit. The regulated area may take the form of (1) a temporary enclosure, as required by paragraph (e)(6) of this section, or (2) an area demarcated in any manner that minimizes the number of employees exposed to asbestos, tremolite, anthophyllite, or actinolite.

"Removal" means the taking out or stripping of asbestos, tremolite, anthophyllite, or actinolite or materials containing asbestos, tremolite, anthophyllite, or actinolite.

[Sec. 1926.58(b)]

"Renovation" means the modifying of any existing structure, or portion thereof, where exposure to airborne asbestos, tremolite, anthophyllite, actinolite may result.

"Repair" means overhauling, rebuilding, reconstructing, or reconditioning of structures or substrates where asbestos, tremolite, anthophyllite,or actinolite is present.

"Tremolite, anthophyllite and actinolite" means the non-asbestos form of these minerals, and any of these minerals that have been chemically treated and/or altered.

(c) *Permissible exposure limit (PEL).* The employer shall ensure that no employee is exposed to an airborne concentration of asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals in excess of 0.2 fiber per cubic centimeter of air as an eight (8) hour time-weighted average (TWA), as determined by the method prescribed in Appendix A of this section, or by an equivalent method.

(d) *Communication among employers.* On multi-employer worksites, an employer performing asbestos, tremolite, anthophyllite, or actinolite work requiring the establishment of a regulated area shall inform other employers on the site of the nature of the employer's work with asbestos, tremolite, anthophyllite, or actinolite and of the existence of and requirements pertaining to regulated areas.

(e) *Regulated areas*—(1) *General.* The employer shall establish a regulated area in work areas where airborne concentrations of asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals exceed or can reasonably be expected to exceed the permissible exposure limit prescribed in paragraph (c) of this section.

(2) *Demarcation.* The regulated area shall be demarcated in any manner that minimizes the number of persons within the area and protects persons outside the area from exposure to airborne concentrations of asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals in excess of the permissible exposure limit.

(3) *Access.* Access to regulated areas shall be limited to authorized persons or to persons authorized by the Act or regulations issued pursuant thereto.

(4) *Respirators.* All persons entering a regulated area shall be supplied with a respirator, selected in accordance with paragraph (h)(2) of this section.

(5) *Prohibited activities.* The employer shall ensure that employees do not eat, drink, smoke, chew tobacco or gum, or apply cosmetics in the regulated area.

(6) *Requirements for asbestos removal, demolition, and renovation operations.* (i) Wherever feasible, the employer shall establish negative-pressure enclosures before commencing removal, demolition, and renovation operations.

(ii) The employer shall designate a competent person to perform or supervise the following duties:

(A) Set up the enclosure;

(B) Ensure the integrity of the enclosure;

(C) Control entry to and exit from the enclosure;

(D) Supervise all employee exposure monitoring required by this section;

(E) Ensure that employees working within the enclosure wear protective clothing and respirators as required by paragraphs (i) and (h) of this section and;

(F) Ensure that employees are trained in the use of engineering controls, work practices, and personal protective equipment;

(G) Ensure that employees use the hygiene facilities and observe the decontamination procedures specified in paragraph (j) of this section; and

(H) Ensure that engineering controls are functioning properly.

(iii) In addition to the qualifications specified in paragraph (b) of this section, the competent person shall be trained in all aspects of asbestos, tremolite, anthophyllite, or actinolite abatement, the contents of this standard, the identification of asbestos, tremolite, anthophyllite, or actinolite and their removal procedures, and other practices for reducing the hazard. Such training shall be obtained in a comprehensive course, such as a course conducted by an EPA Asbestos Training Center, or an equivalent course.

(iv) *Exception:* For small-scale, short-duration operations, such as pipe repair, valve replacement, installing electrical conduits, installing or removing drywall, roofing, and other general building maintenance or renovation, the employer is not required to comply with the requirements of paragraph (e)(6) of this section.

(f) *Exposure monitoring*—(1) *General.* (i) Each employer who has a workplace or work operation covered by this standard shall perform monitoring to determine accurately the airborne concentrations of asbestos, tremolite, anthophyllite, actinolite or a combination of these minerals to which employees may be exposed.

(ii) Determinations of employee exposure shall be made from breathing zone air samples that are representative of the 8-hour TWA of each employee.

(iii) Representative 8-hour TWA employee exposure shall be determined on the basis of one or more samples representing full-shift exposure for employees in each work area.

(2) *Initial monitoring.* (i) Each employer who has a workplace or work operation covered by this standard, except as provided for in paragraph (f)(2)(ii) and (f)(2)(iii) of this section, shall perform initial monitoring at the initiation of each asbestos, tremolite, anthophyllite, actinolite job to accurately determine the airborne concentrations of asbestos, tremolite, anthophyllite, or actinolite to which employees may be exposed.

(ii) The employer may demonstrate that employee exposures are below the action level by means of objective data demonstrating that the product or material containing asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals cannot release airborne fibers in concentrations exceeding the action level under those work conditions having the greatest potential for releasing asbestos, tremolite, anthophyllite, or actinolite.

(iii) Where the employer has monitored each asbestos, tremolite, anthophyllite, or actinolite job, and the data were obtained during work operations conducted under workplace conditions closely resembling the processes, type of material, control methods, work practices, and environmental conditions used and prevailing in the employer's current operations, the employer may rely on such earlier monitoring results to satisfy the requirements of paragraph (f)(2)(i) of this section.

(3) *Periodic monitoring within regulated areas.* The employer shall conduct daily monitoring that is representative of the exposure of each employee who is assigned to work within a regulated area. *Exception:* When all employees within a regulated area are equipped with supplied-air respirators operated in the positive-pressure mode, the employer may dispense with the daily monitoring required by this paragraph.

(4) *Termination of monitoring.* If the periodic monitoring required by paragraph (f)(3) of this section reveals that employee exposures, as indicated by statistically reliable measurements, are below the action level, the employer may discontinue monitoring for those employees whose exposures are represented by such monitoring.

(5) *Method of monitoring.* (i) All samples taken to satisfy the monitoring requirements of paragraph (f) of this section shall be personal samples

[Sec. 1926.58(f)(5)(i)]

collected following the porocedures specified in Appendix A.

(ii) All samples taken to satisfy the monitoring requirements of paragraph (f) of this section shall be evaluated using the OSHA Reference Method (ORM) specified in Appendix A, or an equivalent counting method.

(iii) If an equivalent method to the ORM is used, the employer shall ensure that the method meets the following criteria:

(A) Replicate exposure data used to establish equivalency are collected in side-by-side field and laboratory comparisons;

(B) The comparison indicates that 90 percent of the samples collected in the range 0.5 to 2.0 times the permissible limit have an accuracy range of plus or minus 25 percent of the ORM results with a 95 percent confidence level as demonstrated by a statistically valid protocol; and

(C) The equivalent method is documented and the results of the comparison testing are maintained.

(iv) To satisfy the monitoring requirements of paragraph (f), employers shall rely on the results of monitoring analysis performed by laboratories that have instituted quality assurance programs that include the elements prescribed in Appendix A.

(6) *Employee notification of monitoring results.* (i) The employer shall notify affected employees of the monitoring results that represent that employee's exposure as soon as possible following receipt of monitoring results.

(ii) The employer shall notify affected employees of the results of monitoring representing the employee's exposure in writing either individually or by posting at a centrally located place that is accessible to affected employees.

(7) *Observation of monitoring.* (i) The employer shall provide affected employees or their designated representatives an opportunity to observe any monitoring of employee exposure to asbestos, tremolite, anthophyllite, or actinolite conducted in accordance with this section.

(ii) When observation of the monitoring of employee exposure to asbestos, tremolite, anthophyllite, or actinolite requires entry into an area where the use of protective clothing or equipment is required, the observer shall be provided with and be required to use such clothing and equipment and shall comply with all other applicable safety and health procedures.

(g) *Methods of compliance.*—(1) *Engineering controls and work practices.* (i) The employer shall use one or any combination of the following control methods to achieve compliance with the permissible exposure limit prescribed by paragraph (c) of this section:

(A) Local exhaust ventilation equipped with HEPA filter dust collection systems;

(B) General ventilation systems;

(C) Vacuum cleaners equipped with HEPA filters;

(D) Enclosure or isolation of processes producing asbestos, tremolite, anthophyllite, or actinolite dust;

(E) Use of wet methods, wetting agents, or removal encapsulants to control employee exposures during asbestos, tremolite, anthophyllite, or actinolite handling, mixing, removal, cutting, application, and cleanup;

(F) Prompt disposal of wastes contaminated with asbestos, tremolite, anthophyllite, or actinolite in leak-tight containers; or

(G) Use of work practices or other engineering controls that the Assistant Secretary can show to be feasible.

(ii) Wherever the feasible engineering and work practice controls described above are not sufficient to reduce employee exposure to or below the limit prescribed in paragraph (c), the employer shall use them to reduce employee exposure to the lowest levels attainable by these controls and shall supplement them by the use of respiratory protection that complies with the requirements of paragraph (h) of this section.

(2) *Prohibitions.* (i) High-speed abrasive disc saws that are not equipped with appropriate engineering controls shall not be used for work related to asbestos, tremolite, anthophyllite, or actinolite.

(ii) Compressed air shall not be used to remove asbestos, tremolite, anthophyllite, or actinolite or materials containing asbestos, tremolite, anthophyllite, or actinolite unless the compressed air is used in conjunction with an enclosed ventilation system designed to capture the dust cloud created by the compressed air.

(iii) Materials containing asbestos, tremolite, anthophyllite, or actinolite shall not be applied by spray methods.

(3) *Employee rotation.* The employer shall not use employee rotation as a means of compliance with the exposure limit prescribed in paragraph (c) of this section.

(h) *Respiratory protection.*—(1) *General.* The employer shall provide respirators, and ensure that they are used, where required by this section. Respirators shall be used in the following circumstances:

(i) During the interval necessary to install or implement feasible engineering and work practice controls;

(ii) In work operations such as maintenance and repair activities, or other activities for which engineering and work practice controls are not feasible;

(iii) In work situations where feasible engineering and work practice controls are not yet sufficient to reduce exposure to or below the exposure limit; and

(iv) In emergencies.

(2) *Respirator selection.* (i) Where respirators are used, the employer shall select and provide, at no cost to the employee, the appropriate respirator as specified in Table D–4, and shall ensure that the employee uses the respirator provided.

(ii) The employer shall select respirators from among those jointly approved as being acceptable for protection by the Mine Safety and Health Administration (MSHA) and the National Institute for Occupational Safety and Health (NIOSH) under the provisions of 30 CFR Part 11.

(iii) The employer shall provide a powered, air-purifying respirator in lieu of any negative-pressure respirator specified in Table D–4 whenever:

(A) An employee chooses to use this type of respirator; and

(B) This respirator will provide adequate protection to the employee.

TABLE D–4.—RESPIRATORY PROTECTION FOR ASBESTOS, TREMOLITE, ANTHOPHYLLITE, AND ACTINOLITE FIBERS

Airborne concentration of asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals	Required respirator
Not in excess of 2 f/cc (10 X PEL).	1. Half-mask air-purifying respirator equipped with high-efficiency filters.
Not in excess of 10 f/cc (50 X PEL).	1. Full facepiece air-purifying respirator equipped with high-efficiency filters.
Not in excess of 20 f/cc (100 X PEL).	1. Any powered air purifying respirator equipped with high efficiency filters. 2. Any supplied-air respirator operated in continuous flow mode.
Not in excess of 200 f/cc (1000 X PEL).	1. Full facepiece supplied-air respirator operated in pressure demand mode.
Greater than 200 f/cc (>1,000 X PEL) or unknown concentration.	1. Full facepiece supplied air respirator operated in pressure demand mode equipped with an auxiliary positive pressure self-contained breathing apparatus.

NOTE: a. Respirators assigned for higher environmental concentrations may be used at lower concentrations.

b. A high-efficiency filter means a filter that is at least 99.97 percent efficient against mono-dispersed particles of 0.3 micrometers in diameter or larger.

(3) *Respirator program.* (i) Where respiratory protection is used, the employer shall institute a respirator program in accordance with 29 CFR 1910.134(b), (d), (e), and (f).

(ii) The employer shall permit each employee who uses a filter respirator to

[Sec. 1926.58(h)(3)(ii)]

change the filter elements whenever an increase in breathing resistance is detected and shall maintain an adequate supply of filter elements for this purpose.

(iii) Employees who wear respirators shall be permitted to leave work areas to wash their faces and respirator facepieces whenever necessary to prevent skin irritation associated with respirator use.

(iv) No employee shall be assigned to tasks requiring the use of respirators if, based on his or her 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 of other employees will be impaired by the use of a respirator. Such employee shall be assigned to another job or given the opportunity to transfer to a different position the duties of which he or she is able to perform with the same employer, in the same geographical area, and with the same seniority, status, and rate of pay he or she had just prior to such transfer, if such a different position is available.

(4) *Respirator fit testing.* (i) The employer shall ensure that the respirator issued to the employee exhibits the least possible facepiece leakage and that the respirator is fitted properly.

(ii) Employers shall perform either quantitative or qualitative face fit tests at the time of initial fitting and at least every 6 months thereafter for each employee wearing a negative-pressure respirator. The qualitative fit tests may be used only for testing the fit of half-mask respirators where they are permited to be worn, and shall be conducted in accordance with Appendix C. The tests shall be used to select facepieces that provide the required protection as prescribed in Table 1.

(l) *Protective clothing*—(1) *General.* The employer shall provide and require the use of protective clothing, such as coveralls or similar whole-body clothing, head coverings, gloves, and foot coverings for any employee exposed to airborne concentrations of asbestos, tremolite, anthophyllite, actinolite or a combination of these minerals that exceed the permissible exposure limit prescribed in paragraph (c) of this section.

(2) *Laundering.* (i) The employer shall ensure that laundering of contaminated clothing is done so as to prevent the release of airborne asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals in excess of the exposure limit prescribed in paragraph (c) of this section.

(ii) Any employer who gives contaminated clothing to another person for laundering shall inform such person of the requirement in paragraph (l)(2)(i) of this section to effectively prevent the release of airborne asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals in excess of the exposure limit prescribed in paragraph (c) of this section.

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

(4) *Protective clothing for removal, demolition, and renovation operations.* (i) The competent person shall periodically examine worksuits worn by employees for rips or tears that may occur during performance of work.

(ii) When rips or tears are detected while an employee is working within a negative-pressure enclosure, rips and tears shall be immediately mended, or the worksuit shall be immediately replaced.

(j) *Hygiene facilities and practices*—(1) *General.* (i) The employer shall provide clean change areas for employees required to work in regulated areas or required by paragraph (l)(1) of this section to wear protective clothing. *Exception:* In lieu of the change area requirement specified in paragraph (j)(1)(i), the employer may permit employees engaged in small scale, short duration operations, as described in paragraph (e)(6) of this section, to clean their protective clothing with a portable HEPA-equipped vacuum before such employees leave the area where maintenance was performed.

(ii) The employer shall ensure that change areas are equipped with separate storage facilities for protective clothing and street clothing, in accordance with section 1910.141(e).

(iii) Whenever food or beverages are consumed at the worksite and employees are exposed to airborne concentrations of asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals in excess of the permissible exposure limit, the employer shall provide lunch areas in which the airborne concentrations of asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals are below the action level.

(2) *Requirements for removal, demolition, and renovation operations*—(i) *Decontamination area.* Except for small scale, short duration operations, as described in paragraph (e)(6) of this section, the employer shall establish a decontamination area that is adjacent and connected to the regulated area for the decontamination of employees contaminated with asbestos, tremolite, anthophyllite, or actinolite. The decontamination area shall consist of an equipment room, shower area, and clean room in series. The employer shall ensure that employees enter and exit the regulated area through the decontamination area.

(ii) *Clean room.* The clean room shall be equipped with a locker or appropriate storage container for each employee's use.

(iii) *Shower area.* Where feasible, shower facilities shall be provided which comply with 29 CFR 1910.141(d)(3). The showers shall be contiguous both to the equipment room and the clean change room, unless the employer can demonstrate that this location is not feasible. Where the employer can demonstrate that it is not feasible to locate the shower between the equipment room and the clean change room, the employer shall ensure that employees:

(A) Remove asbestos, tremolite, anthophyllite, or actinolite contamination from their worksuits using a HEPA vacuum before proceeding to a shower that is not contiguous to the work area; or

(B) Remove their contaminated worksuits, don clean worksuits, and proceed to a shower that is not contiguous to the work area.

(iv) *Equipment room.* The equipment room shall be supplied with impermeable, labeled bags and containers for the containment and disposal of contaminated protective clothing and equipment.

(v) *Decontamination area entry procedures.* (A) the employer shall ensure that employees:

(*1*) Enter the decontamination area through the clean room;

(*2*) Remove and deposit street clothing within a locker provided for their use; and

(*3*) Put on protective clothing and respiratory protection before leaving the clean room.

(B) Before entering the enclosure, the employer shall ensure that employees pass through the equipment room.

(vi) *Decontamination area exit procedures.* (A) Before leaving the regulated area, the employer shall ensure that employees remove all gross contamination and debris from their protective clothing.

(B) The employer shall ensure that employees remove their protective clothing in the equipment room and deposit the clothing in labeled impermeable bags or containers.

(C) The employer shall ensure that employees do not remove their respirators in the equipment room.

[Sec. 1926.58(j)(2)(vi)(C)]

(D) The employer shall ensure that employees shower prior to entering the clean room.

(E) The employer shall ensure that, after showering, employees enter the clean room before changing into street clothes.

(k) *Communication of hazards to employees*—(1) *Signs.* (i) Warning signs that demarcate the regulated area shall be provided and displayed at each location where airborne concentrations of asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals may be in excess of the exposure limit prescribed in paragraph (c) of this section. Signs shall be posted at such a distance from such a location that an employee may read the signs and take necessary protective steps before entering the area marked by the signs.

(ii) The warning signs required by paragraph (k)(1)(i) of this section shall bear the following information:

DANGER

ASBESTOS

CANCER AND LUNG DISEASE HAZARD

AUTHORIZED PERSONNEL ONLY

RESPIRATORS AND PROTECTIVE CLOTHING ARE REQUIRED IN THIS AREA

(iii) Where minerals in the regulated area are only tremolite, anthophyllite or actinolite, the employer may replace the term "asbestos" with the appropriate mineral name.

(2) *Labels.* (i) Labels shall be affixed to all products containing asbestos, tremolite, anthophyllite, or actinolite and to all containers containing such products, including waste containers. Where feasible, installed asbestos, tremolite, anthophyllite, or actinolite products shall contain a visible label.

(ii) Labels shall be printed in large, bold letters on a contrasting background.

(iii) Labels shall be used in accordance with the requirements of 29 CFR 1910.1200(f) of OSHA's Hazard Communication standard, and shall contain the folowing information:

DANGER

CONTAINS ASBESTOS FIBERS

AVOID CREATING DUST

CANCER AND LUNG DISEASE HAZARD

(iv) Where minerals to be labeled are only tremolite, anthophyllite and actinolite, the employer may replace the term "asbestos" with the appropriate mineral name.

(v) Labels shall contain a warning statement against breathing airborne asbestos, tremolite, anthophyllite, or actinolite fibers.

(vi) The provisions for labels required by paragraphs (k)(2)(i)–(k)(2)(iv) do not apply where:

(A) asbestos, tremolite, anthophyllite, or actinolite fibers have been modified by a bonding agent, coating, binder, or other material, provided that the manufacturer can demonstrate that, during any reasonably foreseeable use, handling, storage, disposal, processing, or transportation, no airborne concentrations of asbestos, tremolite, anthophyllite, actinolite, or a combination of these mineral fibers in excess of the action level will be released, or

(B) asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals is present in a product in concentrations less than 0.1 percent by weight.

(3) *Employee information and training.* (i) The employer shall institute a training program for all employees exposed to airborne concentrations of asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals in excess of the action level and shall ensure their participation in the program.

(ii) Training shall be provided prior to or at the time of initial assignment, unless the employee has received equivalent training within the previous 12 months, and at least annually thereafter.

(iii) The training program shall be conducted in a manner that the employee is able to understand. The employer shall ensure that each such employee is informed of the following:

(A) Methods of recognizing asbestos, tremolite, anthophyllite, and actinolite;

(B) The health effects associated with asbestos, tremolite, anthophyllite, or actinolite exposure;

(C) The relationship between smoking and asbestos, tremolite, anthophyllite, and actinolite in producing lung cancer;

(D) The nature of operations that could result in exposure to asbestos, tremolite, anthophyllite, and actinolite, the importance of necessary protective controls to minimize exposure including, as applicable, engineering controls, work practices, respirators, housekeeping procedures, hygiene facilities, protective clothing, decontamination procedures, emergency procedures, and waste disposal procedures, and any necessary instruction in the use of these controls and procedures;

(E) The purpose, proper use, fitting instructions, and limitations of respirators as required by 29 CFR 1910.134;

(F) The appropriate work practices for performing the asbestos, tremolite, anthophyllite, or actinolite job; and

(G) Medical surveillance program requirements.

(H) A review of this standard, including appendices.

(4) *Access to training materials.* (i) The employer shall make readily available to all affected employees without cost all written materials relating to the employee training program, including a copy of this regulation.

(ii) The employer shall provide to the Assistant Secretary and the Director, upon request, all information and training materials relating to the employee information and training program.

(l) *Housekeeping*—(1) *Vacuuming.* Where vacuuming methods are selected, HEPA filtered vacuuming equipment must be used. The equipment shall be used and emptied in a manner that minimizes the reentry of asbestos, tremolite, anthophyllite, or actinolite into the workplace.

(2) *Waste disposal.* Asbestos waste, scrap, debris, bags, containers, equipment, and contaminated clothing consigned for disposal shall be collected and disposed of in sealed, labeled, impermeable bags or other closed, labeled, impermeable containers.

(m) *Medical surveillance*—(1) *General*—(i) *Employees covered.* The employer shall institute a medical surveillance program for all employees engaged in work involving levels of asbestos, tremolite, anthophyllite, actinolite or a combination of these minerals, at or above the action level for 30 or more days per year, or who are required by this section to wear negative pressure respirators.

(ii) *Examination by a physician.* (A) The employer shall ensure that all medical examinations and procedures are performed by or under the supervision of a licensed physician, and are provided at no cost to the employee and at a reasonable time and place.

(B) Persons other than such licensed physicians who administer the pulmonary function testing required by this section shall complete a training course in spirometry sponsored by an appropriate academic or professional institution.

(2) *Medical examinations and consultations*—(i) *Frequency.* The employer shall make available medical examinations and consultations to each employee covered under paragraph

[Sec. 1926.58(m)(2)(i)]

(m)(1)(i) of this section on the following schedules:

(A) Prior to assignment of the employee to an area where negative-pressure respirators are worn;

(B) When the employee is assigned to an area where exposure to asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals may be at or above the action level for 30 or more days per year, a medical examination must be given within 10 working days following the thirtieth day of exposure;

(C) And at least annually thereafter.

(D) If the examining physician determines that any of the examinations should be provided more frequently than specified, the employer shall provide such examinations to affected employees at the frequencies specified by the physician.

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

(ii) *Content.* Medical examinations made available pursuant to paragraphs (m)(2)(i)(A)–(m)(2)(i)(C) of this section shall include:

(A) A medical and work history with special emphasis directed to the pulmonary, cardiovascular, and gastrointestinal systems.

(B) On initial examination, the standardized questionnaire contained in Appendix D, Part 1, and, on annual examination, the abbreviated standardized questionnaire contained in Appendix D, Part 2.

(C) A physical examination directed to the pulmonary and gastrointestinal systems, including a chest roentgenogram to be administered at the discretion of the physician, and pulmonary function tests of forced vital capacity (FVC) and forced expiratory volume at one second (FEV_1). Interpretation and classification of chest roentgenograms shall be conducted in accordance with Appendix E.

(D) Any other examinations or tests deemed necessary by the examining physician.

(3) *Information provided to the physician.* The employer shall provide the following information to the examining physician:

(i) A copy of this standard and Appendices D, E, and I;

(ii) A description of the affected employee's duties as they relate to the employee's exposure;

(iii) The employee's representative exposure level or anticipated exposure level;

(iv) A description of any personal protective and respiratory equipment used or to be used; and

(v) Information from previous medical examinations of the affected employee that is not otherwise available to the examining physician.

(4) *Physician's written opinion.* (i) The employer shall obtain a written opinion from the examining physician. This written opinion shall contain the results of the medical examination and shall include:

(A) The physician's opinion as to whether the employee has any detected medical conditions that would place the employee at an increased risk of material health impairment from exposure to asbestos, tremolite, anthophyllite, or actinolite;

(B) Any recommended limitations on the employee or on the use of personal protective equipment such as respirators; and

(C) A statement that the employee has been informed by the physician of the results of the medical examination and of any medical conditions that may result from asbestos, tremolite, anthophyllite, or actinolite exposure.

(ii) The employer shall instruct the physician not to reveal in the written opinion given to the employer specific findings or diagnoses unrelated to occupational exposure to asbestos, tremolite, anthophyllite, or actinolite.

(iii) The employer shall provide a copy of the physician's written opinion to the affected employee within 30 days from its receipt.

(n) *Recordkeeping*—(1) *Objective data for exempted operations.* (i) Where the employer has relied on objective data that demonstrate that products made from or containing asbestos, tremolite, anthophyllite, or actinolite are not capable of releasing fibers of asbestos, tremolite, anthophyllite, or actinolite or a combination of these minerals, in concentrations at or above the action level under the expected conditions of processing, use, or handling to exempt such operations from the initial monitoring requirements under paragraph (f)(2) of this section, the employer shall establish and maintain an accurate record of objective data reasonably relied upon in support of the exemption.

(ii) The record shall include at least the following information:

(A) The product qualifying for exemption;

(B) The source of the objective data;

(C) The testing protocol, results of testing, and/or analysis of the material for the release of asbestos, tremolite, anthophyllite, or actinolite;

(D) A description of the operation exempted and how the data support the exemption; and

(E) Other data relevant to the operations, materials, processing, or employee exposures covered by the exemption.

(iii) The employer shall maintain this record for the duration of the employer's reliance upon such objective data.

(2) *Exposure measurements.* (i) The employer shall keep an accurate record of all measurements taken to monitor employee exposure to asbestos, tremolite, anthophyllite, or actinolite as prescribed in paragraph (f) of this section.

Note: The employer may utilize the services of competent organizations such as industry trade associations and employee associations to maintain the records required by this section.

(ii) This record shall include at least the following information:

(A) The date of measurement;

(B) The operation involving exposure to asbestos, tremolite, anthophyllite, or actinolite that is being monitored;

(C) Sampling and analytical methods used and evidence of their accuracy;

(D) Number, duration, and results of samples taken;

(E) Type of protective devices worn, if any; and

(F) Name, social security number, and exposure of the employees whose exposures are represented.

(iii) The employer shall maintain this record for at least thirty (30) years, in accordance with 29 CFR 1910.20.

(3) *Medical surveillance.* (i) The employer shall establish and maintain an accurate record for each employee subject to medical surveillance by paragraph (m) of this section, in accordance with 29 CFR 1910.20.

(ii) The record shall include at least the following information:

(A) The name and social security number of the employee;

(B) A copy of the employee's medical examination results, including the medical history, questionnaire responses, results of any tests, and physician's recommendations.

(C) Physician's written opinions;

(D) Any employee medical complaints related to exposure to asbestos, tremolite, anthophyllite, or actinolite; and

(E) A copy of the information provided to the physician as required by paragraph (m) of this section.

(iii) The employer shall ensure that this record is maintained for the duration of employment plus thirty (30) years, in accordance with 29 CFR 1910.20.

[Sec. 1926.58(n)(3)(iii)]

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(4) *Training records.* The employer shall maintain all employee training records for one 1 year beyond the last date of employment by that employer.

(5) *Availability.* (i) The employer, upon written request, shall make all records required to be maintained by this section available to the Assistant Secretary and the Director for examination and copying.

(ii) The employer, upon request, shall make any exposure records required by paragraphs (f) and (n) of this section available for examination and copying to affected employees, former employees, designated representatives, and the Assistant Secretary, in accordance with 29 CFR 1910.20(a)–(e) and (g)–(i).

(iii) The employer, upon request, shall make employee medical records required by paragraphs (m) and (n) of this section available for examination and copying to the subject employee, anyone having the specific written consent of the subject employee, and the Assistant Secretary, in accordance with 29 CFR 1910.20.

(6) *Transfer of records.* (i) The employer shall comply with the requirements concerning transfer of records set forth in 29 CFR 1910.20 (h).

(ii) Whenever the employer ceases to do business and there is no successor employer to receive and retain the records for the prescribed period, the employer shall notify the Director at least 90 days prior to disposal and, upon request, transmit them to the Director.

(o) *Dates*—(1) *Effective date.* This section shall become effective [insert date 30 days from publication in the Federal Register]. The requirements of the asbestos standard issued in June 1972 (37 FR 11318), as amended, and published in 29 CFR 1910.1001 (1985) remain in effect until compliance is achieved with the parallel provisions of this standard.

(2) *Start-up dates.* (i) The requirements of paragraphs (c) through (n) of this section, including the engineering controls specified in paragraph (g)(1) of this section, shall be complied with by [insert date 210 days from publication in the Federal Register].

(p) *Appendices.* (1) Appendices A, C, D, and E to this section are incorporated as part of this section and the contents of these appendices are mandatory.

(2) Appendices B, F, G, H, and I to this section are informational and are not intended to create any additional obligations not otherwise imposed or to detract from any existing obligations.

Appendix A to § 1926.58—OSHA Reference Method—Mandatory

This mandatory appendix specifies the procedure for analyzing air samples for asbestos, tremolite, anthophyllite, and actinolite and specifies quality control procedures that must be implemented by laboratories performing the analysis. The sampling and analytical methods described below represent the elements of the available monitoring methods (such as the NIOSH P&CAM 400 method) which OSHA considers to be essential to achieve adequate employee exposure monitoring while allowing employers to use methods that are already established within their organizations. All employers who are required to conduct air monitoring under paragraph (f) of the standard are required to utilize analytical laboratories that use this procedure, or an equivalent method, for collecting and analyzing samples.

Sampling and Analytical Procedure

1. The sampling medium for air samples shall be mixed cellulose ester filter membranes. These shall be designated by the manufacturer as suitable for asbestos, tremolite, anthophyllite, and actinolite counting. See below for rejection of blanks.

2. The preferred collection device shall be the 25-mm diameter cassette with an open-faced 50-mm extension cowl. The 37-mm cassette may be used if necessary but only if written justification for the need to use the 37-mm filter cassette accompanies the sample results in the employee's exposure monitoring record.

3. An air flow rate between 0.5 liter/min and 2.5 liters/min shall be selected for the 25/mm cassette. If the 37-mm cassette is used, an air flow rate between 1 liter/min and 2.5 liters/min shall be selected.

4. Where possible, a sufficient air volume for each air sample shall be collected to yield between 100 and 1,300 fibers per square millimeter on the membrane filter. If a filter darkens in appearance or if loose dust is seen on the filter, a second sample shall be started.

5. Ship the samples in a rigid container with sufficient packing material to prevent dislodging the collected fibers. Packing material that has a high electrostatic charge on its surface (e.g., expanded polystyrene) cannot be used because such material can cause loss of fibers to the sides of the cassette.

6. Calibrate each personal sampling pump before and after use with a representative filter cassette installed between the pump and the calibration device.

7. Personal samples shall be taken in the "breathing zone" of the employee (i.e., attached to or near the collar or lapel near the worker's face).

8. Fiber counts shall be made by positive phase contrast using a microscope with an 8 to 10 X eyepiece and a 40 to 45 X objective for a total magnification of approximately 400 X and a numerical aperture of 0.65 to 0.75. The microscope shall also be fitted with a green or blue filter.

9. The microscope shall be fitted with a Walton-Beckett eyepiece graticule calibrated for a field diameter of 100 micrometers (+/− 2 micrometers).

10. The phase-shift detection limit of the microscope shall be about 3 degrees measured using the HSE phase shift test slide as outlined below.

a. Place the test slide on the microscope stage and center it under the phase objective.

b. Bring the blocks of grooved lines into focus.

Note.—The slide consists of seven sets of grooved lines (ca. 20 grooves to each block) in descending order of visibility from sets 1 to 7, seven being the least visible. The requirements for asbestos, tremolite, anthophyllite, and actinolite counting are that the microscope optics must resolve the grooved lines in set 3 completely, although they may appear somewhat faint, and that the grooved lines in sets 6 and 7 must be invisible. Sets 4 and 5 must be at least partially visible but may vary slightly in visibility between microscopes. A microscope that fails to meet these requirements has either too low or too high a resolution to be used for asbestos, tremolite, anthophyllite, and actinolite counting.

c. If the image deteriorates, clean and adjust the microscope optics. If the problem persists, consult the microscope manufacturer.

11. Each set of samples taken will include 10 percent blanks or a minimum of 2 blanks. The blank results shall be averaged and subtracted from the analytical results before reporting. Any samples represented by a blank having a fiber count in excess of 7 fibers/100 fields shall be rejected.

12. The samples shall be mounted by the acetone/triacetin method or a method with an equivalent index of refraction and similar clarity.

13. Observe the following counting rules.

a. Count only fibers equal to or longer than 5 micrometers. Measure the length of curved fibers along the curve.

b. Count all particles as asbestos, tremolite, anthophyllite, and actinolite that have a length-to-width ratio (aspect ratio) of 3:1 or greater.

c. Fibers lying entirely within the boundary of the Walton-Beckett graticule field shall receive a count of 1. Fibers crossing the boundary once, having one end within the circle, shall receive the count of one half (½). Do not count any fiber that crosses the graticule boundary more than once. Reject and do not count any other fibers even though they may be visible outside the graticule area.

d. Count bundles of fibers as one fiber unless individual fibers can be identified by observing both ends of an individual fiber.

e. Count enough graticule fields to yield 100 fibers. Count a minimum of 20 fields; stop counting at 100 fields regardless of fiber count.

14. Blind recounts shall be conducted at the rate of 10 percent.

Quality Control Procedures

1. Intralaboratory program. Each laboratory and/or each company with more than one microscopist counting slides shall establish a statistically designed quality assurance program involving blind recounts and

comparisons between microscopists to monitor the variability of counting by each microscopist and between microscopists. In a company with more than one laboratory, the program shall include all laboratories, and shall also evaluate the laboratory-to-laboratory variability.

2. Interlaboratory program. Each laboratory analyzing asbestos, tremolite, anthophyllite, and actinolite samples for compliance determination shall implement an interlaboratory quality assurance program that as a minimum includes participation of at least two other independent laboratories. Each laboratory shall participate in round robin testing at least once every 6 months with at least all the other laboratories in its interlaboratory quality assurance group. Each laboratory shall submit slides typical of its own workload for use in this program. The round robin shall be designed and results analyzed using appropriate statistical methodology.

3. All individuals performing asbestos, tremolite, anthophyllite, and actinolite analysis must have taken the NIOSH course for sampling and evaluating airborne asbestos, tremolite, anthophyllite, and actinolite dust or an equivalent course.

4. When the use of different microscopes contributes to differences between counters and laboratories, the effect of the different microscope shall be evaluated and the microscope shall be replaced, as necessary.

5. Current results of these quality assurance programs shall be posted in each laboratory to keep the microscopists informed.

Appendix B to § 1926.58—Detailed Procedure for Asbestos Tremolite, Anthophyllite, and Actinolite Sampling and Analysis—Non-Mandatory

This appendix contains a detailed procedure for sampling and analysis and includes those critical elements specified in Appendix A. Employers are not required to use this procedure, but they are required to use Appendix A. The purpose of Appendix B is to provide a detailed step-by-step sampling and analysis procedure that conforms to the elements specified in Appendix A. Since this procedure may also standardize the analysis and reduce variability, OSHA encourages employers to use this appendix.

Asbestos, Tremolite, Anthophyllite, and Actinolite Sampling and Analysis Method

Technique: Microscopy, Phase Contrast.

Analyte: Fibers (Manual count).

Sample Preparation: Acetone/triacetin method.

Calibration: Phase-shift detection limit about 3 degrees.

Range: 100 to 1300 fibers/mm² filter area.

Estimated Limit of Detection: 7 fibers/mm² filter area.

Sampler: Filter (0.8–1.2 um mixed cellulose ester membrane, 25-mm diameter).

Flow Rate: 0.5 l/min to 2.5 l/min (25-mm cassette); 1.0 l/min to 2.5 l/min (37-mm cassette).

Sample Volume: Adjust to obtain 100 to 1300 fibers/mm².

Shipment: Routine.

Sample Stability: Indefinite.

Blanks: 10% of samples (minimum 2).

Standard Analytical Error: 0.25.

Applicability: The working range is 0.02 f/cc (1920–L air sample) to 1.25 f/cc (400–L air sample). The method gives an index of airborne asbestos, tremolite, anthophyllite, and actinolite fibers but may be used for other materials such as fibrous glass by inserting suitable parameters into the counting rules. The method does not differentiate between asbestos, tremolite, anthophyllite, and actinolite and other fibers. Asbestos, tremolite, anthophyllite, and actinolite fibers less than ca. 0.25 um diameter will not be detected by this method.

Interferences: Any other airborne fiber may interfere since all particles meeting the counting criteria are counted. Chain-like particles may appear fibrous. High levels of nonfibrous dust particles may obscure fibers in the field of view and raise the detection limit.

Reagents

1. Acetone.

2. Triacetin (glycerol triacetate), reagent grade.

Special Precautions

Acetone is an extremely flammable liquid and precautions must be taken not to ignite it. Heating of acetone must be done in a ventilated laboratory fume hood using a flameless, spark-free heat source.

Equipment

1. Collection device: 25-mm cassette with 50-mm extension cowl with cellulose ester filter, 0.8 to 1.2 mm pore size and backup pad.

Note.—Analyze representative filters for fiber background before use and discard the filter lot if more than 5 fibers/100 fields are found.

2. Personal sampling pump, greater than or equal to 0.5 L/min, with flexible connecting tubing.

3. Microscope, phase contrast, with green or blue filter, 8 to 10X eyepiece, and 40 to 45X phase objective (total magnification ca 400X); numerical aperture = 0.65 to 0.75.

4. Slides, glass, single-frosted, pre-cleaned, 25 × 75 mm.

5. Cover slips, 25 × 25 mm, no. 1½ unless otherwise specified by microscope manufacturer.

6. Knife, #1 surgical steel, curved blade.

7. Tweezers.

8. Flask, Guth-type, insulated neck, 250 to 500 mL (with single-holed rubber stopper and elbow-jointed glass tubing, 16 to 22 cm long).

9. Hotplate, spark-free, stirring type; heating mantle; or infrared lamp and magnetic stirrer.

10. Syringe, hypodermic, with 22-gauge needle.

11. Graticule, Walton-Beckett type with 100 um diameter circular field at the specimen plane (area = 0.00785 mm²). (Type G–22).

Note.—The graticule is custom-made for each microscope.

12. HSE/NPL phase contrast test slide, Mark II.

13. Telescope, ocular phase-ring centering.

14. Stage micrometer (0.01 mm divisions).

Sampling

1. Calibrate each personal sampling pump with a representative sampler in line.

2. Fasten the sampler to the worker's lapel as close as possible to the worker's mouth. Remove the top cover from the end of the cowl extension (open face) and orient face down. Wrap the joint between the extender and the monitor's body with shrink tape to prevent air leaks.

3. Submit at least two blanks (or 10% of the total samples, whichever is greater) for each set of samples. Remove the caps from the field blank cassettes and store the caps and cassettes in a clean area (bag or box) during the sampling period. Replace the caps in the cassettes when sampling is completed.

4. Sample at 0.5 L/min or greater. Do not exceed 1 mg total dust loading on the filter. Adjust sampling flow rate, Q (L/min), and time to produce a fiber density, E (fibers/mm²), of 100 to 1300 fibers/mm² (3.85×10^4 to 5×10^4 fibers per 25-mm filter with effective collection area (A_c = 385 mm²)) for optimum counting precision (see step 21 below). Calculate the minimum sampling time, t_{min} (min) at the action level (one-half of the current standard), L (f/cc) of the fibrous aerosol being sampled:

$$t_{min} = \frac{(Ac)(E)}{(Q)(L)10^3}$$

5. Remove the field monitor at the end of sampling, replace the plastic top cover and small end caps, and store the monitor.

6. Ship the samples in a rigid container with sufficient packing material to prevent jostling or damage. NOTE: Do not use polystyrene foam in the shipping container because of electrostatic forces which may cause fiber loss from the sampler filter.

Sample Preparation

Note.—The object is to produce samples with a smooth (non-grainy) background in a medium with a refractive index equal to or less than 1.46. The method below collapses the filter for easier focusing and produces permanent mounts which are useful for quality control and interlaboratory comparison. Other mounting techniques meeting the above criteria may also be used, e.g., the nonpermanent field mounting technique used in P & CAM 239.

7. Ensure that the glass slides and cover slips are free of dust and fibers.

8. Place 40 to 60 ml of acetone into a Guth-type flask. Stopper the flask with a single-hole rubber stopper through which a glass tube extends 5 to 8 cm into the flask. The portion of the glass tube that exits the top of the stopper (5 to 10 cm) is bent downward in an elbow that makes an angle of 20 to 30 degrees with the horizontal.

9. Place the flask in a stirring hotplate or wrap in a heating mantle. Heat the acetone gradually to its boiling temperature (ca. 56°C).

Caution.—The acetone vapor must be generated in a ventilated fume hood away from all open flames and spark sources. Alternate heating methods can be used, providing no open flame or sparks are present.

[Sec. 1926.58, Appendix B]

10. Mount either the whole sample filter or a wedge cut from the sample filter on a clean glass slide.

a. Cut wedges of ca. 25 percent of the filter area with a curved-blade steel surgical knife using a rocking motion to prevent tearing.

b. Place the filter or wedge, dust side up, on the slide. Static electricity will usually keep the filter on the slide until it is cleared.

c. Hold the glass slide supporting the filter approximately 1 to 2 cm from the glass tube part where the acetone vapor is escaping from the heated flask. The acetone vapor stream should cause a condensation spot on the glass slide ca. 2 to 3 cm in diameter. Move the glass slide gently in the vapor stream. The filter should clear in 2 to 5 sec. If the filter curls, distorts, or is otherwise rendered unusable, the vapor stream is probably not strong enough. Periodically wipe the outlet part with tissue to prevent liquid acetone dripping onto the filter.

d. Using the hypodermic syringe with a 22-gauge needle, place 1 to 2 drops of triacetin on the filter. Gently lower a clean 25-mm square cover slip down onto the filter at a slight angle to reduce the possibility of forming bubbles. If too many bubbles form or the amount of triacetin is unsufficient, the cover slip may become detached within a few hours.

e. Glue the edges of the cover slip to the glass slide using a lacquer or nail polish.

Note.—If clearing is slow, the slide preparation may be heated on a hotplate (surface temperature 50°C) for 15 min to hasten clearing. Counting may proceed immediately after clearing and mounting are completed.

Calibration and Quality Control

11. Calibration of the Walton-Beckett graticule. The diameter, d_c (mm), of the circular counting area and the disc diameter must be specified when ordering the graticule.

a. Insert any available graticule into the eyepiece and focus so that the graticule lines are sharp and clear.

b. Set the appropriate interpupillary distance and, if applicable, reset the binocular head adjustment so that the magnification remains constant.

c. Install the 40 to 45 X phase objective.

d. Place a stage micrometer on the microscope object stage and focus the microscope on the graduated lines.

e. Measure the magnified grid length, L_e (um), using the stage micrometer.

f. Remove the graticule from the microscope and measure its actual grid length, L_a (mm). This can best be accomplished by using a stage fitted with verniers.

g. Calculate the circle diameter, d_c (mm), for the Walton-Beckett graticule:

$$d_c = \frac{L_a \times D}{L_e}$$

Example: If L_e = 108 um, L_a = 2.93 mm and D = 100 um, then d_c = 2.71 mm.

h. Check the field diameter, D (acceptable range 100 mm ± 2 mm) with a stage micrometer upon receipt of the graticule from the manufacturer. Determine field area (mm²).

12. Microscope adjustments. Follow the manufacturer's instructions and also the following:

a. Adjust the light source for even illumination across the field of view at the condenser iris.

Note.—Kohler illumination is preferred, where available.

b. Focus on the particulate material to be examined.

c. Make sure that the field iris is in focus, centered on the sample, and open only enough to fully illuminate the field of view.

d. Use the telescope ocular supplied by the manufacturer to ensure that the phase rings (annular diaphragm and phase-shifting element) are concentric.

13. Check the phase-shift detection limit of the microscope periodically.

a. Remove the HSE/NPL phase-contrast test slide from its shipping container and center it under the phase objective.

b. Bring the blocks of grooved lines into focus.

Note.—The slide consists of seven sets of grooves (ca. 20 grooves to each block) in descending order of visibility from sets 1 to 7. The requirements for counting are that the microscope optics must resolve the grooved lines in set 3 completely, although they may appear somewhat faint, and that the grooved lines in sets 6 to 7 must be invisible. Sets 4 and 5 must be at least partially visible but may vary slightly in visibility between microscopes. A microscope which fails to meet these requirements has either too low or too high a resolution to be used for asbestos, tremolite, anthophyllite, and actinolite counting.

c. If the image quality deteriorates, clean the microscope optics and, if the problem persists, consult the microscope manufacturer.

14. Quality control of filter counts.

a. Prepare and count field blanks along with the field samples. Report the counts on each blank. Calculate the mean of the field blank counts and subtract this value from each sample count before reporting the results.

Note 1.—The identity of the blank filters should be unknown to the counter until all counts have been completed.

Note 2.—If a field blank yields fiber counts greater than 7 fibers/100 fields, report possible contamination of the samples.

b. Perform blind recounts by the same counter on 10 percent of filters counted (slides relabeled by a person other than the counter).

15. Use the following test to determine whether a pair of counts on the same filter should be rejected because of possible bias. This statistic estimates the counting repeatability at the 95% confidence level. Discard the sample if the difference between the two counts exceeds 2.77 $(F)s_r$, where F = average of the two filter counts and S_r = relative standard deviation, which should be derived by each laboratory based on historical in-house data.

Note.—If a pair of counts is rejected as a result of this test, recount the remaining samples in the set and test the new counts against the first counts. Discard all rejected paired counts.

16. Enroll each new counter in a training course that compares performance of counters on a variety of samples using this procedure.

Note.—To ensure good reproducibility, all laboratories engaged in asbestos, tremolite, anthophyllite, and actinolite counting are required to participate in the Proficiency Analytical Testing (PAT) Program and should routinely participate with other asbestos, tremolite, anthophyllite, and actinolite fiber counting laboratories in the exchange of field samples to compare performance of counters.

Measurement

17. Place the slide on the mechanical stage of the calibrated microscope with the center of the filter under the objective lens. Focus the microscope on the plane of the filter.

18. Regularly check phase-ring alignment and Kohler illumination.

19. The following are the counting rules:

a. Count only fibers longer than 5 um. Measure the length of curved fibers along the curve.

b. Count only fibers with a length-to-width ratio equal to or greater than 3:1.

c. For fibers that cross the boundary of the graticule field, do the following:

1. Count any fiber longer than 5 um that lies entirely within the graticule area.

2. Count as ½ fiber any fiber with only one end lying within the graticule area.

3. Do not count any fiber that crosses the graticule boundary more than once.

4. Reject and do not count all other fibers.

d. Count bundles of fibers as one fiber unless individual fibers can be identified by observing both ends of a fiber.

e. Count enough graticule fields to yield 100 fibers. Count a minimum of 20 fields. Stop at 100 fields regardless of fiber count.

20. Start counting from one end of the filter and progress along a radial line to the other end, shift either up or down on the filter, and continue in the reverse direction. Select fields randomly by looking away from the eyepiece briefly while advancing the mechanical stage. When an agglomerate covers ca. ¼ or more of the field of view, reject the field and select another. Do not report rejected fields in the number of total fields counted.

Note.—When counting a field, continuously scan a range of focal planes by moving the fine focus knob to detect very fine fibers which have become embedded in the filter. The small-diameter fibers will be very faint but are an important contribution to the total count.

[Sec. 1926.58, Appendix B]

Calculations

21. Calculate and report fiber density on the filter, E (fibers/mm²); by dividing the total fiber count, F; minus the mean field blank count, B, by the number of fields, n; and the field area, A_f (0.00785mm² for a properly calibrated Walton-Beckett graticule):

$$E = \frac{F - B}{(n)(A_f)} \text{ fibers/mm}^2$$

22. Calculate the concentration, C (f/cc), of fibers in the air volume sampled, V (L), using the effective collection area of the filter, A_c (385 mm² for a 25-mm filter):

$$C = \frac{(E)(Ac)}{V(10^3)}$$

Note.—Periodically check and adjust the value of A_c if necessary.

Appendix C to § 1926.58—Qualitative and Quantitative Fit Testing Procedures—Mandatory

Qualitative Fit Test Protocols

I. Isoamyl Acetate Protocol

A. Odor threshold screening.

1. Three 1-liter glass jars with metal lids (e.g. Mason or Bell jars) are required.

2. Odor-free water (e.g. distilled or spring water) at approximately 25 °C shall be used for the solutions.

3. The isoamyl acetate (IAA) (also known as isopentyl acetate) stock solution is prepared by adding 1 cc of pure IAA to 800 cc of odor free water in a 1-liter jar and shaking for 30 seconds. This solution shall be prepared new at least weekly.

4. The screening test shall be conducted in a room separate from the room used for actual fit testing. The two rooms shall be well ventilated but shall not be connected to the same recirculating ventilation system.

5. The odor test solution is prepared in a second jar by placing 0.4 cc of the stock solution into 500 cc of odor free water using a clean dropper or pipette. Shake for 30 seconds and allow to stand for two to three minutes so that the IAA concentration above the liquid may reach equilibrium. This solution may be used for only one day.

6. A test blank is prepared in a third jar by adding 500 cc of odor free water.

7. The odor test and test blank jars shall be labelled 1 and 2 for jar identification. If the labels are put on the lids they can be periodically peeled, dried off and switched to maintain the integrity of the test.

8. The following instructions shall be typed on a card and placed on the table in front of the two test jars (i.e. 1 and 2): "The purpose of this test is to determine if you can smell banana oil at a low concentration. The two bottles in front of you contain water. One of these bottles also contains a small amount of banana oil. Be sure the covers are on tight, then shake each bottle for two seconds. Unscrew the lid of each bottle, one at a time, and sniff at the mouth of the bottle. Indicate to the test conductor which bottle contains banana oil."

9. The mixtures used in the IAA odor detection test shall be prepared in an area separate from where the test is performed, in order to prevent olfactory fatigue in the subject.

10. If the test subject is unable to correctly identify the jar containing the odor test solution, the IAA qualitative fit test may not be used.

11. If the test subject correctly identifies the jar containing the odor test solution, the test subject may proceed to respirator selection and fit testing.

B. Respirator Selection.

1. The test subject shall be allowed to pick the most comfortable respirator from a selection including respirators of various sizes from different manufacturers. The selection shall include at least five sizes of elastomeric half facepieces, from at least two manufacturers.

2. The selection process shall be conducted in a room separate from the fit-test chamber to prevent odor fatigue. Prior to the selection process, the test subject shall be shown how to put on a respirator, how it should be positioned on the face, how to set strap tension and how to determine a "comfortable" respirator. A mirror shall be available to assist the subject in evaluating the fit and positioning of the respirator. This instruction may not constitute the subject's formal training on respirator use, as it is only a review.

3. The test subject should understand that the employee is being asked to select the respirator which provides the most comfortable fit. Each respirator represents a different size and shape and, if fit properly and used properly will provide adequate protection.

4. The test subject holds each facepiece up to the face and eliminates those which obviously do not give a comfortable fit. Normally, selection will begin with a half-mask and if a good fit cannot be found, the subject will be asked to test the full facepiece respirators. (A small percentage of users will not be able to wear any half-mask.)

5. The more comfortable facepieces are noted; the most comfortable mask is donned and *worn at least five minutes* to assess comfort. All donning and adjustments of the facepiece shall be performed by the test subject without assistance from the test conductor or other person. Assistance in assessing comfort can be given by discussing the points in #6 below. If the test subject is not familiar with using a particular respirator, the test subject shall be directed to don the mask several times and to adjust the straps each time to become adept at setting proper tension on the straps.

6. Assessment of comfort shall include reviewing the following points with the test subject and allowing the test subject adequate time to determine the comfort of the respirator:

- Positioning of mask on nose.
- Room for eye protection.
- Room to talk.
- Positioning mask on face and cheeks.

7. The following criteria shall be used to help determine the adequacy of the respirator fit:

- Chin properly placed.
- Strap tension.
- Fit across nose bridge.
- Distance from nose to chin.
- Tendency to slip.
- Self-observation in mirror.

8. The test subject shall conduct the conventional negative and positive-pressure fit checks before conducting the negative- or positive-pressure test the subject shall be told to "seat" the mask by rapidly moving the head from side-to-side and up and down, while taking a few deep breaths.

9. The test subject is now ready for fit testing.

10. After passing the fit test, the test subject shall be questioned again regarding the comfort of the respirator. If it has become uncomfortable, another model of respirator shall be tried.

11. The employee shall be given the opportunity to select a different facepiece and be retested if the chosen facepiece becomes increasingly uncomfortable at any time.

C. Fit test.

1. The fit test chamber shall be similar to a clear 55 gal drum liner suspended inverted over a 2 foot diameter frame, so that the top of the chamber is about 6 inches above the test subject's head. The inside top center of the chamber shall have a small hook attached.

2. Each respirator used for the fitting and fit testing shall be equipped with organic vapor cartridges or offer protection against organic vapors. The cartridges or masks shall be changed at least weekly.

3. After selecting, donning, and properly adjusting a respirator, the test subject shall wear it to the fit testing room. This room shall be separate from the room used for odor threshold screening and respirator selection, and shall be well ventilated, as by an exhaust fan or lab hood, to prevent general room contamination.

4. A copy of the following test exercises and rainbow passage shall be taped to the inside of the test chamber:

Test Exercises

i. Breathe normally.

ii. Breathe deeply. Be certain breaths are *deep* and *regular*.

iii. Turn head all the way from one side to the other. Inhale on each side. Be certain movement is complete. Do not bump the respirator against the shoulders.

iv. Nod head up-and-down. Inhale when head is in the full up position (looking toward ceiling). Be certain motions are complete and made about every second. Do not bump the respirator on the chest.

v. Talking. Talk aloud and slowly for several minutes. The following paragraph is called the Rainbow Passage. Reading it will result in a wide range of facial movements, and thus be useful to satisfy this requirement.

[Sec. 1926.58, Appendix C]

APPENDIX C

Environmental Protection Agency (EPA)
National Emission Standard for Hazardous
Air Pollutants (NESHAPS) (40 CFR Part 61, Subpart M)
Amended November 11, 1990

February 4, 1991

Dear Asbestos Contractor or Owner:

On November 20, 1990, the Environmental Protection Agency (EPA) promulgated the revised National Emission Standards for Hazardous Air Pollutants: Asbestos NESHAP Revision. This final rule became effective on November 20, 1990. Therefore, you must immediately begin to comply with applicable sections of 40 CFR Parts 61.140 to 61.156 of the revised NESHAP Standard.

The revisions require each owner or operator of a demolition or renovation project to comply with the following:

A. 40CFR 61.145 (Standard for Demolition and Renovation)

1. Throughly inspect the affected facility or part of the facility where the demolition or renovation project will occur for the presence of friable and nonfriable asbestos containing materials.

2. Remove all regulated asbestos-containing materials (RACMs) from each effected facility if the amounts are equal to or, should exceed 260 LF, 160 SF or 35CF for EPA classified demolition projects. However, all asbestos containing materials must be removed prior to demolition and renovation activities which will disturb such materials under asbestos laws and regulations.

3. Submit written notifications for all demolition projects involving less than and more than 80 linear meters (260 LF), 15 square meters (160 SF), and 1 cubic meter (35 CF) and also if no asbestos is found;

4. Submit written notifications for all renovations projects involving at least 260 LF, 160 SF, and 35 CF;

5. Submit written notifications at least 10 working days before asbestos removal begins for renovation projects involving item NO. 4 above.

6. Submit written notifications at least 10 working days before asbestos removal begins for demolition projects involving item NO. 3 above;

7. Renotify the Administrator of all new start and completion dates if the original start and completion dates should change;

8. Provide a written notification of a new start date at least 10 working days before asbestos stripping removal work begins.

9. Utilize a certified person to supervise the asbestos project.

10. Keep a copy of the Administrator's written approval to employ another method to abate asbestos if wetting would result in equipment damage or a safety hazard. You must obtain prior approval before using an alternative method.

11. Record the temperature in the area containing the facility components at the beginning, middle, and end of each workday and keep daily temperature records, if wetting operations are suspended due to freezing temperatures. Keep the temperature records for 2 years.

12. Employ only an EPA/EPD trained on-site individual to monitor asbestos removal and disposal at each site.

13. Complete and return a copy of the Waste Shipment Record (within thirty-five (35) days) for asbestos waste and completion form to affected owner and Asbestos Licensing and Certification Unit.

14. Place wet asbestos waste into labeled leak-tight containers or leak-tight wrapping.

15. If asbestos nonfriable waste cannot be placed in leak-tight wrapping, such waste, while wet, may also be placed in prelined containers and transported and disposed of in bulk. Only adequately labeled, wet, and leak-tight wrapping may be placed in prelined containers.

16. Mark vehicles used to transport asbestos-containing waste materials during loading and unloading of the waste materials.

17. Provide a copy of the waste shipment record to the disposal site owners or operators at the same time as the asbestos-containing waste materials are being deposited at legal disposal site.

18. Obtain a copy of the signed waste shipment record and forward a signed copy to the Asbestos Licensing and Certification Unit and affected owner/generator.

19. Keep copies of waste shipment records on files for at least two (2) years.

20. Legally dispose of all asbestos-containing waste materials as soon as practical in an approved and permitted disposal site for such materials.

21. Provide a 45 day prior notification if you plan to excavate asbestos waste. If the date to begin excavation should change, a new 10 day written notification must be provided.

22. Obtain prior permission from the Administrator before using an alternative method or converting asbestos-containing waste into asbestos (asbestos free) materials (s) and before disposing of any converted asbestos waste.

23. Please review the following <u>new</u> definitions:

    - Adequately wetting
    - Nonfriable ACM
    - Category I and II nonfriable ACM
    - Fugitive sources and glovebag
    - Cutting and grinding of ACM
    - In poor condition and leak-tight
    - Malfunction and natural barrier
    - Nonscheduled renovation operations
    - Owners or operators
    - Regulated asbestos-containing material
    - Resilient floor covering
    - Waste generator and waste shipment record
    - Working day

You must also comply with all applicable sections of the revised NESHAP Asbestos Standard.

Should you have questions or need an interpretation of the November 20, 1990 revised NESHAP Asbestos Standard, please contact Mr.Alan W. Powell and Mr. John Hund of Region IV EPA at 404-347-5014 or contact the Asbestos Program at 404-656-4999.

Sincerely,

Marvin Bradford

Marvin Bradford
Program Manager
Asbestos Licensing & Certification Unit

MB:aj

Tuesday
November 20, 1990

Part III

Environmental Protection Agency

40 CFR Part 61

National Emission Standards for Hazardous Air Pollutants; Asbestos NESHAP Revision; Final Rule

ENVIRONMENTAL PROTECTION AGENCY

40 CFR Part 61

[AD-FRL-3814-7]

RIN 2060-AC57

National Emission Standards for Hazardous Air Pollutants; Asbestos NESHAP Revision

AGENCY: Environmental Protection Agency.

ACTION: Final rule.

SUMMARY: This Federal Register notice promulgates rules under section 112 of the Clean Air Act (CAA) for asbestos emissions and is based on the Administrator's determination that asbestos presents a significant risk to human health as a result of air emissions from one or more source categories and is therefore a hazardous air pollutant (*see* 36 FR 3031, March 31, 1971). The purpose of the revisions promulgated today is to enhance enforcement and promote compliance with the current standard without altering the stringency of existing controls. On January 10, 1989 the Environmental Protection Agency (EPA or the Agency) proposed amendments to the asbestos National Emission Standard for Hazardous Air Pollutants (NESHAP) that would require control device and fugitive emission monitoring, recordkeeping, and reporting for asbestos milling, manufacturing, and fabricating operations. For planned demolitions and renovations, revisions to the notification requirements were proposed, and safety was added as a reason for exemption from the use of wet removal methods. Recordkeeping requirements were proposed for asbestos waste disposal. Clarifying revisions to several definitions and provisions were also proposed. Numerous comments were received on the proposed revisions, and today's notice responds to those comments, and incorporates changes as a result of those comments.

EFFECTIVE DATE: November 20, 1990. Under section 307(b)(1) of the Clean Air Act, judicial review of the actions taken by this notice is available only by filing a petition for review in the United States Court of Appeals for the District of Columbia Circuit within 60 Days of today's publication of these rules. Under section 307(b)(2) of the Clean Air Act, the requirements that are the subject of today's notice may not be challenged later in civil or criminal proceedings brought by EPA to enforce these requirements.

ADDRESSES: *Background information document.* The background information document (BID) for the promulgated revisions may be obtained from the U.S. EPA Library (MD–35), Research Triangle Park, North Carolina, 27711, telephone no. (919) 541–2777. Please refer to "Background Information for Promulgated Asbestos NESHAP Revisions," (Publication No. EPA 450/3–90/017). The BID contains a summary of all the public comments made on the proposed revisions and the Administrator's responses to the comments.

Dockets. Docket No. A–88–28 contains supporting information used in developing the final revisions to the asbestos NESHAP and is available for public inspection and copying between 8:30 a.m. and 3:30 p.m., Monday through Friday, at EPA's Air Docket (LE–131), Room M–1500, 1st Floor, Waterside Mall, 401 M Street, SW., Washington, DC 20460. A reasonable fee may be charged for copying.

FOR FURTHER INFORMATION CONTACT: For further information and official interpretations of applicability, compliance requirements, and reporting aspects of the promulgated revisions, contact the appropriate Regional, State or local office contact as listed in 40 CFR 61.04. For further information on the background of the regulatory decisions in the promulated revisions, contact Mr. Sims Roy, Standards Development Branch, Emission Standards Division (MD–13), U.S. Environmental Protection Agency, Research Triangle Park, North Carolina 27711, telephone no. (919) 541–5263. For further information on the technical aspects of the promulgated revisions, contact Mr. Ronald Myers, Industrial Studies Branch, U.S. Environmental Protection Agency, Research Triangle Park, North Carolina 27711, telephone no. (919) 541–5407.

SUPPLEMENTARY INFORMATION:

I. The Standards

The promulgated revisions implement section 112 of the Clean Air Act (CAA) and are based on the Administrator's determination that asbestos presents a significant risk to human health as a result of air emissions from one or more source categories and is therefore a hazardous air pollutant (*see* 36 FR 3031 (March 31, 1971)). The revisions promulgated today amend the asbestos NESHAP to enhance enforcement and promote compliance with the current standard without altering the stringency of existing controls.

Milling, Manufacturing and Fabricating

The revisions to the standards require asbestos milling, manufacturing and fabricating sources to conduct daily monitoring for visible emissions. While the absence of visible emissions does not mean there are no asbestos fibers being emitted, the presence of visible emissions does indicate a serious control device malfunction. Because visible emissions monitoring is intended primarily to detect serious control device malfunctions, weekly inspections of air cleaning devices are also required. In addition, the revisions promulgated require these sources to maintain records of the results of visible emissions monitoring and control device inspections, and to submit quarterly a copy of visible emissions monitoring records of visible emissions occurred during the quarter. The revision requires owners or operators who install fabric filters after the effective date of this rule to provide for easy inspection of the bags.

Demolition and Renovation

The revisions require the owner or operator of a demolition or renovation activity to provide additional information in notifications, and to renotify EPA if the start date of a demolition or renovation changes from that given in the original notification. Another revision requires owners or operators to give a 10-day notice for renovations. A person trained in the provisions of this rule and the means of complying with them is required to be on site when asbestos-containing material (ACM) is stripped, removed or disturbed. When wetting is suspended due to freezing temperatures, owners or operators are required to measure air temperature in the work area three times during the workday and keep daily temperature records for at least 2 years. The revisions also clarify EPA's position regarding the handling and treatment of nonfriable asbestos materials such as resilient floor covering, including vinyl asbestos floor tile, and roofing material.

Waste Disposal

The revisions require vehicles used to transport asbestos-containing waste material to be marked with the sign prescribed by the Occupational Safety and Health Administration during loading and unloading to warn people of the presence of asbestos. For all asbestos-containing waste material transported offsite, the revisions require that a waste shipment record (WSR) be provided to the waste site owner or operator at the time that the waste is

delivered to the waste disposal site. If a copy of the WSR signed by the waste site owner or operator is not received within 35 days of the date the waste was accepted by the initial transporter, the revisions direct the waste generator to contact the transporter and/or disposal site owner or operator to determine the status of the waste shipment. The revisions further direct the waste generator to submit an exception report to EPA if a signed copy of the WSR is not received within 45 days of the date the waste was accepted by the initial transporter. Labels are required on containers of asbestos-containing waste material from manufacturing, fabricating, demolition and renovation activities indicating the name of the waste generator and the location where the waste was generated.

Inactive Waste Disposal Sites

The revisions require the owner or operator of an inactive waste disposal site for a milling, manufacturing or fabricating operation to notify the Administrator in writing prior to excavating or otherwise disturbing asbestos-containing waste material that has been deposited at the disposal site and to record on the deed to the property a notation that will inform future purchasers of the property that it has been used for the disposal of asbestos-containing waste material and that the survey plot and record of the location and quantity of such waste material are on file with the Administrator.

Active Waste Disposal Sites

The revisions require the owner or operator of an active waste disposal site to maintain WSRs and report in writing the receipt of a significant amount of improperly enclosed or uncovered waste to EPA by the following working day. The owner or operator of an active waste disposal site is required by the revisions promulgated today to send a signed copy of the WSR back to the waste generator no more than 30 days after receipt of the waste, to attempt to reconcile any discrepancy between the quantity given on the WSR and the quantity actually received and, failing to do so within 15 days after receiving the waste, to report the discrepancy and any attempts to reconcile it to the Administrator. The revisions promulgated today also require the owner or operator of an active disposal site to maintain records of the location, depth and area, and volume of asbestos-containing waste material within the disposal site on a map or diagram of the disposal area. Upon closure, the owner or operator must comply with all the rules promulgated for inactive waste disposal sites. A revision requires the owner or operator of an active waste disposal site to notify the Administrator in writing prior to excavating or otherwise disturbing asbestos-containing waste material that has been deposited at the disposal site and covered.

Asbestos Conversion Processes

A section is promulgated to clarify that operations that convert asbestos-containing waste material into nonasbestos (asbestos-free) material are covered by the NESHAP. The provisions promulgated require the owner or operator of such an operation to obtain prior written approval of the Administrator to construct the facility, and conduct a start-up performance test using specified analytical methods and procedures. Requirements for continuous monitoring during and after the initial 90 days of operation, emissions control, maintenance of records of test results on site, and reports to the Administrator are also promulgated today.

II. Environmental, Energy and Economic Impacts

The environmental, energy, and economic impacts of the revisions for demolition and renovation, including waste disposal, were estimated from two baselines. One is full compliance with the NESHAP, and the other is current use of engineering controls and work practices. Enforcement experience indicates that many asbestos removal operations related to demolition and the subsequent waste disposal operations are performed out of compliance with the NESHAP. The lack of compliance with the NESHAP removal provisions leads to the improper disposal of some waste, especially demolition waste, with the result that emissions from the disposal of demolition waste greatly exceed other emissions, including process emissions from milling, manufacturing, and fabricating. Liability and other considerations generally lead the owners of buildings being renovated to follow or even exceed the requirements of the NESHAP. Thus, the appropriate baseline for demolition is current use of work practices rather than full compliance. At asbestos milling, manufacturing, and fabricating facilities, the required air pollution control devices are generally in place. Thus, for milling, manufacturing, and fabricating, full compliance with the NESHAP, including the waste disposal requirements, is assumed for the baseline.

Few emission measurement data exit for asbestos sources. Thus, emissions were estimated using engineering methods and assumptions, which resulted in substantial uncertainty. A detailed description of the approaches used to estimate emissions is found in "Asbestos Emission Estimates for Milling, Manufacturing, Fabricating, Demolition, Renovation, and Waste Disposal," which is contained in Docket A–88–28. Estimated process emissions under the current NESHAP at full compliance for milling, manufacturing, and fabricating are approximately 7,400 kg/yr. Based on current practices, estimated emissions from the removal activities associated with demolition and renovation are approximately 1,300 kg/yr and estimated waste disposal emissions from all sources are 227,000 kg/yr. If demolition and renovation were in full compliance, estimated emissions from asbestos removal activities associated with demolition and renovation would be about 700 kg/yr. Estimated emissions from waste disposal, assuming full compliance with the NESHAP by all sources, would be about 600 kg/yr.

The costs of the revisions are expected to be small relative to normal operating costs for these industries. The revisions are intended to promote compliance and enhance enforceability. Small additional costs are associated with the recordkeeping and reporting requirements of the revisions. Economic impacts of the promulgated alternatives are expected to be minimal. Adverse impacts of the promulgated revisions on water, noise, and energy were considered. Due to the nature of the revisions, no significant adverse impacts on water, noise, or energy are anticipated.

III. Public Participation

The revisions were proposed and published in the Federal Register on January 10, 1989 (54 FR 912). The preamble to the proposed standards revisions noted the availability in the docket of the supporting information used in developing the proposed revisions. Public comments were solicited at the time of proposal.

To provide interested persons the opportunity for oral presentation of data, views, or arguments concerning the proposed revisions, a public hearing was held on February 8, 1989, at Research Triangle Park, North Carolina. The hearing was open to the public, and 6 persons presented comments.

The public comment period specified in the Federal Register notice was from January 10, 1989 to March 7, 1989. One

hundred comment letters were received in response to the Federal Register proposal. The comments have been carefully considered and, where determined to be appropriate by the Administrator, changes have been made to the proposed revisions.

IV. Significant Comments and Changes to the Proposed Revisions

Comments on the proposed revisions were received from industry, trade associations and regulatory agencies. A detailed discussion of these comments and responses can be found in the promulgation BID, which is referred to in the ADDRESSES section of this preamble. The comments and responses summarized in the BID serve as the basis for the changes that have been made to the revisions between proposal and promulgation. The major comments and responses are summarized in this preamble. Most of the comment letters contained multiple comments. Significant comments have been divided into the following areas: demolition and renovation, and waste disposal.

Demolition and Renovation

Nonfriable ACM

Comment: Several commenters argued that the rule should be modified to clarify that certain products are nonfriable and, therefore, not regulated. Asbestos cement (A/C) products, including transite and exterior shingles, should be included among nonfriable products according to commenters IV-D-49, IV-D-72, and IV-D-93. Asbestos-containing flooring products, such as tile and sheet vinyl flooring, were considered by several commenters (IV-D-15, IV-D-47, IV-D-48, IV-D-55, IV-D-84, and IV-D-95) to always be nonfriable and exempt from the rule, with the exception of flooring that was being sanded (IV-D-47, IV-D-48). Another commenter, IV-D-48, in reference to asbestos roofing products, argued that there is no basis in the record for saying that severely weathered asphaltic material could become brittle. Commenters IV-D-21, IV-D-31, IV-D-48, IV-D-49, and IV-D-93 recommended that the rule be clarified to exempt all nonfriable materials as the rule is currently understood. Commenter IV-D-93 argued that in present day ACM, the asbestos fibers are locked in cement or bituminous or resinous binders and that the materials can be removed and disposed of without any significant release to the environment.

Response: In 1973 when the asbestos NESHAP rules were first promulgated for the demolition of buildings, EPA's intention was to distinguish between materials that would readily release asbestos fibers when damaged or disturbed and those materials that were unlikely to result in the release of significant amounts of asbestos fibers. To accomplish this, EPA labeled as "friable" those materials that were likely to readily release fibers. Friable materials, when dry, could easily be crumbled, pulverized, or reduced to powder using hand pressure. The term "reduced to powder" is readily understood to mean that the affected material is changed to a dust or powder that can become airborne. "Pulverized" indicates that the resulting material will include dust as well as a large number of small pieces of the original material. The term "crumbled" indicates that the affected material is easily (i.e., using hand pressure) broken into a large number of small pieces. Although dust is likely to be produced as a result of crumbling, it is possible that there are some types of materials that can be crumbled without producing dust. It is also understood that crumbling refers to an action that occurs essentially in one effort and not to repeated attempts to crumble the material. For example, floor tile in good condition can be broken by hand into a few large pieces, but it is not easily broken in one effort into many small pieces. On the other hand, floor tile that has lost its structural matrix is in poor condition and can be broken into many small pieces in one effort.

Later, EPA realized that, in some instances, nonfriable materials that were subjected to intense forces, such as the intense mechanical forces encountered during demolition, could be crumbled, pulverized, or reduced to powder. In these instances, certain materials which had been considered nonfriable appeared capable of releasing significant amounts of asbestos fibers to the atmosphere. Examples of practices that were observed by EPA to reduce otherwise nonfriable asbestos material to dust capable of becoming airborne included the breaking of nonfriable insulation from steel beams by repeatedly running over the beams with a crawler tractor. In view of the damage done to these otherwise nonfriable materials and the resulting increased potential for fiber release, these and other similar practices involving nonfriable asbestos material were considered to render nonfriable ACM into dust capable of becoming airborne.

As a result, EPA issued a policy determination in 1985 regarding the removal of nonfriable asbestos material that was consistent with EPA's intent to distinguish between material that could release significant amounts of asbestos fibers during demolition and renovation operations and those that would not. This policy determination stated in essence that any ACM, whether originally friable or nonfriable that become (or are likely to become) crumbled, pulverized, or reduced to powder are covered by the NESHAP. Specifically, the determination stated that

> • • • even though the regulations address only material that is presently friable, it does not limit itself to material that is friable at the time of notification. Rather, if at any point during the renovation or demolition, additional friable asbestos material is • • • created from nonfriable forms, then this additional friable material becomes subject to the regulations from the time of creation • • •

The issuance of this determination did not alter the intent of the NESHAP, but was consistent with the intent of the standard that was written to prevent significant emissions of asbestos fibers. The intent of the policy determination was that it apply narrowly to specific instances where otherwise nonfriable materials would be damaged during demolition or renovation to the extent that significant amounts of asbestos fibers would be released to the atmosphere. A statement in the determination to the effect that some nonfriable materials may remain nonfriable throughout demolition and renovation is evidence that this determination was intended to be narrowly interpreted and not used to require removal of all nonfriable materials. For example, materials such as resilient floor covering, asphalt roofing products, packings, and gaskets would rarely, if ever, need to be removed because, even when broken or damaged, they would not release significant amounts of asbestos fibers. But, just as it is important to recognize that some nonfriable materials do not have to be removed prior to demolition, it is also important to recognize that some nonfriable materials should be removed prior to demolition if, as a result of the forces of demolition, nonfriable material is likely to become crumbled, pulverized, or otherwise reduced to powder. For example, the A/C siding on a building that is to be demolished using a wrecking ball is very likely to be crumbled or pulverized with increased potential for the release of significant levels of asbestos fibers. Such material in this instance should be removed prior to demolition.

Since this policy determination was made, there has been some confusion in

its application. As a result, contractors operating in more than one enforcement jurisdiction have encountered different interpretations for similar demolition operations. For example, there have been instances in which contractors are required, prior to demolition, to remove floor tile in one enforcement jurisdiction but not in another. Contractors and/or building owners and operators are unsure as to what materials must be removed and what materials can be left in place and are often hesitant to proceed without a ruling from EPA, which can involve significant delays.

As a consequence, EPA received a number of requests from State and regional enforcement agencies to clarify what is required under the NESHAP in dealing with nonfriable materials since the 1985 policy determination was issued. In response to these requests, a clarification of the nonfriable issue was included in the revisions proposed on January 10, 1989. These revisions were intended to clarify the intent of the original rule. Basically, EPA stated in the January 10, 1989, Federal Register notice that certain nonfriable materials, such as floor tile, roofing products, and packings and gaskets that are in good condition, can be left in buildings being demolished because fiber release from these materials, even if the materials are damaged, is relatively small compared to the fiber release from friable materials. Other nonfriable products such as A/C products have a greater potential to release asbestos fibers when heavily damaged and may have to be removed prior to demolition.

In response to the revisions proposed on January 10, 1989, numerous comments were submitted to EPA. Many of the commenters argued that EPA was attempting to regulate nonfriable materials, which were explicitly exempted in previous asbestos NESHAP rulemakings. Many comments stated that the proposed revisions did not help to clarify EPA's position on nonfriable material and may have made matters more confusing.

In responding to the comments, a literature survey was conducted to determine if it was possible to quantify the fiber release potential of nonfriable materials when they are damaged during demolition. All of the available data on fiber release from floor tile, roofing products, gaskets, packings, and A/C products was reviewed. In some instances, the fiber release data were measured during actual removal operations, while other data were from simulated removal activities in laboratory settings. For the materials evaluated, the potential for fiber release appeared minimal and substantially lower than for friable materials. These findings, while uncertain, support EPA's original argument that there is a basis for making a distinction between materials that readily release fibers and those that do not.

As a result of the comments received on this issue and the additional information gathered in response to comments, EPA has been able to compile a list of nonfriable ACM that, under normal conditions, do not have to be removed prior to demolition operations. These ACM are not expected to release significant amounts of asbestos fibers to the outside air during demolition and, consistent with the intent of the existing standards, are not being regulated. A definition of "category I nonfriable ACM" is added to the final rule, which lists resilient floor covering, roofing products, gaskets, and packings. However, if these materials are in poor condition and are friable or they are subjected to sanding, grinding, cutting, or abrading, they are to be treated as friable asbestos material. Category I nonfriable ACM that is in poor condition, but is not friable and will not be subjected to sanding, grinding, cutting, or abrading, is not subject to the NESHAP. "In poor condition" has been defined to mean that the binding of the material is losing its integrity as indicated by peeling, cracking, or crumbling of the material. Other nonfriable materials are identified as Category II nonfriable ACM and have to be evaluated on a case-by-case basis. Category II materials that become crumbled, pulverized, or reduced to powder during removal or during demolition are covered by the NESHAP.

Broken ACM

Comment: Commenters IV-D-47, IV-D-89, IV-D-93, and IV-D-95 explained that use of the term "broken" to describe materials that are subject to the rule is inconsistent with the current NESHAP and expands coverage of the NESHAP. These commenters stated that merely breaking nonfriable material does not equate to fiber release. One commenter, IV-D-89, noted that noncompliance may increase where nonfriable material is broken during demolition or renovation, but is not controlled or reported according to the NESHAP.

Response: After considering this issue, EPA agrees with commenters that retaining the word "broken" could be interpreted as substantially increasing the scope of the standard and, therefore, has removed it from the definition. Most nonfriable materials can be broken without releasing significant quantities of airborne asbestos fibers. It is only when the material is extensively damaged, *i.e.*, crumbled, pulverized, or reduced to powder, that the potential for significant fiber release is greatly increased. Also, in the definitions of "asbestos-containing waste material," "friable asbestos material," and elsewhere, the word "broken" is deleted. The EPA is planning to issue additional information in the future on this and other aspects of the NESHAP to help enforcement officials and the regulated community interpret and apply the NESHAP provisions.

Inspections

Comment. Three commenters argued that EPA should include mandatory asbestos surveys in the rule. Commenter IV-D-4 stated that EPA should require surveys for all buildings prior to and separate from any demolition or renovation activity. Commenter IV-D-4 stated that such building surveys could become part of a public record, making the absence of a survey a violation. Commenter IV-D-4 noted that, if the survey indicated that a structure was asbestos free, all notification and enforcement costs would be eliminated. Also, commenter IV-D-4 explained that a demolition without proper notification could be easily established later.

Commenters IV-D-57 and IV-D-84 stated that EPA's requirement to survey buildings prior to demolition and renovation is implicit and should be made explicit and require that surveys be performed by an accredited asbestos inspector. Commenter IV-D-57 also noted that OSHA requires a building survey by a competent person and stated that EPA should similarly require a site-specific survey before demolition, with details on how the building will be demolished and how the asbestos will be controlled.

Response: The EPA currently requires that a facility be inspected for asbestos prior to demolition or renovation. As a result of the survey, information on the asbestos material present, the nature of the demolition or renovation, and measures that will be taken to control emissions of asbestos must be reported to EPA. Commenters IV-D-57 and IV-D-84 are correct in saying that it is an implicit requirement and that it is not stated explicitly in the rule. The final rule expressly requires a facility survey for asbestos prior to demolition or renovation. Although previously implied, this revision clarifies EPA's position on the requirement to perform building surveys.

The EPA also considered the suggestion to require that surveys be

1. Air cleaning device designation or number _____

2. Date of inspection _____ _____ _____ _____

3. Time of inspection _____ _____ _____ _____

4. Is air cleaning device operating properly (yes/no) _____ _____ _____ _____

5. Tears, holes, or abrasions in fabric filter (yes/no) _____ _____ _____ _____

6. Dust on clean side of fabric filters (yes/no) _____ _____ _____ _____

7. Other signs of malfunctions or potential malfunctions (yes/no) _____ _____ _____ _____

8. Describe other malfunctions or signs of potential malfunctions. _____

_____

_____

9. Describe corrective action(s) taken. _____

_____

_____

10. Date and time corrective action taken _____ _____ _____ _____

11. Inspected by

(Print/Type Name)	(Title)	(Signature)	(Date)
(Print/Type Name)	(Title)	(Signature)	(Date)

Figure 2. Air Cleaning Device Inspection Checklist

BILLING CODE 6560-50-C

6. Section 61.143 is revised to read as follows:

§ 61.143 Standard for roadways.

No person may construct or maintain a roadway with asbestos tailings or asbestos-containing waste material on that roadway, unless, for asbestos tailings.

(a) It is a temporary roadway on an area of asbestos ore deposits (asbestos mine); or

(b) It is a temporary roadway at an active asbestos mill site and is encapsulated with a resinous or bituminous binder. The encapsulated road surface must be maintained at a minimum frequency of one per year to prevent dust emissions; or

(c) It is encapsulated in asphalt concrete meeting the specifications contained in section 401 of Standard Specifications for Construction of Roads and Bridges on Federal Highway Projects, FP-85, 1985, or their equivalent.

7. In § 61.144, paragraph (a)(9) and paragraphs (b) (1) and (2) are revised, and paragraphs (b)(3) through (b)(8) are added to read as follows:

§ 61.144 Standards for manufacturing.

(a) * * *

(9) The manufacture of chlorine utilizing asbestos diaphragm technology.

* * * * *

(b) * * *

(1) Discharge no visible emissions to the outside air from these operations or from any building or structure in which they are conducted or from any other fugitive sources; or

(2) Use the methods specified by § 61.152 to clean emissions from these operations containing particulate asbestos material before they escape to, or are vented to, the outside air.

(3) Monitor each potential source of asbestos emissions from any part of the manufacturing facility, including air cleaning devices, process equipment, and buildings housing material processing and handling equipment, at least once each day during daylight hours for visible emissions to the outside air during periods of operation. The monitoring shall be visual observation of at least 15 seconds duration per source of emissions.

(4) Inspect each air cleaning device at least once each week for proper operation and for changes that signal the potential for malfunctions, including, to the maximum extent possible without dismantling other than opening the device, the presence of tears, holes, and abrasions in filter bags and for dust deposits on the clean side of bags. For air cleaning devices that cannot be inspected on a weekly basis according to this paragraph, submit to the Administrator, and revise as necessary, a written maintenance plan to include, at a minimum, the following:

(i) Maintenance schedule.

(ii) Recordkeeping plan.

(5) Maintain records of the results of visible emission monitoring and air cleaning device inspections using a format similar to that shown in Figures 1 and 2 and include the following.

(i) Date and time of each inspection.

(ii) Presence or absence of visible emissions.

(iii) Condition of fabric filters, including presence of any tears, holes and abrasions.

(iv) Presence of dust deposits on clean side of fabric filters.

(v) Brief description of corrective actions taken, including date and time.

(vi) Daily hours of operation for each air cleaning device.

(6) Furnish upon request, and make available at the affected facility during normal business hours for inspection by the Administrator, all records required under this section.

(7) Retain a copy of all monitoring and inspection records for at least 2 years.

(8) Submit quarterly a copy of the visible emission monitoring records to the Administrator if visible emissions occurred during the report period. Quarterly reports shall be postmarked by the 30th day following the end of the calendar quarter.

8. Sections 61.146 and 61.147 are removed, and § 61.145 is revised to read as follows:

§ 61.145 Standard for demolition and renovation.

(a) *Applicability.* To determine which requirements of paragraphs (a), (b), and (c) of this section apply to the owner or operator of a demolition or renovation activity and prior to the commencement of the demolition or renovation, thoroughly inspect the affected facility or part of the facility where the demolition or renovation operation will occur for the presence of asbestos, including Category I and Category II nonfriable ACM. The requirements of paragraphs (b) and (c) of this section apply to each owner or operator of a demolition or renovation activity, including the removal of RACM as follows:

(1) In a facility being demolished, all the requirements of paragraphs (b) and (c) of this section apply, except as provided in paragraph (a)(3) of this section, if the combined amount of RACM is

(i) At least 80 linear meters (260 linear feet) on pipes or at least 15 square meters (160 square feet) on other facility components, or

(ii) At least 1 cubic meter (35 cubic feet) off facility components where the length or area could not be measured previously.

(2) In a facility being demolished, only the notification requirements of paragraphs (b)(1), (2), (3)(i) and (iv), and (4)(i) through (vii) and (4)(ix) and (xvi) of this section apply, if the combined amount of RACM is

(i) Less than 80 linear meters (260 linear feet) on pipes less than 15 square meters (160 square feet) on other facility components, and

(ii) Less than one cubic meter (35 cubic feet) off facility components where the length or area could not be measured previously or there is no asbestos.

(3) If the facility is being demolished under an order of a State or local government agency, issued because the facility is structurally unsound and in danger of imminent collapse, only the requirements of paragraphs (b)(1), (b)(2), (b)(3)(iii), (b)(4) (except (b)(4)(viii)), (b)(5), and (c)(4) through (c)(9) of this section apply.

(4) In a facility being renovated, including any individual nonscheduled renovation operation, all the requirements of paragraphs (b) and (c) of this section apply if the combined amount of RACM to be stripped, removed, dislodged, cut, drilled, or similarly disturbed is

(i) At least 80 linear meters (260 linear feet) on pipes or at least 15 square meters (160 square feet) on other facility components, or

(ii) At least 1 cubic meter (35 cubic feet) off facility components where the length or area could not be measured previously.

(iii) To determine whether paragraph (a)(4) of this section applies to planned renovation operations involving individual nonscheduled operations, predict the combined additive amount of RACM to be removed or stripped during a calendar year of January 1 through December 31.

(iv) To determine whether paragraph (a)(4) of this section applies to emergency renovation operations, estimate the combined amount of RACM to be removed or stripped as a result of the sudden, unexpected event that necessitated the renovation.

(5) Owners or operators of demolition and renovation operations are exempt from the requirements of §§ 61.05(a), 61.07, and 61.09.

(b) *Notification requirements.* Each owner or operator of a demolition or

renovation activity to which this section applies shall:

(1) Provide the Administrator with written notice of intention to demolish or renovate. Delivery of the notice by U.S. Postal Service, commercial delivery service, or hand delivery is acceptable.

(2) Update notice, as necessary, including when the amount of asbestos affected changes by at least 20 percent.

(3) Postmark or deliver the notice as follows:

(i) At least 10 working days before asbestos stripping or removal work or any other activity begins (such as site preparation that would break up, dislodge or similarly disturb asbestos material), if the operation is described in paragraphs (a) (1) and (4) (except (a)(4)(iii) and (a)(4)(iv)) of this section. If the operation is as described in paragraph (a)(2) of this section, notification is required 10 working days before demolition begins.

(ii) At least 10 working days before the end of the calendar year preceding the year for which notice is being given for renovations described in paragraph (a)(4)(iii) of this section.

(iii) As early as possible before, but not later than, the following working day if the operation is a demolition ordered according to paragraph (a)(3) of this section or, if the operation is a renovation described in paragraph (a)(4)(iv) of this section.

(iv) For asbestos stripping or removal work in a demolition or renovation operation, described in paragraphs (a) (1) and (4) (except (a)(4)(iii) and (a)(4)(iv)) of this section, and for a demolition described in paragraph (a)(2) of this section, that will begin on a date other than the one contained in the original notice, notice of the new start date must be provided to the Administrator as follows:

(A) When the asbestos stripping or removal operation or demolition operation covered by this paragraph will begin after the date contained in the notice,

(1) Notify the Administrator of the new start date by telephone as soon as possible before the original start date, and

(2) Provide the Administrator with a written notice of the new start date as soon as possible before, and no later than, the original start date. Delivery of the updated notice by the U.S. Postal Service, commercial delivery service, or hand delivery is acceptable.

(B) When the asbestos stripping or removal operation or demolition operation covered by this paragraph will begin on a date earlier than the original start date,

(1) Provide the Administrator with a written notice of the new start date at least 10 working days before asbestos stripping or removal work begins.

(2) For demolitions covered by paragraph (a)(2) of this section, provide the Administrator written notice of a new start date at least 10 working days before commencement of demolition. Delivery of updated notice by U.S. Postal Service, commercial delivery service, or hand delivery is acceptable.

(C) In no event shall an operation covered by this paragraph begin on a date other than the date contained in the written notice of the new start date.

(4) Include the following in the notice:

(i) An indication of whether the notice is the original or a revised notification.

(ii) Name, address, and telepbone number of both the facility owner and operator and the asbestos removal contractor owner or operator.

(iii) Type of operation: demolition or renovation.

(iv) Description of the facility or affected part of the facility including the size (square meters [square feet] and number of floors), age, and present and prior use of the facility.

(v) Procedure, including analytical methods, employed to detect the presence of RACM and Category I and Category II nonfriable ACM.

(vi) Estimate of the approximate amount of RACM to be removed from the facility in terms of length of pipe in linear meters (linear feet), surface area in square meters (square feet) on other facility components, or volume in cubic meters (cubic feet) if off the facility components. Also, estimate the approximate amount of Category I and Category II nonfriable ACM in the affected part of the facility that will not be removed before demolition.

(vii) Location and street address (including building number or name and floor or room number, if appropriate), city, county, and state, of the facility being demolished or renovated.

(viii) Scheduled starting and completion dates of asbestos removal work (or any other activity, such as site preparation that would break up, dislodge, or similarly disturb asbestos material) in a demolition or renovation; planned renovation operations involving individual nonscheduled operations shall only include the beginning and ending dates of the report period as described in paragraph (a)(4)(iii) of this section.

(ix) Scheduled starting and completion dates of demolition or renovation.

(x) Description of planned demolition or renovation work to be performed and method(s) to be employed, including demolition or renovation techniques to be used and description of affected facility components.

(xi) Description of work practices and engineering controls to be used to comply with the requirements of this subpart, including asbestos removal and waste-handling emission control procedures.

(xii) Name and location of the waste disposal site where the asbestos-containing waste material will be deposited.

(xiii) A certification that at least one person trained as required by paragraph (c)(8) of this section will supervise the stripping and removal described by this notification. This requirement shall become effective 1 year after promulgation of this regulation.

(xiv) For facilities described in paragraph (a)(3) of this section, the name, title, and authority of the State or local government representative who has ordered the demolition, the date that the order was issued, and the date on which the demolition was ordered to begin. A copy of the order shall be attached to the notification.

(xv) For emergency renovations described in paragraph (a)(4)(iv) of this section, the date and hour that the emergency occurred, a description of the sudden, unexpected event, and an explanation of how the event caused an unsafe condition, or would cause equipment damage or an unreasonable financial burden.

(xvi) Description of procedures to be followed in the event that unexpected RACM is found or Category II nonfriable ACM becomes crumbled, pulverized, or reduced to powder.

(xvii) Name, address, and telephone number of the waste transporter.

(5) The information required in paragraph (b)(4) of this section must be reported using a form similiar to that shown in Figure 3.

(c) *Procedures for asbestos emission control.* Each owner or operator of a demolition or renovation activity to whom this paragraph applies, according to paragraph (a) of this section, shall comply with the following procedures:

(1) Remove all RACM from a facility being demolished or renovated before any activity begins that would break up, dislodge, or similarly disturb the material or preclude access to the material for subsequent removal. RACM need not be removed before demolition if:

(i) It is Category I nonfriable ACM that is not in poor condition and is not friable.

(ii) It is on a facility component that encased in concrete or other similarly

hard material and is adequately wet whenever exposed during demolition; or

(iii) It was not accessible for testing and was, therefore, not discovered until after demolition began and, as a result of the demolition, the material cannot be safely removed. If not removed for safety reasons, the exposed RACM and any asbestos-contaminated debris must be treated as asbestos-containing waste material and adequately wet at all times until disposed of.

(iv) They are Category II nonfriable ACM and the probability is low that the materials will become crumbled, pulverized, or reduced to powder during demolition.

(2) When a facility component that contains, is covered with, or is coated with RACM is being taken out of the facility as a unit or in sections:

(i) Adequately wet all RACM exposed during cutting or disjoining operations; and

(ii) Carefully lower each unit or section to the floor and to ground level, not dropping, throwing, sliding, or otherwise damaging or disturbing the RACM.

(3) When RACM is stripped from a facility component while it remains in place in the facility, adequately wet the RACM during the stripping operation.

(i) In renovation operations, wetting is not required if:

(A) The owner or operator has obtained prior written approval from the Administrator based on a written application that wetting to comply with this paragraph would unavoidably damage equipment or present a safety hazard; and

(B) The owner or operator uses of the following emission control methods:

(*1*) A local exhaust ventilation and collection system designed and operated to capture the particulate asbestos material produced by the stripping and removal of the asbestos materials. The system must exhibit no visible emissions to the outside air or be designed and operated in accordance with the requirements in § 61.152.

(*2*) A glove-bag system designed and operated to contain the particulate asbestos material produced by the stripping of the asbestos materials.

(*3*) Leak-tight wrapping to contain all RACM prior to dismantlement.

(ii) In renovation operations where wetting would result in equipment damage or a safety hazard, and the methods allowed in paragraph (c)(3)(i) of this section cannot be used, another method may be used after obtaining written approval from the Administrator based upon a determination that it is equivalent to wetting in controlling emissions or to the methods allowed in paragraph (c)(3)(i) of this section.

(iii) A copy of the Administrator's written approval shall be kept at the worksite and made available for inspection.

(4) After a facility component covered with, coated with, or containing RACM has been taken out of the facility as a unit or in sections pursuant to paragraph (c)(2) of this section, it shall be stripped or contained in leak-tight wrapping, except as described in paragraph (c)(5) of this section. If stripped, either:

(i) Adequately wet the RACM during stripping; or

(ii) Use a local exhaust ventilation and collection system designed and operated to capture the particulate asbestos material produced by the stripping. The system must exhibit no visible emissions to the outside air or be designed and operated in accordance with the requirements in § 61.152.

(5) For large facility components such as reactor vessels, large tanks, and steam generators, but not beams (which must be handled in accordance with paragraphs (c)(2), (3), and (4) of this section), the RACM is not required to be stripped if the following requirements are met:

(i) The component is removed, transported, stored, disposed of, or reused without disturbing or damaging the RACM.

(ii) The component is encased in a leak-tight wrapping.

(iii) The leak-tight wrapping is labeled according to § 61.149(d)(1)(i), (ii), and (iii) during all loading and unloading operations and during storage.

(6) For all RACM, including material that has been removed or stripped:

(i) Adequately wet the material and ensure that it remains wet until collected and contained or treated in preparation for disposal in accordance with § 61.150; and

(ii) Carefully lower the material to the ground and floor, not dropping, throwing, sliding, or otherwise damaging or disturbing the material.

(iii) Transport the material to the ground via leak-tight chutes or containers if it has been removed or stripped more than 50 feet above ground level and was not removed as units or in sections.

(iv) RACM contained in leak-tight wrapping that has been removed in accordance with paragraphs (c)(4) and (c)(3)(i)(B)(*3*) of this section need not be wetted.

(7) When the temperature at the point of wetting is below 0 °C (32 °F):

(i) The owner or operator need not comply with paragraph (c)(2)(i) and the wetting provisions of paragraph (c)(3) of this section.

(ii) The owner or operator shall remove facility components containing, coated with, or covered with RACM as units or in sections to the maximum extent possible.

(iii) During periods when wetting operations are suspended due to freezing temperatures, the owner or operator must record the temperature in the area containing the facility components at the beginning, middle, and end of each workday and keep daily temperature records available for inspection by the Administrator during normal business hours at the demolition or renovation site. The owner or operator shall retain the temperature records for at least 2 years.

(8) Effective 1 year after promulgation of this regulation, no RACM shall be stripped, removed, or otherwise handled or disturbed at a facility regulated by this section unless at least one on-site representative, such as a foreman or management-level person or other authorized representative, trained in the provisions of this regulation and the means of complying with them, is present. Every 2 years, the trained on-site individual shall receive refresher training in the provisions of this regulation. The required training shall include as a minimum: applicability; notifications; material identification; control procedures for removals including, at least, wetting, local exhaust ventilation, negative pressure enclosures, glove-bag procedures, and High Efficiency Particulate Air (HEPA) filters; waste disposal work practices; reporting and recordkeeping; and asbestos hazards and worker protection. Evidence that the required training has been completed shall be posted and made available for inspection by the Administrator at the demolition or renovation site.

(9) For facilities described in paragraph (a)(3) of this section, adequately wet the portion of the facility that contains RACM during the wrecking operation.

(10) If a facility is demolished by intentional burning, all RACM including Category I and Category II nonfriable ACM must be removed in accordance with the NESHAP before burning.

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APPENDIX B

Occupational Safety and Health Administration (OSHA) Standards (29 CFR 1910.1001 and 1926.58)

1926.58 Asbestos, tremolite, anthophyllite, and actinolite.

[Sec. 1926.58 added by 51 FR 22756, June 20, 1986]

(a) *Scope and application.* This section applies to all construction work as defined in 29 CFR 1910.12(b), including but not limited to the following:

(1) Demolition or salvage of structures where asbestos, tremolite, anthophyllite, or actinolite is present;

(2) Removal or encapsulation of materials containing asbestos, tremolite, anthophyllite, or actinolite;

(3) Construction, alteration, repair, maintenance, or renovation of structures, substrates, or portions thereof, that contain asbestos, tremolite, anthophyllite, or actinolite;

(4) Installation of products containing asbestos, tremolite, anthophyllite, or actinolite;

(5) Asbestos, tremolite, anthophyllite, and actinolite spill/emergency cleanup; and

(6) Transportation, disposal, storage, or containment of asbestos, tremolite, anthophyllite, or actinolite or products containing asbestos, tremolite, anthophyllite, or actinolite on the site or location at which construction activities are performed.

(b) *Definitions.* "Action level" means an airborne concentration of asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals of 0.1 fiber per cubic centimeter (f/cc) of air calculated as an eight (8)-hour time-weighted average.

"Asbestos" includes chrysotile, amosite, crocidolite, tremolite asbestos, anthophyllite asbestos, actinolite asbestos, and any of these minerals that has been chemically treated and/or altered.

"Assistant Secretary" means the Assistant Secretary of Labor for Occupational Safety and Health, U.S. Department of Labor, or designee.

"Authorized person" means any person authorized by the employer and required by work duties to be present in regulated areas.

"Clean room" means an uncontaminated room having facilities for the storage of employees' street clothing and uncontaminated materials and equipment.

"Competent person" means one who is capable of identifying existing asbestos, tremolite, anthophyllite, or actinolite hazards in the workplace and who has the authority to take prompt corrective measures to eliminate them, as specified in 29 CFR 1926.32(f). The duties of the competent person include at least the following: establishing the negative-pressure enclosure, ensuring its integrity, and controlling entry to and exit from the enclosure; supervising any employee exposure monitoring required by the standard; ensuring that all employees working within such an enclosure wear the appropriate personal protective equipment, are trained in the use of appropriate methods of exposure control, and use the hygiene facilities and decontamination procedures specified in the standard; and ensuring that engineering controls in use are in proper operating condition and are functioning properly.

"Decontamination area" means an enclosed area adjacent and connected to the regulated area and consisting of an equipment room, shower area, and clean room, which is used for the decontamination of workers, materials, and equipment contaminated with asbestos, tremolite, anthophyllite, or actinolite.

"Demolition" means the wrecking or taking out of any load-supporting structural member and any related razing, removing, or stripping of asbestos, tremolite, anthophyllite, or actinolite products.

"Director" means the Director, National Institute for Occupational Safety and Health, U.S. Department of Health and Human Services, or designee.

"Employee exposure" means that exposure to airborne asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals, that would occur if the employee were not using respiratory protective equipment.

"Equipment room (change room)" means a contaminated room located within the decontamination area that is supplied with impermeable bags or containers for the disposal of contaminated protective clothing and equipment.

"Fiber" means a particulate form of asbestos, tremolite, anthophyllite, or actinolite, 5 micrometers or longer, with a length-to-diameter ratio of at least 3 to 1.

"High-efficiency particulate air (HEPA) filter" means a filter capable of trapping and retaining at least 99.97 percent of all monodispersed particles of 0.3 micrometers in diameter or larger.

"Regulated area" means an area established by the employer to demarcate areas where airborne concentrations of asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals exceed or can reasonably be expected to exceed the permissible exposure limit. The regulated area may take the form of (1) a temporary enclosure, as required by paragraph (e)(6) of this section, or (2) an area demarcated in any manner that minimizes the number of employees exposed to asbestos, tremolite, anthophyllite, or actinolite.

"Removal" means the taking out or stripping of asbestos, tremolite, anthophyllite, or actinolite or materials containing asbestos, tremolite, anthophyllite, or actinolite.

[Sec. 1926.58(b)]

"Renovation" means the modifying of any existing structure, or portion thereof, where exposure to airborne asbestos, tremolite, anthophyllite, actinolite may result.

"Repair" means overhauling, rebuilding, reconstructing, or reconditioning of structures or substrates where asbestos, tremolite, anthophyllite,or actinolite is present.

"Tremolite, anthophyllite and actinolite" means the non-asbestos form of these minerals, and any of these minerals that have been chemically treated and/or altered.

(c) *Permissible exposure limit (PEL).* The employer shall ensure that no employee is exposed to an airborne concentration of asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals in excess of 0.2 fiber per cubic centimeter of air as an eight (8) hour time-weighted average (TWA), as determined by the method prescribed in Appendix A of this section, or by an equivalent method.

(d) *Communication among employers.* On multi-employer worksites, an employer performing asbestos, tremolite, anthophyllite, or actinolite work requiring the establishment of a regulated area shall inform other employers on the site of the nature of the employer's work with asbestos, tremolite, anthophyllite, or actinolite and of the existence of and requirements pertaining to regulated areas.

(e) *Regulated areas*—(1) *General.* The employer shall establish a regulated area in work areas where airborne concentrations of asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals exceed or can reasonably be expected to exceed the permissible exposure limit prescribed in paragraph (c) of this section.

(2) *Demarcation.* The regulated area shall be demarcated in any manner that minimizes the number of persons within the area and protects persons outside the area from exposure to airborne concentrations of asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals in excess of the permissible exposure limit.

(3) *Access.* Access to regulated areas shall be limited to authorized persons or to persons authorized by the Act or regulations issued pursuant thereto.

(4) *Respirators.* All persons entering a regulated area shall be supplied with a respirator, selected in accordance with paragraph (h)(2) of this section.

(5) *Prohibited activities.* The employer shall ensure that employees do not eat, drink, smoke, chew tobacco or gum, or apply cosmetics in the regulated area.

(6) *Requirements for asbestos removal, demolition, and renovation operations.* (i) Wherever feasible, the employer shall establish negative-pressure enclosures before commencing removal, demolition, and renovation operations.

(ii) The employer shall designate a competent person to perform or supervise the following duties:

(A) Set up the enclosure;

(B) Ensure the integrity of the enclosure;

(C) Control entry to and exit from the enclosure;

(D) Supervise all employee exposure monitoring required by this section;

(E) Ensure that employees working within the enclosure wear protective clothing and respirators as required by paragraphs (i) and (h) of this section and;

(F) Ensure that employees are trained in the use of engineering controls, work practices, and personal protective equipment;

(G) Ensure that employees use the hygiene facilities and observe the decontamination procedures specified in paragraph (j) of this section; and

(H) Ensure that engineering controls are functioning properly.

(iii) In addition to the qualifications specified in paragraph (b) of this section, the competent person shall be trained in all aspects of asbestos, tremolite, anthophyllite, or actinolite abatement, the contents of this standard, the identification of asbestos, tremolite, anthophyllite, or actinolite and their removal procedures, and other practices for reducing the hazard. Such training shall be obtained in a comprehensive course, such as a course conducted by an EPA Asbestos Training Center, or an equivalent course.

(iv) *Exception:* For small-scale, short-duration operations, such as pipe repair, valve replacement, installing electrical conduits, installing or removing drywall, roofing, and other general building maintenance or renovation, the employer is not required to comply with the requirements of paragraph (e)(6) of this section.

(f) *Exposure monitoring*—(1) *General.* (i) Each employer who has a workplace or work operation covered by this standard shall perform monitoring to determine accurately the airborne concentrations of asbestos, tremolite, anthophyllite, actinolite or a combination of these minerals to which employees may be exposed.

(ii) Determinations of employee exposure shall be made from breathing zone air samples that are representative of the 8-hour TWA of each employee.

(iii) Representative 8-hour TWA employee exposure shall be determined on the basis of one or more samples representing full-shift exposure for employees in each work area.

(2) *Initial monitoring.* (i) Each employer who has a workplace or work operation covered by this standard, except as provided for in paragraph (f)(2)(ii) and (f)(2)(iii) of this section, shall perform initial monitoring at the initiation of each asbestos, tremolite, anthophyllite, actinolite job to accurately determine the airborne concentrations of asbestos, tremolite, anthophyllite, or actinolite to which employees may be exposed.

(ii) The employer may demonstrate that employee exposures are below the action level by means of objective data demonstrating that the product or material containing asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals cannot release airborne fibers in concentrations exceeding the action level under those work conditions having the greatest potential for releasing asbestos, tremolite, anthophyllite, or actinolite.

(iii) Where the employer has monitored each asbestos, tremolite, anthophyllite, or actinolite job, and the data were obtained during work operations conducted under workplace conditions closely resembling the processes, type of material, control methods, work practices, and environmental conditions used and prevailing in the employer's current operations, the employer may rely on such earlier monitoring results to satisfy the requirements of paragraph (f)(2)(i) of this section.

(3) *Periodic monitoring within regulated areas.* The employer shall conduct daily monitoring that is representative of the exposure of each employee who is assigned to work within a regulated area. *Exception:* When all employees within a regulated area are equipped with supplied-air respirators operated in the positive-pressure mode, the employer may dispense with the daily monitoring required by this paragraph.

(4) *Termination of monitoring.* If the periodic monitoring required by paragraph (f)(3) of this section reveals that employee exposures, as indicated by statistically reliable measurements, are below the action level, the employer may discontinue monitoring for those employees whose exposures are represented by such monitoring.

(5) *Method of monitoring.* (i) All samples taken to satisfy the monitoring requirements of paragraph (f) of this section shall be personal samples

[Sec. 1926.58(f)(5)(i)]

collected following the porocedures specified in Appendix A.

(ii) All samples taken to satisfy the monitoring requirements of paragraph (f) of this section shall be evaluated using the OSHA Reference Method (ORM) specified in Appendix A, or an equivalent counting method.

(iii) If an equivalent method to the ORM is used, the employer shall ensure that the method meets the following criteria:

(A) Replicate exposure data used to establish equivalency are collected in side-by-side field and laboratory comparisons;

(B) The comparison indicates that 90 percent of the samples collected in the range 0.5 to 2.0 times the permissible limit have an accuracy range of plus or minus 25 percent of the ORM results with a 95 percent confidence level as demonstrated by a statistically valid protocol; and

(C) The equivalent method is documented and the results of the comparison testing are maintained.

(iv) To satisfy the monitoring requirements of paragraph (f), employers shall rely on the results of monitoring analysis performed by laboratories that have instituted quality assurance programs that include the elements prescribed in Appendix A.

(6) *Employee notification of monitoring results.* (i) The employer shall notify affected employees of the monitoring results that represent that employee's exposure as soon as possible following receipt of monitoring results.

(ii) The employer shall notify affected employees of the results of monitoring representing the employee's exposure in writing either individually or by posting at a centrally located place that is accessible to affected employees.

(7) *Observation of monitoring.* (i) The employer shall provide affected employees or their designated representatives an opportunity to observe any monitoring of employee exposure to asbestos, tremolite, anthophyllite, or actinolite conducted in accordance with this section.

(ii) When observation of the monitoring of employee exposure to asbestos, tremolite, anthophyllite, or actinolite requires entry into an area where the use of protective clothing or equipment is required, the observer shall be provided with and be required to use such clothing and equipment and shall comply with all other applicable safety and health procedures.

(g) *Methods of compliance.*—(1) *Engineering controls and work practices.* (i) The employer shall use one or any combination of the following control methods to achieve compliance with the permissible exposure limit prescribed by paragraph (c) of this section:

(A) Local exhaust ventilation equipped with HEPA filter dust collection systems;

(B) General ventilation systems;

(C) Vacuum cleaners equipped with HEPA filters;

(D) Enclosure or isolation of processes producing asbestos, tremolite, anthophyllite, or actinolite dust;

(E) Use of wet methods, wetting agents, or removal encapsulants to control employee exposures during asbestos, tremolite, anthophyllite, or actinolite handling, mixing, removal, cutting, application, and cleanup;

(F) Prompt disposal of wastes contaminated with asbestos, tremolite, anthophyllite, or actinolite in leak-tight containers; or

(G) Use of work practices or other engineering controls that the Assistant Secretary can show to be feasible.

(ii) Wherever the feasible engineering and work practice controls described above are not sufficient to reduce employee exposure to or below the limit prescribed in paragraph (c), the employer shall use them to reduce employee exposure to the lowest levels attainable by these controls and shall supplement them by the use of respiratory protection that complies with the requirements of paragraph (h) of this section.

(2) *Prohibitions.* (i) High-speed abrasive disc saws that are not equipped with appropriate engineering controls shall not be used for work related to asbestos, tremolite, anthophyllite, or actinolite.

(ii) Compressed air shall not be used to remove asbestos, tremolite, anthophyllite, or actinolite or materials containing asbestos, tremolite, anthophyllite, or actinolite unless the compressed air is used in conjunction with an enclosed ventilation system designed to capture the dust cloud created by the compressed air.

(iii) Materials containing asbestos, tremolite, anthophyllite, or actinolite shall not be applied by spray methods.

(3) *Employee rotation.* The employer shall not use employee rotation as a means of compliance with the exposure limit prescribed in paragraph (c) of this section.

(h) *Respiratory protection.*—(1) *General.* The employer shall provide respirators, and ensure that they are used, where required by this section. Respirators shall be used in the following circumstances:

(i) During the interval necessary to install or implement feasible engineering and work practice controls;

(ii) In work operations such as maintenance and repair activities, or other activities for which engineering and work practice controls are not feasible;

(iii) In work situations where feasible engineering and work practice controls are not yet sufficient to reduce exposure to or below the exposure limit; and

(iv) In emergencies.

(2) *Respirator selection.* (i) Where respirators are used, the employer shall select and provide, at no cost to the employee, the appropriate respirator as specified in Table D–4, and shall ensure that the employee uses the respirator provided.

(ii) The employer shall select respirators from among those jointly approved as being acceptable for protection by the Mine Safety and Health Administration (MSHA) and the National Institute for Occupational Safety and Health (NIOSH) under the provisions of 30 CFR Part 11.

(iii) The employer shall provide a powered, air-purifying respirator in lieu of any negative-pressure respirator specified in Table D–4 whenever:

(A) An employee chooses to use this type of respirator; and

(B) This respirator will provide adequate protection to the employee.

TABLE D–4.—RESPIRATORY PROTECTION FOR ASBESTOS, TREMOLITE, ANTHOPHYLLITE, AND ACTINOLITE FIBERS

Airborne concentration of asbestos, tremolite, anthophyllite, actinolite, or a combination of these materials	Required respirator
Not in excess of 2 f/cc (10 X PEL).	1. Half-mask air-purifying respirator equipped with high-efficiency filters.
Not in excess of 10 f/cc (50 X PEL).	1. Full facepiece air-purifying respirator equipped with high-efficiency filters.
Not in excess of 20 f/cc (100 X PEL).	1. Any powered air purifying respirator equipped with high efficiency filters. 2. Any supplied-air respirator operated in continuous flow mode.
Not in excess of 200 f/cc (1000 X PEL).	1. Full facepiece supplied-air respirator operated in pressure demand mode.
Greater than 200 f/cc (>1,000 X PEL) or unknown concentration.	1. Full facepiece supplied air respirator operated in pressure demand mode equipped with an auxiliary positive pressure self-contained breathing apparatus.

NOTE: a. Respirators assigned for higher environmental concentrations may be used at lower concentrations.

b. A high-efficiency filter means a filter that is at least 99.97 percent efficient against mono-dispersed particles of 0.3 micrometers in diameter or larger.

(3) *Respirator program.* (i) Where respiratory protection is used, the employer shall institute a respirator program in accordance with 29 CFR 1910.134(b), (d), (e), and (f).

(ii) The employer shall permit each employee who uses a filter respirator to

change the filter elements whenever an increase in breathing resistance is detected and shall maintain an adequate supply of filter elements for this purpose.

(iii) Employees who wear respirators shall be permitted to leave work areas to wash their faces and respirator facepieces whenever necessary to prevent skin irritation associated with respirator use.

(iv) No employee shall be assigned to tasks requiring the use of respirators if, based on his or her 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 of other employees will be impaired by the use of a respirator. Such employee shall be assigned to another job or given the opportunity to transfer to a different position the duties of which he or she is able to perform with the same employer, in the same geographical area, and with the same seniority, status, and rate of pay he or she had just prior to such transfer, if such a different position is available.

(4) *Respirator fit testing.* (i) The employer shall ensure that the respirator issued to the employee exhibits the least possible facepiece leakage and that the respirator is fitted properly.

(ii) Employers shall perform either quantitative or qualitative face fit tests at the time of initial fitting and at least every 6 months thereafter for each employee wearing a negative-pressure respirator. The qualitative fit tests may be used only for testing the fit of half-mask respirators where they are permited to be worn, and shall be conducted in accordance with Appendix C. The tests shall be used to select facepieces that provide the required protection as prescribed in Table 1.

(l) *Protective clothing*—(1) *General.* The employer shall provide and require the use of protective clothing, such as coveralls or similar whole-body clothing, head coverings, gloves, and foot coverings for any employee exposed to airborne concentrations of asbestos, tremolite, anthophyllite, actinolite or a combination of these minerals that exceed the permissible exposure limit prescribed in paragraph (c) of this section.

(2) *Laundering.* (i) The employer shall ensure that laundering of contaminated clothing is done so as to prevent the release of airborne asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals in excess of the exposure limit prescribed in paragraph (c) of this section.

(ii) Any employer who gives contaminated clothing to another person for laundering shall inform such person of the requirement in paragraph (l)(2)(i) of this section to effectively prevent the release of airborne asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals in excess of the exposure limit prescribed in paragraph (c) of this section.

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

(4) *Protective clothing for removal, demolition, and renovation operations.* (i) The competent person shall periodically examine worksuits worn by employees for rips or tears that may occur during performance of work.

(ii) When rips or tears are detected while an employee is working within a negative-pressure enclosure, rips and tears shall be immediately mended, or the worksuit shall be immediately replaced.

(j) *Hygiene facilities and practices*—(1) *General.* (i) The employer shall provide clean change areas for employees required to work in regulated areas or required by paragraph (l)(1) of this section to wear protective clothing. *Exception:* In lieu of the change area requirement specified in paragraph (j)(1)(i), the employer may permit employees engaged in small scale, short duration operations, as described in paragraph (e)(6) of this section, to clean their protective clothing with a portable HEPA-equipped vacuum before such employees leave the area where maintenance was performed.

(ii) The employer shall ensure that change areas are equipped with separate storage facilities for protective clothing and street clothing, in accordance with section 1910.141(e).

(iii) Whenever food or beverages are consumed at the worksite and employees are exposed to airborne concentrations of asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals in excess of the permissible exposure limit, the employer shall provide lunch areas in which the airborne concentrations of asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals are below the action level.

(2) *Requirements for removal, demolition, and renovation operations*—(i) *Decontamination area.* Except for small scale, short duration operations, as described in paragraph (e)(6) of this section, the employer shall establish a decontamination area that is adjacent and connected to the regulated area for the decontamination of employees contaminated with asbestos, tremolite, anthophyllite, or actinolite. The decontamination area shall consist of an equipment room, shower area, and clean room in series. The employer shall ensure that employees enter and exit the regulated area through the decontamination area.

(ii) *Clean room.* The clean room shall be equipped with a locker or appropriate storage container for each employee's use.

(iii) *Shower area.* Where feasible, shower facilities shall be provided which comply with 29 CFR 1910.141(d)(3). The showers shall be contiguous both to the equipment room and the clean change room, unless the employer can demonstrate that this location is not feasible. Where the employer can demonstrate that it is not feasible to locate the shower between the equipment room and the clean change room, the employer shall ensure that employees:

(A) Remove asbestos, tremolite, anthophyllite, or actinolite contamination from their worksuits using a HEPA vacuum before proceeding to a shower that is not contiguous to the work area; or

(B) Remove their contaminated worksuits, don clean worksuits, and proceed to a shower that is not contiguous to the work area.

(iv) *Equipment room.* The equipment room shall be supplied with impermeable, labeled bags and containers for the containment and disposal of contaminated protective clothing and equipment.

(v) *Decontamination area entry procedures.* (A) the employer shall ensure that employees:

(*1*) Enter the decontamination area through the clean room;

(*2*) Remove and deposit street clothing within a locker provided for their use; and

(*3*) Put on protective clothing and respiratory protection before leaving the clean room.

(B) Before entering the enclosure, the employer shall ensure that employees pass through the equipment room.

(vi) *Decontamination area exit procedures.* (A) Before leaving the regulated area, the employer shall ensure that employees remove all gross contamination and debris from their protective clothing.

(B) The employer shall ensure that employees remove their protective clothing in the equipment room and deposit the clothing in labeled impermeable bags or containers.

(C) The employer shall ensure that employees do not remove their respirators in the equipment room.

[Sec. 1926.58(j)(2)(vi)(C)]

(D) The employer shall ensure that employees shower prior to entering the clean room.

(E) The employer shall ensure that, after showering, employees enter the clean room before changing into street clothes.

(k) *Communication of hazards to employees*—(1) *Signs.* (i) Warning signs that demarcate the regulated area shall be provided and displayed at each location where airborne concentrations of asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals may be in excess of the exposure limit prescribed in paragraph (c) of this section. Signs shall be posted at such a distance from such a location that an employee may read the signs and take necessary protective steps before entering the area marked by the signs.

(ii) The warning signs required by paragraph (k)(1)(i) of this section shall bear the following information:

DANGER

ASBESTOS

CANCER AND LUNG DISEASE HAZARD

AUTHORIZED PERSONNEL ONLY

RESPIRATORS AND PROTECTIVE CLOTHING ARE REQUIRED IN THIS AREA

(iii) Where minerals in the regulated area are only tremolite, anthophyllite or actinolite, the employer may replace the term "asbestos" with the appropriate mineral name.

(2) *Labels.* (i) Labels shall be affixed to all products containing asbestos, tremolite, anthophyllite, or actinolite and to all containers containing such products, including waste containers. Where feasible, installed asbestos, tremolite, anthophyllite, or actinolite products shall contain a visible label.

(ii) Labels shall be printed in large, bold letters on a contrasting background.

(iii) Labels shall be used in accordance with the requirements of 29 CFR 1910.1200(f) of OSHA's Hazard Communication standard, and shall contain the folowing information:

DANGER

CONTAINS ASBESTOS FIBERS

AVOID CREATING DUST

CANCER AND LUNG DISEASE HAZARD

(iv) Where minerals to be labeled are only tremolite, anthophyllite and actinolite, the employer may replace the term "asbestos" with the appropriate mineral name.

(v) Labels shall contain a warning statement against breathing airborne asbestos, tremolite, anthophyllite, or actinolite fibers.

(vi) The provisions for labels required by paragraphs (k)(2)(i)–(k)(2)(iv) do not apply where:

(A) asbestos, tremolite, anthophyllite, or actinolite fibers have been modified by a bonding agent, coating, binder, or other material, provided that the manufacturer can demonstrate that, during any reasonably foreseeable use, handling, storage, disposal, processing, or transportation, no airborne concentrations of asbestos, tremolite, anthophyllite, actinolite, or a combination of these mineral fibers in excess of the action level will be released, or

(B) asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals is present in a product in concentrations less than 0.1 percent by weight.

(3) *Employee information and training.* (i) The employer shall institute a training program for all employees exposed to airborne concentrations of asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals in excess of the action level and shall ensure their participation in the program.

(ii) Training shall be provided prior to or at the time of initial assignment, unless the employee has received equivalent training within the previous 12 months, and at least annually thereafter.

(iii) The training program shall be conducted in a manner that the employee is able to understand. The employer shall ensure that each such employee is informed of the following:

(A) Methods of recognizing asbestos, tremolite, anthophyllite, and actinolite;

(B) The health effects associated with asbestos, tremolite, anthophyllite, or actinolite exposure;

(C) The relationship between smoking and asbestos, tremolite, anthophyllite, and actinolite in producing lung cancer;

(D) The nature of operations that could result in exposure to asbestos, tremolite, anthophyllite, and actinolite, the importance of necessary protective controls to minimize exposure including, as applicable, engineering controls, work practices, respirators, housekeeping procedures, hygiene facilities, protective clothing, decontamination procedures, emergency procedures, and waste disposal procedures, and any necessary instruction in the use of these controls and procedures;

(E) The purpose, proper use, fitting instructions, and limitations of respirators as required by 29 CFR 1910.134;

(F) The appropriate work practices for performing the asbestos, tremolite, anthophyllite, or actinolite job; and

(G) Medical surveillance program requirements.

(H) A review of this standard, including appendices.

(4) *Access to training materials.* (i) The employer shall make readily available to all affected employees without cost all written materials relating to the employee training program, including a copy of this regulation.

(ii) The employer shall provide to the Assistant Secretary and the Director, upon request, all information and training materials relating to the employee information and training program.

(l) *Housekeeping*—(1) *Vacuuming.* Where vacuuming methods are selected, HEPA filtered vacuuming equipment must be used. The equipment shall be used and emptied in a manner that minimizes the reentry of asbestos, tremolite, anthophyllite, or actinolite into the workplace.

(2) *Waste disposal.* Asbestos waste, scrap, debris, bags, containers, equipment, and contaminated clothing consigned for disposal shall be collected and disposed of in sealed, labeled, impermeable bags or other closed, labeled, impermeable containers.

(m) *Medical surveillance*—(1) *General*—(i) *Employees covered.* The employer shall institute a medical surveillance program for all employees engaged in work involving levels of asbestos, tremolite, anthophyllite, actinolite or a combination of these minerals, at or above the action level for 30 or more days per year, or who are required by this section to wear negative pressure respirators.

(ii) *Examination by a physician.* (A) The employer shall ensure that all medical examinations and procedures are performed by or under the supervision of a licensed physician, and are provided at no cost to the employee and at a reasonable time and place.

(B) Persons other than such licensed physicians who administer the pulmonary function testing required by this section shall complete a training course in spirometry sponsored by an appropriate academic or professional institution.

(2) *Medical examinations and consultations*—(i) *Frequency.* The employer shall make available medical examinations and consultations to each employee covered under paragraph

[Sec. 1926.58(m)(2)(i)]

(m)(1)(i) of this section on the following schedules:

(A) Prior to assignment of the employee to an area where negative-pressure respirators are worn;

(B) When the employee is assigned to an area where exposure to asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals may be at or above the action level for 30 or more days per year, a medical examination must be given within 10 working days following the thirtieth day of exposure;

(C) And at least annually thereafter.

(D) If the examining physician determines that any of the examinations should be provided more frequently than specified, the employer shall provide such examinations to affected employees at the frequencies specified by the physician.

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

(ii) *Content.* Medical examinations made available pursuant to paragraphs (m)(2)(i)(A)–(m)(2)(i)(C) of this section shall include:

(A) A medical and work history with special emphasis directed to the pulmonary, cardiovascular, and gastrointestinal systems.

(B) On initial examination, the standardized questionnaire contained in Appendix D, Part 1, and, on annual examination, the abbreviated standardized questionnaire contained in Appendix D, Part 2.

(C) A physical examination directed to the pulmonary and gastrointestinal systems, including a chest roentgenogram to be administered at the discretion of the physician, and pulmonary function tests of forced vital capacity (FVC) and forced expiratory volume at one second (FEV_1). Interpretation and classification of chest roentgenograms shall be conducted in accordance with Appendix E.

(D) Any other examinations or tests deemed necessary by the examining physician.

(3) *Information provided to the physician.* The employer shall provide the following information to the examining physician:

(i) A copy of this standard and Appendices D, E, and I;

(ii) A description of the affected employee's duties as they relate to the employee's exposure;

(iii) The employee's representative exposure level or anticipated exposure level;

(iv) A description of any personal protective and respiratory equipment used or to be used; and

(v) Information from previous medical examinations of the affected employee that is not otherwise available to the examining physician.

(4) *Physician's written opinion.* (i) The employer shall obtain a written opinion from the examining physician. This written opinion shall contain the results of the medical examination and shall include:

(A) The physician's opinion as to whether the employee has any detected medical conditions that would place the employee at an increased risk of material health impairment from exposure to asbestos, tremolite, anthophyllite, or actinolite;

(B) Any recommended limitations on the employee or on the use of personal protective equipment such as respirators; and

(C) A statement that the employee has been informed by the physician of the results of the medical examination and of any medical conditions that may result from asbestos, tremolite, anthophyllite, or actinolite exposure.

(ii) The employer shall instruct the physician not to reveal in the written opinion given to the employer specific findings or diagnoses unrelated to occupational exposure to asbestos, tremolite, anthophyllite, or actinolite.

(iii) The employer shall provide a copy of the physician's written opinion to the affected employee within 30 days from its receipt.

(n) *Recordkeeping*—(1) *Objective data for exempted operations.* (i) Where the employer has relied on objective data that demonstrate that products made from or containing asbestos, tremolite, anthophyllite, or actinolite are not capable of releasing fibers of asbestos, tremolite, anthophyllite, or actinolite or a combination of these minerals, in concentrations at or above the action level under the expected conditions of processing, use, or handling to exempt such operations from the initial monitoring requirements under paragraph (f)(2) of this section, the employer shall establish and maintain an accurate record of objective data reasonably relied upon in support of the exemption.

(ii) The record shall include at least the following information:

(A) The product qualifying for exemption;

(B) The source of the objective data;

(C) The testing protocol, results of testing, and/or analysis of the material for the release of asbestos, tremolite, anthophyllite, or actinolite;

(D) A description of the operation exempted and how the data support the exemption; and

(E) Other data relevant to the operations, materials, processing, or employee exposures covered by the exemption.

(iii) The employer shall maintain this record for the duration of the employer's reliance upon such objective data.

(2) *Exposure measurements.* (i) The employer shall keep an accurate record of all measurements taken to monitor employee exposure to asbestos, tremolite, anthophyllite, or actinolite as prescribed in paragraph (f) of this section.

Note: The employer may utilize the services of competent organizations such as industry trade associations and employee associations to maintain the records required by this section.

(ii) This record shall include at least the following information:

(A) The date of measurement;

(B) The operation involving exposure to asbestos, tremolite, anthophyllite, or actinolite that is being monitored;

(C) Sampling and analytical methods used and evidence of their accuracy;

(D) Number, duration, and results of samples taken;

(E) Type of protective devices worn, if any; and

(F) Name, social security number, and exposure of the employees whose exposures are represented.

(iii) The employer shall maintain this record for at least thirty (30) years, in accordance with 29 CFR 1910.20.

(3) *Medical surveillance.* (i) The employer shall establish and maintain an accurate record for each employee subject to medical surveillance by paragraph (m) of this section, in accordance with 29 CFR 1910.20.

(ii) The record shall include at least the following information:

(A) The name and social security number of the employee;

(B) A copy of the employee's medical examination results, including the medical history, questionnaire responses, results of any tests, and physician's recommendations.

(C) Physician's written opinions;

(D) Any employee medical complaints related to exposure to asbestos, tremolite, anthophyllite, or actinolite; and

(E) A copy of the information provided to the physician as required by paragraph (m) of this section.

(iii) The employer shall ensure that this record is maintained for the duration of employment plus thirty (30) years, in accordance with 29 CFR 1910.20.

[Sec. 1926.58(n)(3)(iii)]

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(4) *Training records.* The employer shall maintain all employee training records for one 1 year beyond the last date of employment by that employer.

(5) *Availability.* (i) The employer, upon written request, shall make all records required to be maintained by this section available to the Assistant Secretary and the Director for examination and copying.

(ii) The employer, upon request, shall make any exposure records required by paragraphs (f) and (n) of this section available for examination and copying to affected employees, former employees, designated representatives, and the Assistant Secretary, in accordance with 29 CFR 1910.20(a)–(e) and (g)–(i).

(iii) The employer, upon request, shall make employee medical records required by paragraphs (m) and (n) of this section available for examination and copying to the subject employee, anyone having the specific written consent of the subject employee, and the Assistant Secretary, in accordance with 29 CFR 1910.20.

(6) *Transfer of records.* (i) The employer shall comply with the requirements concerning transfer of records set forth in 29 CFR 1910.20 (h).

(ii) Whenever the employer ceases to do business and there is no successor employer to receive and retain the records for the prescribed period, the employer shall notify the Director at least 90 days prior to disposal and, upon request, transmit them to the Director.

(o) *Dates*—(1) *Effective date.* This section shall become effective [insert date 30 days from publication in the Federal Register]. The requirements of the asbestos standard issued in June 1972 (37 FR 11318), as amended, and published in 29 CFR 1910.1001-(1985) remain in effect until compliance is achieved with the parallel provisions of this standard.

(2) *Start-up dates.* (i) The requirements of paragraphs (c) through (n) of this section, including the engineering controls specified in paragraph (g)(1) of this section, shall be complied with by [insert date 210 days from publication in the Federal Register].

(p) *Appendices.* (1) Appendices A, C, D, and E to this section are incorporated as part of this section and the contents of these appendices are mandatory.

(2) Appendices B, F, G, H, and I to this section are informational and are not intended to create any additional obligations not otherwise imposed or to detract from any existing obligations.

Appendix A to § 1926.58—OSHA Reference Method—Mandatory

This mandatory appendix specifies the procedure for analyzing air samples for asbestos, tremolite, anthophyllite, and actinolite and specifies quality control procedures that must be implemented by laboratories performing the analysis. The sampling and analytical methods described below represent the elements of the available monitoring methods [such as the NIOSH P&CAM method] which OSHA considers to be essential to achieve adequate employee exposure monitoring while allowing employers to use methods that are already established within their organizations. All employers who are required to conduct air monitoring under paragraph (f) of the standard are required to utilize analytical laboratories that use this procedure, or an equivalent method, for collecting and analyzing samples.

Sampling and Analytical Procedure

1. The sampling medium for air samples shall be mixed cellulose ester filter membranes. These shall be designated by the manufacturer as suitable for asbestos, tremolite, anthophyllite, and actinolite counting. See below for rejection of blanks.

2. The preferred collection device shall be the 25-mm diameter cassette with an open-faced 50-mm extension cowl. The 37-mm cassette may be used if necessary but only if written justification for the need to use the 37-mm filter cassette accompanies the sample results in the employee's exposure monitoring record.

3. An air flow rate between 0.5 liter/min and 2.5 liters/min shall be selected for the 25/mm cassette. If the 37-mm cassette is used, an air flow rate between 1 liter/min and 2.5 liters/min shall be selected.

4. Where possible, a sufficient air volume for each air sample shall be collected to yield between 100 and 1,300 fibers per square millimeter on the membrane filter. If a filter darkens in appearance or if loose dust is seen on the filter, a second sample shall be started.

5. Ship the samples in a rigid container with sufficient packing material to prevent dislodging the collected fibers. Packing material that has a high electrostatic charge on its surface [e.g., expanded polystyrene] cannot be used because such material can cause loss of fibers to the sides of the cassette.

6. Calibrate each personal sampling pump before and after use with a representative filter cassette installed between the pump and the calibration devices.

7. Personal samples shall be taken in the "breathing zone" of the employee (i.e., attached to or near the collar or lapel near the worker's face).

8. Fiber counts shall be made by positive phase contrast using a microscope with an 8 to 10 X eyepiece and a 40 to 45 X objective for a total magnification of approximately 400 X and a numerical aperture of 0.65 to 0.75. The microscope shall also be fitted with a green or blue filter.

9. The microscope shall be fitted with a Walton-Beckett eyepiece graticule calibrated for a field diameter of 100 micrometers (+/− 2 micrometers).

10. The phase-shift detection limit of the microscope shall be about 3 degrees measured using the HSE phase shift test slide as outlined below.

a. Place the test slide on the microscope stage and center it under the phase objective.

b. Bring the blocks of grooved lines into focus.

Note.—The slide consists of seven sets of grooved lines (ca. 20 grooves to each block) in descending order of visibility from sets 1 to 7, seven being the least visible. The requirements for asbestos, tremolite, anthophyllite, and actinolite counting are that the microscope optics must resolve the grooved lines in set 3 completely, although they may appear somewhat faint, and that the grooved lines in sets 6 and 7 must be invisible. Sets 4 and 5 must be at least partially visible but may vary slightly in visibility between microscopes. A microscope that fails to meet these requirements has either too low or too high a resolution to be used for asbestos, tremolite, anthophyllite, and actinolite counting.

c. If the image deteriorates, clean and adjust the microscope optics. If the problem persists, consult the microscope manufacturer.

11. Each set of samples taken will include 10 percent blanks or a minimum of 2 blanks. The blank results shall be averaged and subtracted from the analytical results before reporting. Any samples represented by a blank having a fiber count in excess of 7 fibers/100 fields shall be rejected.

12. The samples shall be mounted by the acetone/triacetin method or a method with an equivalent index of refraction and similar clarity.

13. Observe the following counting rules.

a. Count only fibers equal to or longer than 5 micrometers. Measure the length of curved fibers along the curve.

b. Count all particles as asbestos, tremolite, anthophyllite, and actinolite that have a length-to-width ratio (aspect ratio) of 3:1 or greater.

c. Fibers lying entirely within the boundary of the Walton-Beckett graticule field shall receive a count of 1. Fibers crossing the boundary once, having one end within the circle, shall receive the count of one half (½). Do not count any fiber that crosses the graticule boundary more than once. Reject and do not count any other fibers even though they may be visible outside the graticule area.

d. Count bundles of fibers as one fiber unless individual fibers can be identified by observing both ends of an individual fiber.

e. Count enough graticule fields to yield 100 fibers. Count a minimum of 20 fields; stop counting at 100 fields regardless of fiber count.

14. Blind recounts shall be conducted at the rate of 10 percent.

Quality Control Procedures

1. Intralaboratory program. Each laboratory and/or each company with more than one microscopist counting slides shall establish a statistically designed quality assurance program involving blind recounts and

[Sec. 1926.58, Appendix A]

Calibration and Quality Control

11. Calibration of the Walton-Beckett graticule. The diameter, d_c (mm), of the circular counting area and the disc diameter must be specified when ordering the graticule.

a. Insert any available graticule into the eyepiece and focus so that the graticule lines are sharp and clear.

b. Set the appropriate interpupillary distance and, if applicable, reset the binocular head adjustment so that the magnification remains constant.

c. Install the 40 to 45 × phase objective.

d. Place a stage micrometer on the microscope object stage and focus the microscope on the graduate lines.

e. Measure the magnified grid length, L_s (mm), using the stage micrometer.

f. Remove the graticule from the microscope and measure its actual grid length, L_g (mm). This can best be accomplished by using a stage fitted with verniers.

g. Calculate the circle diameter, d_c (mm), for the Walton-Beckett graticule:

$$d_c = \frac{L_g \times D}{L_s}$$

Example.—If L_s = 108 um, L_g = 2.93 mm and D = 100 um, then d_c = 2.71 mm.

h. Check the field diameter, D (acceptable range 100 mm ± 2 mm) with a stage micrometer upon receipt of the graticule from the manufacturer. Determine field area (mm²).

12. Microscope adjustments. Follow the manufacturer's instructions and also the following:

a. Adjust the light source for even illumination across the field of view at the condenser iris.

Note.—Kohler illumination is preferred, where available.

b. Focus on the particulate material to be examined.

c. Make sure that the field iris is in focus, centered on the sample, and open only enough to fully illuminate the field of view.

d. Use the telescope ocular supplied by the manufacturer to ensure that the phase rings (annular diaphragm and phase-shifting elements) are concentric.

13. Check the phase-shift detection limit of the microscope periodically.

a. Remove the HSE/NPL phase-contrast test slide from its shipping container and center it under the phase objective.

b. Bring the blocks of grooved lines into focus.

Note.—The slide consists of seven sets of grooves (ca. 20 grooves to each block) in descending order of visibility from sets 1 to 7. The requirements for counting are that the microscope optics must resolve the grooved lines in set 3 completely, although they may appear somewhat faint, and that the grooved lines in sets 6 to 7 must be invisible. Sets 4 and 5 must be at least partially visible but may vary slightly in visibility between microscopes. A microscope which fails to meet these requirements has either too low or too high a resolution to be used for asbestos, tremolite, anthophyllite, and actinolite counting.

c. If the image quality deteriorates, clean the microscope optics and, if the problem persists, consult the microscope manufacturer.

14. Quality control of fiber counts.

a. Prepare and count field blanks along with the field samples. Report the counts on each blank. Calculate the mean of the field blank counts and subtract this value from each sample count before reporting the results.

Note 1.—The identity of the blank filters should be unknown to the counter until all counts have been completed.

Note 2: If a field blank yields fiber counts greater than 7 fibers/100 fields, report possible contamination of the samples.

b. Perform blind recounts by the same counter on 10 percent of filters counted (slides relabeled by a person other than the counter).

15. Use the following test to determine whether a pair of counts on the same filter should be rejected because of possible bias. This statistic estimates the counting repeatability at the 95% confidence level. Discard the sample if the difference between the two counts exceeds $2.77(F)s_r$, where F = average of the two fiber counts and s_r = relative standard deviation, which should be derived by each laboratory based on historical in-house data.

Note.—If a pair of counts is rejected as a result of this test, recount the remaining samples in the set and test the new counts against the first counts. Discard all rejected paired counts.

16. Enroll each new counter in a training course that compares performance of counters on a variety of samples using this procedure.

Note.—To ensure good reproducibility, all laboratories engaged in asbestos, tremolite, anthophyllite, and actinolite counting are required to participate in the Proficiency Analytical Testing (PAT) Program and should routinely participate with other asbestos, tremolite, anthophyllite, and actinolite fiber counting laboratories in the exchange of field samples to compare performance of counters.

Measurement

17. Place the slide on the mechanical stage of the calibrated microscope with the center of the filter under the objective lens. Focus the microscope on the plane of the filter.

18. Regularly check phase-ring alignment and Kohler illumination.

19. The following are the counting rules:

a. Count only fibers longer than 5 um. Measure the length of curved fibers along the curve.

b. Count only fibers with a length-to-width ratio equal to or greater than 3:1.

c. For fibers that cross the boundary of the graticule field, do the following:

1. Count any fiber longer than 5 um that lies entirely within the graticule area.

2. Count as ½ fiber any fiber with only one end lying within the graticule area.

3. Do not count any fiber that crosses the graticule boundary more than once.

4. Reject and do not count all other fibers.

d. Count bundles of fibers as one fiber unless individual fibers can be identified by observing both ends of a fiber.

e. Count enough graticule fields to yield 100 fibers. Count a minimum of 20 fields. Stop at 100 fields regardless of fiber count.

20. Start counting from one end of the filter and progress along a radial line to the other end, shift either up or down on the filter, and continue in the reverse direction. Select fields randomly by looking away from the eyepiece briefly while advancing the mechanical stage. When an agglomerate covers ca. ⅛ or more of the field of view, reject the field and select another. Do not report rejected fields in the number of total fields counted.

Note.—When counting a field, continuously scan a range of focal planes by moving the fine focus knob to detect very fine fibers which have become embedded in the filter. The small-diameter fibers will be very faint but are an important contribution to the total count.

Calculations

21. Calculate and report fiber density on the filter, E (fibers/mm²); by dividing the total fiber count, F; minus the mean field blank count, B, by the number of fields, n; and the field area, A_f (0.00785 mm² for a properly calibrated Walton-Beckett graticule):

$$E = \frac{F - B}{(n)(A_f)} \text{ fibers/mm}^2$$

[Sec. 1910.1001, Appendix B]

permitted to be used for asbestos, tremolite, anthophyllite, and actinolite work. For effective protection, respirators must fit your face and head snugly. Your employer is required to conduct fit tests when you are first assigned a respirator and every 6 months thereafter. Respirators should not be loosened or removed in work situations where their use is required.

B. Protective Clothing: You are required to wear protective clothing in work areas where asbestos, tremolite, anthophyllite, and actinolite fiber concentrations exceed the permissible exposure limit (PEL) of 0.2 f/cc to prevent contamination of the skin. Where protective clothing is required, your employer must provide you with clean garments. Unless you are working on a large asbestos, tremolite, anthophyllite, and actinolite removal or demolition project, your employer must also provide a change room and separate lockers for your street clothes and contaminated work clothes. If you are working on a large asbestos, tremolite, anthophyllite, and actinolite removal or demolition project and where it is feasible to do so, your employer must provide a clean room, shower, and decontamination room contiguous to the work area. When leaving the work area, you must remove contaminated clothing before proceeding to the shower. If the shower is not adjacent to the work area, you must vacuum your clothing before proceeding to the change room and shower. To prevent inhaling fibers in contaminated change rooms and showers, leave your respirator on until you leave the shower and enter the clean change room.

IV. Disposal Procedures and Cleanup

A. Wastes that are generated by processes where asbestos, tremolite, anthophyllite, and actinolite is present include:

1. Empty asbestos, tremolite, anthophyllite, and actinolite shipping containers.

2. Process wastes such as cuttings, trimmings, or reject material.

3. Housekeeping waste from sweeping or vacuuming.

4. Asbestos, tremolite, anthophyllite, and actinolite fireproofing or insulating material that is removed from buildings.

5. Building products that contain asbestos, tremolite, anthophyllite, and actinolite removed during building renovation or demolition.

6. Contaminated disposable protective clothing.

B. Empty shipping bags can be flattened under exhaust hoods and packed into airtight containers for disposal. Empty shipping drums are difficult to clean and should be sealed.

C. Vacuum logs or disposable paper filters should not be cleaned, but should be sprayed with a fine water mist and placed into a labeled waste container.

D. Process waste and housekeeping waste should be wetted with water or a mixture of water and surfactant prior to packaging in disposable containers.

E. Material containing asbestos, tremolite, anthophyllite, and actinolite that is removed from buildings must be disposed of in leak-tight 6-mil thick plastic bags, plastic-lined cardboard containers, or plastic-lined metal containers. These wastes, which are removed while wet, should be sealed in containers before they dry out to minimize the release of asbestos, tremolite, anthophyllite, and actinolite fibers during handling.

V. Access to Information

A. Each year, your employer is required to inform you of the information contained in this standard and appendices for asbestos, tremolite, anthophyllite, and actinolite. In addition, your employer must instruct you in the proper work practices for handling materials containing asbestos, tremolite, anthophyllite, and actinolite, and the correct use of protective equipment.

B. Your employer is required to determine whether you are being exposed to asbestos, tremolite, anthophyllite, and actinolite. You or your representative has the right to observe employee measurements and to record the results obtained. Your employer is required to inform you of your exposure, and, if you are exposed above the permissible limit, he or she is required to inform you of the actions that are being taken to reduce your exposure to within the permissible limit.

C. Your employer is required to keep records of your exposures and medical examinations. These exposure records must be kept for at least thirty (30) years. Medical records must be kept for the period of your employment plus thirty (30) years.

D. Your employer is required to release your exposure and medical records to your physician or designated representative upon your written request.

Appendix H to § 1910.1001—Medical Surveillance Guidelines for Asbestos Tremolite, Anthophyllite, and Actinolite Non-Mandatory

I. Route of Entry Inhalation, Ingestion

II. Toxicology

Clinical evidence of the adverse effects associated with exposure to asbestos, tremolite, anthophyllite, and actinolite, is present in the form of several well-conducted epidemiological studies of occupationally exposed workers, family contacts of workers, and persons living near asbestos, tremolite, anthophyllite, and actinolite mines. These studies have shown a definite association between exposure to asbestos, tremolite, anthophyllite, and actinolite and an increased incidence of lung cancer, pleural and peritoneal mesothelioma, gastrointestinal cancer, and asbestosis. The latter is a disabling fibrotic lung disease that is caused only by exposure to asbestos. Exposure to asbestos, tremolite, anthophyllite, and actinolite has also been associated with an increased incidence of esophageal, kidney, laryngeal, pharyngeal, and buccal cavity cancers. As with other known chronic occupational diseases, disease associated with asbestos, tremolite, anthophyllite, and actinolite generally appears about 20 years following the first occurrence of exposure. There are no known acute effects associated with exposure to asbestos, tremolite, anthophyllite, and actinolite.

Epidemiological studies indicate that the risk of lung cancer among exposed workers who smoke cigarettes is greatly increased over the risk of lung cancer among non-exposed smokers or exposed nonsmokers. These studies suggest that cessation of smoking will reduce the risk of lung cancer for a person exposed to asbestos, tremolite, anthophyllite, and actinolite but will not reduce it to the same level of risk as that existing for an exposed worker who has never smoked.

III. Signs and Symptoms of Exposure-Related Disease

The signs and symptoms of lung cancer or gastrointestinal cancer induced by exposure to asbestos, tremolite, anthophyllite, and actinolite are not unique, except that a chest X-ray of an exposed patient with lung cancer may show pleural plaques, pleural calcification, or pleural fibrosis. Symptoms characteristic of mesothelioma include shortness of breath, pain in the walls of the chest, or abdominal pain. Mesothelioma has a much longer latency period compared with lung cancer (40 years versus 15–20 years), and mesothelioma is therefore more likely to be found among workers who were first exposed to asbestos at an early age. Mesothelioma is always fatal.

Asbestosis is pulmonary fibrosis caused by the accumulation of asbestos fibers in the lungs. Symptoms include shortness of breath, coughing, fatigue, and vague feelings of sickness. When the fibrosis worsens, shortness of breath occurs even at rest. The diagnosis of asbestosis is based on a history of exposure to asbestos, the presence of characteristic radiologic changes, end-inspiratory crackles (rales), and other clinical features of fibrosing lung disease. Pleural plaques and thickening are observed on X-rays taken during the early stages of the disease. Asbestosis is often a progressive disease even in the absence of continued exposure, although this appears to be a highly individualized characteristic. In severe cases, death may be caused by respiratory or cardiac failure.

[Sec. 1910.1001, Appendix H]

IV. Surveillance and Preventive Considerations

As noted above, exposure to asbestos, tremolite, anthophyllite, and actinolite has been linked to an increased risk of lung cancer, mesothelioma, gastrointestinal cancer, and asbestosis among occupationally exposed workers. Adequate screening tests to determine an employee's potential for developing serious chronic diseases, such as cancer, from exposure to asbestos, tremolite, anthophyllite, and actinolite do not presently exist. However, some tests, particularly chest X-rays and pulmonary function tests, may indicate that an employee has been overexposed to asbestos, tremolite, anthophyllite, and actinolite, increasing his or her risk of developing exposure-related chronic diseases. It is important for the physician to become familiar with the operating conditions in which occupational exposure to asbestos, tremolite, anthophyllite, and actinolite is likely to occur. This is particularly important in evaluating medical and work histories and in conducting physical examinations. When an active employee has been identified as having been overexposed to asbestos, tremolite, anthophyllite, and actinolite, measures taken by the employer to eliminate or mitigate further exposure should also lower the risk of serious long-term consequences.

The employer is required to institute a medical surveillance program for all employees who are or will be exposed to asbestos, tremolite, anthophyllite, and actinolite at or above the action level (0.1 fiber per cubic centimeter of air) for 30 or more days per year and for all employees who are assigned to wear a negative-pressure respirator. All examinations and procedures must be performed by or under the supervision of a licensed physician, at a reasonable time and place, and at no cost to the employee.

Although broad latitude is given to the physician in prescribing specific tests to be included in the medical surveillance program, OSHA requires inclusion of the following elements in the routine examination:

(i) Medical and work histories with special emphasis directed to symptoms of the respiratory system, cardiovascular system, and digestive tract.

(ii) Completion of the respiratory disease questionnaire contained in Appendix D.

(iii) A physical examination including a chest roentgenogram and pulmonary function test that includes measurement of the employee's forced vital capacity (FVC) and forced expiratory volume at one second (FEV_1).

(iv) Any laboratory or other test that the examining physician deems by sound medical practice to be necessary.

The employer is required to make the prescribed tests available at least annually to those employees covered; more often than specified if recommended by the examining physician; and upon termination of employment.

The employer is required to provide the physician with the following information: A copy of this standard and appendices; a description of the employee's duties as they relate to asbestos exposure; the employee's representative level of exposure to asbestos tremolite, anthophyllite, and actinolite; a description of any personal protective and respiratory equipment used; and information from previous medical examinations of the affected employee that is not otherwise available to the physician. Making this information available to the physician will aid in the evaluation of the employee's health in relation to assigned duties and fitness to wear personal protective equipment, if required.

The employer is required to obtain a written opinion from the examining physician containing the results of the medical examination; the physician's opinion as to whether the employee has any detected medical conditions that would place the employee at an increased risk of exposure-related disease; any recommended limitations on the employee or on the use of personal protective equipment; and a statement that the employee has been informed by the physician of the results of the medical examination and of any medical conditions related to asbestos, tremolite, anthophyllite, and actinolite exposure that require further explanation or treatment. This written opinion must not reveal specific findings or diagnoses unrelated to exposure to asbestos, tremolite, anthophyllite, and actinolite, and a copy of the opinion must be provided to the affected employee.

[Sec. 1910.1001, Appendix H]

1926.58 Asbestos, tremolite, anthophyllite, and actinolite.

[Sec. 1926.58 added by 51 FR 22756, June 20, 1986]

(a) *Scope and application.* This section applies to all construction work as defined in 29 CFR 1910.12(b), including but not limited to the following:

(1) Demolition or salvage of structures where asbestos, tremolite, anthophyllite, or actinolite is present;

(2) Removal or encapsulation of materials containing asbestos, tremolite, anthophyllite, or actinolite;

(3) Construction, alteration, repair, maintenance, or renovation of structures, substrates, or portions thereof, that contain asbestos, tremolite, anthophyllite, or actinolite;

(4) Installation of products containing asbestos, tremolite, anthophyllite, or actinolite;

(5) Asbestos, tremolite, anthophyllite, and actinolite spill/emergency cleanup; and

(6) Transportation, disposal, storage, or containment of asbestos, tremolite, anthophyllite, or actinolite or products containing asbestos, tremolite, anthophyllite, or actinolite on the site or location at which construction activities are performed.

(b) *Definitions.* "Action level" means an airborne concentration of asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals of 0.1 fiber per cubic centimeter (f/cc) of air calculated as an eight (8)-hour time-weighted average.

"Asbestos" includes chrysotile, amosite, crocidolite, tremolite asbestos, anthophyllite asbestos, actinolite asbestos, and any of these minerals that has been chemically treated and/or altered.

"Assistant Secretary" means the Assistant Secretary of Labor for Occupational Safety and Health, U.S. Department of Labor, or designee.

"Authorized person" means any person authorized by the employer and required by work duties to be present in regulated areas.

"Clean room" means an uncontaminated room having facilities for the storage of employees' street clothing and uncontaminated materials and equipment.

"Competent person" means one who is capable of identifying existing asbestos, tremolite, anthophyllite, or actinolite hazards in the workplace and who has the authority to take prompt corrective measures to eliminate them, as specified in 29 CFR 1926.32(f). The duties of the competent person include at least the following: establishing the negative-pressure enclosure, ensuring its integrity, and controlling entry to and exit from the enclosure; supervising any employee exposure monitoring required by the standard; ensuring that all employees working within such an enclosure wear the appropriate personal protective equipment, are trained in the use of appropriate methods of exposure control, and use the hygiene facilities and decontamination procedures specified in the standard; and ensuring that engineering controls in use are in proper operating condition and are functioning properly.

"Decontamination area" means an enclosed area adjacent and connected to the regulated area and consisting of an equipment room, shower area, and clean room, which is used for the decontamination of workers, materials, and equipment contaminated with asbestos, tremolite, anthophyllite, or actinolite.

"Demolition" means the wrecking or taking out of any load-supporting structural member and any related razing, removing, or stripping of asbestos, tremolite, anthophyllite, or actinolite products.

"Director" means the Director, National Institute for Occupational Safety and Health, U.S. Department of Health and Human Services, or designee.

"Employee exposure" means that exposure to airborne asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals, that would occur if the employee were not using respiratory protective equipment.

"Equipment room (change room)" means a contaminated room located within the decontamination area that is supplied with impermeable bags or containers for the disposal of contaminated protective clothing and equipment.

"Fiber" means a particulate form of asbestos, tremolite, anthophyllite, or actinolite, 5 micrometers or longer, with a length-to-diameter ratio of at least 3 to 1.

"High-efficiency particulate air (HEPA) filter" means a filter capable of trapping and retaining at least 99.97 percent of all monodispersed particles of 0.3 micrometers in diameter or larger.

"Regulated area" means an area established by the employer to demarcate areas where airborne concentrations of asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals exceed or can reasonably be expected to exceed the permissible exposure limit. The regulated area may take the form of (1) a temporary enclosure, as required by paragraph (e)(6) of this section, or (2) an area demarcated in any manner that minimizes the number of employees exposed to asbestos, tremolite, anthophyllite, or actinolite.

"Removal" means the taking out or stripping of asbestos, tremolite, anthophyllite, or actinolite or materials containing asbestos, tremolite, anthophyllite, or actinolite.

[Sec. 1926.58(b)]

"Renovation" means the modifying of any existing structure, or portion thereof, where exposure to airborne asbestos, tremolite, anthophyllite, actinolite may result.

"Repair" means overhauling, rebuilding, reconstructing, or reconditioning of structures or substrates where asbestos, tremolite, anthophyllite,or actinolite is present.

"Tremolite, anthophyllite and actinolite" means the non-asbestos form of these minerals, and any of these minerals that have been chemically treated and/or altered.

(c) *Permissible exposure limit (PEL).* The employer shall ensure that no employee is exposed to an airborne concentration of asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals in excess of 0.2 fiber per cubic centimeter of air as an eight (8) hour time-weighted average (TWA), as determined by the method prescribed in Appendix A of this section, or by an equivalent method.

(d) *Communication among employers.* On multi-employer worksites, an employer performing asbestos, tremolite, anthophyllite, or actinolite work requiring the establishment of a regulated area shall inform other employers on the site of the nature of the employer's work with asbestos, tremolite, anthophyllite, or actinolite and of the existence of and requirements pertaining to regulated areas.

(e) *Regulated areas*—(1) *General.* The employer shall establish a regulated area in work areas where airborne concentrations of asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals exceed or can reasonably be expected to exceed the permissible exposure limit prescribed in paragraph (c) of this section.

(2) *Demarcation.* The regulated area shall be demarcated in any manner that minimizes the number of persons within the area and protects persons outside the area from exposure to airborne concentrations of asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals in excess of the permissible exposure limit.

(3) *Access.* Access to regulated areas shall be limited to authorized persons or to persons authorized by the Act or regulations issued pursuant thereto.

(4) *Respirators.* All persons entering a regulated area shall be supplied with a respirator, selected in accordance with paragraph (h)(2) of this section.

(5) *Prohibited activities.* The employer shall ensure that employees do not eat, drink, smoke, chew tobacco or gum, or apply cosmetics in the regulated area.

(6) *Requirements for asbestos removal, demolition, and renovation operations.* (i) Wherever feasible, the employer shall establish negative-pressure enclosures before commencing removal, demolition, and renovation operations.

(ii) The employer shall designate a competent person to perform or supervise the following duties:

(A) Set up the enclosure;

(B) Ensure the integrity of the enclosure;

(C) Control entry to and exit from the enclosure;

(D) Supervise all employee exposure monitoring required by this section;

(E) Ensure that employees working within the enclosure wear protective clothing and respirators as required by paragraphs (i) and (h) of this section and;

(F) Ensure that employees are trained in the use of engineering controls, work practices, and personal protective equipment;

(G) Ensure that employees use the hygiene facilities and observe the decontamination procedures specified in paragraph (j) of this section; and

(H) Ensure that engineering controls are functioning properly.

(iii) In addition to the qualifications specified in paragraph (b) of this section, the competent person shall be trained in all aspects of asbestos, tremolite, anthophyllite, or actinolite abatement, the contents of this standard, the identification of asbestos, tremolite, anthophyllite, or actinolite and their removal procedures, and other practices for reducing the hazard. Such training shall be obtained in a comprehensive course, such as a course conducted by an EPA Asbestos Training Center, or an equivalent course.

(iv) *Exception:* For small-scale, short-duration operations, such as pipe repair, valve replacement, installing electrical conduits, installing or removing drywall, roofing, and other general building maintenance or renovation, the employer is not required to comply with the requirements of paragraph (e)(6) of this section.

(f) *Exposure monitoring*—(1) *General.* (i) Each employer who has a workplace or work operation covered by this standard shall perform monitoring to determine accurately the airborne concentrations of asbestos, tremolite, anthophyllite, actinolite or a combination of these minerals to which employees may be exposed.

(ii) Determinations of employee exposure shall be made from breathing zone air samples that are representative of the 8-hour TWA of each employee.

(iii) Representative 8-hour TWA employee exposure shall be determined on the basis of one or more samples representing full-shift exposure for employees in each work area.

(2) *Initial monitoring.* (i) Each employer who has a workplace or work operation covered by this standard, except as provided for in paragraph (f)(2)(ii) and (f)(2)(iii) of this section, shall perform initial monitoring at the initiation of each asbestos, tremolite, anthophyllite, actinolite job to accurately determine the airborne concentrations of asbestos, tremolite, anthophyllite, or actinolite to which employees may be exposed.

(ii) The employer may demonstrate that employee exposures are below the action level by means of objective data demonstrating that the product or material containing asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals cannot release airborne fibers in concentrations exceeding the action level under those work conditions having the greatest potential for releasing asbestos, tremolite, anthophyllite, or actinolite.

(iii) Where the employer has monitored each asbestos, tremolite, anthophyllite, or actinolite job, and the data were obtained during work operations conducted under workplace conditions closely resembling the processes, type of material, control methods, work practices, and environmental conditions used and prevailing in the employer's current operations, the employer may rely on such earlier monitoring results to satisfy the requirements of paragraph (f)(2)(i) of this section.

(3) *Periodic monitoring within regulated areas.* The employer shall conduct daily monitoring that is representative of the exposure of each employee who is assigned to work within a regulated area. *Exception:* When all employees within a regulated area are equipped with supplied-air respirators operated in the positive-pressure mode, the employer may dispense with the daily monitoring required by this paragraph.

(4) *Termination of monitoring.* If the periodic monitoring required by paragraph (f)(3) of this section reveals that employee exposures, as indicated by statistically reliable measurements, are below the action level, the employer may discontinue monitoring for those employees whose exposures are represented by such monitoring.

(5) *Method of monitoring.* (i) All samples taken to satisfy the monitoring requirements of paragraph (f) of this section shall be personal samples

[Sec. 1926.58(f)(5)(i)]

collected following the porocedures specified in Appendix A.

(ii) All samples taken to satisfy the monitoring requirements of paragraph (f) of this section shall be evaluated using the OSHA Reference Method (ORM) specified in Appendix A, or an equivalent counting method.

(iii) If an equivalent method to the ORM is used, the employer shall ensure that the method meets the following criteria:

(A) Replicate exposure data used to establish equivalency are collected in side-by-side field and laboratory comparisons;

(B) The comparison indicates that 90 percent of the samples collected in the range 0.5 to 2.0 times the permissible limit have an accuracy range of plus or minus 25 percent of the ORM results with a 95 percent confidence level as demonstrated by a statistically valid protocol; and

(C) The equivalent method is documented and the results of the comparison testing are maintained.

(iv) To satisfy the monitoring requirements of paragraph (f), employers shall rely on the results of monitoring analysis performed by laboratories that have instituted quality assurance programs that include the elements prescribed in Appendix A.

(6) *Employee notification of monitoring results.* (i) The employer shall notify affected employees of the monitoring results that represent that employee's exposure as soon as possible following receipt of monitoring results.

(ii) The employer shall notify affected employees of the results of monitoring representing the employee's exposure in writing either individually or by posting at a centrally located place that is accessible to affected employees.

(7) *Observation of monitoring.* (i) The employer shall provide affected employees or their designated representatives an opportunity to observe any monitoring of employee exposure to asbestos, tremolite, anthophyllite, or actinolite conducted in accordance with this section.

(ii) When observation of the monitoring of employee exposure to asbestos, tremolite, anthophyllite, or actinolite requires entry into an area where the use of protective clothing or equipment is required, the observer shall be provided with and be required to use such clothing and equipment and shall comply with all other applicable safety and health procedures.

(g) *Methods of compliance.*—(1) *Engineering controls and work practices.* (i) The employer shall use one or any combination of the following control methods to achieve compliance with the permissible exposure limit prescribed by paragraph (c) of this section:

(A) Local exhaust ventilation equipped with HEPA filter dust collection systems;

(B) General ventilation systems;

(C) Vacuum cleaners equipped with HEPA filters;

(D) Enclosure or isolation of processes producing asbestos, tremolite, anthophyllite, or actinolite dust;

(E) Use of wet methods, wetting agents, or removal encapsulants to control employee exposures during asbestos, tremolite, anthophyllite, or actinolite handling, mixing, removal, cutting, application, and cleanup;

(F) Prompt disposal of wastes contaminated with asbestos, tremolite, anthophyllite, or actinolite in leak-tight containers; or

(G) Use of work practices or other engineering controls that the Assistant Secretary can show to be feasible.

(ii) Wherever the feasible engineering and work practice controls described above are not sufficient to reduce employee exposure to or below the limit prescribed in paragraph (c), the employer shall use them to reduce employee exposure to the lowest levels attainable by these controls and shall supplement them by the use of respiratory protection that complies with the requirements of paragraph (h) of this section.

(2) *Prohibitions.* (i) High-speed abrasive disc saws that are not equipped with appropriate engineering controls shall not be used for work related to asbestos, tremolite, anthophyllite, or actinolite.

(ii) Compressed air shall not be used to remove asbestos, tremolite, anthophyllite, or actinolite or materials containing asbestos, tremolite, anthophyllite, or actinolite unless the compressed air is used in conjunction with an enclosed ventilation system designed to capture the dust cloud created by the compressed air.

(iii) Materials containing asbestos, tremolite, anthophyllite, or actinolite shall not be applied by spray methods.

(3) *Employee rotation.* The employer shall not use employee rotation as a means of compliance with the exposure limit prescribed in paragraph (c) of this section.

(h) *Respiratory protection.*—(1) *General.* The employer shall provide respirators, and ensure that they are used, where required by this section. Respirators shall be used in the following circumstances:

(i) During the interval necessary to install or implement feasible engineering and work practice controls;

(ii) In work operations such as maintenance and repair activities, or other activities for which engineering and work practice controls are not feasible;

(iii) In work situations where feasible engineering and work practice controls are not yet sufficient to reduce exposure to or below the exposure limit; and

(iv) In emergencies.

(2) *Respirator selection.* (i) Where respirators are used, the employer shall select and provide, at no cost to the employee, the appropriate respirator as specified in Table D–4, and shall ensure that the employee uses the respirator provided.

(ii) The employer shall select respirators from among those jointly approved as being acceptable for protection by the Mine Safety and Health Administration (MSHA) and the National Institute for Occupational Safety and Health (NIOSH) under the provisions of 30 CFR Part 11.

(iii) The employer shall provide a powered, air-purifying respirator in lieu of any negative-pressure respirator specified in Table D–4 whenever:

(A) An employee chooses to use this type of respirator; and

(B) This respirator will provide adequate protection to the employee.

TABLE D–4.—RESPIRATORY PROTECTION FOR ASBESTOS, TREMOLITE, ANTHOPHYLLITE, AND ACTINOLITE FIBERS

Airborne concentration of asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals	Required respirator
Not in excess of 2 f/cc (10 X PEL).	1. Half-mask air-purifying respirator equipped with high-efficiency filters.
Not in excess of 10 f/cc (50 X PEL).	1. Full facepiece air-purifying respirator equipped with high-efficiency filters.
Not in excess of 20 f/cc (100 X PEL).	1. Any powered air purifying respirator equipped with high efficiency filters. 2. Any supplied-air respirator operated in continuous flow mode.
Not in excess of 200 f/cc (1000 X PEL).	1. Full facepiece supplied-air respirator operated in pressure demand mode.
Greater than 200 f/cc (>1,000 X PEL) or unknown concentration.	1. Full facepiece supplied air respirator operated in pressure demand mode equipped with an auxiliary positive pressure self-contained breathing apparatus.

NOTE: a. Respirators assigned for higher environmental concentrations may be used at lower concentrations.

b. A high-efficiency filter means a filter that is at least 99.97 percent efficient against mono-dispersed particles of 0.3 micrometers in diameter or larger.

(3) *Respirator program.* (i) Where respiratory protection is used, the employer shall institute a respirator program in accordance with 29 CFR 1910.134(b), (d), (e), and (f).

(ii) The employer shall permit each employee who uses a filter respirator to

[Sec. 1926.58(h)(3)(ii)]

change the filter elements whenever an increase in breathing resistance is detected and shall maintain an adequate supply of filter elements for this purpose.

(iii) Employees who wear respirators shall be permitted to leave work areas to wash their faces and respirator facepieces whenever necessary to prevent skin irritation associated with respirator use.

(iv) No employee shall be assigned to tasks requiring the use of respirators if, based on his or her 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 of other employees will be impaired by the use of a respirator. Such employee shall be assigned to another job or given the opportunity to transfer to a different position the duties of which he or she is able to perform with the same employer, in the same geographical area, and with the same seniority, status, and rate of pay he or she had just prior to such transfer, if such a different position is available.

(4) *Respirator fit testing.* (i) The employer shall ensure that the respirator issued to the employee exhibits the least possible facepiece leakage and that the respirator is fitted properly.

(ii) Employers shall perform either quantitative or qualitative face fit tests at the time of initial fitting and at least every 6 months thereafter for each employee wearing a negative-pressure respirator. The qualitative fit tests may be used only for testing the fit of half-mask respirators where they are permited to be worn, and shall be conducted in accordance with Appendix C. The tests shall be used to select facepieces that provide the required protection as prescribed in Table 1.

(l) *Protective clothing*—(1) *General.* The employer shall provide and require the use of protective clothing, such as coveralls or similar whole-body clothing, head coverings, gloves, and foot coverings for any employee exposed to airborne concentrations of asbestos, tremolite, anthophyllite, actinolite or a combination of these minerals that exceed the permissible exposure limit prescribed in paragraph (c) of this section.

(2) *Laundering.* (i) The employer shall ensure that laundering of contaminated clothing is done so as to prevent the release of airborne asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals in excess of the exposure limit prescribed in paragraph (c) of this section.

(ii) Any employer who gives contaminated clothing to another person for laundering shall inform such person of the requirement in paragraph (l)(2)(i) of this section to effectively prevent the release of airborne asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals in excess of the exposure limit prescribed in paragraph (c) of this section.

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

(4) *Protective clothing for removal, demolition, and renovation operations.* (i) The competent person shall periodically examine worksuits worn by employees for rips or tears that may occur during performance of work.

(ii) When rips or tears are detected while an employee is working within a negative-pressure enclosure, rips and tears shall be immediately mended, or the worksuit shall be immediately replaced.

(j) *Hygiene facilities and practices*—(1) *General.* (i) The employer shall provide clean change areas for employees required to work in regulated areas or required by paragraph (l)(1) of this section to wear protective clothing. *Exception:* In lieu of the change area requirement specified in paragraph (j)(1)(i), the employer may permit employees engaged in small scale, short duration operations, as described in paragraph (e)(6) of this section, to clean their protective clothing with a portable HEPA-equipped vacuum before such employees leave the area where maintenance was performed.

(ii) The employer shall ensure that change areas are equipped with separate storage facilities for protective clothing and street clothing, in accordance with section 1910.141(e).

(iii) Whenever food or beverages are consumed at the worksite and employees are exposed to airborne concentrations of asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals in excess of the permissible exposure limit, the employer shall provide lunch areas in which the airborne concentrations of asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals are below the action level.

(2) *Requirements for removal, demolition, and renovation operations*—(i) *Decontamination area.* Except for small scale, short duration operations, as described in paragraph (e)(6) of this section, the employer shall establish a decontamination area that is adjacent and connected to the regulated area for the decontamination of employees contaminated with asbestos, tremolite, anthophyllite, or actinolite. The decontamination area shall consist of an equipment room, shower area, and clean room in series. The employer shall ensure that employees enter and exit the regulated area through the decontamination area.

(ii) *Clean room.* The clean room shall be equipped with a locker or appropriate storage container for each employee's use.

(iii) *Shower area.* Where feasible, shower facilities shall be provided which comply with 29 CFR 1910.141(d)(3). The showers shall be contiguous both to the equipment room and the clean change room, unless the employer can demonstrate that this location is not feasible. Where the employer can demonstrate that it is not feasible to locate the shower between the equipment room and the clean change room, the employer shall ensure that employees:

(A) Remove asbestos, tremolite, anthophyllite, or actinolite contamination from their worksuits using a HEPA vacuum before proceeding to a shower that is not contiguous to the work area; or

(B) Remove their contaminated worksuits, don clean worksuits, and proceed to a shower that is not contiguous to the work area.

(iv) *Equipment room.* The equipment room shall be supplied with impermeable, labeled bags and containers for the containment and disposal of contaminated protective clothing and equipment.

(v) *Decontamination area entry procedures.* (A) the employer shall ensure that employees:

(*1*) Enter the decontamination area through the clean room;

(*2*) Remove and deposit street clothing within a locker provided for their use; and

(*3*) Put on protective clothing and respiratory protection before leaving the clean room.

(B) Before entering the enclosure, the employer shall ensure that employees pass through the equipment room.

(vi) *Decontamination area exit procedures.* (A) Before leaving the regulated area, the employer shall ensure that employees remove all gross contamination and debris from their protective clothing.

(B) The employer shall ensure that employees remove their protective clothing in the equipment room and deposit the clothing in labeled impermeable bags or containers.

(C) The employer shall ensure that employees do not remove their respirators in the equipment room.

[Sec. 1926.58(j)(2)(vi)(C)]

(D) The employer shall ensure that employees shower prior to entering the clean room.

(E) The employer shall ensure that, after showering, employees enter the clean room before changing into street clothes.

(k) *Communication of hazards to employees*—(1) *Signs.* (i) Warning signs that demarcate the regulated area shall be provided and displayed at each location where airborne concentrations of asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals may be in excess of the exposure limit prescribed in paragraph (c) of this section. Signs shall be posted at such a distance from such a location that an employee may read the signs and take necessary protective steps before entering the area marked by the signs.

(ii) The warning signs required by paragraph (k)(1)(i) of this section shall bear the following information:

DANGER

ASBESTOS

CANCER AND LUNG DISEASE HAZARD

AUTHORIZED PERSONNEL ONLY

RESPIRATORS AND PROTECTIVE CLOTHING ARE REQUIRED IN THIS AREA

(iii) Where minerals in the regulated area are only tremolite, anthophyllite or actinolite, the employer may replace the term "asbestos" with the appropriate mineral name.

(2) *Labels.* (i) Labels shall be affixed to all products containing asbestos, tremolite, anthophyllite, or actinolite and to all containers containing such products, including waste containers. Where feasible, installed asbestos, tremolite, anthophyllite, or actinolite products shall contain a visible label.

(ii) Labels shall be printed in large, bold letters on a contrasting background.

(iii) Labels shall be used in accordance with the requirements of 29 CFR 1910.1200(f) of OSHA's Hazard Communication standard, and shall contain the folowing information:

DANGER

CONTAINS ASBESTOS FIBERS

AVOID CREATING DUST

CANCER AND LUNG DISEASE HAZARD

(iv) Where minerals to be labeled are only tremolite, anthophyllite and actinolite, the employer may replace the term "asbestos" with the appropriate mineral name.

(v) Labels shall contain a warning statement against breathing airborne asbestos, tremolite, anthophyllite, or actinolite fibers.

(vi) The provisions for labels required by paragraphs (k)(2)(i)–(k)(2)(iv) do not apply where:

(A) asbestos, tremolite, anthophyllite, or actinolite fibers have been modified by a bonding agent, coating, binder, or other material, provided that the manufacturer can demonstrate that, during any reasonably foreseeable use, handling, storage, disposal, processing, or transportation, no airborne concentrations of asbestos, tremolite, anthophyllite, actinolite, or a combination of these mineral fibers in excess of the action level will be released, or

(B) asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals is present in a product in concentrations less than 0.1 percent by weight.

(3) *Employee information and training.* (i) The employer shall institute a training program for all employees exposed to airborne concentrations of asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals in excess of the action level and shall ensure their participation in the program.

(ii) Training shall be provided prior to or at the time of initial assignment, unless the employee has received equivalent training within the previous 12 months, and at least annually thereafter.

(iii) The training program shall be conducted in a manner that the employee is able to understand. The employer shall ensure that each such employee is informed of the following:

(A) Methods of recognizing asbestos, tremolite, anthophyllite, and actinolite;

(B) The health effects associated with asbestos, tremolite, anthophyllite, or actinolite exposure;

(C) The relationship between smoking and asbestos, tremolite, anthophyllite, and actinolite in producing lung cancer;

(D) The nature of operations that could result in exposure to asbestos, tremolite, anthophyllite, and actinolite, the importance of necessary protective controls to minimize exposure including, as applicable, engineering controls, work practices, respirators, housekeeping procedures, hygiene facilities, protective clothing, decontamination procedures, emergency procedures, and waste disposal procedures, and any necessary instruction in the use of these controls and procedures;

(E) The purpose, proper use, fitting instructions, and limitations of respirators as required by 29 CFR 1910.134;

(F) The appropriate work practices for performing the asbestos, tremolite, anthophyllite, or actinolite job; and

(G) Medical surveillance program requirements.

(H) A review of this standard, including appendices.

(4) *Access to training materials.* (i) The employer shall make readily available to all affected employees without cost all written materials relating to the employee training program, including a copy of this regulation.

(ii) The employer shall provide to the Assistant Secretary and the Director, upon request, all information and training materials relating to the employee information and training program.

(l) *Housekeeping*—(1) *Vacuuming.* Where vacuuming methods are selected, HEPA filtered vacuuming equipment must be used. The equipment shall be used and emptied in a manner that minimizes the reentry of asbestos, tremolite, anthophyllite, or actinolite into the workplace.

(2) *Waste disposal.* Asbestos waste, scrap, debris, bags, containers, equipment, and contaminated clothing consigned for disposal shall be collected and disposed of in sealed, labeled, impermeable bags or other closed, labeled, impermeable containers.

(m) *Medical surveillance*—(1) *General*—(i) *Employees covered.* The employer shall institute a medical surveillance program for all employees engaged in work involving levels of asbestos, tremolite, anthophyllite, actinolite or a combination of these minerals, at or above the action level for 30 or more days per year, or who are required by this section to wear negative pressure respirators.

(ii) *Examination by a physician.* (A) The employer shall ensure that all medical examinations and procedures are performed by or under the supervision of a licensed physician, and are provided at no cost to the employee and at a reasonable time and place.

(B) Persons other than such licensed physicians who administer the pulmonary function testing required by this section shall complete a training course in spirometry sponsored by an appropriate academic or professional institution.

(2) *Medical examinations and consultations*—(i) *Frequency.* The employer shall make available medical examinations and consultations to each employee covered under paragraph

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(m)(1)(i) of this section on the following schedules:

(A) Prior to assignment of the employee to an area where negative-pressure respirators are worn;

(B) When the employee is assigned to an area where exposure to asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals may be at or above the action level for 30 or more days per year, a medical examination must be given within 10 working days following the thirtieth day of exposure;

(C) And at least annually thereafter.

(D) If the examining physician determines that any of the examinations should be provided more frequently than specified, the employer shall provide such examinations to affected employees at the frequencies specified by the physician.

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

(ii) *Content.* Medical examinations made available pursuant to paragraphs (m)(2)(i)(A)–(m)(2)(i)(C) of this section shall include:

(A) A medical and work history with special emphasis directed to the pulmonary, cardiovascular, and gastrointestinal systems.

(B) On initial examination, the standardized questionnaire contained in Appendix D, Part 1, and, on annual examination, the abbreviated standardized questionnaire contained in Appendix D, Part 2.

(C) A physical examination directed to the pulmonary and gastrointestinal systems, including a chest roentgenogram to be administered at the discretion of the physician, and pulmonary function tests of forced vital capacity (FVC) and forced expiratory volume at one second (FEV_1). Interpretation and classification of chest roentgenograms shall be conducted in accordance with Appendix E.

(D) Any other examinations or tests deemed necessary by the examining physician.

(3) *Information provided to the physician.* The employer shall provide the following information to the examining physician:

(i) A copy of this standard and Appendices D, E, and I;

(ii) A description of the affected employee's duties as they relate to the employee's exposure;

(iii) The employee's representative exposure level or anticipated exposure level;

(iv) A description of any personal protective and respiratory equipment used or to be used; and

(v) Information from previous medical examinations of the affected employee that is not otherwise available to the examining physician.

(4) *Physician's written opinion.* (i) The employer shall obtain a written opinion from the examining physician. This written opinion shall contain the results of the medical examination and shall include:

(A) The physician's opinion as to whether the employee has any detected medical conditions that would place the employee at an increased risk of material health impairment from exposure to asbestos, tremolite, anthophyllite, or actinolite;

(B) Any recommended limitations on the employee or on the use of personal protective equipment such as respirators; and

(C) A statement that the employee has been informed by the physician of the results of the medical examination and of any medical conditions that may result from asbestos, tremolite, anthophyllite, or actinolite exposure.

(ii) The employer shall instruct the physician not to reveal in the written opinion given to the employer specific findings or diagnoses unrelated to occupational exposure to asbestos, tremolite, anthophyllite, or actinolite.

(iii) The employer shall provide a copy of the physician's written opinion to the affected employee within 30 days from its receipt.

(n) *Recordkeeping*—(1) *Objective data for exempted operations.* (i) Where the employer has relied on objective data that demonstrate that products made from or containing asbestos, tremolite, anthophyllite, or actinolite are not capable of releasing fibers of asbestos, tremolite, anthophyllite, or actinolite or a combination of these minerals, in concentrations at or above the action level under the expected conditions of processing, use, or handling to exempt such operations from the initial monitoring requirements under paragraph (f)(2) of this section, the employer shall establish and maintain an accurate record of objective data reasonably relied upon in support of the exemption.

(ii) The record shall include at least the following information:

(A) The product qualifying for exemption;

(B) The source of the objective data;

(C) The testing protocol, results of testing, and/or analysis of the material for the release of asbestos, tremolite, anthophyllite, or actinolite;

(D) A description of the operation exempted and how the data support the exemption; and

(E) Other data relevant to the operations, materials, processing, or employee exposures covered by the exemption.

(iii) The employer shall maintain this record for the duration of the employer's reliance upon such objective data.

(2) *Exposure measurements.* (i) The employer shall keep an accurate record of all measurements taken to monitor employee exposure to asbestos, tremolite, anthophyllite, or actinolite as prescribed in paragraph (f) of this section.

Note: The employer may utilize the services of competent organizations such as industry trade associations and employee associations to maintain the records required by this section.

(ii) This record shall include at least the following information:

(A) The date of measurement;

(B) The operation involving exposure to asbestos, tremolite, anthophyllite, or actinolite that is being monitored;

(C) Sampling and analytical methods used and evidence of their accuracy;

(D) Number, duration, and results of samples taken;

(E) Type of protective devices worn, if any; and

(F) Name, social security number, and exposure of the employees whose exposures are represented.

(iii) The employer shall maintain this record for at least thirty (30) years, in accordance with 29 CFR 1910.20.

(3) *Medical surveillance.* (i) The employer shall establish and maintain an accurate record for each employee subject to medical surveillance by paragraph (m) of this section, in accordance with 29 CFR 1910.20.

(ii) The record shall include at least the following information:

(A) The name and social security number of the employee;

(B) A copy of the employee's medical examination results, including the medical history, questionnaire responses, results of any tests, and physician's recommendations.

(C) Physician's written opinions;

(D) Any employee medical complaints related to exposure to asbestos, tremolite, anthophyllite, or actinolite; and

(E) A copy of the information provided to the physician as required by paragraph (m) of this section.

(iii) The employer shall ensure that this record is maintained for the duration of employment plus thirty (30) years, in accordance with 29 CFR 1910.20.

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(4) *Training records.* The employer shall maintain all employee training records for one 1 year beyond the last date of employment by that employer.

(5) *Availability.* (i) The employer, upon written request, shall make all records required to be maintained by this section available to the Assistant Secretary and the Director for examination and copying.

(ii) The employer, upon request, shall make any exposure records required by paragraphs (f) and (n) of this section available for examination and copying to affected employees, former employees, designated representatives, and the Assistant Secretary, in accordance with 29 CFR 1910.20(a)–(e) and (g)–(i).

(iii) The employer, upon request, shall make employee medical records required by paragraphs (m) and (n) of this section available for examination and copying to the subject employee, anyone having the specific written consent of the subject employee, and the Assistant Secretary, in accordance with 29 CFR 1910.20.

(6) *Transfer of records.* (i) The employer shall comply with the requirements concerning transfer of records set forth in 29 CFR 1910.20 (h).

(ii) Whenever the employer ceases to do business and there is no successor employer to receive and retain the records for the prescribed period, the employer shall notify the Director at least 90 days prior to disposal and, upon request, transmit them to the Director.

(o) *Dates*—(1) *Effective date.* This section shall become effective [insert date 30 days from publication in the Federal Register]. The requirements of the asbestos standard issued in June 1972 (37 FR 11318), as amended, and published in 29 CFR 1910.1001 (1985) remain in effect until compliance is achieved with the parallel provisions of this standard.

(2) *Start-up dates.* (i) The requirements of paragraphs (c) through (n) of this section, including the engineering controls specified in paragraph (g)(1) of this section, shall be complied with by [insert date 210 days from publication in the Federal Register].

(p) *Appendices.* (1) Appendices A, C, D, and E to this section are incorporated as part of this section and the contents of these appendices are mandatory.

(2) Appendices B, F, G, H, and I to this section are informational and are not intended to create any additional obligations not otherwise imposed or to detract from any existing obligations.

Appendix A to § 1926.58—OSHA Reference Method—Mandatory

This mandatory appendix specifies the procedure for analyzing air samples for asbestos, tremolite, anthophyllite, and actinolite and specifies quality control procedures that must be implemented by laboratories performing the analysis. The sampling and analytical methods described below represent the elements of the available monitoring methods (such as the NIOSH P400 method) which OSHA considers to be essential to achieve adequate employee exposure monitoring while allowing employers to use methods that are already established within their organizations. All employers who are required to conduct air monitoring under paragraph (f) of the standard are required to utilize analytical laboratories that use this procedure, or an equivalent method, for collecting and analyzing samples.

Sampling and Analytical Procedure

1. The sampling medium for air samples shall be mixed cellulose ester filter membranes. These shall be designated by the manufacturer as suitable for asbestos, tremolite, anthophyllite, and actinolite counting. See below for rejection of blanks.

2. The preferred collection device shall be the 25-mm diameter cassette with an open-faced 50-mm extension cowl. The 37-mm cassette may be used if necessary but only if written justification for the need to use the 37-mm filter cassette accompanies the sample results in the employee's exposure monitoring record.

3. An air flow rate between 0.5 liter/min and 2.5 liters/min shall be selected for the 25/mm cassette. If the 37-mm cassette is used, an air flow rate between 1 liter/min and 2.5 liters/min shall be selected.

4. Where possible, a sufficient air volume for each air sample shall be collected to yield between 100 and 1,300 fibers per square millimeter on the membrane filter. If a filter darkens in appearance or if loose dust is seen on the filter, a second sample shall be started.

5. Ship the samples in a rigid container with sufficient packing material to prevent dislodging the collected fibers. Packing material that has a high electrostatic charge on its surface (e.g., expanded polystyrene) cannot be used because such material can cause loss of fibers to the sides of the cassette.

6. Calibrate each personal sampling pump before and after use with a representative filter cassette installed between the pump and the calibration devices.

7. Personal samples shall be taken in the "breathing zone" of the employee (i.e., attached to or near the collar or lapel near the worker's face).

8. Fiber counts shall be made by positive phase contrast using a microscope with an 8 to 10 X eyepiece and a 40 to 45 X objective for a total magnification of approximately 400 X and a numerical aperture of 0.65 to 0.75. The microscope shall also be fitted with a green or blue filter.

9. The microscope shall be fitted with a Walton-Beckett eyepiece graticule calibrated for a field diameter of 100 micrometers (+/− 2 micrometers).

10. The phase-shift detection limit of the microscope shall be about 3 degrees measured using the HSE phase shift test slide as outlined below.

a. Place the test slide on the microscope stage and center it under the phase objective.

b. Bring the blocks of grooved lines into focus.

Note.—The slide consists of seven sets of grooved lines (ca. 20 grooves to each block) in descending order of visibility from sets 1 to 7, seven being the least visible. The requirements for asbestos, tremolite, anthophyllite, and actinolite counting are that the microscope optics must resolve the grooved lines in set 3 completely, although they may appear somewhat faint, and that the grooved lines in sets 6 and 7 must be invisible. Sets 4 and 5 must be at least partially visible but may vary slightly in visibility between microscopes. A microscope that fails to meet these requirements has either too low or too high a resolution to be used for asbestos, tremolite, anthophyllite, and actinolite counting.

c. If the image deteriorates, clean and adjust the microscope optics. If the problem persists, consult the microscope manufacturer.

11. Each set of samples taken will include 10 percent blanks or a minimum of 2 blanks. The blank results shall be averaged and subtracted from the analytical results before reporting. Any samples represented by a blank having a fiber count in excess of 7 fibers/100 fields shall be rejected.

12. The samples shall be mounted by the acetone/triacetin method or a method with an equivalent index of refraction and similar clarity.

13. Observe the following counting rules.

a. Count only fibers equal to or longer than 5 micrometers. Measure the length of curved fibers along the curve.

b. Count all particles as asbestos, tremolite, anthophyllite, and actinolite that have a length-to-width ratio (aspect ratio) of 3:1 or greater.

c. Fibers lying entirely within the boundary of the Walton-Beckett graticule field shall receive a count of 1. Fibers crossing the boundary once, having one end within the circle, shall receive the count of one half (½). Do not count any fiber that crosses the graticule boundary more than once. Reject and do not count any other fibers even though they may be visible outside the graticule area.

d. Count bundles of fibers as one fiber unless individual fibers can be identified by observing both ends of an individual fiber.

e. Count enough graticule fields to yield 100 fibers. Count a minimum of 20 fields; stop counting at 100 fields regardless of fiber count.

14. Blind recounts shall be conducted at the rate of 10 percent.

Quality Control Procedures

1. Intralaboratory program. Each laboratory and/or each company with more than one microscopist counting slides shall establish a statistically designed quality assurance program involving blind recounts and

[Sec. 1926.58, Appendix A]

comparisons between microscopists to monitor the variability of counting by each microscopist and between microscopists. In a company with more than one laboratory, the program shall include all laboratories, and shall also evaluate the laboratory-to-laboratory variability.

2. Interlaboratory program. Each laboratory analyzing asbestos, tremolite, anthophyllite, and actinolite samples for compliance determination shall implement an interlaboratory quality assurance program that as a minimum includes participation of at least two other independent laboratories. Each laboratory shall participate in round robin testing at least once every 6 months with at least all the other laboratories in its interlaboratory quality assurance group. Each laboratory shall submit slides typical of its own workload for use in this program. The round robin shall be designed and results analyzed using appropriate statistical methodology.

3. All individuals performing asbestos, tremolite, anthophyllite, and actinolite analysis must have taken the NIOSH course for sampling and evaluating airborne asbestos, tremolite, anthophyllite, and actinolite dust or an equivalent course.

4. When the use of different microscopes contributes to differences between counters and laboratories, the effect of the different microscope shall be evaluated and the microscope shall be replaced, as necessary.

5. Current results of these quality assurance programs shall be posted in each laboratory to keep the microscopists informed.

Appendix B to § 1926.58—Detailed Procedure for Asbestos Tremolite, Anthophyllite, and Actinolite Sampling and Analysis—Non-Mandatory

This appendix contains a detailed procedure for sampling and analysis and includes those critical elements specified in Appendix A. Employers are not required to use this procedure, but they are required to use Appendix A. The purpose of Appendix B is to provide a detailed step-by-step sampling and analysis procedure that conforms to the elements specified in Appendix A. Since this procedure may also standardize the analysis and reduce variability, OSHA encourages employers to use this appendix.

Asbestos, Tremolite, Anthophyllite, and Actinolite Sampling and Analysis Method

Technique: Microscopy, Phase Contrast.

Analyte: Fibers (Manual count).

Sample Preparation: Acetone/triacetin method.

Calibration: Phase-shift detection limit about 3 degrees.

Range: 100 to 1300 fibers/mm² filter area.

Estimated Limit of Detection: 7 fibers/mm² filter area.

Sampler: Filter (0.8–1.2 um mixed cellulose ester membrane, 25-mm diameter).

Flow Rate: 0.5 l/min to 2.5 l/min (25-mm cassette); 1.0 l/min to 2.5 l/min (37-mm cassette).

Sample Volume: Adjust to obtain 100 to 1300 fibers/mm².

Shipment: Routine.

Sample Stability: Indefinite.

Blanks: 10% of samples (minimum 2).

Standard Analytical Error: 0.25.

Applicability: The working range is 0.02 f/cc (1920–L air sample) to 1.25 f/cc (400–L air sample). The method gives an index of airborne asbestos, tremolite, anthophyllite, and actinolite fibers but may be used for other materials such as fibrous glass by inserting suitable parameters into the counting rules. The method does not differentiate between asbestos, tremolite, anthophyllite, and actinolite and other fibers. Asbestos, tremolite, anthophyllite, and actinolite fibers less than ca. 0.25 um diameter will not be detected by this method.

Interferences: Any other airborne fiber may interfere since all particles meeting the counting criteria are counted. Chain-like particles may appear fibrous. High levels of nonfibrous dust particles may obscure fibers in the field of view and raise the detection limit.

Reagents

1. Acetone.

2. Triacetin (glycerol triacetate), reagent grade.

Special Precautions

Acetone is an extremely flammable liquid and precautions must be taken not to ignite it. Heating of acetone must be done in a ventilated laboratory fume hood using a flameless, spark-free heat source.

Equipment

1. Collection device: 25-mm cassette with 50-mm extension cowl with cellulose ester filter, 0.8 to 1.2 mm pore size and backup pad.

Note.—Analyze representative filters for fiber background before use and discard the filter lot if more than 5 fibers/100 fields are found.

2. Personal sampling pump, greater than or equal to 0.5 L/min, with flexible connecting tubing.

3. Microscope, phase contrast, with green or blue filter, 8 to 10X eyepiece, and 40 to 45X phase objective (total magnification ca 400X); numerical aperture = 0.65 to 0.75.

4. Slides, glass, single-frosted, pre-cleaned, 25 × 75 mm.

5. Cover slips, 25 × 25 mm, no. 1½ unless otherwise specified by microscope manufacturer.

6. Knife, #1 surgical steel, curved blade.

7. Tweezers.

8. Flask, Guth-type, insulated neck, 250 to 500 mL (with single-holed rubber stopper and elbow-jointed glass tubing, 16 to 22 cm long).

9. Hotplate, spark-free, stirring type; heating mantle; or infrared lamp and magnetic stirrer.

10. Syringe, hypodermic, with 22-gauge needle.

11. Graticule, Walton-Beckett type with 100 um diameter circular field at the specimen plane (area = 0.00785 mm²). (Type G–22).

Note.—The graticule is custom-made for each microscope.

12. HSE/NPL phase contrast test slide, Mark II.

13. Telescope, ocular phase-ring centering.

14. Stage micrometer (0.01 mm divisions).

Sampling

1. Calibrate each personal sampling pump with a representative sampler in line.

2. Fasten the sampler to the worker's lapel as close as possible to the worker's mouth. Remove the top cover from the end of the cowl extension (open face) and orient face down. Wrap the joint between the extender and the monitor's body with shrink tape to prevent air leaks.

3. Submit at least two blanks (or 10% of the total samples, whichever is greater) for each set of samples. Remove the caps from the field blank cassettes and store the caps and cassettes in a clean area (bag or box) during the sampling period. Replace the caps in the cassettes when sampling is completed.

4. Sample at 0.5 L/min or greater. Do not exceed 1 mg total dust loading on the filter. Adjust sampling flow rate, Q (L/min), and time to produce a fiber density, E (fibers/mm²), of 100 to 1300 fibers/mm² (3.85×10^4 to 5×10^4 fibers per 25-mm filter with effective collection area (A_c = 385 mm²)) for optimum counting precision (see step 21 below). Calculate the minimum sampling time, t_{min} (min) at the action level (one-half of the current standard), L (f/cc) of the fibrous aerosol being sampled:

$$t_{min} = \frac{(Ac)(E)}{(Q)(L)10^3}$$

5. Remove the field monitor at the end of sampling, replace the plastic top cover and small end caps, and store the monitor.

6. Ship the samples in a rigid container with sufficient packing material to prevent jostling or damage. NOTE: Do not use polystyrene foam in the shipping container because of electrostatic forces which may cause fiber loss from the sampler filter.

Sample Preparation

Note.—The object is to produce samples with a smooth (non-grainy) background in a medium with a refractive index equal to or less than 1.46. The method below collapses the filter for easier focusing and produces permanent mounts which are useful for quality control and interlaboratory comparison. Other mounting techniques meeting the above criteria may also be used, e.g., the nonpermanent field mounting technique used in P & CAM 239.

7. Ensure that the glass slides and cover slips are free of dust and fibers.

8. Place 40 to 60 ml of acetone into a Guth-type flask. Stopper the flask with a single-hole rubber stopper through which a glass tube extends 5 to 8 cm into the flask. The portion of the glass tube that exits the top of the stopper (5 to 10 cm) is bent downward in an elbow that makes an angle of 20 to 30 degrees with the horizontal.

9. Place the flask in a stirring hotplate or wrap in a heating mantle. Heat the acetone gradually to its boiling temperature (ca. 56°C).

Caution.—The acetone vapor must be generated in a ventilated fume hood away from all open flames and spark sources. Alternate heating methods can be used, providing no open flame or sparks are present.

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10. Mount either the whole sample filter or a wedge cut from the sample filter on a clean glass slide.

a. Cut wedges of ca. 25 percent of the filter area with a curved-blade steel surgical knife using a rocking motion to prevent tearing.

b. Place the filter or wedge, dust side up, on the slide. Static electricity will usually keep the filter on the slide until it is cleared.

c. Hold the glass slide supporting the filter approximately 1 to 2 cm from the glass tube part where the acetone vapor is escaping from the heated flask. The acetone vapor stream should cause a condensation spot on the glass slide ca. 2 to 3 cm in diameter. Move the glass slide gently in the vapor stream. The filter should clear in 2 to 5 sec. If the filter curls, distorts, or is otherwise rendered unusable, the vapor stream is probably not strong enough. Periodically wipe the outlet part with tissue to prevent liquid acetone dripping onto the filter.

d. Using the hypodermic syringe with a 22-gauge needle, place 1 to 2 drops of triacetin on the filter. Gently lower a clean 25-mm square cover slip down onto the filter at a slight angle to reduce the possibility of forming bubbles. If too many bubbles form or the amount of triacetin is insufficient, the cover slip may become detached within a few hours.

e. Glue the edges of the cover slip to the glass slide using a lacquer or nail polish.

Note.—If clearing is slow, the slide preparation may be heated on a hotplate (surface temperature 50°C) for 15 min to hasten clearing. Counting may proceed immediately after clearing and mounting are completed.

Calibration and Quality Control

11. Calibration of the Walton-Beckett graticule. The diameter, d_c (mm), of the circular counting area and the disc diameter must be specified when ordering the graticule.

a. Insert any available graticule into the eyepiece and focus so that the graticule lines are sharp and clear.

b. Set the appropriate interpupillary distance and, if applicable, reset the binocular head adjustment so that the magnification remains constant.

c. Install the 40 to 45 X phase objective.

d. Place a stage micrometer on the microscope object stage and focus the microscope on the graduated lines.

e. Measure the magnified grid length, L_u (um), using the stage micrometer.

f. Remove the graticule from the microscope and measure its actual grid length, L_a (mm). This can best be accomplished by using a stage fitted with verniers.

g. Calculate the circle diameter, d_c (mm), for the Walton-Beckett graticule:

$$d_c = \frac{L_a \times D}{L_u}$$

Example: If $L_u = 108$ um, $L_a = 2.93$ mm and $D = 100$ um, then $d_c = 2.71$ mm.

h. Check the field diameter. D (acceptable range 100 mm ± 2 mm) with a stage micrometer upon receipt of the graticule from the manufacturer. Determine field area (mm²).

12. Microscope adjustments. Follow the manufacturer's instructions and also the following:

a. Adjust the light source for even illumination across the field of view at the condenser iris.

Note.—Kohler illumination is preferred, where available.

b. Focus on the particulate material to be examined.

c. Make sure that the field iris is in focus, centered on the sample, and open only enough to fully illuminate the field of view.

d. Use the telescope ocular supplied by the manufacturer to ensure that the phase rings (annular diaphragm and phase-shifting elements) are concentric.

13. Check the phase-shift detection limit of the microscope periodically.

a. Remove the HSE/NPL phase-contrast test slide from its shipping container and center it under the phase objective.

b. Bring the blocks of grooved lines into focus.

Note.—The slide consists of seven sets of grooves (ca. 20 grooves to each block) in descending order of visibility from sets 1 to 7. The requirements for counting are that the microscope optics must resolve the grooved lines in set 3 completely, although they may appear somewhat faint, and that the grooved lines in sets 6 to 7 must be invisible. Sets 4 and 5 must be at least partially visible but may vary slightly in visibility between microscopes. A microscope which fails to meet these requirements has either too low or too high a resolution to be used for asbestos, tremolite, anthophyllite, and actinolite counting.

c. If the image quality deteriorates, clean the microscope optics and, if the problem persists, consult the microscope manufacturer.

14. Quality control of filter counts.

a. Prepare and count field blanks along with the field samples. Report the counts on each blank. Calculate the mean of the field blank counts and subtract this value from each sample count before reporting the results.

Note 1.—The identity of the blank filters should be unknown to the counter until all counts have been completed.

Note 2.—If a field blank yields fiber counts greater than 7 fibers/100 fields, report possible contamination of the samples.

b. Perform blind recounts by the same counter on 10 percent of filters counted (slides relabeled by a person other than the counter).

15. Use the following test to determine whether a pair of counts on the same filter should be rejected because of possible bias. This statistic estimates the counting repeatability at the 95% confidence level.

Discard the sample if the difference between the two counts exceeds 2.77 (F)s_r, where F = average of the two fiber counts and S_r = relative standard deviation, which should be derived by each laboratory based on historical in-house data.

Note.—If a pair of counts is rejected as a result of this test, recount the remaining samples in the set and test the new counts against the first counts. Discard all rejected paired counts.

16. Enroll each new counter in a training course that compares performance of counters on a variety of samples using this procedure.

Note.—To ensure good reproducibility, all laboratories engaged in asbestos, tremolite, anthophyllite, and actinolite counting are required to participate in the Proficiency Analytical Testing (PAT) Program and should routinely participate with other asbestos, tremolite, anthophyllite, and actinolite fiber counting laboratories in the exchange of field samples to compare performance of counters.

Measurement

17. Place the slide on the mechanical stage of the calibrated microscope with the center of the filter under the objective lens. Focus the microscope on the plane of the filter.

18. Regularly check phase-ring alignment and Kohler illumination.

19. The following are the counting rules:

a. Count only fibers longer than 5 um. Measure the length of curved fibers along the curve.

b. Count only fibers with a length-to-width ratio equal to or greater than 3:1.

c. For fibers that cross the boundary of the graticule field, do the following:

1. Count any fiber longer than 5 um that lies entirely within the graticule area.

2. Count as ½ fiber any fiber with only one end lying within the graticule area.

3. Do not count any fiber that crosses the graticule boundary more than once.

4. Reject and do not count all other fibers.

d. Count bundles of fibers as one fiber unless individual fibers can be identified by observing both ends of a fiber.

e. Count enough graticule fields to yield 100 fibers. Count a minimum of 20 fields. Stop at 100 fields regardless of fiber count.

20. Start counting from one end of the filter and progress along a radial line to the other end, shift either up or down on the filter, and continue in the reverse direction. Select fields randomly by looking away from the eyepiece briefly while advancing the mechanical stage. When an agglomerate covers ca. ¼ or more of the field of view, reject the field and select another. Do not report rejected fields in the number of total fields counted.

Note.—When counting a field, continuously scan a range of focal planes by moving the fine focus knob to detect very fine fibers which have become embedded in the filter. The small-diameter fibers will be very faint but are an important contribution to the total count.

[Sec. 1926.58, Appendix B]

Calculations

21. Calculate and report fiber density on the filter, E (fibers/mm²); by dividing the total fiber count, F; minus the mean field blank count, B, by the number of fields, n; and the field area, A_f (0.00785mm² for a properly calibrated Walton-Beckett graticule):

$$E = \frac{F - B}{(n)(A_f)} \text{ fibers/mm}^2$$

22. Calculate the concentration, C (f/cc), of fibers in the air volume sampled, V (L), using the effective collection area of the filter, A_c (385 mm² for a 25-mm filter):

$$C = \frac{(E)(Ac)}{V(10^3)}$$

Note.—Periodically check and adjust the value of A_c if necessary.

Appendix C to § 1926.58—Qualitative and Quantitative Fit Testing Procedures—Mandatory

Qualitative Fit Test Protocols

I. Isoamyl Acetate Protocol

A. Odor threshold screening.

1. Three 1-liter glass jars with metal lids (e.g. Mason or Bell jars) are required.

2. Odor-free water (e.g. distilled or spring water) at approximately 25 °C shall be used for the solutions.

3. The isoamyl acetate (IAA) (also known as isopentyl acetate) stock solution is prepared by adding 1 cc of pure IAA to 800 cc of odor free water in a 1-liter jar and shaking for 30 seconds. This solution shall be prepared new at least weekly.

4. The screening test shall be conducted in a room separate from the room used for actual fit testing. The two rooms shall be well ventilated but shall not be connected to the same recirculating ventilation system.

5. The odor test solution is prepared in a second jar by placing 0.4 cc of the stock solution into 500 cc of odor free water using a clean dropper or pipette. Shake for 30 seconds and allow to stand for two to three minutes so that the IAA concentration above the liquid may reach equilibrium. This solution may be used for only one day.

6. A test blank is prepared in a third jar by adding 500 cc of odor free water.

7. The odor test and test blank jars shall be labelled 1 and 2 for jar identification. If the labels are put on the lids they can be periodically peeled, dried off and switched to maintain the integrity of the test.

8. The following instructions shall be typed on a card and placed on the table in front of the two test jars (i.e. 1 and 2): "The purpose of this test is to determine if you can smell banana oil at a low concentration. The two bottles in front of you contain water. One of these bottles also contains a small amount of banana oil. Be sure the covers are on tight, then shake each bottle for two seconds. Unscrew the lid of each bottle, one at a time, and sniff at the mouth of the bottle. Indicate to the test conductor which bottle contains banana oil."

9. The mixtures used in the IAA odor detection test shall be prepared in an area separate from where the test is performed, in order to prevent olfactory fatigue in the subject.

10. If the test subject is unable to correctly identify the jar containing the odor test solution, the IAA qualitative fit test may not be used.

11. If the test subject correctly identifies the jar containing the odor test solution, the test subject may proceed to respirator selection and fit testing.

B. Respirator Selection.

1. The test subject shall be allowed to pick the most comfortable respirator from a selection including respirators of various sizes from different manufacturers. The selection shall include at least five sizes of elastomeric half facepieces, from at least two manufacturers.

2. The selection process shall be conducted in a room separate from the fit-test chamber to prevent odor fatigue. Prior to the selection process, the test subject shall be shown how to put on a respirator, how it should be positioned on the face, how to set strap tension and how to determine a "comfortable" respirator. A mirror shall be available to assist the subject in evaluating the fit and positioning of the respirator. This instruction may not constitute the subject's formal training on respirator use, as it is only a review.

3. The test subject should understand that the employee is being asked to select the respirator which provides the most comfortable fit. Each respirator represents a different size and shape and, if fit properly and used properly will provide adequate protection.

4. The test subject holds each facepiece up to the face and eliminates those which obviously do not give a comfortable fit. Normally, selection will begin with a half-mask and if a good fit cannot be found, the subject will be asked to test the full facepiece respirators. (A small percentage of users will not be able to wear any half-mask.)

5. The more comfortable facepieces are noted; the most comfortable mask is donned and *worn at least five minutes* to assess comfort. All donning and adjustments of the facepiece shall be performed by the test subject without assistance from the test conductor or other person. Assistance in assessing comfort can be given by discussing the points in #6 below. If the test subject is not familiar with using a particular respirator, the test subject shall be directed to don the mask several times and to adjust the straps each time to become adept at setting proper tension on the straps.

6. Assessment of comfort shall include reviewing the following points with the test subject and allowing the test subject adequate time to determine the comfort of the respirator:

- Positioning of mask on nose.
- Room for eye protection.
- Room to talk.
- Positioning mask on face and cheeks.

7. The following criteria shall be used to help determine the adequacy of the respirator fit:

- Chin properly placed.
- Strap tension.
- Fit across nose bridge.
- Distance from nose to chin.
- Tendency to slip.
- Self-observation in mirror.

8. The test subject shall conduct the conventional negative and positive-pressure fit checks before conducting the negative- or positive-pressure test the subject shall be told to "seal" the mask by rapidly moving the head from side-to-side and up and down, while taking a few deep breaths.

9. The test subject is now ready for fit testing.

10. After passing the fit test, the test subject shall be questioned again regarding the comfort of the respirator. If it has become uncomfortable, another model of respirator shall be tried.

11. The employee shall be given the opportunity to select a different facepiece and be retested if the chosen facepiece becomes increasingly uncomfortable at any time.

C. Fit test.

1. The fit test chamber shall be similar to a clear 55 gal drum liner suspended inverted over a 2 foot diameter frame, so that the top of the chamber is about 6 inches above the test subject's head. The inside top center of the chamber shall have a small hook attached.

2. Each respirator used for the fitting and fit testing shall be equipped with organic vapor cartridges or offer protection against organic vapors. The cartridges or masks shall be changed at least weekly.

3. After selecting, donning, and properly adjusting a respirator, the test subject shall wear it to the fit testing room. This room shall be separate from the room used for odor threshold screening and respirator selection, and shall be well ventilated, as by an exhaust fan or lab hood, to prevent general room contamination.

4. A copy of the following test exercises and rainbow passage shall be taped to the inside of the test chamber:

Test Exercises

i. Breathe normally.

ii. Breathe deeply. Be certain breaths are *deep* and *regular*.

iii. Turn head all the way from one side to the other. Inhale on each side. Be certain movement is complete. Do not bump the respirator against the shoulders.

iv. Nod head up-and-down. Inhale when head is in the full up position (looking toward ceiling). Be certain motions are complete and made about every second. Do not bump the respirator on the chest.

v. Talking. Talk aloud and slowly for several minutes. The following paragraph is called the Rainbow Passage. Reading it will result in a wide range of facial movements, and thus be useful to satisfy this requirement.

[Sec. 1926.58, Appendix C]

Alternative passages which serve the same purpose may also be used.

vi. Jogging in place.

vii. Breathe normally.

Rainbow Passage

When the sunlight strikes raindrops in the air, they act like a prism and form a rainbow. The rainbow is a division of white light into many beautiful colors. These take the shape of a long round arch, with its path high above, and its two ends apparently beyond the horizon. There is, according to legend, a boiling pot of gold at one end. People look, but no one ever finds it. When a man looks for something beyond reach, his friends say he is looking for the pot of gold at the end of the rainbow.

5. Each test subject shall wear the respirator for at least 10 minutes before starting the fit test.

6. Upon entering the test chamber, the test subject shall be given a 6 inch by 5 inch piece of paper towel or other porous absorbent single ply material, folded in half and wetted with three-quarters of one cc of pure IAA. The test subject shall hang the wet towel on the hook at the top of the chamber.

7. Allow two minutes for the IAA test concentration to be reached before starting the fit-test exercises. This would be an appropriate time to talk with the test subject, to explain the fit test, the importance of cooperation, the purpose for the head exercises, or to demonstrate some of the exercises.

8. Each exercise described in #4 above shall be performed for at least one minute.

9. If at any time during the test, the subject detects the banana-like odor of IAA, the test has failed. The subject shall quickly exit from the test chamber and leave the test area to avoid olfactory fatigue.

10. If the test is failed, the subject shall return to the selection room and remove the respirator, repeat the odor sensitivity test, select and put on another respirator, return to the test chamber, and again begin the procedure described in the c(4) through c(8) above. The process continues until a respirator that fits well has been found. Should the odor sensitivity test be failed, the subject shall wait about 5 minutes before retesting. Odor sensitivity will usually have returned by this time.

11. If a person cannot pass the fit test described above wearing a half-mask respirator from the available selection, full facepiece models must be used.

12. When a respirator is found that passes the test, the subject breaks the faceseal and takes a breath before exiting the chamber. This is to assure that the reason the test subject is not smelling the IAA is the good fit of the respirator facepiece seal and not olfactory fatigue.

13. When the test subject leaves the chamber, the subject shall remove the saturated towel and return it to the person conducting the test. To keep the area from becoming contaminated, the used towels shall be kept in a self-sealing bag so there is no significant IAA concentration buildup in the test chamber during subsequent tests.

14. At least two facepieces shall be selected for the IAA test protocol. The test subject shall be given the opportunity to wear them for one week to choose the one which is more comfortable to wear.

15. Persons who have successfully passed this fit test with a half-mask respirator may be assigned the use of the test respirator in atmospheres with up to 10 times the PEL of airborne asbestos. In atmospheres greater than 10 times, and less than 100 times the PEL (up to 100 ppm), the subject must pass the IAA test using a full face negative pressure respirator. (The concentration of the IAA inside the test chamber must be increased by ten times for QLFT of the full facepiece.)

16. The test shall not be conducted if there is any hair growth between the skin and the facepiece sealing surface.

17. If hair growth or apparel interfere with a satisfactory fit, then they shall be altered or removed so as to eliminate interference and allow a satisfactory fit. If a satisfactory fit is still not attained, the test subject must use a positive-pressure respirator such as powered air-purifying respirators, supplied air respirator, or self-contained breathing apparatus.

18. If a test subject exhibits difficulty in breathing during the tests, she or he shall be referred to a physician trained in respirator diseases or pulmonary medicine to determine whether the test subject can wear a respirator while performing her or his duties.

19. Qualitative fit testing shall be repeated at least every six months.

20. In addition, because the sealing of the respirator may be affected, qualitative fit testing shall be repeated immediately when the test subject has a:

(1) Weight change of 20 pounds or more,

(2) Significant facial scarring in the area of the facepiece seal,

(3) Significant dental changes; i.e.; multiple extractions without prothesis, or acquiring dentures,

(4) Reconstructive or cosmetic surgery, or

(5) Any other condition that may interfere with facepiece sealing.

D. Recordkeeping.

A summary of all test results shall be maintained in each office for 3 years. The summary shall include:

(1) Name of test subject.

(2) Date of testing.

(3) Name of the test conductor.

(4) Respirators selected (indicate manufacturer, model, size and approval number).

(5) Testing agent.

II. Saccharin Solution Aerosol Protocol

A. Respirator Selection.

Respirators shall be selected as described in section IB (respirator selection) above, except that each respirator shall be equipped with a particulate filter.

B. Taste Threshold Screening.

1. An enclosure about head and shoulders shall be used for threshold screening (to determine if the individual can taste saccharin) and for fit testing. The enclosure shall be approximately 12 inches in diameter by 14 inches tall with at least the front clear to allow free movement of the head when a respirator is worn.

2. The test enclosure shall have a three-quarter inch hole in front of the test subject's nose and mouth area to accommodate the nebulizer nozzle.

3. The entire screening and testing procedure shall be explained to the test subject prior to conducting the screening test.

4. During the threshold screening test, the test subject shall don the test enclosure and breathe with open mouth with tongue extended.

5. Using a DeVilbiss Model 40 Inhalation Medication Nebulizer or equivalent, the test conductor shall spray the threshold check solution into the enclosure. This nebulizer shall be clearly marked to distinguish it from the fit test solution nebulizer.

6. The threshold check solution consists of 0.83 grams of sodium saccharin, USP in water. It can be prepared by putting 1 cc of the test solution (see C 7 below) in 100 cc of water.

7. To produce the aerosol, the nebulizer bulb is firmly squeezed so that it collapses completely, then is released and allowed to fully expand.

8. Ten squeezes of the nebulizer bulb are repeated rapidly and then the test subject is asked whether the saccharin can be tasted.

9. If the first response is negative, ten more squeezes of the nebulizer bulb are repeated rapidly and the test subject is again asked whether the saccharin can be tasted.

10. If the second response is negative ten more squeezes are repeated rapidly and the test subject is again asked whether the saccharin can be tasted.

11. The test conductor will take note of the number of squeezes required to elicit a taste response.

12. If the saccharin is not tasted after 30 squeezes (Step 10), the saccharin fit test cannot be performed on the test subject.

13. If a taste response is elicited, the test subject shall be asked to take note of the taste for reference in the fit test.

14. Correct use of the nebulizer means that approximately 1 cc of liquid is used at a time in the nebulizer body.

15. The nebulizer shall be thoroughly rinsed in water, shaken dry, and refilled at least every four hours.

C. Fit test.

1. The test subject shall don and adjust the respirator without the assistance from any person.

2. The fit test uses the same enclosure described in IIB above.

3. Each test subject shall wear the respirator for at least 10 minutes before starting the fit test.

4. The test subject shall don the enclosure while wearing the respirator selected in section IB above. This respirator shall be properly adjusted and equipped with a particulate filter.

5. The test subject may not eat, drink (except plain water), or chew gum for 15 minutes before the test.

6. A second DeVilbiss Model 40 Inhalation Medication Nebulizer is used to spray the fit test solution into the enclosure. This nebulizer shall be clearly marked to distinguish it from the screening test solution nebulizer.

[Sec. 1926.58, Appendix C]

7. The fit test solution is prepared by adding 83 grams of sodium saccharin to 100 cc of warm water.

8. As before, the test subject shall breathe with mouth open and tongue extended.

9. The nebulizer is inserted into the hole in the front of the enclosure and the fit test solution is sprayed into the enclosure using the same technique as for the taste threshold screening and the same number of squeezes required to elicit a taste response in the screening. (See B8 through B10 above.)

10. After generation of the aerosol read the following instructions to the test subject. The test subject shall perform the exercises for one minute each.

i. Breathe normally.

ii. Breathe deeply. Be certain breaths are *deep* and *regular*.

iii. Turn head all the way from one side to the other. Be certain movement is complete. Inhale on each side. Do not bump the respirator against the shoulders.

iv. Nod head up-and-down. Be certain motions are complete. Inhale when head is in the full up position (when looking toward the ceiling). Do not bump the respirator on the chest.

v. Talking. Talk aloud and slowly for several minutes. The following paragraph is called the Rainbow Passage. Reading it will result in a wide range of facial movements, and thus be useful to satisfy this requirement. Alternative passages which serve the same purpose may also be used.

vi. Jogging in place.

vii. Breathe normally.

Rainbow Passage

When the sunlight strikes raindrops in the air, they act like a prism and form a rainbow. The rainbow is a division of white light into many beautiful colors. These take the shape of a long round arch, with its path high above, and its two ends apparently beyond the horizon. There is, according to legend, a boiling pot of gold at one end. People look, but no one ever finds it. When a man looks for something beyond his reach, his friends say he is looking for the pot of gold at the end of the rainbow.

11. At the beginning of each exercise, the aerosol concentration shall be replenished using one-half the number of squeezes as initially described in C8.

12. The test subject shall indicate to the test conductor if at any time during the fit test the taste of saccharin is detected.

13. If the saccharin is detected the fit is deemed unsatisfactory and a different respirator shall be tried.

14. At least two facepieces shall be selected by the IAA test protocol. The test subject shall be given the opportunity to wear them for one week to choose the one which is more comfortable to wear.

15. Successful completion of the test protocol shall allow the use of the half mask tested respirator in contaminated atmospheres up to 10 times the PEL of asbestos. In other words this protocol may be used to assign protection factors no higher than ten.

16. The test shall not be conducted if there is any hair growth between the skin and the facepiece sealing surface.

17. If hair growth or apparel interfere with a satisfactory fit, then they shall be altered or removed so as to eliminate interference and allow a satisfactory fit. If a satisfactory fit is still not attained, the test subject must use a positive-pressure respirator such as powered air-purifying respirators, supplied air respirator, or self-contained breathing apparatus.

18. If a test subject exhibits difficulty in breathing during the tests, she or he shall be referred to a physician trained in respirator diseases or pulmonary medicine to determine whether the test subject can wear a respirator while performing her or his duties.

19. Qualitative fit testing shall be repeated at least every six months.

20. In addition, because the sealing of the respirator may be affected, qualitative fit testing shall be repeated immediately when the test subject has a:

(1) Weight change of 20 pounds or more,

(2) Significant facial scarring in the area of the facepiece seal,

(3) Significant dental change; i.e.; multiple extractions without prothesis, or acquiring dentures,

(4) Reconstructive or cosmetic surgery, or

(5) Any other condition that may interfere with facepiece sealing.

D. Recordkeeping.

A summary of all test results shall be maintained in each office for 3 years. The summary shall include:

(1) Name of test subject.

(2) Date of testing.

(3) Name of test conductor.

(4) Respirators selected (indicate manufacturer, model, size and approval number).

(5) Testing agent.

III. Irritant Fume Protocol

A. Respirator selection:

Respirators shall be selected as described in section IB above, except that each respirator shall be equipped with a combination of high-efficiency and acid-gas cartridges.

B. Fit test.

1. The test subject shall be allowed to smell a weak concentration of the irritant smoke to familiarize the subject with the characteristic odor.

2. The test subject shall properly don the respirator selected as above, and wear it for at least 10 minutes before starting the fit test.

3. The test conductor shall review this protocol with the test subject before testing.

4. The test subject shall perform the coaventional positive pressure and negative pressure fit checks (see ANSI Z88.2 1980). Failure of either check shall be cause to select an alternate respirator.

5. Break both ends of a ventilation smoke tube containing stannic oxychloride, such as the MSA part #5645, or equivalent. Attach a short length of tubing to one end of the smoke tude. Attach the other end of the smoke tube to a low pressure air pump set to deliver 200 milliliters per minute.

6. Advise the test subject that the smoke can be irritating to the eyes and instruct the subject to keep the eyes closed while the test is performed.

7. The test conductor shall direct the stream of irritant smoke from the tube towards the faceseal area of the test subject. The person conducting the test shall begin with the tube at least 12 inches from the facepiece and gradually move to within one inch, moving around the whole perimeter of the mask.

8. The test subject shall be instructed to do the following exercises while the respirator is being challenged by the smoke. Each exercise shall be performed for one minute.

i. Breathe normally.

ii. Breathe deeply. Be certain breaths are *deep* and *regular*.

iii. Turn head all the way from one side to the other. Be certain movement is complete. Inhale on each side. Do not bump the respirator against the shoulders.

iv. Nod head up-and-down. Be certain motions are complete and made every second. Inhale when head is in the full up position (looking toward ceiling). Do not bump the respirator against the chest.

v. Talking. Talk aloud and slowly for several minutes. The following paragraph is called the Rainbow Passage. Reading it will result in a wide range of facial movements, and thus be useful to satisfy this requirement. Alternative passages which serve the same purpose may also be used.

Rainbow Passage

When the sunlight strikes raindrops in the air, they act like a prism and form a rainbow. The rainbow is a division of white light into many beautiful colors. These take the shape of a long round arch, with its path high above, and its two end apparently beyond the horizon. There is, according to legend, a boiling pot of gold at one end. People look, but no one ever finds it. When a man looks for something beyond his reach, his friends say he is looking for the pot of gold at the end of the rainbow.

vi. Jogging in Place.

vii. Breathe normally.

9. The test subject shall indicate to the test conductor if the irritant smoke is detected. If smoke is detected, the test conductor shall stop the test. In this case, the tested respirator is rejected and another respirator shall be selected.

10. Each test subject passing the smoke test (i.e., without detecting the smoke) shall be given a sensitivity check of smoke from the same tube to determine if the test subject reacts to the smoke. Failure to evoke a response shall void the fit test.

11. Steps B4, B8, B10 of this fit test protocol shall be performed in a location with exhaust ventilation sufficient to prevent general contamination of the testing area by the test agents.

12. At least two facepieces shall be selected by the IAA test protocol. The test subject shall be given the opportunity to wear them for one week to choose the one which is more comfortable to wear.

13. Respirators successfully tested by the protocol may be used in contaminated atmospheres up to ten times the PEL of asbestos.

14. The test shall not be conducted if there is any hair growth between the skin and the facepiece sealing surface

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15. If hair growth or apparel interfere with a satisfactory fit, then they shall be altered or removed so as to eliminate interference and allow a satisfactory fit. If a satisfactory fit is still not attained, the test subject must use a positive-pressure respirator such as powered air-purifying respirators, supplied air respirator, or self-contained breathing apparatus.

16. If a test subject exhibits difficulty in breathing during the tests, she or he shall be referred to a physician trained in respirator diseases or pulmonary medicine to determine whether the test subject can wear a respirator while performing her or his duties.

17. Qualitative fit testing shall be repeated at least every six months.

18. In addition, because the sealing of the respirator may be affected, qualitative fit testing shall be repeated immediately when the test subject has a:

(1) Weight change of 20 pounds or more.

(2) Significant facial scarring in the area of the facepiece seal.

(3) Significant dental changes: i.e., multiple extractions without prothesis, or acquiring dentures.

(4) Reconstructive or cosmetic surgery, or

(5) Any other condition that may interfere with facepiece sealing.

C. Recordkeeping.

A summary of all test results shall be maintained in each office for 3 years. The summary shall include:

(1) Name of test subject.

(2) Date of testing.

(3) Name of test conductor.

(4) Respirators selected (indicate manufacturer, model, size and approval number).

(5) Testing agent.

Quantitative Fit Test Procedures

1. *General.*

a. The method applies to the negative-pressure nonpowered air-purifying respirators only.

b. The employer shall assign one individual who shall assume the full responsibility for implementing the respirator quantitative fit test program.

2. *Definition.*

a. "Quantitative Fit Test" means the measurement of the effectiveness of a respirator seal in excluding the ambient atmosphere. The test is performed by dividing the measured concentration of challenge agent in a test chamber by the measured concentration of the challenge agent inside the respirator facepiece when the normal air purifying element has been replaced by an essentially perfect purifying element.

b. "Challenge Agent" means the air contaminant introduced into a test chamber so that its concentration inside and outside the respirator may be compared.

c. "Test Subject" means the person wearing the respirator for quantitative fit testing.

d. "Normal Standing Position" means standing erect and straight with arms down along the sides and looking straight ahead.

e. "Fit Factor" means the ratio of challenge agent concentration outside with respect to inside of a respirator inlet covering (facepiece or enclosure).

3. *Apparatus.*

a. *Instrumentation.* Corn oil, sodium chloride or other appropriate aerosol generation, dilution, and measurement systems shall be used for quantitative fit test.

b. *Test chamber.* The test chamber shall be large enough to permit all test subjects to freely perform all required exercises without distributing the challenge agent concentration or the measurement apparatus. The test chamber shall be equipped and constructed so that the challenge agent is effectively isolated from the ambient air yet uniform in concentration throughout the chamber.

c. When testing air-purifying respirators, the normal filter or cartridge element shall be replaced with a high-efficiency particular filter supplied by the same manufacturer.

d. The sampling instrument shall be selected so that a strip chart record may be made of the test showing the rise and fall of challenge agent concentration with each inspiration and expiration at fit factors of at least 2,000.

e. The combination of substitute air-purifying elements (if any), challenge agent, and challenge agent concentration in the test chamber shall be such that the test subject is not exposed in excess of PEL to the challenge agent at any time during the testing process.

f. The sampling port on the test specimen respirator shall be placed and constructed so that there is no detectable leak around the port, a free air flow is allowed into the sampling line at all times and so there is no interference with the fit or performance of the respirator.

g. The test chamber and test set-up shall permit the person administering the test to observe one test subject inside the chamber during the test.

h. The equipment generating the challenge atmosphere shall maintain the concentration of challenge agent constant within a 10 percent variation for the duration of the test.

i. The time lag (interval between an event and its being recorded on the strip chart) of the instrumentation may not exceed 2 seconds.

j. The tubing for the test chamber atmosphere and for the respirator sampling port shall be the same diameter, length and material. It shall be kept as short as possible. The smallest diameter tubing recommended by the manufacturer shall be used.

k. The exhaust flow from the test chamber shall pass through a high-efficiency filter before release to the room.

l. When sodium chloride aerosol is used, the relative humidity inside the test chamber shall not exceed 50 percent.

4. *Procedural Requirements*

a. The fitting of half-mask respirators should be started with those having multiple sizes and a variety of interchangeable cartridges and canisters such as the MSA Comfo II–M, Norton M, Survivair M, A–O M, or Scott–M. Use either of the tests outlined below to assure that the facepiece is properly adjusted.

(1) *Positive pressure test.* With the exhaust port(s) blocked, the negative pressure of slight inhalation should remain constant for several seconds.

(2) *Negative pressure test.* With the intake port(s) blocked, the negative pressure slight inhalation should remain constant for several seconds.

b. After a facepiece is adjusted, the test subject shall wear the facepiece for at least a minutes before conducting a qualitative test by using either of the methods described below and using the exercise regime described in 5.a., b., c., d. and e.

(1) *Isoamyl acetate test.* When using organic vapor cartridges, the test subject who can smell the odor should be unable to detect the odor of isoamyl acetate squirted into the air near the most vulnerable portions of the facepiece seal, in a location which is separated from the test area, the test subject shall be instructed to close her/his eyes during the test period. A combination cartridge or canister with organic vapor and high-efficiency filters shall be used when available for the particular mask being tested. The test subject shall be given an opportunity to smell the odor of isoamyl acetate before the test is conducted.

(2) *Irritant fume test.* When using high-efficiency filters, the test subject should be unable to detect the odor of irritant fume (stannic chloride or titanium tetrachloride ventilation smoke tubes) squirted into the air near the most vulnerable portions of the facepiece seal. The test subject shall be instructed to close her/his eyes during the test period.

c. The test subject may enter the quantitative testing chamber only if she or he has obtained a satisfactory fit as stated in 4.b. of this Appendix.

d. Before the subject enters the test chamber, a reasonably stable challenge agent concentration shall be measured in the test chamber.

e. Immediately after the subject enters the test chamber, the challenge agent concentration inside the respirator shall be measured to ensure that the peak penetration does not exceed 5 percent for a half-mask and 1 percent for a full facepiece.

f. A stable challenge agent concentration shall be obtained prior to the actual start of testing.

(1) Respirator restraining straps may not be overtightened for testing. The straps shall be adjusted by the wearer to give a reasonably comfortable fit typical of normal use.

5. *Exercise Regime.* Prior to entering the test chamber, the test subject shall be given complete instructions as to her/his part in the test procedures. The test subject shall perform the following exercises, in the order given, for each independent test.

a. *Normal Breathing (NB).* In the normal standing position, without talking, the subject shall breathe normally for at least one minute.

b. *Deep Breathing (DB).* In the normal standing position the subject shall do deep breathing for at least one minute pausing so as not to hyperventilate.

c. *Turning head side to side. (SS).* Standing in place the subject shall slowly turn his/her head from side between the extreme positions to each side. The head shall be held at each extreme position for at least 5 seconds. Perform for at least three complete cycles.

[Sec. 1926.56, Appendix C]

d. *Moving head up and down (UD).* Standing in place, the subject shall slowly move his/her head up and down between the extreme position straight up and the extreme position straight down. The head shall be held at each extreme position for at least 5 seconds. Perform for at least three complete cycles.

e. *Reading (R).* The subject shall read out slowly and loud so as to be heard clearly by the test conductor or monitor. The test subject shall read the "rainbow passage" at the end of this section.

f. *Grimace (G).* The test subject shall grimace, smile, frown, and generally contort the face using the facial muscles. Continue for at least 15 seconds.

g. *Bend over and touch toes (B).* The test subject shall bend at the waist and touch toes and return to upright position. Repeat for at least 30 seconds.

h. *Jogging in place (J).* The test subject shall perform jog in place for at least 30 seconds.

i. *Normal Breathing (NB).* Same as exercise a.

Rainbow Passage

When the sunlight strikes raindrops in the air, they act like a prism and form a rainbow. The rainbow is a division of white light into many beautiful colors. These take the shape of a long round arch, with its path high above, and its two ends apparently beyond the horizon. There is, according to legend, a boiling pot of gold at one end. People look, but no one ever finds it. When a man looks for something beyond reach, his friends say he is looking for the pot of gold at the end of the rainbow.

6. The test shall be terminated whenever any single peak penetration exceeds 5 percent for half-masks and 1 percent for full facepieces. The test subject may be refitted and retested. If two of the three required tests are terminated, the fit shall be deemed inadequate. (See paragraph 4.h.).

7. *Calculation of Fit Factors.*

a. The fit factor determined by the quantitative fit test equals the average concentration inside the respirator.

b. The average test chamber concentration is the arithmetic average of the test chamber concentration at the beginning and of the end of the test.

c. The average peak concentration of the challenge agent inside the respirator shall be the arithmetic average peak concentrations for each of the nine exercises of the test which are computed as the arithmetic average of the peak concentrations found for each breath during the exercise.

d. The average peak concentration for an exercise may be determined graphically if there is not a great variation in the peak concentrations during a single exercise.

8. *Interpretation of Test Results.* The fit factor measured by the quantitative fit testing shall be the lowest of the three protection factors resulting from three independent tests.

9. *Other Requirements.*

a. The test subject shall not be permitted to wear a half-mask or full facepiece mask if the minimum fit factor of 100 or 1,000, respectively, cannot be obtained. If hair growth or apparel interfere with a satisfactory fit, then they shall be altered or removed so as to eliminate interference and allow a satisfactory fit. If a satisfactory fit is still not attained, the test subject must use a positive-pressure respirator such as powered air-purifying respirators, supplied air respirator, or self-contained breathing apparatus.

b. The test shall not be conducted if there is any hair growth between the skin and the facepiece sealing surface.

c. If a test subject exhibits difficulty in breathing during the tests, she or he shall be referred to a physician trained in respirator diseases or pulmonary medicine to determine whether the test subject can wear a respirator while performing her or his duties.

d. The test subject shall be given the opportunity to wear the assigned respirator for one week. If the respirator does not provide a satisfactory fit during actual use, the test subject may request another QNFT which shall be performed immediately.

e. A respirator fit factor card shall be issued to the test subject with the following information:

(1) Name.

(2) Date of fit test.

(3) Protection factors obtained through each manufacturer, model and approval number of respirator tested.

(4) Name and signature of the person that conducted the test.

f. Filters used for qualitative or quantitative fit testing shall be replaced weekly, whenever increased breathing resistance is encountered, or when the test agent has altered the integrity of the filter media. Organic vapor cartridges/canisters shall be replaced daily or sooner if there is any indication of breakthrough by the test agent.

10. In addition, because the sealing of the respirator may be affected, quantitative fit testing shall be repeated immediately when the test subject has a:

(1) Weight change of 20 pounds or more,

(2) Significant facial scarring in the area of the facepiece seal,

(3) Significant dental change; i.e.; multiple extractions without prothesis, or acquiring dentures,

(4) Reconstructive or cosmetic surgery, or

(5) Any other condition that may interfere with facepiece sealing.

11. *Recordkeeping.*

A summary of all test results shall be maintained for 3 years. The summary shall include:

(1) Name of test subject.

(2) Date of testing.

(3) Name of the test conductor.

(4) Fit factors obtained from every respirator tested (indicate manufacturer, model, size and approval number).

Appendix D to § 1926.58—Medical Questionnaires; Mandatory

This mandatory appendix contains the medical questionnaires that must be administered to all employees who are exposed to asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals above the action level, and who will therefore be included in their employer's medical surveillance program. Part 1 of the appendix contains the Initial Medical Questionnaire, which must be obtained for all new hires who will be covered by the medical surveillance requirements. Part 2 includes the abbreviated Periodical Medical Questionnaire, which must be administered to all employees who are provided periodic medical examinations under the medical surveillance provisions of the standard.

[Sec. 1926.58, Appendix D]

Part 1
INITIAL MEDICAL QUESTIONNAIRE

1. NAME _____

2. SOCIAL SECURITY # ___ ___ ___ ___ ___ ___ ___ ___ ___
(1 2 3 4 5 6 7 8 9)

3. CLOCK NUMBER ___ ___ ___ ___ ___ ___
(10 11 12 13 14 15)

4. PRESENT OCCUPATION _____

5. PLANT _____

6. ADDRESS _____

7. _____
(Zip Code)

8. TELEPHONE NUMBER _____

9. INTERVIEWER _____

10. DATE _____ ___ ___ ___ ___ ___ ___
(16 17 18 19 20 21)

11. Date of Birth _____ ___ ___ ___ ___ ___ ___
Month Day Year (22 23 24 25 26 27)

12. Place of Birth _____

13. Sex
1. Male ___
2. Female ___

14. What is your marital status?
1. Single ___
2. Married ___
3. Widowed ___
4. Separated/Divorced ___

15. Race
1. White ___
2. Black ___
3. Asian ___
4. Hispanic ___
5. Indian ___
6. Other ___

16. What is the highest grade completed in school? _____
(For example 12 years is completion of high school)

OCCUPATIONAL HISTORY

17A. Have you ever worked full time (30 hours per week or more) for 6 months or more?
1. Yes ___ 2. No ___

IF YES TO 17A:

B. Have you ever worked for a year or more in any dusty job?
1. Yes ___ 2. No ___
3. Does Not Apply ___

Specify . Industry _____ Total Years Worked ___

Was dust exposure: 1. Mild ___ 2. Moderate ___ 3. Severe ___

C. Have you ever been exposed to gas or chemical fumes in your work? 1. Yes ___ 2. No ___
Specify job/industry _____ Total Years Worked ___

Was exposure: 1. Mild ___ 2. Moderate ___ 3. Severe ___

D. What has been your usual occupation or job--the one you have worked at the longest?

1. Job occupation _____

2. Number of years employed in this occupation _____

3. Position/job title _____

4. Business, field or industry _____

(Record on lines the years in which you have worked in any of these industries, e.g. 1960-1969)

Have you ever worked:

	YES	NO
E. In a mine?.....	( )	( )
F. In a quarry?.....	( )	( )
G. In a foundry?.....	( )	( )
H. In a pottery?.....	( )	( )
I. In a cotton, flax or hemp mill?.....	( )	( )
J. With asbestos?.....	( )	( )

18. PAST MEDICAL HISTORY

	YES	NO
A. Do you consider yourself to be in good health?	( )	( )
If "NO" state reason _____		
B. Have you any defect of vision?.....	( )	( )
If "YES" state nature of defect _____		
C. Have you any hearing defect?.....	( )	( )
If "YES" state nature of defect _____		

3A. Hay Fever? 1. Yes __ 2. No __

IF YES TO 3A:
B. Was it confirmed by a doctor? 1. Yes __ 2. No __ 3. Does Not Apply __

C. At what age did it start? Age in Years __ Does Not Apply __

23A. Have you ever had chronic bronchitis? 1. Yes __ 2. No __

IF YES TO 23A:
B. Do you still have it? 1. Yes __ 2. No __ 3. Does Not Apply __

C. Was it confirmed by a doctor? 1. Yes __ 2. No __ 3. Does Not Apply __

D. At what age did it start? Age in Years __ Does Not Apply __

24A. Have you ever had emphysema? 1. Yes __ 2. No __

IF YES TO 24A:
B. Do you still have it? 1. Yes __ 2. No __ 3. Does Not Apply __

C. Was it confirmed by a doctor? 1. Yes __ 2. No __ 3. Does Not Apply __

D. At what age did it start? Age in Years __ Does Not Apply __

25A. Have you ever had asthma? 1. Yes __ 2. No __

IF YES TO 25A:
B. Do you still have it? 1. Yes __ 2. No __ 3. Does Not Apply __

C. Was it confirmed by a doctor? 1. Yes __ 2. No __ 3. Does Not Apply __

D. At what age did it start? Age in Years __ Does Not Apply __

E. If you no longer have it, at what age did it stop? Age stopped __ Does Not Apply __

26. Have you ever had:

A. Any other chest illness? 1. Yes __ 2. No __

If yes, please specify _____

D. Are you suffering from or have you ever suffered from:

a. Epilepsy (or fits, seizures, convulsions)?	[ ]	[ ]
b. Rheumatic fever?	[ ]	[ ]
c. Kidney disease?	[ ]	[ ]
d. Bladder disease?	[ ]	[ ]
e. Diabetes?	[ ]	[ ]
f. Jaundice?	[ ]	[ ]

19. CHEST COLDS AND CHEST ILLNESSES

19A. If you get a cold, does it usually go to your chest? (Usually means more than 1/2 the time) 1. Yes __ 2. No __ 3. Don't get colds __

20A. During the past 3 years, have you had any chest illnesses that have kept you off work, indoors at home, or in bed? 1. Yes __ 2. No __

IF YES TO 20A:
B. Did you produce phlegm with any of these chest illnesses? 1. Yes __ 2. No __ 3. Does Not Apply __

C. In the last 3 years, how many such illnesses with (increased) phlegm did you have which lasted a week or more? Number of illnesses __ No such illnesses __

21. Did you have any lung trouble before the age of 16? 1. Yes __ 2. No __

22. Have you ever had any of the following?

1A. Attacks of bronchitis? 1. Yes __ 2. No __

IF YES TO 1A:
B. Was it confirmed by a doctor? 1. Yes __ 2. No __ 3. Does Not Apply __

C. At what age was your first attack? Age in Years __ Does Not Apply __

2A. Pneumonia (include bronchopneumonia)? 1. Yes __ 2. No __

IF YES TO 2A:
B. Was it confirmed by a doctor? 1. Yes __ 2. No __ 3. Does Not Apply __

C. At what age did you first have it? Age in Years __ Does Not Apply __

B. Any chest operations? 1. Yes __ 2. No __

If yes, please specify _____

C. Any chest injuries? 1. Yes __ 2. No __

If yes, please specify _____

27A. Has a doctor ever told you that you had heart trouble? 1. Yes __ 2. No __

IF YES TO 27A:

B. Have you ever had treatment for heart trouble in the past 10 years? 1. Yes __ 2. No __ 3. Does Not Apply __

28A. Has a doctor ever told you that you had high blood pressure? 1. Yes __ 2. No __

IF YES TO 28A:

B. Have you had any treatment for high blood pressure (hypertension) in the past 10 years? 1. Yes __ 2. No __ 3. Does Not Apply __

29. When did you last have your chest X-rayed? (Year) 25 __ 26 __ 27 __ 28 __

30. Where did you last have your chest X-rayed (if known)? _____

What was the outcome? _____

FAMILY HISTORY

31. Were either of your natural parents ever told by a doctor that they had a chronic lung condition such as:

	FATHER			MOTHER		
	1. Yes	2. No	3. Don't Know	1. Yes	2. No	3. Don't Know
A. Chronic Bronchitis?	__	__	__	__	__	__
B. Emphysema?	__	__	__	__	__	__
C. Asthma?	__	__	__	__	__	__
D. Lung cancer?	__	__	__	__	__	__
E. Other chest conditions	__	__	__	__	__	__
F. Is parent currently alive?	__	__	__	__	__	__
G. Please Specify	__ Age if Living __ Age at Death __ Don't Know			__ Age if Living __ Age at Death __ Don't Know		

H. Please specify cause of death

_____ _____

COUGH

32A. Do you usually have a cough? (Count a cough with first smoke or on first going out of doors. Exclude clearing of throat.) (If no, skip to question 33C.) 1. Yes __ 2. No __

B. Do you usually cough as much as 4 to 6 times a day 4 or more days out of the week? 1. Yes __ 2. No __

C. Do you usually cough at all on getting up or first thing in the morning? 1. Yes __ 2. No __

D. Do you usually cough at all during the rest of the day or at night? 1. Yes __ 2. No __

IF YES TO ANY OF ABOVE (32A, B, C, or D), ANSWER THE FOLLOWING. IF NO TO ALL, CHECK DOES NOT APPLY AND SKIP TO NEXT PAGE

E. Do you usually cough like this on most days for 3 consecutive months or more during the year? 1. Yes __ 2. No __ 3. Does not apply __

F. For how many years have you had the cough? Number of years __ Does not apply __

33A. Do you usually bring up phlegm from your chest? (Count phlegm with the first smoke or on first going out of doors. Exclude phlegm from the nose. Count swallowed phlegm.) (If no, skip to 33C) 1. Yes __ 2. No __

B. Do you usually bring up phlegm like this as much as twice a day 4 or more days out of the week? 1. Yes __ 2. No __

C. Do you usually bring up phlegm at all on getting up or first thing in the morning? 1. Yes __ 2. No __

D. Do you usually bring up phlegm at all during the rest of the day or at night? 1. Yes __ 2. No __

IF YES TO ANY OF THE ABOVE (33A, B, C, or D), ANSWER THE FOLLOWING: IF NO TO ALL, CHECK DOES NOT APPLY AND SKIP TO 34A.

E. Do you bring up phlegm like this on most days for 3 consecutive months or more during the year? 1. Yes __ 2. No __ 3. Does not apply __

F. For how many years have you had trouble with phlegm? — Number of years __ Does not apply __

EPISODES OF COUGH AND PHLEGM

34A. Have you had periods or episodes of (increased*) cough and phlegm lasting for 3 weeks or more each year? *(For persons who usually have cough and/or phlegm) — 1. Yes __ 2. No __

IF YES TO 34A

B. For how long have you had at least 1 such episode per year? — Number of years __ Does not apply __

WHEEZING

35A. Does your chest ever sound wheezy or whistling

1. When you have a cold? — 1. Yes __ 2. No __
2. Occasionally apart from colds? — 1. Yes __ 2. No __
3. Most days or nights? — 1. Yes __ 2. No __

IF YES TO 1, 2, or 3 in 35A

B. For how many years has this been present? — Number of years __ Does not apply __

36A. Have you ever had an attack of wheezing that has made you feel short of breath? — 1. Yes __ 2. No __

IF YES TO 36A

B. How old were you when you had your first such attack? — Age in years __ Does not apply __

C. Have you had 2 or more such episodes? — 1. Yes __ 2. No __ 3. Does not apply __

D. Have you ever required medicine or treatment for the(se) attack(s)? — 1. Yes __ 2. No __ 3. Does not apply __

BREATHLESSNESS

37. If disabled from walking by any condition other than heart or lung disease, please describe and proceed to question 38A. Nature of condition(s)_____

38A. Are you troubled by shortness of breath when hurrying on the level or walking up a slight hill? — 1. Yes __ 2. No __

IF YES TO 38A

B. Do you have to walk slower than people of your age on the level because of breathlessness? — 1. Yes __ 2. No __ 3. Does not apply __

C. Do you ever have to stop for breath when walking at your own pace on the level? — 1. Yes __ 2. No __ 3. Does not apply __

D. Do you ever have to stop for breath after walking about 100 yards (or after a few minutes) on the level? — 1. Yes __ 2. No __ 3. Does not apply __

E. Are you too breathless to leave the house or breathless on dressing or climbing one flight of stairs? — 1. Yes __ 2. No __ 3. Does not apply __

TOBACCO SMOKING

39A. Have you ever smoked cigarettes? (No means less than 20 packs of cigarettes or 12 oz. of tobacco in a lifetime or less than 1 cigarette a day for 1 year.) — 1. Yes __ 2. No __

IF YES TO 39A

B. Do you now smoke cigarettes (as of one month ago) — 1. Yes __ 2. No __ 3. Does not apply __

C. How old were you when you first started regular cigarette smoking? — Age in years __ Does not apply __

D. If you have stopped smoking cigarettes completely, how old were you when you stopped? — Age stopped __ Check if still smoking __ Does not apply __

E. How many cigarettes do you smoke per day now? — Cigarettes per day __ Does not apply __

F. On the average of the entire time you smoked, how many cigarettes did you smoke per day? — Cigarettes per day __ Does not apply __

G. Do or did you inhale the cigarette smoke? — 1. Does not apply 2. Not at all 3. Slightly 4. Moderately 5. Deeply __

40A. Have you ever smoked a pipe regularly? (Yes means more than 12 oz. of tobacco in a lifetime.) — 1. Yes __ 2. No __

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[Sec. 1926.64, Appendix D]

IF YES TO 40A:
FOR PERSONS WHO HAVE EVER SMOKED A PIPE

B. 1. How old were you when you started to smoke a pipe regularly? — Age __

2. If you have stopped smoking a pipe completely, how old were you when you stopped? — Age stopped __; Check if still smoking pipe __; Does not apply __

C. On the average over the entire time you smoked a pipe, how much pipe tobacco did you smoke per week? — __ oz. per week (a standard pouch of tobacco contains 1 1/2 oz.); __ Does not apply

D. How much pipe tobacco are you smoking now? — oz. per week __; Not currently smoking a pipe __

E. Do you or did you inhale the pipe smoke? — 1. Never smoked __; 2. Not at all __; 3. Slightly __; 4. Moderately __; 5. Deeply __

41A. Have you ever smoked cigars regularly? (Yes means more than 1 cigar a week for a year) — 1. Yes __ 2. No __

IF YES TO 41A
FOR PERSONS WHO HAVE EVER SMOKED CIGARS

B. 1. How old were you when you started smoking cigars regularly? — Age __

2. If you have stopped smoking cigars completely, how old were you when you stopped. — Age stopped __; Check if still smoking cigars __; Does not apply __

C. On the average over the entire time you smoked cigars, how many cigars did you smoke per week? — Cigars per week __; Does not apply __

D. How many cigars are you smoking per week now? — Cigars per week __; Check if not smoking cigars currently __

E. Do or did you inhale the cigar smoke? — 1. Never smoked __; 2. Not at all __; 3. Slightly __; 4. Moderately __; 5. Deeply __

Signature _____ Date _____

Part 2
PERIODIC MEDICAL QUESTIONNAIRE

1. NAME _____

2. SOCIAL SECURITY # __ __ __ __ __ __ __ __ __ __ __ (1 2 3 4 5 6 7 8 9)

3. CLOCK NUMBER __ __ __ __ __ __ (10 11 12 13 14 15)

4. PRESENT OCCUPATION _____

5. PLANT _____

6. ADDRESS _____

7. _____ (Zip Code)

8. TELEPHONE NUMBER _____

9. INTERVIEWER _____

10. DATE _____ __ __ __ __ __ __ (16 17 18 19 20 21)

11. What is your marital status? — 1. Single __; 2. Married __; 3. Widowed __; 4. Separated/Divorced __

12. OCCUPATIONAL HISTORY

12A. In the past year, did you work full time (30 hours per week or more) for 6 months or more? — 1. Yes __ 2. No __

IF YES TO 12A:

12B. In the past year, did you work in a dusty job? — 1. Yes __ 2. No __ 3. Does Not Apply __

12C. Was dust exposure: — 1. Mild __ 2. Moderate __ 3. Severe __

12D. In the past year, were you exposed to gas or chemical fumes in your work? — 1. Yes __ 2. No __

12E. Was exposure: — 1. Mild __ 2. Moderate __ 3. Severe __

12F. In the past year, what was your: — 1. Job/occupation? _____ 2. Position/job title? _____

[Sec. 1926.58, Appendix D]

13. RECENT MEDICAL HISTORY

13A. Do you consider yourself to be in good health? Yes ___ No ___

If NO, state reason _____

13B. In the past year, have you developed:

	Yes	No
Epilepsy?	___	___
Rheumatic fever?	___	___
Kidney disease?	___	___
Bladder disease?	___	___
Diabetes?	___	___
Jaundice?	___	___
Cancer?	___	___

14. CHEST COLDS AND CHEST ILLNESSES

14A. If you get a cold, does it usually go to your chest? (Usually means more than 1/2 the time)

1. Yes ___ 2. No ___
3. Don't get colds ___

15A. During the past year, have you had any chest illnesses that have kept you off work, indoors at home, or in bed?

1. Yes ___ 2. No ___
3. Does Not Apply ___

If YES TO 15A:

15B. Did you produce phlegm with any of these chest illnesses?

1. Yes ___ 2. No ___
3. Does Not Apply ___

15C. In the past year, how many such illnesses with (increased) phlegm did you have which lasted a week or more?

Number of illnesses ___
No such illnesses ___

16. RESPIRATORY SYSTEM

In the past year have you had:

	Yes or No	Further Comment on Positive Answers
Asthma	____	
Bronchitis	____	
Hay Fever	____	
Other Allergies	____	
Pneumonia	____	
Tuberculosis	____	
Chest Surgery	____	
Other Lung Problems	____	
Heart Disease	____	

Do you have:

	Yes or No	Further Comment on Positive Answers
Frequent colds	____	
Chronic cough	____	
Shortness of breath when walking or climbing one flight or stairs	____	

Do you:

Wheeze	____	
Cough up phlegm	____	
Smoke cigarettes	____	Packs per day ___ How many years ___

Date _____ Signature _____

Appendix E to § 1926.58—Interpretation and Classification of Chest Roentgenograms—Mandatory

(a) Chest roentgenograms shall be interpreted and classified in accordance with a professionally accepted classification system and recorded on a Roentgenographic Interpretation Form. "Form CSD/NIOSH (M) 2.8.

(b) Chest roentgenograms shall be interpreted and classified only by a B-reader, a board eligible/certified radiologist, or an experienced physician with known expertise in pneumoconioses.

(c) All interpreters, whenever interpreting chest roentgenograms made under this section, shall have immediately available for reference a complete set of the ILO–U/C International Classification of Radiographs for Pneumoconioses, 1980.

Appendix F to 1926.58—Work Practices and Engineering Controls for Major Asbestos Removal, Renovation, and Demolition Operations—Non-Mandatory

This is a non-mandatory appendix designed to provide guidelines to assist employers in complying with the requirements of 29 CFR 1926.58. Specifically, this appendix describes the equipment, methods, and procedures that should be used in major asbestos removal projects conducted to abate a recognized asbestos hazard or in preparation for building renovation or demolition. These projects require the construction of negative-pressure temporary enclosures to contain the asbestos material and to prevent the exposure of bystanders and other employees at the worksite. Paragraph (e)(6) of the standard requires that "... [W]henever feasible, the employer shall establish negative-pressure enclosures before commencing asbestos removal, demolition, or renovation operations." Employers should also be aware that, when conducting asbestos removal projects, they may be required under the National Emissions Standards for Hazardous Air Pollutants (NESHAPS), 40 CFR Part 61, Subpart M, or EPA regulations under the Clear Water Act.

Construction of a negative-pressure enclosure is a simple but time-consuming process that requires careful preparation and execution; however, if the procedures below are followed, contractors should be assured of achieving a temporary barricade that will protect employees and others outside the enclosure from exposure to asbestos and minimize to the extent possible the exposure of asbestos workers inside the barrier as well.

The equipment and materials required to construct these barriers are readily available and easily installed and used. In addition to an enclosure around the removal site, the standard requires employers to provide hygiene facilities that ensure that their asbestos contaminated employees do not leave the work site with asbestos on their persons or clothing; the construction of these facilities is also described below. The steps in the process of preparing the asbestos removal site, building the enclosure, constructing hygiene facilities, removing the asbestos-containing material, and restoring the site include:

(1) Planning the removal project;
(2) Procuring the necessary materials and equipment;
(3) Preparing the work area;
(4) Removing the asbestos-containing material;
(5) Cleaning the work area; and
(6) Disposing of the asbestos-containing waste.

Planning the Removal Project

The planning of an asbestos removal project is critical to completing the project safely and cost-effectively. A written asbestos removal plan should be prepared that describes the equipment and procedures that will be used throughout the project. The asbestos abatement plan will aid not only in executing the project but also in complying with the reporting requirements of the USEPA asbestos regulations (40 CFR 61, Subpart M), which call for specific information such as a description of control methods and control equipment to be used and the disposal sites the contractor proposes to use to dispose of the asbestos containing materials.

The asbestos abatement plan should contain the following information:

- A physical description of the work area;
- A description of the approximate amount of material to be removed;
- A schedule for turning off and sealing existing ventilation systems;
- Personnel hygiene procedures;
- Labeling procedures;
- A description of personal protective equipment and clothing to be worn by employees;
- A description of the local exhaust ventilation systems to be used;
- A description of work practices to be observed by employees;
- A description of the methods to be used to remove the asbestos-containing material;
- The wetting agent to be used;
- A description of the sealant to be used at the end of the project;
- An air monitoring plan;
- A description of the method to be used to transport waste material; and
- The location of the dump site.

Materials and Equipment Necessary for Asbestos Removal

Although individual asbestos removal projects vary in terms of the equipment required to accomplish the removal of the material, some equipment and materials are common to most asbestos removal operations. Equipment and materials that should be available at the beginning of each project are: (1) rolls of polyethylene sheeting; (2) rolls of gray duct tape or clear plastic tape; (3) HEPA filtered vacuum(s); (4) HEPA-filtered portable ventilation system(s); (5) a wetting agent; (6) an airless sprayer; (7) a portable shower unit; (8) appropriate respirators; (9) disposable coveralls; (10) signs and labels; (11) pre-printed disposal bags; and (12) a manometer or pressure gauge.

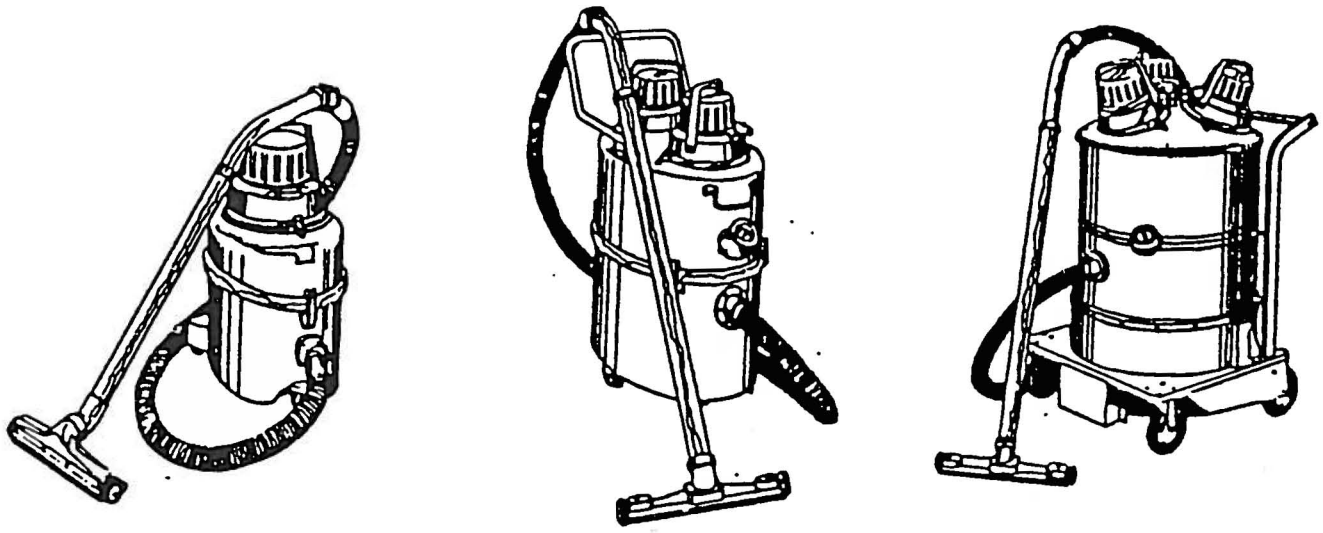
Rolls of Polyethylene Plastic and Tape. Rolls of polyethylene plastic (6 mil in thickness) should be available to construct the asbestos removal enclosure and to seal windows, doors, ventilation systems, wall penetrations, and ceilings and floors in the work area. Gray duct tape or clear plastic tape should be used to seal the edges of the plastic and to seal any holes in the plastic enclosure. Polyethylene plastic sheeting can be purchased in rolls up to 12–20 feet in width and up to 100 feet in length.

HEPA-Filtered Vacuum. A HEPA-filtered vacuum is essential for cleaning the work area after the asbestos has been removed. Such vacuums are designed to be used with a HEPA (High Efficiency Particulate Air) filter, which is capable of removing 99.97 percent of the asbestos particles from the air. Various sizes and capacities of HEPA vacuums are available. One manufacturer, Nilfisk of America, Inc.*, produces three models that range in capacity from 5.25 gallons to 17 gallons (see Figure F–1). All of these models are portable, and all have long hoses capable of reaching out-of-the-way places, such as areas above ceiling tiles, behind pipes, etc.

Exhaust Air Filtration System. A portable ventilation system is necessary to create a negative pressure within the asbestos removal enclosure. Such units are equipped with a HEPA filter and are designed to exhaust and clean the air inside the enclosure before exhausting it to the outside of the enclosure (See Figure F–2). Systems are available from several manufacturers. One supplier, Micro-Trap, Inc.,* has two ventilation units that range in capacity from 600 cubic feet per minute (CFM) to 1,700 CFM. According to the manufacturer's literature, Micro-Trap * units filter particles of 0.3 micron in size with an efficiency of 99.99 percent. The number and capacity of units required to ventilate an enclosure depend on the size of the area to be ventilated.

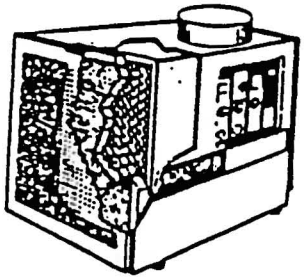
* Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

[Sec. 1926.58, Appendix F]



Source: Product Catalog, Asbestos Control Technologies, Inc., Maple Shade, N.J., 1986.

Figure F-1. HEPA Filtered Vacuums



Source: Product Catalog, Asbestos Control Technologies, Inc., Maple Shade, N.J., 1986.

Figure F-2. Portable Exhaust Ventilation System with HEPA Filter

Wetting Agents. Wetting agents (surfactants) are added to water (which is then called amended water) and used to soak asbestos-containing materials; amended water penetrates more effectively than plain water and permits more thorough soaking of the asbestos-containing materials. Wetting the asbestos-containing material reduces the number of fibers that will break free and become airborne when the asbestos-containing material is handled or otherwise disturbed. Asbestos-containing materials should be thoroughly soaked before removal is attempted; the dislodged material should feel spongy to the touch. Wetting agents are generally prepared by mixing 1 to 3 ounces of wetting agent to 5 gallons of water.

One type of asbestos, amosite, is relatively resistant to soaking, either with plain or amended water. The work practices of choice when working with amosite containing material are to soak the material as much as possible and then to bag it for disposal immediately after removal, so that the material has no time to dry and be ground into smaller particles that are more likely to liberate airborne asbestos.

In a very limited number of situations, it may not be possible to wet the asbestos-containing material before removing it. Examples of such rare situations are: (1) Removal of asbestos material from a "live" electrical box that was oversprayed with the material when the rest of the area was sprayed with asbestos-containing coating; and (2) removing asbestos-containing insulation from a live steam pipe. In both of these situations, the preferred approach would be to turn off the electricity or steam, respectively, to permit wet removal methods to be used. However, where removal work must be performed during working hours, i.e., when normal operations cannot be disrupted, the asbestos-containing material must be removed dry. Immediate bagging is then the only method of minimizing the amount of airborne asbestos generated.

Airless Sprayer. Airless sprayers are used to apply amended water to asbestos-containing materials. Airless sprayers allow the amended water to be applied in a fine spray that minimizes the release of asbestos fibers by reducing the impact of the spray on the material to be removed. Airless sprayers are inexpensive and readily available.

Portable Shower. Unless the site has available a permanent shower facility that is contiguous to the removal area, a portable shower system is necessary to permit employees to clean themselves after exposure to asbestos and to remove any asbestos contamination from their hair and bodies. Taking a shower prevents employees from leaving the work area with asbestos on their clothes and thus prevents the spread of asbestos contamination to areas outside the asbestos removal area. This measure also protects members of the families of asbestos workers from possible exposure to asbestos. Showers should be supplied with warm water and a drain. A shower water filtration system to filter asbestos fibers from the shower water is recommended. Portable shower units are readily available, inexpensive, and easy to install and transport.

Respirators. Employees involved in asbestos removal projects should be provided with appropriate NIOSH-approved respirators. Selection of the appropriate respirator should be based on the concentration of asbestos fibers in the work area. If the concentration of asbestos fibers is unknown, employees should be provided with respirators that will provide protection against the highest concentration of asbestos fibers that can reasonably be expected to exist in the work area. For most work within an enclosure, employees should wear half-mask dual-filter cartridge respirators. Disposable face mask respirators (single-use) should not be used to protect employers from exposure to asbestos fibers.

Disposable Coveralls. Employees involved in asbestos removal operations should be provided with disposable impervious coveralls that are equipped with head and foot covers. Such coveralls are typically made of Tyvek.[1] The coverall has a zipper front and elastic wrists and ankles.

Signs and Labels. Before work begins, a supply of signs to demarcate the entrance to the work area should be obtained. Signs are available that have the wording required by the final OSHA standard. The required labels are also commercially available as press-on labels and pre-printed on the 6-mil polyethylene plastic bags used to dispose of asbestos-containing waste material.

Preparing the Work Area

Preparation for constructing negative-pressure enclosures should begin with the removal of all movable objects from the work

[1] Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

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area, e.g., desks, chairs, rugs, and light fixtures, to ensure that these objects do not become contaminated with asbestos. When movable objects are contaminated or are suspected of being contaminated, they should be vacuumed with a HEPA vacuum and cleaned with amended water, unless they are made of material that will be damaged by the wetting agent; wiping with plain water is recommend in those cases where amended water will damage the object. Before the asbestos removal work begins, objects that cannot be removed from the work area should be covered with a 6-mil-thick polyethylene plastic sheeting that is securely taped with duct tape or plastic tape to achieve an air-tight seal around the object.

Constructing the Enclosure

When all objects have either been removed from the work area or covered with plastic, all penetrations of the floor, walls, and ceiling should be sealed with 6-mil polyethylene plastic and tape to prevent airborne asbestos from escaping into areas outside the work area of from lodging in cracks around the penetrations. Penetrations that require sealing are typically found around electrical conduits, telephone wires, and water supply and drain pipes. A single entrance to be used for access and egress to the work area should be selected, and all other doors and windows should be sealed with tape or be covered with 6-mil polyethylene plastic sheeting and securely taped. Covering windows and unnecessary doors with a layer of polyethylene before covering the walls provides a second layer of protection and saves time in installation because it reduces the number of edges that must be cut and taped. All other surfaces such as support columns, ledges, pipes, and other surfaces should also be covered with polyethylene plastic sheeting and taped before the walls themselves are completely covered with sheeting.

Next a thin layer of spray adhesive should be sprayed along the top of all walls surrounding the enclosed work area, close to the wall-ceiling interface, and a layer of polyethylene plastic sheeting should be stuck to this adhesive and taped. The entire inside surfaces of all wall areas are covered in this manner, and the sheeting over the walls is extended across the floor area until it meets in the center of the area, where it is taped to form a single layer of material encasing the entire room except for the ceiling. A final layer of plastic sheeting is then laid across the plastic-covered floor area and up the walls to a level of 2 feet or so; this layer provides a second protective layer of plastic sheeting over the floor, which can then be removed and disposed of easily after the asbestos-containing material that has dropped to the floor has been bagged and removed.

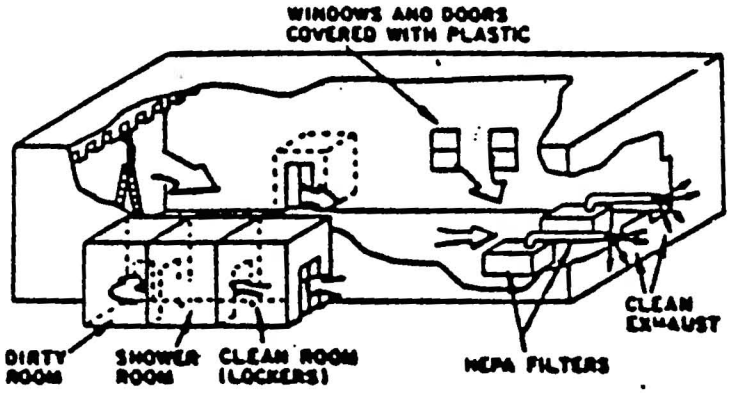
Building Hygiene Facilities

Paragraph (j) of the final standard mandates that employers involved in asbestos removal, demolition, or renovation operations provide their employees with hygiene facilities to be used to decontaminate asbestos-exposed workers, equipment, and clothing before such employees leave the work area. These decontamination facilities consist of:

(1) A clean change room;
(2) A shower; and
(3) An equipment room.

The clean change room is an area in which employees remove their street clothes and don their respirators and disposable protective clothing. The clean room should have hooks on the wall or be equipped with lockers for the storage of workers' clothing and personal articles. Extra disposable coveralls and towels can also be stored in the clean change room.

The shower should be contiguous with both the clean and dirty change room (see Figure F-3) and should be used by all workers leaving the work area. The shower should also be used to clean asbestos-contaminated equipment and materials, such as the outsides of asbestos waste bags and hand tools used in the removal process.



Source: EPA 1985. Asbestos Waste Management Guidance (EPA/530-SW-85-027).

Figure F-3. Gateway View of Enclosure and Hygiene Facilities

The equipment room (also called the dirty change room) is the area where workers remove their protective coveralls and where equipment that is to be used in the work area can be stored. The equipment room should be lined with 6-mil-thick polyethylene plastic sheeting in the same way as was done in the work area enclosure. Two layers of 6-mil polyethylene plastic sheeting that are not taped together from a double flap or barrier between the equipment room and the work area and between the shower and the clean change room (see Figure F-4).

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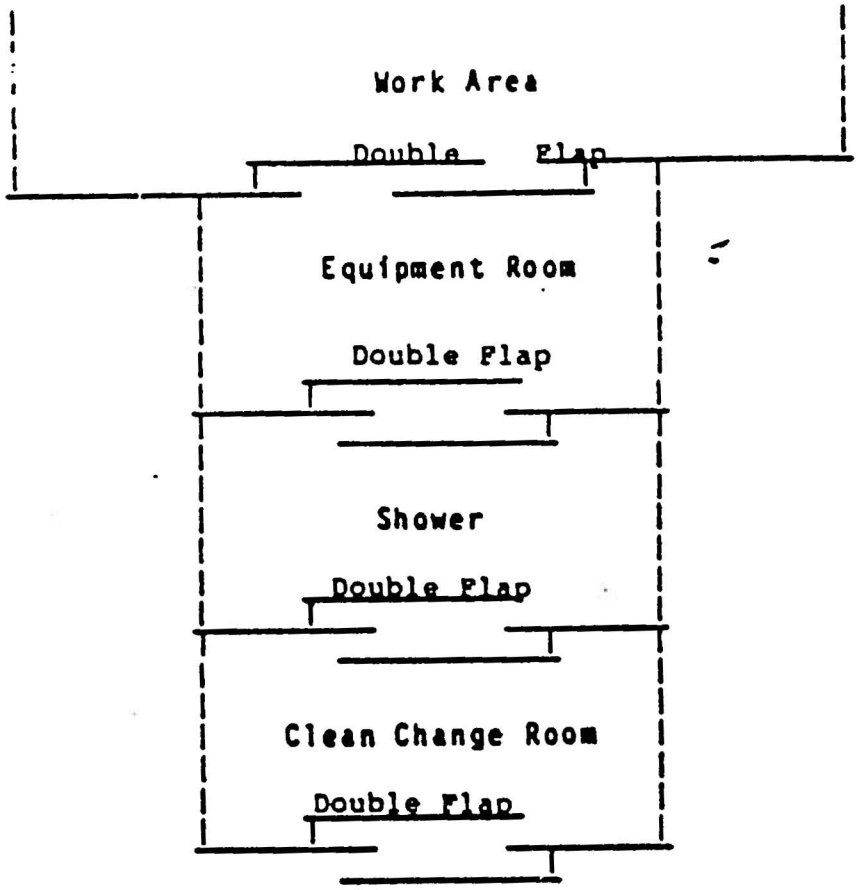

Figure F-4. Typical Hygiene Facility Layout

When feasible, the clean change room, shower, and equipment room should be contiguous and adjacent to the negative-pressure enclosure surrounding the removal area. In the overwhelming number of cases, hygiene facilities can be built contiguous to the negative-pressure enclosure. In some cases, however, hygiene facilities may have to be located on another floor of the building where removal of asbestos-containing materials is taking place. In these instances, the hygiene facilities can in effect be made to be contiguous to the work area by constructing a polythylene plastic "tunnel" from the work area to the hygiene facilities. Such a tunnel can be made even in cases where the hygiene facilities are located several floors above or below the work area; the tunnel begins with a double flap door at the enclosure, extends through the exit from the floor, continues down the necessary number of flights of stairs and goes through a double-flap entrance to the hygiene facilities, which have been prepared as described above. The tunnel is constructed of 2-inch by 4-inch lumber or aluminum struts and covered with 6-mil-thick polyethylene plastic sheeting.

In the rare instances when there is not enough space to permit any hygiene facilities to be built at the work site, employees should be directed to change into a clean disposable worksuit immediately after exiting the enclosure (without removing their respirators) and to proceed immediately to the shower. Alternatively, employees could be directed to vacuum their disposable coveralls with a HEPA-filtered vacuum before proceeding to a shower located a distance from the enclosure.

The clean room, shower, and equipment room must be sealed completely to ensure that the sole source of air flow through these areas originates from uncontaminated areas outside the asbestos removal, demolition, or renovation enclosure. The shower must be drained properly after each use to ensure that contaminated water is not released to uncontaminated areas. If waste water is inadvertently released, it should be cleaned up as soon as possible to prevent any asbestos in the water from drying and becoming airborne in areas outside the work area.

Establishing Negative Pressure Within the Enclosure

After construction of the enclosure is completed, a ventilation system(s) should be installed to create a negative pressure within the enclosure with respect to the area outside the enclosure. Such ventilation systems must be equipped with HEPA filters to prevent the release of asbestos fibers to the environment outside the enclosure and should be operated 24 hours per day during the entire project until the final cleanup is completed and the results of final air samples are received from the laboratory. A sufficient amount of air should be exhausted to create a pressure of −0.02 inches of water within the enclosure with respect to the area outside the enclosure.

These ventilation systems should exhaust the HEPA-filtered clean air outside the building in which the asbestos removal, demolition, or renovation is taking place (see Figure F-6). If access to the outside is not available, the ventilation system can exhaust the HEPA-filtered asbestos-free air to an area within the building that is as far away as possible from the enclosure. Care should be taken to ensure that the clean air is released either to an asbestos-free area or in such a way as not to disturb any asbestos-containing materials.

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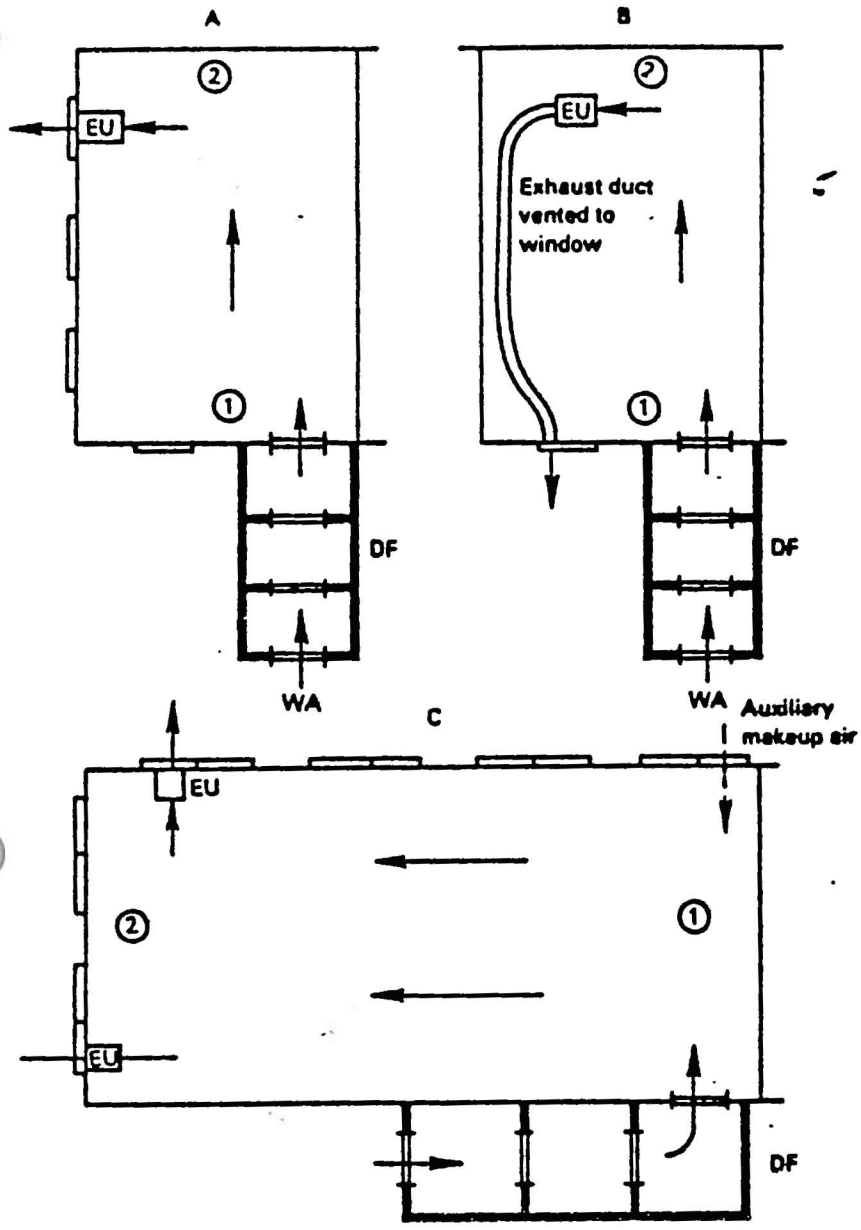

Source: EPA 1985. Guidance for Controlling Asbestos-Containing materials in Buildings (EPA 560/5-85-024).

Figure F-6. Examples of Negative Pressure Systems. DF, Decontamination Facility; EU, Exhaust Unit; WA, Worker Access; A, Single-room work area with multiple windows; B, Single-room work area with single window near entrance; C, Large single-room work area with windows and auxiliary makeup air source (dotted arrow). Arrows denote direction of air flow. Circled numbers indicate progression of removal sequence.

A manometer or pressure gauge for measuring the negative pressure within the enclosure should be installed and should be monitored frequently throughout all work shifts during which asbestos removal, demolition, or renovation takes place. Several types of manometers and pressure gauges are available for this purpose.

All asbestos removal, renovation, and demolition operations should have a program for monitoring the concentration of airborne asbestos and employee exposures to asbestos. Area samples should be collected inside the enclosure (approximately four samples for 5000 square feet of enclosure area). At least two samples should be collected outside the work area, one at the entrance to the clean change room and one at the exhaust of the portable ventilation system. In addition, several breathing zone samples should be collected from those workers who can reasonably be expected to have the highest potential exposure to asbestos.

Removing Asbestos Materials

Paragraph (e)(6)(ii) requires that employers involved in asbestos removal, demolition, or renovation operations designate a competent person to:

(1) Set up the enclosure;
(2) Ensure the integrity of the enclosure;
(3) Control entry to and exit from the enclosure;
(4) Supervise all employee exposure monitoring required by this section;
(5) Ensure the use of protective clothing and equipment;
(6) Ensure that employees are trained in the use of engineering controls, work practices, and personal protective equipment;
(7) Ensure the use of hygiene facilities and the observance of proper decontamination procedures; and
(8) Ensure that engineering controls are functioning properly.

The competent person will generally be a Certified Industrial Hygienist, an industrial hygienist with training and experience in the handling of asbestos, or a person who has such training and experience as a result of on-the-job training and experience.

Ensuring the integrity of the enclosure is accomplished by inspecting the enclosure before asbestos removal work begins and prior to each work shift throughout the entire period work is being conducted in the enclosure. The inspection should be conducted by locating all areas where air might escape from the enclosure; this is best accomplished by running a hand over all seams in the plastic enclosure to ensure that no seams are ripped and the tape is securely in place.

The competent person should also ensure that all unauthorized personnel do not enter the enclosure and that all employees and other personnel who enter the enclosure have the proper protective clothing and equipment. He or she should also ensure that all employees and other personnel who enter the enclosure use the hygiene facilities and observe the proper decontamination procedures (described below).

Proper work practices are necessary during asbestos removal, demolition, and renovation to ensure that the concentration of asbestos fibers inside the enclosure remains as low as possible. One of the most important work practices is to wet the asbestos-containing material before it is disturbed. After the asbestos-containing material is thoroughly wetted, it should be removed by scraping (as in the case of sprayed-on or troweled-on ceiling material) or removed by cutting the metal bands or wire mesh that support the asbestos-containing material on boilers or pipes. Any residue that remains on the surface of the object from which asbestos is being removed should be wire brushed and wet wiped.

Bagging asbestos waste material promptly after its removal is another work practice control that is effective in reducing the airborne concentration of asbestos within the

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- Appropriate work practices are used;
- Necessary protective clothing and equipment are used; and
- Appropriate decontamination procedures are being followed.

Cleaning the Work Area

After all of the asbestos-containing material is removed and bagged, the entire work area should be cleaned until it is free of all visible asbestos dust. All surfaces from which asbestos has been removed should be cleaned by wire brushing the surfaces, HEPA vacuuming these surfaces, and wiping them with amended water. The inside of the plastic enclosure should be vacuumed with a HEPA vacuum and wet wiped until there is no visible dust in the enclosure. Particular attention should be given to small horizontal surfaces such as pipes, electrical conduits, lights, and support tracks for drop ceilings. All such surfaces should be free of visible dust before the final air samples are collected.

Additional sampling should be conducted inside the enclosure after the cleanup of the work area has been completed. Approximately four area samples should be collected for each 5000 square feet of enclosure area. The enclosure should not be dismantled unless the final samples show asbestos concentrations of less than the final standard's action level. EPA recommends that a clearance level of 0.01 f/cc be achieved before cleanup is considered complete.

A clearance checklist is an effective method of ensuring that all surfaces are adequately cleaned and the enclosure is ready to be dismantled. Figure F-7 shows a checklist that can be used during the final inspection phase of asbestos abatement, removal, or renovation operations.

Final Inspection of Asbestos Removal, Renovation, and Demolition Projects

Date: _____
Project: _____
Location: _____
Building: _____

CHECKLIST:

Residual dust on:	Yes	No		Yes	No
a. Floor	____	____	e. Horizontal surfaces	____	____
b. Horizontal surfaces	____	____	f. Pipes	____	____
c. Pipes	____	____	g. Ducts	____	____
d. Ventilation equipment	____	____	h. Register	____	____
			i. Lights	____	____

FIELD NOTES:
Record any problems encountered here.

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

FINAL AIR SAMPLE RESULTS: _____
_____
_____

Figure F-7. Clearance Checklist

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enclosure. Whenever possible, the asbestos should be removed and placed directly into bags for disposal rather than dropping the material to the floor and picking up all of the material when the removal is complete. If a significant amount of time elapses between the time that the material is removed and the time it is bagged, the asbestos material is likely to dry out and generate asbestos-laden dust when it is disturbed by people working within the enclosure. Any asbestos-contaminated supplies and equipment that cannot be decontaminated should be disposed of in pre-labeled bags; items in this category include plastic sheeting, disposable work clothing, respirator cartridges, and contaminated wash water.

A checklist is one of the most effective methods of ensuring adequate surveillance of the integrity of the asbestos removal enclosure. Such a checklist is shown in Figure F-6. Filling out the checklist at the beginning of each shift in which asbestos removal is being performed will serve to document that all the necessary precautions will be taken during the asbestos removal work. The checklist contains entries for ensuring that:

- The work area enclosure is complete;
- The negative-pressure system is in operation;
- Necessary signs and labels are used;

Asbestos Removal, Renovation, and Demolition Checklist

Date: _____ Location: _____

Supervisor _____ Project # _____

Work Area (sq. ft.) _____

		Yes	No
I.	Work site barrier		
	Floor covered	____	____
	Walls covered	____	____
	Area ventilation off	____	____
	All edges sealed	____	____
	Penetrations sealed	____	____
	Entry curtains	____	____
II.	Negative Air Pressure		
	HEPA Vac _____ Ventilation system _____		
	Constant operation	____	____
	Negative pressure achieved	____	____
III.	Signs		
	Work area entrance	____	____
	Bags labeled	____	____
IV.	Work Practices		
	Removed material promptly bagged	____	____
	Material worked wet	____	____
	HEPA vacuum used	____	____
	No smoking	____	____
	No eating, drinking	____	____
	Work area cleaned after completion	____	____
	Personnel decontaminated each departure	____	____
V.	Protective Equipment		
	Disposable clothing used one time	____	____
	Proper NIOSH-approved respirators	____	____
VII.	Showers		
	On site	____	____
	Functioning	____	____
	Soap and towels	____	____
	Used by all personnel	____	____

Figure F-6. Checklist

[Sec. 1926.58, Appendix F]

Appendix G to § 1926.58—Work Practices and Engineering Controls for Small-Scale, Short-Duration Asbestos Renovation and Maintenance Activities—Non-Mandatory

This appendix is not mandatory. In that construction industry employers may choose to comply with all of the requirements of OSHA's final rule for occupational exposure to asbestos in the construction industry, § 1926.58. However, employers wishing to be exempted from the requirements of paragraphs (e)(6) and (f)(2)(ii)(*B*) of § 1926.58 shall comply with the provisions of this appendix when performing small-scale, short-duration renovation or maintenance activities. OSHA anticipates that employers in the electrical, carpentry, utility, plumbing, and interior construction trades may wish to avail themselves of the final standard's exemptions for small-scale, short-duration renovation and maintenance operations.

Definition of Small-Scale, Short-Duration Activities

For the purposes of this appendix, small-scale, short-duration renovation and maintenance activities are tasks such as, but not limited to:

- Removal of asbestos-containing insulation on pipes;
- Removal of small quantities of asbestos-containing insulation on beams or above ceilings;
- Replacement of an asbestos-containing gasket on a valve;
- Installation or removal of a small section of drywall;
- Installation of electrical conduits through or proximate to asbestos-containing materials.

Evidence in the record (see the Summary and Explanation section of the preamble for paragraph (g), Methods of Compliance, for specific citations) suggests that the use of certain engineering and work practice controls is capable of reducing employee exposures to asbestos to levels below the final standard's action level (0.1 f/cc). Several controls and work practices, used either singly or in combination, can be employed effectively to reduce asbestos exposures during small maintenance and renovation operations. These include:

- Wet methods;
- Removal methods
  - —Use of Glove bags
  - —Removal of entire asbestos insulated pipes or structures
  - —Use of mini-enclosures
- Enclosure of asbestos materials; and
- Maintenance programs.

This appendix describes these controls and work practices in detail.

Preparation of the Area Before Renovation or Maintenance Activities

The first step in preparing to perform a small-scale, short-duration asbestos renovation or maintenance task, regardless of the abatement method that will be used, is the removal from the work area of all objects that are movable to protect them from asbestos contamination. Objects that cannot be removed must be covered completely with a 6-mil-thick polyethylene plastic sheeting before the task begins. If objects have already been contaminated, they should be thoroughly cleaned with a High Efficiency Particulate Air [(HEPA] filtered vacuum or be wet wiped before they are removed from the work area or completely encased in the plastic.

Wet Methods

Whenever feasible, and regardless of the abatement method to be used (e.g., removal, enclosure, use of glove bags), wet methods must be used during small-scale, short duration maintenance and renovation activities that involve disturbing asbestos-containing materials. Handling asbestos materials wet is one of the most reliable methods of ensuring that asbestos fibers do not become airborne, and this practice should therefore be used whenever feasible. As discussed in the Summary and Explanation section of the preamble for paragraph (g), Methods of Compliance, wet methods can be used in the great majority of workplace situations. Only in cases where asbestos work must be performed on live electrical equipment, on live steam lines, or in other areas where water will seriously damage materials or equipment may dry removal be performed. Amended water or another wetting agent should be applied by means of an airless sprayer to minimize the extent to which the asbestos-containing material is disturbed.

Asbestos-containing materials should be wetted from the initiation of the maintenance or renovation operation and wetting agents should be used continually throughout the work period to ensure that any dry asbestos-containing material exposed in the course of the work is wet and remains wet until final disposal.

Removal of Small Amount of Asbestos-Containing Materials

Several methods can be used to remove small amounts of asbestos-containing materials during small-scale, short-duration renovation or maintenance tasks. These include the use of glove bags, the removal of an entire asbestos-covered pipe or structure, and the construction of mini-enclosures. The procedures that employers must use for each of these operations if they wish to avail themselves of the final rule's exemptions are described in the following sections.

Glove Bags

As discussed in the Summary and Explanation section of the preamble for paragraph (g), Methods of Compliance, evidence in the record indicate that the use of glove bags to enclose the work area during small-scale, short-duration maintenance or renovation activities will result in employee exposures to asbestos that are below the final standard's action level of 0.1 f/cc. This appendix provides requirements for glove-bag procedures to be followed by employers wishing to avail themselves of the standard's exemptions for such activities. OSHA has determined that the use of these procedures will reduce the 8 hour time weighted average (TWA) exposures of employees involved in these work operations to levels below the action level and will thus provide a degree of employee protection equivalent to that provided by compliance with all provisions of the final rule.

Glove Bag Installation. Glove bags are approximately 40-inch-wide times 64-inch-long bags fitted with arms through which the work can be performed (see Figure G-1(A)). When properly installed and used, they permit workers to repair completely isolated from the asbestos material removed or replaced inside the bag. Glove bags can thus provide a flexible, easily installed, and quickly dismantled temporary small work area enclosure that is ideal for small-scale asbestos renovation or maintenance jobs.

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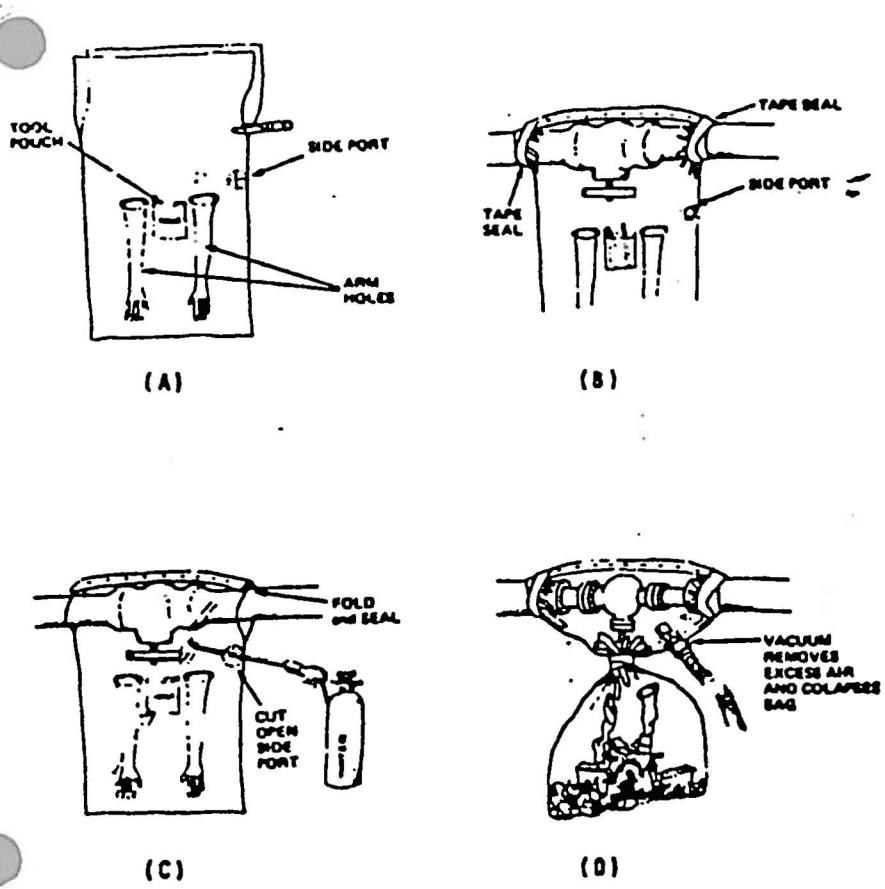

Figure G–1. Diagrams Showing Proper Use of Glove Bags in Small-Scale, Short-Duration Maintenance and Renovation Operations.

These bags are single use control devices that are disposed of at the end of each job. The bags are made of transparent 6-mil-thick polyethylene plastic with arms of Tyvek * material (the same material used to make the disposable protective suits used in major asbestos removal, renovation, and demolition operations and in protective gloves). Glove bags are readily available from safety supply stores or specialty asbestos removal supply houses. Glove bags come pre-labeled with the asbestos warning label prescribed by OSHA and EPA for bags used to dispose of asbestos waste.

Glove Bag Equipment and Supplies. Supplies and materials that are necessary to use glove bags effectively include:

(1) Tape to seal the glove bag to the area from which abebestos is to be removed;

(2) Amended water or other wetting agents;

(3) An airless sprayer for the application of the wetting agent;

(4) Bridging encapsulant (a paste-like substance for coating asbestos) to seal the rough edges of any asbestos-containing materials that remain within the glove bag at the points of attachment after the rest of the asbestos has be removed;

(5) Tools such as razor knives, nips, and wire brushes (or other tools suitable for cutting wire, etc.);

(6) A HEPA filter-equipped vacuum for evacuating the glove bag (to minimize the release of asbestos fibers) during removal of the bag from the work area and for cleaning any material that may have escaped during the installation of the glove bag; and

(7) HEPA-equipped dust cartridge respirators for use by the employees involved in the removal of asbestos with the glove bag.

Glove Bag Work Practices. The proper use of glove bags requires the following steps:

(1) Glove bags must be installed so that they completely cover the pipe or other structure where asbestos work is to be done. Glove bags are installed by cutting the sides of the glove bag to fit the size of the pipe from which asbestos is to be removed. The glove bag is attached to the pipe by folding the open edges together and securely sealing them with tape. All openings in the glove bag must be sealed with duct tape or equivalent material. The bottom seam of the glove bag must also be sealed with duct tape or equivalent to prevent any leakage from the bag that may result from a defect in the bottom seam (Figure G–1(B)).

(2) The employee who is performing the asbestos removal with the glove bag must don a half mask dual-cartridge HEPA-equipped respirator; respirators should be worn by employees who are in close contact with the glove bag and who may thus be exposed as a result of small gaps in the seams of the bag or holes punched through the bag by a razor knife or a piece of wire mesh.

(3) The removed asbestos material from the pipe or other surface that has fallen into the enclosed bag must be thoroughly wetted with a wetting agent (applied with an airless sprayer through the pre-cut port provided in most gloves bags or applied through a small hole cut in the bag) (Figure G–1(C)).

(4) Once the asbestos material has been thoroughly wetted, it can be removed from the pipe, beam or other surface. The choice of tool to use to remove the asbestos-containing material depends on the type of material to be removed. Asbestos-containing materials are generally covered with painted canvas and/or wire mesh. Painted canvas can be cut with a razor knife and peeled away from the asbestos-containing material underneath. Once the canvas has been peeled away, the asbestos-containing material underneath may be dry, in which case it should be re-sprayed with a wetting agent to ensure that it generates as little dust as possible when removed. If the asbestos-containing material is covered with wire mesh, the mesh should be cut with nips, tin snips, or other appropriate tool and removed.

A wetting agent must then be used to spray any layer of dry material that is exposed beneath the mesh, the surface of the stripped underlying structure, and the inside of the glove bag.

(5) After removal of the layer of asbestos-containing material, the pipe or surface from which asbestos has been removed must be thoroughly cleaned with a wire brush and wet wiped with a wetting agent until no traces of the asbestos containing material can be seen.

(6) Any asbestos containing insulation edges that have been exposed as a result of the removal or maintenance activity must be encapsulated with bridging encapsulant to ensure that the edges do not release asbestos fibers to the atmosphere after the glove bag has been removed.

(7) When the asbestos removal and encapsulation have been completed, a vacuum hose from a HEPA filtered vacuum must be inserted into the glove bag through the port to remove any air in the bag that may contain asbestos fibers. When the air has been removed from the bag, the bag should be squeezed tightly (as close to the top as possible), twisted, and sealed with tape, to keep the asbestos materials safely in the bottom of the bag. The HEPA vacuum can

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* Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

then be removed from the bag and the glove bag itself can be removed from the work area to be disposed of properly (Figure C–1(D)).

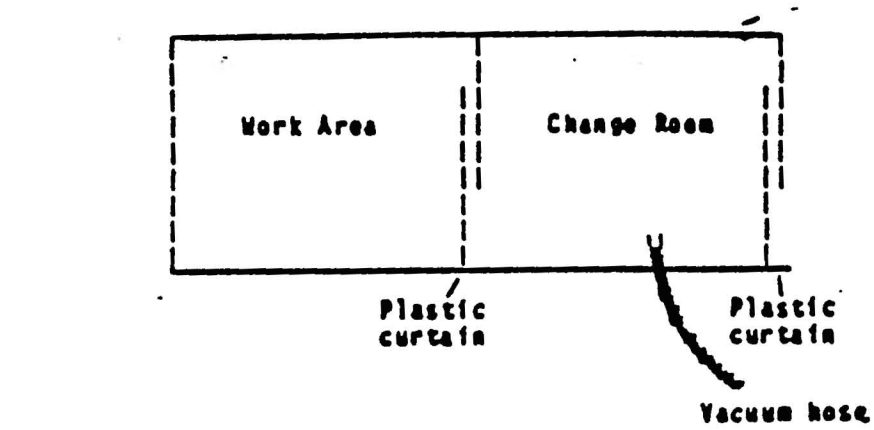

Figure C–2. Schematic of Mini-enclosure

Mini-Enclosures

In some instances, such as removal of asbestos from a small ventilation system or from a short length of duct, a glove bag may not be either large enough or of the proper shape to enclose the work area. In such cases, a mini-enclosure can be built around the area where small-scale, short-duration asbestos maintenance or renovation work is to be performed (Figure C–2). Such an enclosure should be constructed of 6-mil-thick polyethylene plastic sheeting and can be small enough to restrict entry to the asbestos work area to one worker.

For example, a mini-enclosure can be built in a small utility closet when asbestos-containing duct covering is to be removed. The enclosure is constructed by:

(1) Affixing plastic sheeting to the walls with spray adhesive and tape;

(2) Covering the floor with plastic and sealing the plastic covering the floor to the plastic on the walls.

(3) Sealing any penetrations such as pipes or electrical conduits with tape; and

(4) Constructing a small change room (approximately 3 feet square) made of 6-mil-thick polyethylene plastic supported by 2-inch by 4-inch lumber (the plastic should be attached to the lumber supports with staples or spray adhesive and tape).

The change room should be contiguous to the mini enclosure, and is necessary to allow the worker to vacuum off his protective coveralls and remove them before leaving the work area. While inside the enclosure, the worker should wear Tyvek[1] disposable coveralls and use the appropriate (EPA filtered dual cartridge respiratory protection.

The advantages of mini-enclosures are that they limit the spread of asbestos contamination, reduce the potential exposure of bystanders and other workers who may be working in adjacent areas, and are quick and easy to install. The disadvantage of mini-enclosures is that they may be too small to contain the equipment necessary to create a negative pressure within the enclosure; however, the double layer of plastic sheeting will serve to restrict the release of asbestos fibers to the area outside the enclosure.

Removal of Entire Structures

When pipes are insulated with asbestos-containing materials, removal of the entire pipe may be more protective, easier, and more cost-effective than stripping the asbestos insulation from the pipe. Before such a pipe is cut, the asbestos-containing insulation must be wrapped with 6-mil polyethylene plastic and securely sealed with duct tape or equivalent. This plastic covering will prevent asbestos fibers from becoming airborne as a result of the vibration created by the power saws used to cut the pipe. If possible, the pipes should be cut at locations that are not insulated to avoid disturbing the asbestos. If a pipe is completely insulated with asbestos-containing materials, small sections should be stripped using the glove-bag method described above before the pipe is cut at the stripped sections.

Enclosure

The decision to enclose rather than remove asbestos-containing material from an area depends on the building owner's preference, i.e., for removal or containment. Owners consider such factors as cost effectiveness, the physical configuration of the work area, and the amount of traffic in the area when determining which abatement method to use.

If the owner chooses to enclose the structure rather than to remove the asbestos-containing material insulating it, a solid structure (airtight walls and ceilings) must be built around the asbestos covered pipe or structure to prevent the release of asbestos-containing materials into the area beyond the enclosure and to prevent disturbing these

[1] Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

[Sec. 1926.58, Appendix G]

materials by casual contact during future maintenance operations.

Such a permanent [i.e., for the life of the building] enclosure should be built of new construction materials and should be impact resistant and airtight. Enclosure walls should be made of tongue-and-groove boards, boards with spine joints, or gypsum boards having taped seams. The underlying structure must be able to support the weight of the enclosure. [Suspended ceilings with laid in panels do not provide airtight enclosures and should not be used to enclose structures covered with asbestos-containing materials.] All joints between the walls and ceiling of the enclosure should be caulked to prevent the escape of asbestos fibers. During the installation of enclosures, tools that are used [such as drills or rivet tools] should be equipped with HEPA-filtered vacuums. Before constructing the enclosure, all electrical conduits, telephone lines, recessed lights, and pipes in the area to be enclosed should be moved to ensure that the enclosure will not have to be re-opened later for routine or emergency maintenance. If such lights or other equipment cannot be moved to a new location for logistic reasons, or if moving them will disturb the asbestos-containing materials, removal rather than enclosure of the asbestos-containing materials is the appropriate control method to use.

Maintenance Program

An asbestos maintenance program must be initiated in all facilities that have asbestos-containing materials. Such a program should include:

- Development of an inventory of all asbestos-containing materials in the facility;
- Periodic examination of all asbestos-containing materials to detect deterioration;
- Written procedures for handling asbestos materials during the performance of small-scale, short-duration maintenance and renovation activities;
- Written procedures for asbestos disposal; and
- Written procedures for dealing with asbestos-related emergencies.

Members of the building's maintenance engineering staff [electricians, heating/air conditioning engineers, plumbers, etc.] who may be required to handle asbestos-containing materials should be trained in safe procedures. Such training should include at a minimum:

- Information regarding types of asbestos and its various uses and forms;
- Information on the health effects associated with asbestos exposure;
- Descriptions of the proper methods of handling asbestos-containing materials; and
- Information on the use of HEPA-equipped dual cartridge respiratory and other personal protection during maintenance activities.

Prohibited Activities

The training program for the maintenance engineering staff should describe methods of handling asbestos-containing materials as well as routine maintenance activities that are prohibited when asbestos-containing materials are involved. For example, maintenance staff employees should be instructed:

- *Not* to drill holes in asbestos-containing materials;
- *Not* to hang plants or pictures on structures covered with asbestos-containing materials;
- *Not* to sand asbestos-containing floor tile;
- *Not* to damage asbestos-containing materials while moving furniture or other objects;
- *Not* to install curtains, drapes, or dividers in such a way that they damage asbestos-containing materials;
- *Not* to dust floors, ceilings, moldings or other surfaces in asbestos-contaminated environments with a dry brush or sweep with a dry broom;
- *Not* to use an ordinary vacuum to clean up asbestos-containing debris;
- *Not* to remove ceiling tiles below asbestos-containing materials without wearing the proper respiratory protection, clearing the area of other people, and observing asbestos removal waste disposal procedures;
- *Not* to remove ventilation system filters dry; and
- *Not* to shake ventilation system filters.

Appendix H to § 1926.58—Substance Technical Information for Asbestos, Non-Mandatory

I. Substance Identification

A. Substance: "Asbestos" is the name of a class of magnesium-silicate minerals that occur in fibrous form. Minerals that are included in this group are chrysotile, crocidolite, amosite, anthophyllite asbestos, tremolite asbestos, and actinolite asbestos.

B. Asbestos, tremolite, anthophyllite, and actinolite are used in the manufacture of heat-resistant clothing, automotive brake and clutch linings, and a variety of building materials including floor tiles, roofing felts, ceiling tiles, asbestos-cement pipe and sheet, and fire-resistant drywall. Asbestos, tremolite, anthophyllite and actinolite are also present in pipe and boiler insulation materials, and in sprayed-on materials located on beams, in crawlspaces, and between walls.

C. The potential for an asbestos-containing product to release breathable fibers depends on its degree of friability. Friable means that the material can be crumbled with hand pressure and is therefore likely to emit fibers. The fibrous or fluffy sprayed-on materials used for fireproofing, insulation, or sound proofing are considered to be friable, and they readily release airborne fibers if disturbed. Materials such as vinyl-asbestos floor tile or roofing felts are considered nonfriable and generally do not emit airborne fibers unless subjected to sanding or sawing operations. Asbestos-cement pipe or sheet can emit airborne fibers if the materials are cut or sawed, or if they are broken during demolition operations.

D. Permissible exposure: Exposure to airborne asbestos, tremolite, anthophyllite, and actinolite fibers may not exceed 0.2 fibers per cubic centimeter of air (0.2 f/cc) averaged over the 8-hour workday.

II. Health Hazard Data

A. Asbestos, tremolite, anthophyllite, and actinolite can cause disabling respiratory disease and various types of cancers if the fibers are inhaled. Inhaling or ingesting fibers from contaminated clothing or skin can also result in these diseases. The symptoms of these diseases generally do not appear for 20 or more years after initial exposure.

B. Exposure to asbestos, tremolite, anthophyllite and actinolite has been shown to cause lung cancer, mesothelioma, and cancer of the stomach and colon. Mesothelioma is a rare cancer of the thin membrane lining of the chest and abdomen. Symptoms of mesothelioma include shortness of breath, pain in the walls of the chest, and/or abdominal pain.

III. Respirators and Protective Clothing

A. Respirators: You are required to wear a respirator when performing tasks that result in asbestos, tremolite, anthophyllite and actinolite exposure that exceeds the permissible exposure limit (PEL) of 0.2 f/cc. These conditions can occur while your employer is in the process of installing engineering controls to reduce asbestos, tremolite, anthophyllite and actinolite exposure, or where engineering controls are not feasible to reduce asbestos, tremolite, anthophyllite and actinolite exposure. Air-purifying respirators equipped with a high-efficiency particulate air (HEPA) filter can be used where airborne asbestos, tremolite, anthophyllite and actinolite fiber concentrations do not exceed 2 f/cc; otherwise, air-supplied, positive-pressure, full facepiece respirators must be used. Disposable respirators or dust masks are not permitted to be used for asbestos, tremolite, anthophyllite and actinolite work. For effective protection, respirators must fit your face and head snugly. Your employer is required to conduct fit tests when you are first assigned a respirator and every 6 months thereafter. Respirators should not be loosened or removed in work situations where their use is required.

B. Protective Clothing: You are required to wear protective clothing in work areas where asbestos, tremolite, anthophyllite, and actinolite fiber concentrations exceed the permissible exposure limit (PEL) of 0.2 f/cc to prevent contamination of the skin. Where protective clothing is required, your employer must provide you with clean garments. Unless you are working on a large asbestos, tremolite, anthophyllite, and actinolite removal or demolition project, your employer must also provide a change room and separate lockers for your street clothes and contaminated work clothes. If you are working on a large asbestos, tremolite, anthophyllite, and actinolite removal or demolition project, and where it is feasible to do so, your employer must provide a clean room, shower, and decontamination room contiguous to the work area. When leaving the work area, you must remove contaminated clothing before proceeding to the shower. If the shower is not adjacent to the work area, you must vacuum your clothing before proceeding to change the room and shower. To prevent inhaling fibers in contaminated change rooms and showers, leave your respirator on until you have the shower and enter the clean changeroom.

[Sec. 1926.58, Appendix H]

IV. Disposal Procedures and Cleanup

A. Wastes that are generated by processes where asbestos, tremolite, anthophyllite, and actinolite is present include:

1. Empty asbestos, tremolite, anthophyllite, and actinolite shipping containers.

2. Process wastes such as cuttings, trimmings, or reject materials.

3. Housekeeping waste from sweeping or vacuuming.

4. Asbestos fireproofing or insulating material that is removed from buildings.

5. Asbestos-containing building products removed during building renovation or demolition.

6. Contaminated disposable protective clothing.

B. Empty shipping bags can be flattened under exhaust hoods and packed into airtight containers for disposal. Empty shipping drums are difficult to clean and should be sealed.

C. Vacuum logs or disposable paper filters should not be cleaned, but should be sprayed with a fine water mist and placed into a labeled waste container.

D. Process waste and housekeeping waste should be wetted with water or a mixture of water and surfactant prior to packaging in disposable containers.

E. Asbestos-containing material that is removed from buildings must be disposed of in leak-tight 6-mil thick plastic bags, plastic-lined cardboard containers, or plastic-lined metal containers. These wastes, which are removed while wet, should be sealed in containers before they dry out to minimize the release of asbestos, tremolite, anthophyllite, and actinolite fibers during handling.

V. Access to Information

A. Each year, your employer is required to inform you of the information contained in this standard and appendices for asbestos. In addition, your employer must instruct you in the proper work practices for handling asbestos-containing materials, and the correct use of protective equipment.

B. Your employer is required to determine whether you are being exposed to asbestos. You or your representative has the right to observe employee measurements and to record the results obtained. Your employer is required to inform you of your exposure, and, if you are exposed above the permissible limit, he or she is required to inform you of the actions that are being taken to reduce your exposure to within the permissible limit.

C. Your employer is required to keep records of your exposures and medical examinations. These exposure records must be kept for at least thirty [30] years. Medical records must be kept for the period of your employment plus thirty [30] years.

D. Your employer is required to release your exposure and medical records to your physician or designated representative upon your written request.

Appendix I to § 1926.58—Medical Surveillance Guidelines for Asbestos, Tremolite, Anthophyllite, and Actinolite, Non-Mandatory

I. Route of Entry

Inhalation ingestion.

II. Toxicology

Clinical evidence of the adverse effects associated with exposure to asbestos, tremolite, anthophyllite, and actinolite, is present in the form of several well-conducted epidemiological studies of occupationally exposed workers, family contacts of workers, and persons living near asbestos, tremolite, anthophyllite, and actinolite mines. These studies have shown a definite association between exposure to asbestos, tremolite, anthophyllite, and actinolite and an increased incidence of lung cancer, pleural and peritoneal mesothelioma, gastrointestinal cancer, and asbestosis. The latter is a disabling fibrotic lung disease that is caused only by exposure to asbestos. Exposure to asbestos, tremolite, anthophyllite, and actinolite has also been associated with an increased incidence of esophageal, kidney, laryngeal, pharyngeal, and buccal cavity cancers. As with other known chronic occupational diseases, disease associated with asbestos, tremolite, anthophyllite, and actinolite generally appears about 20 years following the first occurrence of exposure. There are no known acute effects associated with exposure to asbestos, tremolite, anthophyllite, and actinolite.

Epidemiological studies indicate that the risk of lung cancer among exposed workers who smoke cigarettes is greatly increased over the risk of lung cancer among non-exposed smokers or exposed nonsmokers. These studies suggest that cessation of smoking will reduce the risk of lung cancer for a person exposed to asbestos, tremolite, anthophyllite, and actinolite but will not reduce it to the same level of risk as that existing for an exposed worker who has never smoked.

III. Signs and Symptoms of Exposure-Related Disease

The signs and symptoms of lung cancer or gastrointestinal cancer induced by exposure to asbestos, tremolite, anthophyllite, and actinolite are not unique, except that a chest X-ray of an exposed patient with lung cancer may show pleural plaques, pleural calcification, or pleural fibrosis. Symptoms characteristic of mesothelioma include shortness of breath, pain in the walls of the chest, or abdominal pain. Mesothelioma has a much longer latency period compared with lung cancer (40 years versus 15–20 years), and mesothelioma is therefore more likely to be found among workers who were first exposed to asbestos at an early age. Mesothelioma is always fatal.

Asbestosis is pulmonary fibrosis caused by the accumulation of asbestos fibers in the lungs. Symptoms include shortness of breath, coughing, fatigue, and vague feelings of sickness. When the fibrosis worsens, shortness of breath occurs even at rest. The diagnosis of asbestosis is based on a history of exposure to asbestos, the presence of characteristics radiologic changes, end-inspiratory crackles (rales), and other clinical features of fibrosing lung disease. Pleural plaques and thickening are observed on X-rays taken during the early stages of the disease. Asbestosis is often a progressive disease even in the absence of continued exposure, although this appears to be a highly individualized characteristic. In severe cases, death may be caused by respiratory or cardiac failure.

IV. Surveillance and Preventive Considerations

As noted above, exposure to asbestos, tremolite, anthophyllite, and actinolite has been linked to an increased risk of lung cancer, mesothelioma, gastrointestinal cancer, and asbestosis among occupationally exposed workers. Adequate screening tests to determine an employee's potential for developing serious chronic diseases, such as a cancer, from exposure to asbestos, tremolite, anthophyllite, and actinolite do not presently exist. However, some tests, particularly chest X-rays and pulmonary function tests, may indicate that an employee has been overexposed to asbestos, tremolite, anthophyllite, and actinolite, increasing his or her risk of developing exposure related chronic diseases. It is important for the physician to become familiar with the operating conditions in which occupational exposure to asbestos, tremolite, anthophyllite, and actinolite is likely to occur. This is particularly important in evaluating medical and work histories and in conducting physical examinations. When an active employee has been identified as having been overexposed to asbestos, tremolite, anthophyllite, and actinolite, measures taken by the employer to eliminate or mitigate further exposure should also lower the risk of serious long-term consequences.

The employer is required to institute a medical surveillance program for all employees who are or will be exposed to asbestos, tremolite, anthophyllite, and actinolite at or above the action level (0.1 fiber per cubic centimeter of air) for 30 or more days per year and for all employees who are assigned to wear a negative-pressure respirator. All examinations and procedures must be performed by or under the supervision of a licensed physician, at a reasonable time and place, and at no cost to the employee.

Although broad latitude is given to the physician in prescribing specific tests to be included in the medical surveillance program, OSHA requires inclusion of the following elements in the routine examination:

(i) Medical and work histories with special emphasis directed to symptoms of the respiratory system, cardiovascular system, and digestive tract.

(ii) Completion of the respiratory disease questionnaire contained in Appendix D.

(iii) A physical examination including a chest roentgenogram and pulmonary function test that includes measurement of the employee's forced vital capacity (FVC) and forced expiratory volume at one second ($FEV_{1.0}$).

(iv) Any laboratory or other test that the examining physician deems by sound medical practice to be necessary.

The employer is required to make the prescribed tests available at least annually to those employees covered; more often than specified if recommended by the examining physician; and upon termination of employment.

[Sec. 1926.58, Appendix I]

The employer is required to provide the physician with the following information: A copy of this standard and appendices; a description of the employee's duties as they relate to asbestos exposure; the employee's representative level of exposure to asbestos, tremolite, anthophyllite, and actinolite; a description of any personal protective and respiratory equipment used; and information from previous medical examinations of the affected employee that is not otherwise available to the physician. Making this information available to the physician will aid in the evaluation of the employee's health in relation to assigned duties and fitness to wear personal protective equipment, if required.

The employer is required to obtain a written opinion from the examining physician containing the results of the medical examination; the physician's opinion as to whether the employee has any detected medical conditions that would place the employee at an increased risk of exposure-related disease; any recommended limitations on the employee or on the use of personal protective equipment; and a statement that the employee has been informed by the physician of the results of the medical examination and of any medical conditions related to asbestos, tremolite, anthophyllite, and actinolite exposure that require further explanation or treatment. This written opinion must not reveal specific findings or diagnoses unrelated to exposure to asbestos, tremolite, anthophyllite, and actinolite, and a copy of the opinion must be provided to the affected employee.

Subpart E—Personal Protective and Life Saving Equipment [1]

Sec.

1926.100 Head protection.
1926.101 Hearing protection.
1926.102 Eye and face protection.
1926.103 Respiratory protection.
1910.94 Ventilation.
1910.134 Respiratory protection.
1926.104 Safety belts, lifelines, and lanyards.
1926.105 Safety nets.
1926.106 Working over or near water.
1926.107 Definitions applicable to this subpart.

[1] Portions of the listed Part 1910 standards have been identified as applicable to construction.

§ 1926.100 Head protection.

(a) Employees working in areas where there is a possible danger of head injury from impact, or from falling or flying objects, or from electrical shock and burns, shall be protected by protective helmets.

(b) Helmets for the protection of employees against impact and penetration of falling and flying objects shall meet the specifications contained in American National Standards Institute, Z89.1-1969, Safety Requirements for Industrial Head Protection.

(c) Helmets for the head protection of employees exposed to high voltage electrical shock and burns shall meet the specifications contained in American National Standards Institute, Z89.2-1971.

§ 1926.101 Hearing protection.

(a) Wherever it is not feasible to reduce the noise levels or duration of exposures to those specified in Table D-2, Permissible Noise Exposures, in

[Sec. 1926.58, Appendix I]

§1910.1001 ASBESTOS, TREMOLITE, ANTHOPHYLLITE, AND ACTINOLITE.
[Sec. 1910.1001 revised by 51 FR 22733, June 20, 1986]

(a) *Scope and application.* (1) This section applies to all occupational exposures to asbestos, tremolite, anthophyllite, and actinolite, in all industries covered by the Occupational Safety and Health Act, except as provided in paragraph (a)(2) of this section.

(2) This section does not apply to construction work as defined in 29 CFR 1910.12(b). [Exposure to asbestos, tremolite, anthophyllite, and actinolite in construction work is covered by 29 CFR 1926.58.]

(b) *Definitions.* "Action level" means an airborne concentration of asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals, of 0.1 fiber per cubic centimeter (f/cc) of air calculated as an eight (8)—hour time-weighted average.

"Asbestos" includes chrysotile, amosite, crocidolite, tremolite asbestos, anthophyllite asbestos, actinolite asbestos, and any of these minerals that have been chemically treated and/or altered.

"Assistant Secretary" means the Assistant Secretary of Labor for Occupational Safety and Health, U.S. Department of Labor, or designee.

"Authorized person" means any person authorized by the employer and required by work duties to be present in regulated areas.

"Director" means the Director of the National Institute for Occupational Safety and Health, U.S. Department of Health and Human Services, or designee.

"Employee exposure" means that exposure to airborne asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals that would occur if the employee were not using respiratory protective equipment.

"Fiber" means a particulate form of asbestos, tremolite, anthophyllite, or actinolite, 5 micrometers or longer, with a length-to-diameter ratio of at lease 3 to 1.

"High-efficiency particulate air (HEPA) filter" means a filter capable of trapping and retaining at least 99.97 percent of 0.3 micrometer diameter mono-disperse particles.

"Regulated area" means an area established by the employer to demarcate areas where airborne concentrations of asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals exceed, or can reasonably be expected to exceed, the permissible exposure limit.

"Tremolite, anthophyllite, or actinolite" means the non-asbestos form of these minerals, and any of these minerals that have been chemically treated and/or altered.

(c) *Permissible exposure limit (PEL).* The employer shall ensure that no employee is exposed to an airborne concentration of asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals in excess of 0.2 fiber per cubic centimeter of air as an eight (8)-hour time-weighted average (TWA) as determined by the method prescribed in Appendix A of this section, or by an equivalent method

(d) *Exposure monitoring.*—(1) *General.* (i) Determinations of employee exposure shall be made from breathing zone air samples that are representative of the 8-hour TWA of each employee.

(ii) Representative 8-hour TWA employee exposures shall be determined on the basis of one or more samples representing full-shift exposures for each shift for each employee in each job classification in each work area.

(2) *Initial monitoring.* (i) Each employer who has a workplace or work operation covered by this standard, except as provided for in paragraphs (d)(2)(ii) and (d)(2)(iii) of this section, shall perform initial monitoring of employees who are, or may reasonably be expected to be exposed to airborne concentrations at or above the action level.

(ii) Where the employer has monitored after December 20, 1985, and the monitoring satisfies all other requirements of this section, the employer may rely on such earlier monitoring results to satisfy the requirements of paragraph (d)(2)(i) of this section.

(iii) Where the employer has relied upon objective data that demonstrates that asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals is not capable of being released in airborne concentrations at or above the action level under the expected conditions of processing, use, or handling, then no initial monitoring is required.

(3) *Monitoring frequency (periodic monitoring) and patterns.* After the initial determinations required by paragraph (d)(2)(i) of this section, 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 six months for employees whose exposures may reasonably be foreseen to exceed the action level.

(4) *Changes in monitoring frequency.* If either the initial or the periodic monitoring required by paragraphs (d)(2) and (d)(3) of this section statistically indicates that employee exposures are below the action level, the employer may discontinue the monitoring for those employees whose exposures are represented by such monitoring.

(5) *Additional monitoring.* Notwithstanding the provisions of paragraphs (d)(2)(ii) and (d)(4) of this section, the employer shall institute the exposure monitoring required under paragraphs (d)(2)(i) and (d)(3) of this section whenever there has been a change in the production, process, control equipment, personnel or work practices that may result in new or additional exposures above the action level or when the employer has any reason to suspect that a change may result in new or additional exposures above the action level.

(6) *Method of monitoring.* (i) All samples taken to satisfy the monitoring requirements of paragraph (d) shall be personal samples collected following the procedures specified in Appendix A.

(ii) All samples taken to satisfy the monitoring requirements of paragraph (d) shall be evaluated using the OSHA Reference Method (ORM) specified in Appendix A of this section, or an equivalent counting method.

(iii) If an equivalent method to the ORM is used, the employer shall ensure that the method meets the following criteria:

[Sec. 1910.1001(d)(6)(iii)]

(A) Replicate exposure data used to establish equivalency are collected in side-by-side field and laboratory comparisons; and

(B) The comparison indicates that 90% of the samples collected in the range 0.5 to 2.0 times the permissible limit have an accuracy range of plus or minus 25 percent of the ORM results with a 95% confidence level as demonstrated by a statistically valid protocol; and

(C) The equivalent method is documented and the results of the comparison testing are maintained.

(iv) To satisfy the monitoring requirements of paragraph (d) of this section, employers must use the results of monitoring analysis performed by laboratories which have instituted quality assurance programs that include the elements as prescribed in Appendix A.

(7) *Employee notification of monitoring results.* (i) The employer shall, within 15 working days after the receipt of the results of any monitoring performed under the standard, notify the affected employees of these results in writing either individually or by posting of results in an appropriate location that is accessible to affected employees.

(ii) The written notification required by paragraph (d)(7)(i) of this section shall contain the corrective action being taken by the employer to reduce employee exposure to or below the PEL, wherever monitoring results indicated that the PEL had been exceeded.

(e) *Regulated Areas.*—(1) *Establishment.* The employer shall establish regulated areas wherever airborne concentrations of asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals are in excess of the permissible exposure limit prescribed in paragraph (c) of this section.

(2) *Demarcation.* Regulated areas shall be demarcated from the rest of the workplace in any manner that minimizes the number of persons who will be exposed to asbestos, tremolite, anthophyllite, or actinolite.

(3) *Access.* Access to regulated areas shall be limited to authorized persons or to persons authorized by the Act or regulations issued pursuant thereto.

(4) *Provision of respirators.* Each person entering a regulated area shall be supplied with and required to use a respirator, selected in accordance with paragraph (g)(2) of this section.

(5) *Prohibited activities.* The employer shall ensure that employees do not eat, drink, smoke, chew tobacco or gum, or apply cosmetics in the regulated areas.

(f) *Methods of compliance.*—(1) *Engineering controls and work practices.* (i) The employer shall institute engineering controls and work practices to reduce and maintain employee exposure to or below the exposure limit prescribed in paragraph (c) of this section, except to the extent that such controls are not feasible.

(ii) Wherever the feasible engineering controls and work practices that can be instituted are not sufficient to reduce employee exposure to or below the permissible exposure limit prescribed in paragraph (c) of this section, the employer shall use them to reduce employee exposure to the lowest levels achievable by these controls and shall supplement them by the use of respiratory protection that complies with the requirements of paragraph (g) of this section.

(iii) For the following operations, wherever feasible engineering controls and work practices that can be instituted are not sufficient to reduce the employee exposure to or below the permissible exposure limit prescribed in paragraph (c) of this section, the employer shall use them to reduce employee exposure to or below 0.5 fiber per cubic centimeter of air (as an eight-hour time-weighted average) and shall supplement them by the use of any combination of respiratory protection that complies with the requirements of paragraph (g) of this section, work practices and feasible engineering controls that will reduce employee exposure to or below the permissible exposure limit prescribed in paragraph (c) of this section: Coupling cutoff in primary asbestos cement pipe manufacturing; sanding in primary and secondary asbestos cement sheet manufacturing; grinding in primary and secondary friction product manufacturing; carding and spinning in dry textile processes; and grinding and sanding in primary plastics manufacturing.

(iv) Local exhaust ventilation. Local exhaust ventilation and dust collection systems shall be designed, constructed, installed, and maintained in accordance with good practices such as those found in the American National Standard Fundamentals Governing the Design and Operation of Local Exhaust Systems, ANSI Z9.2–1979.

(v) Particular tools. All hand-operated and power-operated tools which would produce or release fibers of asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals so as to expose employees to levels in excess of the exposure limit prescribed in paragraph (c) of this section, such as, but not limited to, saws, scorers, abrasive wheels, and drills, shall be provided with local exhaust ventilation systems which comply with paragraph (f)(1)(iv) of this section.

(vi) Wet methods. Insofar as practicable, asbestos, tremolite, anthophyllite, or actinolite shall be handled, mixed, applied, removed, cut, scored, or otherwise worked in a wet state sufficient to prevent the emission of airborne fibers so as to expose employees to levels in excess of the exposure limit prescribed in paragraph (c) of this section, unless the usefulness of the product would be diminished thereby.

(vii) Materials containing asbestos, tremolite, anthophyllite, or actinolite shall not be applied by spray methods.

(viii) Particular products and operations. No asbestos cement, mortar, coating, grout, plaster, or similar material containing asbestos, tremolite, anthophyllite, or actinolite 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 fibers of asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals so as to expose employees to levels in excess of the limit prescribed in paragraph (c) of this section.

(ix) Compressed air. Compressed air shall not be used to remove asbestos, tremolite, anthophyllite, or actinolite or materials containing asbestos, tremolite, anthophyllite, or actinolite, unless the compressed air is used in conjunction with a ventilation system designed to capture the dust cloud created by the compressed air.

[Sec. 1910.1001(f)(1)(ix)]

(2) *Compliance program.* (i) Where the PEL is exceeded, the employer shall establish and implement a written program to reduce employee exposure to or below the limit by means of engineering and work practice controls as required by paragraph (f)(1) of this section, and by the use of respiratory protection where required or permitted under this section.

(ii) Such programs shall be reviewed and updated as necessary to reflect significant changes in the status of the employer's compliance program.

(iii) Written programs shall be submitted upon request for examination and copying to the Assistant Secretary, the Director, affected employees and designated employee representatives.

(iv) The employer shall not use employee rotation as a means of compliance with the PEL.

(g) *Respiratory protection*—(1) *General.* The employer shall provide respirators, and ensure that they are used, where required by this section. Respirators shall be used in the following circumstances:

(i) During the interval necessary to install or implement feasible engineering and work practice controls;

(ii) In work operations, such as maintenance and repair activities, or other activities for which engineering and work practice controls are not feasible;

(iii) In work situations where feasible engineering and work practice controls are not yet sufficient to reduce exposure to or below the exposure limit; and

(iv) In emergencies.

(2) *Respirator selection.* (i) Where respirators are required under this section, the employer shall select and provide, at no cost to the employee, the appropriate respirator as specified in Table 1. The employer shall select respirators from among those jointly approved as being acceptable for protection by the Mine Safety and Health Administration (MSHA) and by the National Institute for Occupational Safety and Health (NIOSH) under the provisions of 30 CFR Part 11.

(ii) The employer shall provide a powered, air-purifying respirator in lieu of any negative pressure respirator specified in Table 1 whenever:

(A) An employee chooses to use this type of respirator; and

(B) This respirator will provide adequate protection to the employee.

TABLE 1.—RESPIRATORY PROTECTION FOR ASBESTOS, TREMOLITE, ANTHOPHYLLITE, AND ACTINOLITE FIBERS

Airborne concentration of asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals	Required respirator
Not in excess of 2 f/cc (10 X PEL).	1. Half-mask air-purifying respirator equipped with high-efficiency filters.
Not in excess of 10 f/cc (50 X PEL).	1. Full facepiece air-purifying respirator equipped with high-efficiency filters. 2. Any powered air-purifying respirator equipped with high-efficiency filters. 3. Any supplied-air respirator operated in continuous flow mode.
Not in excess of 200 f/cc (1000 X PEL).	1. Full facepiece supplied-air respirator operated in pressure demand mode.
Greater than 200 f/cc (> 1 000 X PEL) or unknown concentration.	1. Full facepiece supplied air respirator operated in pressure demand mode equipped with an auxiliary positive pressure self-contained breathing apparatus.

Note: a. Respirators assigned for higher environmental concentrations may be used at lower concentrations.

b. A high-efficiency filter means a filter that is at least 99.97 percent efficient against mono-dispersed particles of 0.3 micrometers or larger.

(3) *Respirator program.* (i) Where respiratory protection is required, the employer shall institute a respirator program in accordance with 29 CFR 1910.134(b), (d), (e), and (f).

(ii) The employer shall permit each employee who uses a filter respirator to change the filter elements whenever an increase in breathing resistance is detected and shall maintain an adequate supply of filter elements for this purpose.

(iii) Employees who wear respirators shall be permitted to leave the regulated area to wash their faces and respirator facepieces whenever necessary to prevent skin irritation associated with respirator use.

(iv) No employee shall be assigned to tasks requiring the use of respirators if, based upon his or her 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 the use of a respirator. Such employee shall be assigned to another job or given the opportunity to transfer to a different position whose duties he or she is able to perform with the same employer, in the same geographical area and with the same seniority, status, and rate of pay the employee had just prior to such transfer, if such a different position is available.

(4) *Respirator fit testing.* (i) The employer shall ensure that the respirator issued to the employee exhibits the least possible facepiece leakage and that the respirator is fitted properly.

(ii) For each employee wearing negative pressure respirators, employers shall perform either quantitative or qualitative face fit tests at the time of initial fitting and at least every six months thereafter. The qualitative fit tests may be used only for testing the fit of half-mask respirators where they are permitted to be worn, and shall be conducted in accordance with Appendix C. The tests shall be used to select facepieces that provide the required protection as prescribed in Table 1.

(h) *Protective work clothing and equipment*—(1) *Provision and use.* If an employee is exposed to asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals above the PEL, or where the possibility of eye irritation exists, the employer shall provide at no cost to the employee and ensure that the employee uses appropriate protective work clothing and equipment such as, but not limited to:

(i) Coveralls or similar full-body work clothing;

(ii) Gloves, head coverings, and foot coverings; and

(iii) Face shields, vented goggles, or other appropriate protective equipment which complies with § 1910.133 of this Part.

(2) *Removal and storage.* (i) The employer shall ensure that employees remove work clothing contaminated with asbestos, tremolite, anthophyllite, or actinolite only in change rooms provided in accordance with paragraph (i)(1) of this section.

(ii) The employer shall ensure that no employee takes contaminated work clothing out of the change room, except those employees authorized to do so for the purpose of laundering, maintenance, or disposal.

(iii) Contaminated work clothing shall be placed and stored in closed containers which prevent dispersion of the asbestos, tremolite, anthophyllite, and actinolite outside the container.

(iv) Containers of contaminated protective devices or work clothing

[Sec. 1910.1001(h)(2)(iv)]

which are to be taken out of change rooms or the workplace for cleaning, maintenance or disposal, shall bear labels in accordance with paragraph (j)(2) of this section.

(3) *Cleaning and replacement.* (i) The employer shall clean, launder, repair, or replace protective clothing and equipment required by this paragraph to maintain their effectiveness. The employer shall provide clean protective clothing and equipment at least weekly to each affected employee.

(ii) The employer shall prohibit the removal of asbestos, tremolite, anthophyllite, and actinolite from protective clothing and equipment by blowing or shaking.

(iii) Laundering of contaminated clothing shall be done so as to prevent the release of airborne fibers of asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals in excess of the permissible exposure limit prescribed in paragraph (c) of this section.

(iv) Any employer who gives contaminated clothing to another person for laundering shall inform such person of the requirement in paragraph (h)(3)(iii) of this section to effectively prevent the release of airborne fibers of asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals in excess of the permissible exposure limit.

(v) The employer shall inform any person who launders or cleans protective clothing or equipment contaminated with asbestos, tremolite, anthophyllite, or actinolite, of the potentially harmful effects of exposure to asbestos, tremolite, anthophyllite, or actinolite.

(vi) Contaminated clothing shall be transported in sealed impermeable bags, or other closed, impermeable containers, and labeled in accordance with paragraph (j) of this seciton.

(i) *Hygiene facilities and practices*—(1) *Change rooms.* (i) The employer shall provide clean change rooms for employees who work in areas where their airborne exposure to asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals is above the permissible exposure limit.

(ii) The employer shall ensure that change rooms are in accordance with § 1910.141(e) of this part, and are equipped with two separate lockers or storage facilities, so separated as to prevent contamination of the employee's street clothes from his protective work clothing and equipment.

(2) *Showers.* (i) The employer shall ensure that employees who work in areas where their airborne exposure is above the permissible exposure limit shower at the end of the work shift.

(ii) The employer shall provide shower facilities which comply with § 1910.141(d)(3) of this part.

(iii) The employer shall ensure that employees who are required to shower pursuant to paragraph (i)(2)(i) of this section do not leave the workplace wearing any clothing or equipment worn during the work shift.

(3) *Lunchrooms.* (i) The employer shall provide lunchroom facilities for employees who work in areas where their airborne exposure is above the permissible exposure limit.

(ii) The employer shall ensure that lunchroom facilities have a positive pressure, filtered air supply, and are readily accessible to employees.

(iii) The employer shall ensure that employees who work in areas where their airborne exposure is above the permissible exposure limit wash their hands and faces prior to eating, drinking or smoking.

(iv) The employer shall ensure that employees do not enter lunchroom facilities with protective work clothing or equipment unless surface asbestos, tremolite, anthophyllite, and actinolite fibers have been removed from the clothing or equipment by vaccuming or other method that removes dust without causing the asbestos, tremolite, anthophyllite, or actinolite to become airborne.

(j) *Communication of hazards to employees*—(1) *Warning signs.* (i) Posting. Warning signs shall be provided and displayed at each regulated area. In addition, warning signs shall be posted at all approaches to regulated areas so that an employee may read the signs and take necessary protective steps before entering the area.

(ii) Sign specifications. The warning signs required by paragraph (j)(1)(i) of this section shall bear the following information:

DANGER
ASBESTOS
CANCER AND LUNG DISEASE
HAZARD
AUTHORIZED PERSONNEL ONLY
RESPIRATORS AND PROTECTIVE
CLOTHING
ARE REQUIRED IN THIS AREA

(iii) Where minerals in the regulated area are only tremolite, anthophyllite or actinolite, the employer may replace the term "asbestos" with the appropriate mineral name.

(2) *Warning labels.* (i) Labeling. Warning labels shall be affixed to all raw materials, mixtures, scrap, waste, debris, and other products containing asbestos, tremolite, anthophyllite, or actinolite fibers, or to their containers.

(ii) Label specifications. The labels shall comply with the requirements of 29 CFR 1910.1200(f) of OSHA's Hazard Communication standard, and shall include the following information:

DANGER
CONTAINS ASBESTOS FIBERS
AVOID CREATING DUST
CANCER AND LUNG DISEASE
HAZARD

(iii) Where minerals to be labeled are only tremolite, anthophyllite, or actinolite, the employer may replace the term "asbestos" with the appropriate mineral name.

(3) *Material safety data sheets.* Employers who are manufacturers or importers of asbestos, tremolite, anthophyllite, or actinolite or asbestos, tremolite, anthophyllite, or actionlite products shall comply with the requirements regarding development of material safety data sheets as specified in 29 CFR 1910.1200(g) of OSHA's Hazard Communication standard, except as provided by paragraph (j)(4) of this section.

(4) The provisions for labels required by paragraph (j)(2) or for material safety data sheets required by paragraph (j)(3) do not apply where:

(i) Asbestos, tremolite, anthophyllite, or actinolite fibers have been modified by a bonding agent, coating, binder, or other material provided that the manufacturer can demonstrate that during any reasonably foreseeable use,

[Sec. 1910.1001(j)(4)(i)]

handling, storage, disposal, processing, or transportation, no airborne concentrations of fibers of asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals in excess of the action level will be released or

(ii) Asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals is present in a product in concentrations less than 0.1%.

(5) *Employee information and training.* (i) The employer shall institute a training program for all employees who are exposed to airborne concentrations of asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals at or above the action level ensure their participation in the program.

(ii) Training shall be provided prior to or at the time of initial assignment and at least annually thereafter.

(iii) The training program shall be conducted in a manner which the employee is able to understand. The employer shall ensure that each employee is informed of the following:

(A) The health effect associated with asbestos, tremolite, anthophyllite, or actinolite exposure;

(B) The relationship between smoking and exposure to asbestos, tremolite, anthophyllite, and actinolite in producing lung cancer;

(C) The quantity, location, manner of use, release, and storage of asbestos, tremolite, anthophyllite, or actinolite, and the specific nature of operations which could result in exposure to asbestos, tremolite, anthophyllite,or actinolite;

(D) The engineering controls and work practices associated with the employee's job assignment;

(E) The specific procedures implemented to protect employees from exposure to asbestos, tremolite, anthophyllite, or actinolite, such as appropriate work practices, emergency and clean-up procedures, and personal protective equipment to be used;

(F) The purpose, proper use, and limitations of respirators and protective clothing;

(G) The purpose and a description of the medical surveillance program required by paragraph (1) of this section;

(H) A review of this standard, including appendices.

(iv) Access to information and training materials.

(A) The employer shall make a copy of this standard and its appendices readily available without cost to all affected employees.

(B) The employer shall provide, upon request, all materials relating to the employee information and training program to the Assistant Secretary and the training program to the Assistant Secretary and the Director.

(k) *Housekeeping.* (1) All surfaces shall be maintained as free as practicable of accumulations of dusts and waste containing asbestos, tremolite, anthophyllite, or actinolite.

(2) All spills and sudden releases of material containing asbestos, tremolite, anthophyllite, or actinolite shall be cleaned up as soon as possible.

(3) Surfaces contaminated with asbestos, tremolite, anthophyllite, or actinolite may not be cleaned by the use of compressed air.

(4) Vacuuming. HEPA-filtered vacuuming equipment shall be used for vacuuming. The equipment shall be used and emptied in a manner which minimizes the reentry of asbestos, tremolite, anthophyllite, or actinolite into the workplace.

(5) Shoveling, dry sweeping and dry clean-up of asbestos, tremolite, anthophyllite, or actinolite may be used only where vacuuming and/or wet cleaning are not feasible.

(6) Waste disposal. Waste, scrap, debris, bags, containers, equipment, and clothing contaminated with asbestos, tremolite, anthophyllite, or actinolite consigned for disposal, shall be collected and disposed of in sealed impermeable bags, or other closed, impermeable containers.

(l) *Medical surveillance*—(1) *General.—(i) Employees covered.* The employer shall institute a medical surveillance program for all employees who are or will be exposed to airborne concentrations of fibers of asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals at or above the action level.

(ii) *Examination by a physician.* (A) The employer shall ensure that all medical examinations and procedures are performed by or under the supervision of a licensed physician, and shall be provided without cost to the employee and at a reasonable time and place.

(B) Persons other than licensed physicians, who administer the pulmonary function testing required by this section, shall complete a training course in spirometry sponsored by an appropriate academic or professional institution.

(2) *Preplacement examinations.* (i) Before an employee is assigned to an occupation exposed to airborne concentrations of asbestos, tremolite, anthophyllite, or actinolite fibers, a preplacement medical examination shall be provided or made available by the employer.

(ii) Such examination shall include, as a minimum, a medical and work history; A complete physical examination of all systems with emphasis on the respiratory system, the cardiovascular system and digestive tract; completion of the respiratory disease standardized questionnaire in Appendix D, Part 1; a chest roentgenogram (posterior-anterior 14x17 inches); pulmonary function tests to include forced vital capacity (FVC) and forced expiratory volume at 1 second ($FEV_{1.0}$); and any additional tests deemed appropriate by the examining physician. Interpretation and classification of chest roentgenograms shall be conducted in accordance with Appendix E.

(3) *Periodic examinations.* (i) Periodic medical examinations shall be made available annually.

(ii) The scope of the medical examination shall be in conformance with the protocol established in paragraph (1)(2)(ii), except that the frequency of chest roentgenograms shall be conducted in accordance with Table 2, and the abbreviated standardized questionnaire contained in Appendix D, Part 2, shall be administered to the employee

[Sec. 1910.1001(l)(3)(ii)]

TABLE 2.—FREQUENCY OF CHEST ROENTGENOGRAMS

Years since first exposure	Age of employee		
	15 to 35	35+ to 45	45+
0 to 10	Every 5 years	Every 5 years	Every 5 years.
10+	Every 5 years	Every 2 years	Every 1 year.

(4) *Termination of employment examinations.* (i) The employer shall provide, or make available, a termination of employment medical examination for any employee who has been exposed to airborne concentrations of fibers of asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals at or above the action level.

(ii) The medical examination shall be in accordance with the requirements of the periodic examinations stipulated in paragraph (l)(3) of this section, and shall be given within 30 calendar days before or after the date of termination of employment.

(5) *Recent examinations.* No medical examination is required of any employee, if adequate records show that the employee has been examined in accordance with any of the preceding paragraphs [(l)(2)–(l)(4)] within the past 1 year period.

(6) *Information provided to the physician.* The employer shall provide the following information to the examining physician:

(i) A copy of this standard and Appendices D and E.

(ii) A description of the affected employee's duties as they relate to the employee's exposure.

(iii) The employee's representative exposure level or anticipated exposure level.

(iv) A description of any personal protective and respiratory equipment used or to be used.

(v) Information from previous medical examinations of the affected employee that is not otherwise available to the examining physician.

(7) *Physician's written opinion.* (i) The employer shall obtain a written signed opinion from the examining physician. This written opinion shall contain the results of the medical examination and shall include:

(A) The physician's opinion as to whether the employee has any detected medical conditions that would place the employee at an increased risk of material health impairment from exposure to asbestos, tremolite, anthophyllite, or actinolite;

(B) Any recommended limitations on the employee or upon the use of personal protective equipment such as clothing or respirators; and

(C) A statement that the employee has been informed by the physician of the results of the medical examination and of any medical conditions resulting from asbestos, tremolite, anthophyllite, or actinolite exposure that require further explanation or treatment.

(ii) The employer shall instruct the physician not to reveal in the written opinion given to the employer specific findings or diagnoses unrelated to occupational exposure to asbestos, tremolite, anthophyllite, or actinolite.

(iii) The employer shall provide a copy of the physician's written opinion to the affected employee within 30 days from its receipt.

(m) *Recordkeeping.*—(1) *Exposure measurements.* (i) The employer shall keep an accurate record of all measurements taken to monitor employee exposure to asbestos, tremolite, anthophyllite, or actinolite as prescribed in paragraph (d) of this section.

(ii) This record shall include at least the following information:

(A) The date of measurement;

(B) The operation involving exposure to asbestos, tremolite, anthophyllite, or actinolite which is being monitored;

(C) Sampling and analytical methods used and evidence of their accuracy;

(D) Number, duration, and results of samples taken;

(E) Type of respiratory protective devices worn, if any; and

(F) Name, social security number and exposure of the employees whose exposure are represented.

(iii) The employer shall maintain this record for at least thirty (30) years, in accordance with 29 CFR 1910.20.

(2) *Objective data for exempted operations.* (i) Where the processing, use, or handling of products made from or containing asbestos, tremolite, anthophyllite, or actinolite is exempted from other requirements of this section under paragraph (d)(2)(iii) of this section, the employer shall establish and maintain an accurate record of objective data reasonably relied upon in support of the exemption.

(ii) The record shall include at least the following:

(A) The product qualifying for exemption;

(B) The source of the objective data;

(C) The testing protocol, results of testing, and/or analysis of the material for the release of asbestos, tremolite, anthophyllite, or actinolite;

(D) A description of the operation exempted and how the data support the exemption; and

(E) Other data relevant to the operations, materials, processing, or employee exposures covered by the exemption.

(iii) The employer shall maintain this record for the duration of the employer's reliance upon such objective data.

Note.—The employer may utilize the services of competent organizations such as industry trade associations and employee associations to maintain the records required by this section.

(3) *Medical surveillance.* (i) The employer shall establish and maintain an accurate record for each employee subject to medical surveillance by paragraph (l)(1)(i) of this section, in accordance with 29 CFR 1910.20.

(ii) The record shall include at least the following information:

(A) The name and social security number of the employee;

(B) Physician's written opinions;

(C) Any employee medical complaints related to exposure to asbestos, tremolite, anthophyllite, or actinolite; and

(D) A copy of the information provided to the physician as required by paragraph (l)(6) of this section.

(iii) The employer shall ensure that this record is maintained for the

[Sec. 1910.1001(m)(3)(iii)]

duration of employment plus thirty (30) years, in accordance with 29 CFR 1910.20.

(4) *Training.* The employer shall maintain all employee training records for one (1) year beyond the last date of employment of that employee.

(5) *Availability.* (i) The employer, upon written request, shall make all records required to be maintained by this section available to the Assistant Secretary and the Director for examination and copying.

(ii) The employer, upon request shall make any exposure records required by paragraph (m)(1) of this section available for examination and copying to affected employees, former employees, designated representatives and the Assistant Secretary, in accordance with 29 CFR 1910.20 (a)–(e) and (g)–(i).

(iii) The employer, upon request, shall make employee medical records required by paragraph (m)(2) of this section available for examination and copying to the subject employee, to anyone having the specific written consent of the subject employee, and the Assistant Secretary, in accordance with 29 CFR 1910.20.

(6) *Transfer of records.* (i) The employer shall comply with the requirements concerning transfer of records set forth in 29 CFR 1910.20(h).

(ii) Whenever the employer ceases to do business and there is no successor employer to receive and retain the records for the prescribed period, the employer shall notify the Director at least 90 days prior to disposal of records and, upon request, transmit them to the Director.

(n) *Observation of monitoring*—(1) *Employee observation.* The employer shall provide affected employees or their designated representatives an opportunity to observe any monitoring of employee exposure to asbestos, tremolite, anthophyllite, or actinolite conducted in accordance with paragraph (d) of this section.

(2) *Observation procedures.* When observation of the monitoring of employee exposure to asbestos, tremolite, anthophyllite, or actinolite requires entry into an area where the use of protective clothing or equipment is required, the observer shall be provided with and be required to use such clothing and equipment and shall comply with all other applicable safety and health procedures.

(o) *Dates*—(1) *Effective date.* This standard shall become effective July 21, 1986. The requirements of the asbestos standard issued in June 1972 (37 FR 11318), as amended, and published in 29 CFR 1910.1001 (1985) remain in effect until compliance is achieved with the parallel provisions of this standard.

(2) *Start-up dates.* All obligations of this standard commence on the effective date except as follows:

(i) *Exposure monitoring.* Initial monitoring required by paragraph (d)(2) of this section shall be completed as soon as possible but no later than October 20, 1986.

(ii) *Regulated areas.* Regulated areas required to be established by paragraph (e) of this section as a result of initial monitoring shall be set up as soon as possible after the results of that monitoring are known and not later than November 17, 1986.

(iii) *Respiratory protection.* Respiratory protection required by paragraph (g) of this section shall be provided as soon as possible but no later than the following schedule:

(A) Employees whose 8-hour TWA exposure exceeds 2 fibers/cc—July 21, 1986.

(B) Employees whose 8-hour TWA exposure exceeds the PEL but is less than 2 fibers/cc—November 17, 1986.

(C) Powered air-purifying respirators provided under paragraph (g)(2)(ii)—January 16, 1987.

(iv) *Hygiene and lunchroom facilities.* Construction plans for changerooms, showers, lavatories, and lunchroom facilities shall be completed no later than January 16, 1987; and these facilities shall be constructed and in use no later than July 20, 1987. However, if as part of the compliance plan it is predicted by an independent engineering firm that engineering controls and work practices will reduce exposures below the permissible exposure limit by July 20, 1986, for affected employees, then such facilities need not be completed until 1 year after the engineering controls are completed, if such controls have not in fact succeeded in reducing exposure to below the permissible exposure limit.

(v) *Employee information and training.* Employee information and training required by paragraph (j)(5) of this section shall be provided as soon as possible but no later than October 20, 1986.

(vi) *Medical surveillance.* Medical examinations required by paragraph (l) of this section shall be provided as soon as possible but no later than November 17, 1986.

(vii) *Compliance program.* Written compliance programs required by paragraph (f)(2) of this section as a result of initial monitoring shall be completed and available for inspection and copying as soon as possible but no later than July 20, 1987.

(viii) *Methods of compliance.* The engineering and work practice controls as required by paragraph (f)(1) shall be implemented as soon as possible but no later than July 20, 1986.

(p) *Appendices.* (1) Appendices A, C, D, and E to this section are incorporated as part of this section and the contents of these Appendices are mandatory

(2) Appendices B, F, G and H to this section are informational and are not intended to create any additional obligations not otherwise imposed or to detract from any existing obligations.

Appendix A to § 1910.1001—Osha Reference Method—Mandatory

This mandatory appendix specifies the procedure for analyzing air samples for asbestos, tremolite, anthophyllite, and actinolite and specifies quality control procedures that must be implemented by laboratories performing the analysis. The sampling and analytical methods described below represent the elements of the available monitoring methods (such as the NIOSH 7400 method) which OSHA considers to be essential to achieve adequate employee exposure monitoring while allowing employers to use methods that are already established within their organizations. All employers who are required to conduct air monitoring under paragraph (f) of the standard are required to utilize analytical laboratories that use this procedure, or an equivalent method, for collecting and analyzing samples.

Sampling and Analytical Procedure

1. The sampling medium for air samples shall be mixed cellulose ester filter membranes. These shall be designated by the manufacturer as suitable for asbestos, tremolite, anthophyllite, and actinolite counting. See below for rejection of blanks.

[Sec. 1910.1001, Appendix A]

duration of employment plus thirty (30) years, in accordance with 29 CFR 1910.20.

(4) *Training.* The employer shall maintain all employee training records for one (1) year beyond the last date of employment of that employee.

(5) *Availability.* (i) The employer, upon written request, shall make all records required to be maintained by this section available to the Assistant Secretary and the Director for examination and copying.

(ii) The employer, upon request shall make any exposure records required by paragraph (m)(1) of this section available for examination and copying to affected employees, former employees, designated representatives and the Assistant Secretary, in accordance with 29 CFR 1910.20 (a)–(e) and (g)–(i).

(iii) The employer, upon request, shall make employee medical records required by paragraph (m)(2) of this section available for examination and copying to the subject employee, to anyone having the specific written consent of the subject employee, and the Assistant Secretary, in accordance with 29 CFR 1910.20.

(6) *Transfer of records.* (i) The employer shall comply with the requirements concerning transfer of records set forth in 29 CFR 1910.20(h).

(ii) Whenever the employer ceases to do business and there is no successor employer to receive and retain the records for the prescribed period, the employer shall notify the Director at least 90 days prior to disposal of records and, upon request, transmit them to the Director.

(n) *Observation of monitoring*—(1) *Employee observation.* The employer shall provide affected employees or their designated representatives an opportunity to observe any monitoring of employee exposure to asbestos, tremolite, anthophyllite, or actinolite conducted in accordance with paragraph (d) of this section.

(2) *Observation procedures.* When observation of the monitoring of employee exposure to asbestos, tremolite, anthophyllite, or actinolite requires entry into an area where the use of protective clothing or equipment is required, the observer shall be provided with and be required to use such clothing and equipment and shall comply with all other applicable safety and health procedures.

(o) *Dates*—(1) *Effective date.* This standard shall become effective July 21, 1986. The requirements of the asbestos standard issued in June 1972 (37 FR 11318), as amended, and published in 29 CFR 1910.1001 (1985) remain in effect until compliance is achieved with the parallel provisions of this standard.

(2) *Start-up dates.* All obligations of this standard commence on the effective date except as follows:

(i) *Exposure monitoring.* Initial monitoring required by paragraph (d)(2) of this section shall be completed as soon as possible but no later than October 20, 1986.

(ii) *Regulated areas.* Regulated areas required to be established by paragraph (e) of this section as a result of initial monitoring shall be set up as soon as possible after the results of that monitoring are known and not later than November 17, 1986.

(iii) *Respiratory protection.* Respiratory protection required by paragraph (g) of this section shall be provided as soon as possible but no later than the following schedule:

(A) Employees whose 8-hour TWA exposure exceeds 2 fibers/cc—July 21, 1986.

(B) Employees whose 8-hour TWA exposure exceeds the PEL but is less than 2 fibers/cc—November 17, 1986.

(C) Powered air-purifying respirators provided under paragraph (g)(2)(ii)—January 16, 1987.

(iv) *Hygiene and lunchroom facilities.* Construction plans for changerooms, showers, lavatories, and lunchroom facilities shall be completed no later than January 16, 1987; and these facilities shall be constructed and in use no later than July 20, 1987. However, if as part of the compliance plan it is predicted by an independent engineering firm that engineering controls and work practices will reduce exposures below the permissible exposure limit by July 20, 1986, for affected employees, then such facilities need not be completed until 1 year after the engineering controls are completed, if such controls have not in fact succeeded in reducing exposure to below the permissible exposure limit.

(v) *Employee information and training.* Employee information and training required by paragraph (j)(5) of this section shall be provided as soon as possible but no later than October 20, 1986.

(vi) *Medical surveillance.* Medical examinations required by paragraph (i) of this section shall be provided as soon as possible but no later than November 17, 1986.

(vii) *Compliance program.* Written compliance programs required by paragraph (f)(2) of this section as a result of initial monitoring shall be completed and available for inspection and copying as soon as possible but no later than July 20, 1987.

(viii) *Methods of compliance.* The engineering and work practice controls as required by paragraph (f)(1) shall be implemented as soon as possible but no later than July 20, 1986.

(p) *Appendices.* (1) Appendices A, C, D, and E to this section are incorporated as part of this section and the contents of these Appendices are mandatory

(2) Appendices B, F, G and H to this section are informational and are not intended to create any additional obligations not otherwise imposed or to detract from any existing obligations.

Appendix A to § 1910.1001—Osha Reference Method—Mandatory

This mandatory appendix specifies the procedure for analyzing air samples for asbestos, tremolite, anthophyllite, and actinolite and specifies quality control procedures that must be implemented by laboratories performing the analysis. The sampling and analytical methods described below represent the elements of the available monitoring methods (such as the NIOSH 7400 method) which OSHA considers to be essential to achieve adequate employee exposure monitoring while allowing employers to use methods that are already established within their organizations. All employers who are required to conduct air monitoring under paragraph (f) of the standard are required to utilize analytical laboratories that use this procedure, or an equivalent method, for collecting and analyzing samples.

Sampling and Analytical Procedure

1. The sampling medium for air samples shall be mixed cellulose ester filter membranes. These shall be designated by the manufacturer as suitable for asbestos, tremolite, anthophyllite, and actinolite counting. See below for rejection of blanks.

[Sec. 1910.1001, Appendix A]

2. The preferred collection device shall be the 25-mm diameter cassette with an open-faced 50-mm extension cowl. The 37-mm cassette may be used if necessary but only if written justification for the need to use the 37-mm filter cassette accompanies the sample results in the employee's exposure monitoring record.

3. An air flow rate between 0.5 liter/min and 2.5 liters/min shall be selected for the 25-mm cassette. If the 37-mm cassette is used, an air flow rate between 1 liter/min and 2.5 liters/min shall be selected.

4. Where possible, a sufficient air volume for each air sample shall be collected to yield between 100 and 1,300 fibers per square millimeter on the membrane filter. If a filter darkens in appearance or if loose dust is seen on the filter, a second sample shall be started.

5. Ship the samples in a rigid container with sufficient packing material to prevent dislodging the collected fibers. Packing material that has a high electrostatic charge on its surface (e.g., expanded polystyrene) cannot be used because such material can cause loss of fibers to the sides of the cassette.

6. Calibrate each personal sampling pump before and after use with a representative filter cassette installed between the pump and the calibration devices.

7. Personal samples shall be taken in the "breathing zone" of the employee (i.e., attached to or near the collar or lapel near the worker's face).

8. Fiber counts shall be made by positive phase contrast using a microscope with an 8 to 10 X eyepiece and a 40 to 45 X objective for a total magnification of approximately 400 X and a numerical aperture of 0.65 to 0.75. The microscope shall also be fitted with a green or blue filter.

9. The microscope shall be fitted with a Walton-Beckett eyepiece graticule calibrated for a field diameter of 100 micrometers (+/−2 micrometers).

10. The phase-shift detection limit of the microscope shall be about 3 degrees measured using the HSE phase shift test slide as outlined below.

a. Place the test slide on the microscope stage and center it under the phase objective.

b. Bring the blocks of grooved lines into focus.

Note.—The slide consists of seven sets of grooved lines (ca. 20 grooves to each block) in descending order of visibility from sets 1 to 7, seven being the least visible. The requirements for asbestos, tremolite, anthophyllite, and actinolite counting are that the microscope optics must resolve the grooved lines in set 3 completely, although they may appear somewhat faint, and that the grooved lines in sets 6 and 7 must be invisible. Sets 4 and 5 must be at least partially visible but may vary slightly in visibility between microscopes. A microscope that fails to meet these requirements has either too low or too high a resolution to be used for asbestos, tremolite, anthophyllite, and actinolite counting.

c. If the image deteriorates, clean and adjust the microscope optics. If the problem persists, consult the microscope manufacturer.

11. Each set of samples taken will include 10 percent blanks or a minimum of 2 blanks. The blank results shall be averaged and subtracted from the analytical results before reporting. Any samples represented by a blank having a fiber count in excess of 7 fibers/100 fields shall be rejected.

12. The samples shall be mounted by the acetone/triacetin method or a method with an equivalent index of refraction and similar clarity.

13. Observe the following counting rules.

a. Count only fibers equal to or longer than 5 micrometers. Measure the length of curved fibers along the curve.

b. Count all particles as asbestos, tremolite, anthophyllite, and actinolite that have a length-to-width ratio (aspect ratio) of 3:1 or greater.

c. Fibers lying entirely within the boundary of the Walton-Beckett graticule field shall receive a count of 1. Fibers crossing the boundary once, having one end within the circle, shall receive the count of one half (½). Do not count any fiber that crosses the graticule boundary more than once. Reject and do not count any other fibers even though they may be visible outside the graticule area.

d. Count bundles of fibers as one fiber unless individual fibers can be identified by observing both ends of an individual fiber.

e. Count enough graticule fields to yield 100 fibers. Count a minimum of 20 fields; stop counting at 100 fields regardless of fiber count.

14. Blind recounts shall be conducted at the rate of 10 percent.

Quality Control Procedures

1. Intralaboratory program. Each laboratory and/or each company with more than one microscopist counting slides shall establish a statistically designed quality assurance program involving blind recounts and comparisons between microscopists to monitor the variability of counting by each microscopist and between microscopists. In a company with more than one laboratory, the program shall include all laboratories and shall also evaluate the laboratory-to-laboratory variability.

2. Interlaboratory program. Each laboratory analyzing asbestos, tremolite, anthophyllite, and actinolite samples for compliance determination shall implement an interlaboratory quality assurance program that as a minimum includes participation of at least two other independent laboratories. Each laboratory shall participate in round robin testing at least once every 6 months with at least all the other laboratories in its interlaboratory quality assurance group. Each laboratory shall submit slides typical of its own work load for use in this program. The round robin shall be designed and results analyzed using appropriate statistical methodology.

3. All individuals performing asbestos, tremolite, anthophyllite, and actinolite analysis must have taken the NIOSH course for sampling and evaluating airborne asbestos, tremolite, anthophyllite, and actinolite dust or an equivalent course.

4. When the use of different microscopes contributes to differences between counters and laboratories, the effect of the different microscope shall be evaluated and the microscope shall be replaced, as necessary.

5. Current results of these quality assurance programs shall be posted in each laboratory to keep the microscopists informed.

Appendix B to § 1910.1001—Detailed Procedure for Asbestos Tremolite, Anthophyllite, and Actinolite Sampling and Analysis—Non-Mandatory

This appendix contains a detailed procedure for sampling and analysis and includes those critical elements specified in Appendix A. Employers are not required to use this procedure, but they are required to use Appendix A. The purpose of Appendix B is to provide a detailed step-by-step sampling and analysis procedure that conforms to the elements specified in Appendix A. Since this procedure may also standardize the analysis and reduce variability, OSHA encourages employers to use this appendix.

Asbestos, Tremolite, Anthophyllite, and Actinolite Sampling and Analysis Method

Technique: Microscopy, Phase Contrast
Analyte: Fibers (manual count)
Sample Preparation: Acetone/triacetin method
Calibration: Phase-shift detection limit about 3 degrees
Range: 100 to 1300 fibers/mm ^{2} filter area
Estimated limit of detection: 7 fibers/mm ^{2} filter area
Sampler: Filter (0.8–1.2 um mixed cellulose ester membrane, 25-mm diameter)
Flow rate: 0.5 l/min to 2.5 l/min (25-mm cassette) 1.0 l/min to 2.5 l/min (37-mm cassette)

[Sec. 1910.1001, Appendix B]

Sample volume: Adjust to obtain 100 to 1300 fibers/mm ^{2}
Shipment: Routine
Sample stability: Indefinite
Blanks: 10% of samples (minimum 2)
Standard analytical error: 0.25.

Applicability: The working range is 0.02 f/cc (1920-L air sample) to 1.25 f/cc (400-L air sample). The method gives an index of airborne asbestos, tremolite, anthophyllite, and actinolite fibers but may be used for other materials such as fibrous glass by inserting suitable parameters into the counting rules. The method does not differentiate between asbestos, tremolite, anthophyllite, and actinolite and other fibers. Asbestos, tremolite, anthophyllite, and actinolite fibers less than ca. 0.25 um diameter will not be detected by this method.

Interferences: Any other airborne fiber may interfere since all particles meeting the counting criteria are counted. Chainlike particles may appear fibrous. High levels of nonfibrous dust particles may obscure fibers in the field of view and raise the detection limit.

Reagents: 1. Acetone. 2. Triacetin (glycerol triacetate), reagent grade

Special precautions: Acetone is an extremely flammable liquid and precautions must be taken not to ignite it. Heating of acetone must be done in a ventilated laboratory fume hood using a flameless, spark-free heat source.

Equipment: 1. Collection device: 25-mm cassette with 50-mm extension cowl with cellulose ester filter, 0.8 to 1.2 mm pore size and backup pad.

Note: Analyze representative filters for fiber background before use and discard the filter lot if more than 5 fibers/100 fields are found.

2. Personal sampling pump, greater than or equal to 0.5 L/min. with flexible connecting tubing.

3. Microscope, phase contrast, with green or blue filter, 8 to 10X eyepiece, and 40 to 45X phase objective (total magnification ca 400X; numerical aperture = 0.65 to 0.75.

4. Slides, glass, single-frosted, pre-cleaned, 25 x 75 mm.

5. Cover slips, 25 x 25 mm, no. 1½ unless otherwise specified by microscope manufacturer.

6. Knife, No. 1 surgical steel, curved blade.

7. Tweezers.

8. Flask, Guth-type, insulated neck, 250 to 500 mL (with single-holed rubber stopper and elbow-jointed glass tubing, 18 to 22 cm long).

9. Hotplate, spark-free, stirring type; heating mantle; or infrared lamp and magnetic stirrer.

10. Syringe, hypodermic, with 22-gauge needle.

11. Graticule, Walton-Beckett type with 100 um diameter circular field at the specimen plane (area = 0.00785 mm ^{2}). (Type G-22).

Note.—the graticule is custom-made for each microscope.

12. HSE/NPL phase contrast test slide, Mark II.

13. Telescope, ocular phase-ring centering.

14. Stage micrometer (0.01 mm divisions).

Sampling

1. Calibrate each personal sampling pump with a representative sampler in line.

2. Fasten the sampler to the worker's lapel as close as possible to the worker's mouth. Remove the top cover from the end of the cowl extension (open face) and orient face down. Wrap the joint between the extender and the monitor's body with shrink tape to prevent air leaks.

3. Submit at least two blanks (or 10% of the total samples, whichever is greater) for each set of samples. Remove the caps from the field blank cassettes and store the caps and cassettes in a clean area (bag or box) during the sampling period. Replace the caps in the cassettes when sampling is completed.

4. Sample at 0.5 L/min or greater. Do not exceed 1 mg total dust loading on the filter. Adjust sampling flow rate, Q (L/min), and time to produce a fiber density, E (fibers/mm^2), of 100 to 1300 fibers/mm^2 [3.85×10^4 to 5×10^4 fibers per 25-mm filter with effective collection area (A_c=385 mm^2)] for optimum counting precision (see step 21 below). Calculate the minimum sampling time, t_{min} (min) at the action level (one-half of the current standard), L (f/cc) of the fibrous aerosol being sampled:

$$t_{min} = \frac{(Ac)(E)}{(Q)(L)10^6}$$

5. Remove the field monitor at the end of sampling, replace the plastic top cover and small end caps, and store the monitor.

6. Ship the samples in a rigid container with sufficient packing material to prevent jostling or damage.

Note.—Do not use polystyrene foam in the shipping container because of electrostatic forces which may cause fiber loss from the sampler filter.

Sample Preparation

Note.—The object is to produce samples with a smooth (non-grainy) background in a medium with a refractive index equal to or less than 1.46. The method below collapses the filter for easier focusing and produces permanent mounts which are useful for quality control and interlaboratory comparison. Other mounting techniques meeting the above criteria may also be used, e.g., the nonpermanent field mounting technique used in P & CAM 239.

7. Ensure that the glass slides and cover slips are free of dust and fibers.

8. Place 40 to 60 ml of acetone into a Guth-type flask. Stopper the flask with a single-hole rubber stopper through which a glass tube extends 5 to 8 cm into the flask. The portion of the glass tube that exits the top of the stopper (8 to 10 cm) is bent downward in an elbow that makes an angle of 20 to 30 degrees with the horizontal.

9. Place the flask in a stirring hotplate or wrap in a heating mantle. Heat the acetone gradually to its boiling temperature (ca. 58 °C).

Caution.—The acetone vapor must be generated in a ventilated fume hood away from all open flames and spark sources. Alternate heating methods can be used, providing no open flame or sparks are present.

10. Mount either the whole sample filter or a wedge cut from the sample filter on a clean glass slide.

a. Cut wedges of ca. 25 percent of the filter area with a curved-blade steel surgical knife using a rocking motion to prevent tearing.

b. Place the filter or wedge, dust side up, on the slide. Static electricity will usually keep the filter on the slide until it is cleared.

c. Hold the glass slide supporting the filter approximately 1 to 2 cm from the glass tube part where the acetone vapor is escaping from the heated flask. The acetone vapor stream should cause a condensation spot on the glass slide ca. 2 to 3 cm in diameter. Move the glass slide gently in the vapor stream. The filter should clear in 2 to 5 sec. If the filter curls, distorts, or is otherwise rendered unusable, the vapor stream is probably not strong enough. Periodically wipe the outlet port with tissue to prevent liquid acetone dripping onto the filter.

d. Using the hypodermic syringe with a 22-gauge needle, place 1 to 2 drops of triacetin on the filter. Gently lower a clean 25-mm square cover slip down onto the filter at a slight angle to reduce the possibility of forming bubbles. If too many bubbles form or the amount of triacetin is insufficient, the cover slip may become detached within a few hours.

e. Glue the edges of the cover slip to the glass slide using a lacquer or nail polish.

Note.—If clearing is slow, the slide preparation may be heated on a hotplate (surface temperature 50 °C) for 15 min to hasten clearing. Counting may proceed immediately after clearing and mounting are completed.

[Sec. 1910.1001, Appendix B]

Calibration and Quality Control

11. Calibration of the Walton-Beckett graticule. The diameter, d_c(mm), of the circular counting area and the disc diameter must be specified when ordering the graticule.

a. Insert any available graticule into the eyepiece and focus so that the graticule lines are sharp and clear.

b. Set the appropriate interpupillary distance and, if applicable, reset the binocular head adjustment so that the magnification remains constant.

c. Install the 40 to 45 × phase objective.

d. Place a stage micrometer on the microscope object stage and focus the microscope on the graduate lines.

e. Measure the magnified grid length, L_m(mm), using the stage micrometer.

f. Remove the graticule from the microscope and measure its actual grid length, L_o(mm). This can best be accomplished by using a stage fitted with verniers.

g. Calculate the circle diameter, d_c(mm), for the Walton-Beckett graticule:

$$d_c = \frac{L_o \times D}{L_m}$$

Example.—If L_o = 108 um, L_m = 2.93 mm and D = 100 um, then d_c = 2.71 mm.

h. Check the field diameter, D(acceptable range 100 mm ± 2 mm) with a stage micrometer upon receipt of the graticule from the manufacturer. Determine field area (mm²).

12. Microscope adjustments. Follow the manufacturer's instructions and also the following:

a. Adjust the light source for even illumination across the field of view at the condenser iris.

Note.—Kohler illumination is preferred, where available.

b. Focus on the particulate material to be examined.

c. Make sure that the field iris is in focus, centered on the sample, and open only enough to fully illuminate the field of view.

d. Use the telescope ocular supplied by the manufacturer to ensure that the phase rings (annular diaphragm and phase-shifting elements) are concentric.

13. Check the phase-shift detection limit of the microscope periodically.

a. Remove the HSE/NPL phase-contrast test slide from its shipping container and center it under the phase objective.

b. Bring the blocks of grooved lines into focus.

Note.—The slide consists of seven sets of grooves (ca. 20 grooves to each block) in descending order of visibility from sets 1 to 7. The requirements for counting are that the microscope optics must resolve the grooved lines in set 3 completely, although they may appear somewhat faint, and that the grooved lines in sets 6 to 7 must be invisible. Sets 4 and 5 must be at least partially visible but may vary slightly in visibility between microscopes. A microscope which fails to meet these requirements has either too low or too high a resolution to be used for asbestos, tremolite, anthophyllite, and actinolite counting.

c. If the image quality deteriorates, clean the microscope optics and, if the problem persists, consult the microscope manufacturer.

14. Quality control of fiber counts.

a. Prepare and count field blanks along with the field samples. Report the counts on each blank. Calculate the mean of the field blank counts and subtract this value from each sample count before reporting the results.

Note 1.—The identity of the blank filters should be unknown to the counter until all counts have been completed.

Note 2: If a field blank yields fiber counts greater than 7 fibers/100 fields, report possible contamination of the samples.

b. Perform blind recounts by the same counter on 10 percent of filters counted (slides relabeled by a person other than the counter).

15. Use the following test to determine whether a pair of counts on the same filter should be rejected because of possible bias. This statistic estimates the counting repeatability at the 95% confidence level. Discard the sample if the difference between the two counts exceeds 2.77(F)s_r, where F = average of the two fiber counts and s_r = relative standard deviation, which should be derived by each laboratory based on historical in-house data.

Note.—If a pair of counts is rejected as a result of this test, recount the remaining samples in the set and test the new counts against the first counts. Discard all rejected paired counts.

16. Enroll each new counter in a training course that compares performance of counters on a variety of samples using this procedure.

Note.—To ensure good reproducibility, all laboratories engaged in asbestos, tremolite, anthophyllite, and actinolite counting are required to participate in the Proficiency Analytical Testing (PAT) Program and should routinely participate with other asbestos, tremolite, anthophyllite, and actinolite fiber counting laboratories in the exchange of field samples to compare performance of counters.

Measurement

17. Place the slide on the mechanical stage of the calibrated microscope with the center of the filter under the objective lens. Focus the microscope on the plane of the filter.

18. Regularly check phase-ring alignment and Kohler illumination.

19. The following are the counting rules:

a. Count only fibers longer than 5 um. Measure the length of curved fibers along the curve.

b. Count only fibers with a length-to-width ratio equal to or greater than 3:1.

c. For fibers that cross the boundary of the graticule field, do the following:

1. Count any fiber longer than 5 um that lies entirely within the graticule area.

2. Count as ½ fiber any fiber with only one end lying within the graticule area.

3. Do not count any fiber that crosses the graticule boundary more than once.

4. Reject and do not count all other fibers.

d. Count bundles of fibers as one fiber unless individual fibers can be identified by observing both ends of a fiber.

e. Count enough graticule fields to yield 100 fibers. Count a minimum of 20 fields. Stop at 100 fields regardless of fiber count.

20. Start counting from one end of the filter and progress along a radial line to the other end, shift either up or down on the filter, and continue in the reverse direction. Select fields randomly by looking away from the eyepiece briefly while advancing the mechanical stage. When an agglomerate covers ca. ⅛ or more of the field of view, reject the field and select another. Do not report rejected fields in the number of total fields counted.

Note.—When counting a field, continuously scan a range of focal planes by moving the fine focus knob to detect very fine fibers which have become embedded in the filter. The small-diameter fibers will be very faint but are an important contribution to the total count.

Calculations

21. Calculate and report fiber density on the filter, E (fibers/mm²); by dividing the total fiber count, F; minus the mean field blank count, B, by the number of fields, n; and the field area, A_f (0.00785 mm² for a properly calibrated Walton-Beckett graticule):

$$E = \frac{F - B}{(n)(A_f)} \text{ fibers/mm}^2$$

[Sec. 1910.1001, Appendix B]

22. Calculate the concentration, C (f/cc), of fibers in the air volume sampled, V (L), using the effective collection area of the filter, A_c (335 mm^2 for a 25-mm filter):

$$C = \frac{[E][A_c]}{V[10^3]}$$

Note.—Periodically check and adjust the value of A_c, if necessary.

Appendix C to § 1910.1001—Qualitative and Quantitative Fit Testing Procedures—Mandatory

Qualitative Fit Test Protocols

I. Isoamyl Acetate Protocol.

A. Odor Threshold Screening

1. Three 1-liter glass jars with metal lids [e.g. Mason or Bell jars] are required.

2. Odor-free water (e.g. distilled or spring water) at approximately 25° C shall be used for the solutions.

3. The isoamyl acetate (IAA) (also known as isopentyl acetate) stock solution is prepared by adding 1 cc of pure IAA to 800 cc of odor free water in a 1-liter jar and shaking for 30 seconds. This solution shall be prepared new at least weekly.

4. The screening test shall be conducted in a room separate from the room used for actual fit testing. The two rooms shall be well ventilated but shall not be connected to the same recirculating ventilation system.

5. The odor test solution is prepared in a second jar by placing 0.4 cc of the stock solution into 500 cc of odor free water using a clean dropper or pipette. Shake for 30 seconds and allow to stand for two to three minutes so that the IAA concentration above the liquid may reach equilibrium. This solution may be used for only one day.

6. A test blank is prepared in a third jar by adding 500 cc of odor free water.

7. The odor test and test blank jars shall be labelled 1 and 2 for jar identification. If the labels are put on the lids they can be periodically peeled, dried off and switched to maintain the integrity of the test.

8. The following instructions shall be typed on a card and placed on the table in front of the two test jars (i.e. 1 and 2): "The purpose of this test is to determine if you can smell banana oil at a low concentration. The two bottles in front of you contain water. One of these bottles also contains a small amount of banana oil. Be sure the covers are on tight, then shake each bottle for two seconds. Unscrew the lid of each bottle, one at a time, and sniff at the mouth of the bottle. Indicate to the test conductor which bottle contains banana oil."

9. The mixtures used in the IAA odor detection test shall be prepared in an area separate from where the test is performed, in order to prevent olfactory fatigue in the subject.

10. If the test subject is unable to correctly identify the jar containing the odor test solution, the IAA qualitative fit test may not be used.

11. If the test subject correctly identifies the jar containing the odor test solution, the test subject may proceed to respirator selection and fit testing.

B. Respirator Selection

1. The test subject shall be allowed to pick the most comfortable respirator from a selection including respirators of various sizes from different manufacturers. The selection shall include at least five sizes of elastomeric half facepieces, from at least two manufacturers.

2. The selection process shall be conducted in a room separate from the fit-test chamber to prevent odor fatigue. Prior to the selection process, the test subject shall be shown how to put on a respirator, how it should be positioned on the face, how to set strap tension and how to determine a "comfortable" respirator. A mirror shall be available to assist the subject in evaluating the fit and positioning of the respirator. This instruction may not constitute the subject's formal training on respirator use, as it is only a review.

3. The test subject should understand that the employee is being asked to select the respirator which provides the most comfortable fit. Each respirator represents a different size and shape and, if fit properly and used properly will provide adequate protection.

4. The test subject holds each facepiece up to the face and eliminates those which obviously do not give a comfortable fit. Normally, selection will begin with a half-mask and if a good fit cannot be found, the subject will be asked to test the full facepiece respirators. (A small percentage of users will not be able to wear any half-mask.)

5. The more comfortable facepieces are noted; the most comfortable mask is donned and *worn at least five minutes* to assess comfort. All donning and adjustments of the facepiece shall be performed by the test subject without assistance from the test conductor or other person. Assistance in assessing comfort can be given by discussing the points in #6 below. If the test subject is not familiar with using a particular respirator, the test subject shall be directed to don the mask several times and to adjust the straps each time to become adept at setting proper tension on the straps.

6. Assessment of comfort shall include reviewing the following points with the test subject and allowing the test subject adequate time to determine the comfort of the respirator:

- Positioning of mask on nose.
- Room for eye protection.
- Room to talk.
- Positioning mask on face and cheeks.

7. The following criteria shall be used to help determine the adequacy of the respirator fit:

- Chin properly placed.
- Strap tension.
- Fit across nose bridge.
- Distance from nose to chin.
- Tendency to slip.
- Self-observation in mirror.

8. The test subject shall conduct the conventional negative and positive-pressure fit checks (e.g. see ANSI Z88.2–1980). Before conducting the negative- or positive-pressure test the subject shall be told to "seat" the mask by rapidly moving the head from side-to-side and up and down, while taking a few deep breaths.

9. The test subject is now ready for fit testing.

10. After passing the fit test, the test subject shall be questioned again regarding the comfort of the respirator. If it has become uncomfortable, another model of respirator shall be tried.

11. The employee shall be given the opportunity to select a different facepiece and be retested if the chosen facepiece becomes increasingly uncomfortable at any time.

C. Fit Test

1. The fit test chamber shall be similar to a clear 55 gal drum liner suspended inverted over a 2 foot diameter frame, so that the top of the chamber is about 6 inches above the test subject's head. The inside top center of the chamber shall have a small hook attached.

2. Each respirator used for the fitting and fit testing shall be equipped with organic vapor cartridges or offer protection against organic vapors. The cartridges or masks shall be changed at least weekly.

3. After selecting, donning, and properly adjusting a respirator, the test subject shall wear it to the fit testing room. This room shall be separate from the room used for odor threshold screening and respirator selection, and shall be well ventilated, as by an exhaust fan or lab hood, to prevent general room contamination.

4. A copy of the following test exercises and rainbow passage shall be taped to the inside of the test chamber:

Test Exercises

i. Breathe normally.

ii. Breathe deeply. Be certain breaths are *deep* and *regular*.

iii. Turn head all the way from one side to the other. Inhale on each side. Be certain movement is complete. Do not bump the respirator against the shoulders.

iv. Nod head up-and-down. Inhale when head is in the full up position (looking toward ceiling). Be certain motions are complete and made about every second. Do not bump the respirator on the chest.

v. Talking. Talk aloud and slowly for several minutes. The following paragraph is called the Rainbow Passage. Reading it will

result in a wide range of facial movements, and thus be useful to satisfy this requirement. Alternative passages which serve the same purpose may also be used.

vi. Jogging in place.

vii. Breathe normally.

Rainbow Passage

When the sunlight strikes raindrops in the air, they act like a prism and form a rainbow. The rainbow is a division of white light into many beautiful colors. These take the shape of a long round arch, with its path high above, and its two ends apparently beyond the horizon. There is, according to legend, a boiling pot of gold at one end. People look but no one ever finds it. When a man looks for something beyond reach, his friends say he is looking for the pot of gold at the end of the rainbow.

5. Each test subject shall wear the respirator for at least 10 minutes before starting the fit test.

6. Upon entering the test chamber, the test subject shall be given a 6 inch by 6 inch piece of paper towel or other porous absorbent single ply material, folded in half and wetted with three-quarters of one cc of pure IAA. The test subject shall hang the wet towel on the hook at the top of the chamber.

7. Allow two minutes for the IAA test concentration to be reached before starting the fit-test exercises. This would be an appropriate time to talk with the test subject, to explain the fit test, the importance of cooperation, the purpose for the head exercises, or to demonstrate some of the exercises.

8. Each exercise described in #4 above shall be performed for at least one minute.

9. If at any time during the test, the subject detects the banana-like odor of IAA, the test has failed. The subject shall quickly exit from the test chamber and leave the test area to avoid olfactory fatigue.

10. If the test is failed, the subject shall return to the selection room and remove the respirator, repeat the odor sensitivity test, select and put on another respirator, return to the test chamber, and again begin the procedure described in the c(4) through c(8) above. The process continues until a respirator that fits well has been found. Should the odor sensitivity test be failed, the subject shall wait about 5 minutes before retesting. Odor sensitivity will usually have returned by this time.

11. If a person cannot pass the fit test described above wearing a half-mask respirator from the available selection, full facepiece models must be used.

12. When a respirator is found that passes the test, the subject breaks the faceseal and takes a breath before exiting the chamber. This is to assure that the reason the test subject is not smelling the IAA is the good fit of the respirator facepiece seal and not olfactory fatigue.

13. When the test subject leaves the chamber, the subject shall remove the saturated towel and return it to the person conducting the test. To keep the area from becoming contaminated, the used towels shall be kept in a self-sealing bag so there is no significant IAA concentration buildup in the test chamber during subsequent tests.

14. At least two facepieces shall be selected for the IAA test protocol. The test subject shall be given the opportunity to wear them for one week to choose the one which is more comfortable to wear.

15. Persons who have successfully passed this fit test with a half-mask respirator may be assigned the use of the test respirator in atmospheres with up to 10 times the PEL of airborne asbestos. In atmospheres greater than 10 times, and less than 100 times the PEL (up to 100 ppm), the subject must pass the IAA test using a full face negative pressure respirator. (The concentration of the IAA inside the test chamber must be increased by ten times for QLFT of the full facepiece.)

16. The test shall not be conducted if there is any hair growth between the skin the facepiece sealing surface.

17. If hair growth or apparel interfere with a satisfactory fit, then they shall be altered or removed so as to eliminate interference and allow a satisfactory fit. If a satisfactory fit is still not attained, the test subject must use a positive-pressure respirator such as powered air-purifying respirators, supplied air respirator, or self-contained breathing apparatus.

18. If a test subject exhibits difficulty in breathing during the tests, she or he shall be referred to a physician trained in respirator diseases or pulmonary medicine to determine whether the test subject can wear a respirator while performing her or his duties.

19. Qualitative fit testing shall be repeated at least every six months.

20. In addition, because the sealing of the respirator may be affected, qualitative fit testing shall be repeated immediately when the test subject has a:

(1) Weight change of 20 pounds or more,

(2) Significant facial scarring in the area of the facepiece seal,

(3) Significant dental change; i.e., multiple extractions without prothesis, or acquiring dentures,

(4) Reconstructive or cosmetic surgery, or

(5) Any other condition that may interfere with facepiece sealing.

D. Recordkeeping

A summary of all test results shall be maintained in each office for 3 years. The summary shall include:

(1) Name of test subject.

(2) Date of testing.

(3) Name of the test conductor.

(4) Respirators selected (indicate manufacturer, model, size and approval number).

(5) Testing agent.

II. Saccharin Solution Aerosol Protocol

A. Respirator Selection

Respirators shall be selected as described in section IB (respirator selection) above, except that each respirator shall be equipped with a particulate filter.

B. Taste Threshold Screening

1. An enclosure about head and shoulders shall be used for threshold screening (to determine if the individual can taste saccharin) and for fit testing. The enclosure shall be approximately 12 inches in diameter by 14 inches tall with at least the front clear to allow free movement of the head when a respirator is worn.

2. The test enclosure shall have a three-quarter inch hole in front of the test subject's nose and mouth area to accommodate the nebulizer nozzle.

3. The entire screening and testing procedure shall be explained to the test subject prior to conducting the screening test.

4. During the threshold screening test, the test subject shall don the test enclosure and breathe with open mouth with tongue extended.

5. Using a DeVilbiss Model 40 Inhalation Medication Nebulizer or equivalent, the test conductor shall spray the threshold check solution into the enclosure. This nebulizer shall be clearly marked to distinguish it from the fit test solution nebulizer.

6. The threshold check solution consists of 0.83 grams of sodium saccharin, USP in water. It can be prepared by putting 1 cc of the test solution (see C 7 below) in 100 cc. of water.

7. To produce the aerosol, the nebulizer bulb is firmly squeezed so that it collapses completely, then is released and allowed to fully expand.

8. Ten squeezes of the nebulizer bulb are repeated rapidly and then the test subject is asked whether the saccharin can be tasted.

9. If the first response is negative, ten more squeezes of the nebulizer bulb are repeated rapidly and the test subject is again asked whether the saccharin can be tasted.

10. If the second response is negative ten more squeezes are repeated rapidly and the test subject is again asked whether the saccharin can be tasted.

11. The test conductor will take note of the number of squeezes required to elicit a taste response.

12. If the saccharin is not tasted after 30 squeezes (Step 10), the saccharin fit test cannot be performed on the test subject.

13. If a taste response is elicited, the test subject shall be asked to take note of the taste for reference in the fit test.

14. Correct use of the nebulizer means that approximately 1 cc of liquid is used at a time in the nebulizer body.

15. The nebulizer shall be thoroughly rinsed in water, shaken dry, and refilled at least every four hours.

[Sec. 1910.1001, Appendix C]

C. Fit Test

1. The test subject shall don and adjust the respirator without the assistance from any person.

2. The fit test uses the same enclosure described in IIB above.

3. Each test subject shall wear the respirator for at least 10 minutes before starting the fit test.

4. The test subject shall don the enclosure while wearing the respirator selected in section 1B above. This respirator shall be properly adjusted and equipped with a particulate filter.

5. The test subject may not eat, drink (except plain water), or chew gum for 15 minutes before the test.

6. A second DeVilbiss Model 40 Inhalation Medication Nebulizer is used to spray the fit test solution into the enclosure. This nebulizer shall be clearly marked to distinguish it from the screening test solution nebulizer.

7. The fit test solution is prepared by adding 83 grams of sodium saccharin to 100 cc of warm water.

8. As before, the test subject shall breathe with mouth open and tongue extended.

9. The nebulizer is inserted into the hole in the front of the enclosure and the fit test solution is sprayed into the enclosure using the same technique as for the taste threshold screening and the same number of squeezes required to elicit a taste response in the screening. (See B8 through B10 above).

10. After generation of the aerosol read the following instructions to the test subject. The test subject shall perform the exercises for one minute each.

i. Breathe normally.

ii. Breathe deeply. Be certain breaths are *deep* and *regular*.

iii. Turn head all the way from one side *to the other*. Be certain movement is complete. Inhale on each side. Do not bump the respirator against the shoulders.

iv. Nod head up-and-down. Be certain motions are complete. Inhale when head is in the full up position (when looking toward the ceiling). Do not bump the respirator on the chest.

v. Talking. Talk loudly and slowly for several minutes. The following paragraph is called the Rainbow Passage. Reading it will result in a wide range of facial movements, and thus be useful to satisfy this requirement. Alternative passages which serve the same purpose may also be used.

vi. Jogging in place.

vii. Breathe normally.

Rainbow Passage

When the sunlight strikes raindrops in the air, they act like a prism and form a rainbow. The rainbow is a division of white light into many beautiful colors. These take the shape of a long round arch, with its path high above, and its two ends apparently beyond the horizon. There is, according to legend, a boiling pot of gold at one end. People look, but no one ever finds it. When a man looks for something beyond his reach, his friends say he is looking for the pot of gold at the end of the rainbow.

11. At the beginning of each exercise, the aerosol concentration shall be replenished using one-half the number of squeezes as initially described in C9.

12. The test subject shall indicate to the test conductor if at any time during the fit test the taste of saccharin is detected.

13. If the saccharin is detected the fit is deemed unsatisfactory and a different respirator shall be tried.

14. At least two facepieces shall be selected by the IAA test protocol. The test subject shall be given the opportunity to wear them for one week to choose the one which is more comfortable to wear.

15. Successful completion of the test protocol shall allow the use of the half mask tested respirator in contaminated atmospheres up to 10 times the PEL of asbestos. In other words this protocol may be used to assign protection factors no higher than ten.

16. The test shall not be conducted if there is any hair growth between the skin and the facepiece sealing surface.

17. If hair growth or apparel interfere with a satisfactory fit, then they shall be altered or removed so as to eliminate interference and allow a satisfactory fit. If a satisfactory fit is still not attained, the test subject must use a positive-pressure respirator such as powered air-purifying respirators, supplied air respirator, or self-contained breathing apparatus.

18. If a test subject exhibits difficulty in breathing during the tests, she or he shall be referred to a physician trained in respirator diseases or pulmonary medicine to determine whether the test subject can wear a respirator while performing her or his duties.

19. Qualitative fit testing shall be repeated at least every six months.

20. In addition, because the sealing of the respirator may be affected, qualitative fit testing shall be repeated immediately when the test subject has a:

(1) Weight change of 20 pounds or more,

(2) Significant facial scarring in the area of the facepiece seal,

(3) Significant dental change; i.e.: multiple extractions without prothesis, or acquiring dentures,

(4) Reconstructive or cosmetic surgery, or

(5) Any other condition that may interfere with facepiece sealing.

D. Recordkeeping

A summary of all test results shall be maintained in each office for 3 years. The summary shall include:

(1) Name of test subject.

(2) Date of testing.

(3) Name of test conductor.

(4) Respirators selected (indicate manufacturer, model, size and approval number).

(5) Testing agent.

III. Irritant Fume Protocol

A. Respirator selection

Respirators shall be selected as described in section 1B above, except that each respirator shall be equipped with a combination of high-efficiency and acid-gas cartridges.

B. Fit test

1. The test subject shall be allowed to smell a weak concentration of the irritant smoke to familiarize the subject with the characteristic odor.

2. The test subject shall properly don the respirator selected as above, and wear it for at least 10 minutes before starting the fit test.

3. The test conductor shall review this protocol with the test subject before testing.

4. The test subject shall perform the conventional positive pressure and negative pressure fit checks (see ANSI Z88.2 1980). Failure of either check shall be cause to select an alternate respirator.

5. Break both ends of a ventillation smoke tube containing stannic oxychloride, such as the MSA part #5645, or equivalent. Attach a short length of tubing to one end of the smoke tube. Attach the other end of the smoke tube to a low pressure air pump set to deliver 200 milliliters per minute.

6. Advise the test subject that the smoke can be irritating to the eyes and instruct the subject to keep the eyes closed while the test is performed.

7. The test conductor shall direct the stream of irritant smoke from the tube towards the faceseal area of the test subject. The person conducting the test shall begin with the tube at least 12 inches from the facepiece and gradually move to within one inch, moving around the whole perimeter of the mask.

8. The test subject shall be instructed to do the following exercises while the respirator is being challenged by the smoke. Each exercise shall be performed for one minute.

i. Breathe normally.

ii. Breathe deeply. Be certain breaths are *deep* and *regular*.

iii. Turn head all the way from one side to the other. Be certain movement is complete. Inhale on each side. Do not bump the respirator against the shoulders.

iv. Nod head up-and-down. Be certain motions are complete and made every second. Inhale when head is in the full up position (looking toward ceiling). Do not bump the respirator against the chest.

v. Talking. Talk aloud and slowly for several minutes. The following paragraph is called the Rainbow Passage. Reading it will

result in a wide range of facial movements, and thus be useful to satisfy this requirement. Alternative passages which serve the same purpose may also be used.

Rainbow Passage

When the sunlight strikes raindrops in the air, they act like a prism and form a rainbow. The rainbow is a division of white light into many beautiful colors. These take the shape of a long round arch, with its path high above, and its two ends apparently beyond the horizon. There is, according to legend, a boiling pot of gold at one end. People look, but no one ever finds it. When a man looks for something beyond his reach, his friends say he is looking for the pot of gold at the end of the rainbow.

vi. Jogging in Place.

vii. Breathe normally.

9. The test subject shall indicate to the test conductor if the irritant smoke is detected. If smoke is detected, the test conductor shall stop the test. In this case, the tested respirator is rejected and another respirator shall be selected.

10. Each test subject passing the smoke test (i.e. without detecting the smoke) shall be given a sensitivity check of smoke from the same tube to determine if the test subject reacts to the smoke. Failure to evoke a response shall void the fit test.

11. Steps B4, B9, B10 of this fit test protocol shall be performed in a location with exhaust ventilation sufficient to prevent general contamination of the testing area by the test agents.

12. At least two facepieces shall be selected by the IAA test protocol. The test subject shall be given the opportunity to wear them for one week to choose the one which is more comfortable to wear.

13. Respirators successfully tested by the protocol may be used in contaminated atmospheres up to ten times the PEL of asbestos.

14. The test shall not be conducted if there is any hair growth between the skin and the facepiece sealing surface.

15. If hair growth or apparel interfere with a satisfactory fit, then they shall be altered or removed so as to eliminate interference and allow a satisfactory fit. If a satisfactory fit is still not attained, the test subject must use a positive-pressure respirator such as powered air-purifying respirators, supplied air respirator, or self-contained breathing apparatus.

16. If a test subject exhibits difficulty in breathing during the tests, she or he shall be referred to a physician trained in respirator diseases or pulmonary medicine to determine whether the test subject can wear a respirator while performing her or his duties.

17. Qualitative fit testing shall be repeated at least every six months.

18. In addition, because the sealing of the respirator may be affected, qualitative fit testing shall be repeated immediately when the test subject has a:

(1) Weight change of 20 pounds or more,

(2) Significant facial scarring in the area of the facepiece seal,

(3) Significant dental changes; i.e.; multiple extractions without prothesis, or acquiring dentures,

(4) Reconstructive or cosmestic surgery, or

(5) Any other condition that may interfere with facepiece sealing.

C. Recordkeeping

A summary of all test results shall be maintained in each office for 3 years. The summary shall include:

(1) Name of test subject.

(2) Date of testing.

(3) Name of test conductor.

(4) Respirators selected (indicate manufacturer, model, size and approval number).

(5) Testing agent

Quantitative Fit Test Procedures

1. General.

a. The method applies to the negative-pressure nonpowered air-purifying respirators only.

b. The employer shall assign one individual who shall assume the full responsibility for implementing the respirator quantitative fit test program.

2. *Definition.*

a. "Quantitative Fit Test" means the measurement of the effectiveness of a respirator seal in excluding the ambient atmosphere. The test is performed by dividing the measured concentration of challenge agent in a test chamber by the measured concentration of the challenge agent inside the respirator facepiece when the normal air purifying element has been replaced by an essentially perfect purifying element.

b. "Challenge Agent" means the air contaminant introduced into a test chamber so that its concentration inside and outside the respirator may be compared.

c. "Test Subject" means the person wearing the respirator for quantitative fit testing.

d. "Normal Standing Position" means standing erect and straight with arms down along the sides and looking straight ahead.

e. "Fit Factor" means the ratio of challenge agent concentration outside with respect to the inside of a respirator inlet covering (facepiece or enclosure).

3. *Apparatus.*

a. *Instrumentation.* Corn oil, sodium chloride or other appropriate aerosol generation, dilution, and measurement systems shall be used for quantitative fit test.

b. *Test chamber.* The test chamber shall be large enough to permit all test subjects to freely perform all required exercises without distributing the challenge agent concentration or the measurement apparatus. The test chamber shall be equipped and constructed so that the challenge agent is effectively isolated from the ambient air yet uniform in concentration throughout the chamber.

c. When testing air-purifying respirators, the normal filter or cartridge element shall be replaced with a high-efficiency particular filter supplied by the same manufacturer.

d. The sampling instrument shall be selected so that a strip chart record may be made of the test showing the rise and fall of challenge agent concentration with each inspiration and expiration at fit factors of at least 2,000.

e. The combination of substitute air-purifying elements (if any), challenge agent, and challenge agent concentration in the test chamber shall be such that the test subject is not exposed in excess of PEL to the challenge agent at any time during the testing process.

f. The sampling port on the test specimen respirator shall be placed and constructed so that there is no detectable leak around the port, a free air flow, is allowed into the sampling line at all times and so there is no interference with the fit or performance of the respirator.

g. The test chamber and test set-up shall permit the person administering the test to observe one test subject inside the chamber during the test.

h. The equipment generating the challenge atmosphere shall maintain the concentration of challenge agent constant within a 10 percent variation for the duration of the test.

i. The time lag (interval between an event and its being recorded on the strip chart) of the instrumentation may not exceed 2 seconds.

j. The tubing for the test chamber atmosphere and for the respirator sampling port shall be the same diameter, length and material. It shall be kept as short as possible. The smallest diameter tubing recommended by the manufacturer shall be used.

k. The exhaust flow from the test chamber shall pass through a high-efficiency filter before release to the room.

l. When sodium chloride aerosol is used, the relative humidity inside the test chamber shall not exceed 50 percent.

4. *Procedural Requirements.*

a. The fitting of half-mask respirators should be started with those having multiple sizes and a variety of interchangeable cartridges and canisters such as the MSA Comfo II-M, Norton M, Survivair M, A-O M, or Scott-M. Use either of the tests outlined below to assure that the facepiece is properly adjusted.

(1) *Positive pressure test.* With the exhaust port(s) blocked, the negative pressure of slight inhalation should remain constant for several seconds.

(2) *Negative pressure test.* With the intake port(s) blocked, the negative pressure slight

inhalation should remain constant for several seconds.

b. After a facepiece is adjusted, the test subject shall wear the facepiece for at least 5 minutes before conducting a qualitive test by using either of the methods described below and using the exercise regime described in 5.a., b., c., d. and e.

(1) *Isoamyl acetate test.* When using organic vapor cartridges, the test subject who can smell the odor should be unable to detect the odor of isoamyl acetate squirted into the air near the most vulnerable portions of the facepiece seal. In a location which is separated from the test area, the test subject shall be instructed to close her/his eyes during the test period. A combination cartridge or canister with organic vapor and high-efficiency filters shall be used when available for the particular mask being tested. The test subject shall be given an opportunity to smell the odor of isoamyl acetate before the test is conducted.

(2) *Irritant fume test.* When using high-efficiency filters, the test subject should be unable to detect the odor of irritant fume (stannic chloride or titanium tetrachloride ventilation smoke tubes) squirted into the air near the most vulnerable portions of the facepiece seal. The test subject shall be instructed to close her/his eyes during the test period.

c. The test subject may enter the quantitative testing chamber only if she or he has obtained a satisfactory fit as stated in 4.b. of this Appendix.

d. Before the subject enters the test chamber, a reasonably stable challenge agent concentration shall be measured in the test chamber.

e. Immediately after the subject enters the test chamber, the challenge agent concentration inside the respirator shall be measured to ensure that the peak penetration does not exceed 5 percent for a half-mask and 1 percent for a full facepiece.

f. A stable challenge agent concentration shall be obtained prior to the actual start of testing.

(1) Respirator restraining straps may not be overtightened for testing. The straps shall be adjusted by the wearer to give a reasonably comfortable fit typical of normal use.

5. *Exercise Regime.* Prior to entering the test chamber, the test subject shall be given complete instructions as to her/his part in the test procedures. The test subject shall perform the following exercises, in the order given, for each independent test.

a. *Normal Breathing (NB).* In the normal standing position, without talking, the subject shall breathe normally for at least one minute.

b. *Deep Breathing (DB).* In the normal standing position the subject shall do deep breathing for at least one minute pausing so as not to hyperventilate.

c. *Turning head side to side (SS).* Standing in place the subject shall slowly turn his/her head from side between the extreme positions to each side. The head shall be held at each extreme position for at least 5 seconds. Perform for at least three complete cycles.

d. *Moving head up and down (UD).* Standing in place, the subject shall slowly move his/her head up and down between the extreme position straight up and the extreme position straight down. The head shall be held at each extreme position for at least 5 seconds. Perform for at least three complete cycles.

e. *Reading (R).* The subject shall read out slowly and loud so as to be heard clearly by the test conductor or monitor. The test subject shall read the "rainbow passage" at the end of this section.

f. *Grimace (G).* The test subject shall grimace, smile, frown, and generally contort the face using the facial muscles. Continue for at least 15 seconds.

g. *Bend over and touch toes (B).* The test subject shall bend at the waist and touch toes and return to upright position. Repeat for at least 30 seconds.

h. *Jogging in place (J).* The test subject shall perform jog in place for at least 30 seconds.

i. *Normal Breathing (NB).* Same as exercise a.

Rainbow Passage

When the sunlight strikes raindrops in the air, they act like a prism and form a rainbow. The rainbow is a division of white light into many beautiful colors. These take the shape of a long round arch, with its path high above, and its two ends apparently beyond the horizon. There is, according to legend, a boiling pot of gold at one end. People look, but no one ever finds it. When a man looks for something beyond reach, his friends say he is looking for the pot of gold at the end of the rainbow.

6. The test shall be terminated whenever any single peak penetration exceeds 5 percent for half-masks and 1 percent for full facepieces. The test subject may be refitted and retested. If two of the three required tests are terminated, the fit shall be deemed inadequate. (See paragraph 4.h.)

7. *Calculation of Fit Factors.*

a. The fit factor determined by the quantitative fit test equals the average concentration inside the respirator.

b. The average test chamber concentration is the arithmetic average of the test chamber concentration at the beginning and of the end of the test.

c. The average peak concentration of the challenge agent inside the respirator shall be the arithmetic average peak concentrations for each of the nine exercises of the test which are computed as the arithmetic average of the peak concentrations found for each breath during the exercise.

d. The average peak concentration for an exercise may be determined graphically if there is not a great variation in the peak concentrations during a single exercise.

8. *Interpretation of Test Results.* The fit factor measured by the quantitative fit testing shall be the lowest of the three protection factors resulting from three independent tests.

9. *Other Requirements.*

a. The test subject shall not be permitted to wear a half-mask or full facepiece mask if the minimum fit factor of 100 or 1,000, respectively, cannot be obtained. If hair growth or apparel interfere with a satisfactory fit, then they shall be altered or removed so as to eliminate interference and allow a satisfactory fit. If a satisfactory fit is still not attained, the test subject must use a positive-pressure respirator such as powered air-purifying respirators, supplied air respirator, or self-contained breathing apparatus.

b. The test shall not be conducted if there is any hair growth between the skin and the facepiece sealing surface.

c. If a test subject exhibits difficulty in breathing during the tests, she or he shall be referred to a physician trained in respirator diseases or pulmonary medicine to determine whether the test subject can wear a respirator while performing her or his duties.

d. The test subject shall be given the opportunity to wear the assigned respirator for one week. If the respirator does not provide a satisfactory fit during actual use, the test subject may request another QNFT which shall be performed immediately.

e. A respirator fit factor card shall be issued to the test subject with the following information:

(1) Name.

(2) Date of fit test.

(3) Protection factors obtained through each manufacturer, model and approval number of respirator tested.

(4) Name and signature of the person that conducted the test.

f. Filters used for qualitative or quantitative fit testing shall be replaced weekly, whenever increased breathing resistance is encountered, or when the test agent has altered the integrity of the filter media.

Organic vapor cartridges/canisters shall be replaced daily or sooner if there is any indication of breakthrough by the test agent.

10. In addition, because the sealing of the respirator may be affected, quantitative fit testing shall be repeated immediately when the test subject has a:

(1) Weight change of 20 pounds or more,

(2) Significant facial scarring in the area of the facepiece seal,

(3) Significant dental change; i.e., multiple extractions without prothesis, or acquiring dentures,

(4) Reconstructive or cosmetic surgery, or

(5) Any other condition that may interfere with facepiece sealing.

[Sec. 1910.1001, Appendix C]

11. *Recordkeeping.*

A summary of all test results shall be maintained in for 3 years. The summary shall include:

(1) Name of test subject.

(2) Date of testing.

(3) Name of the test conductor.

(4) Fit factors obtained from every respirator tested (indicate manufacturer, model, size and approval number).

Appendix D to § 1910.1001—Medical Questionnaires; Mandatory

This mandatory appendix contains the medical questionnaires that must be administered to all employees who are exposed to asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals above the action level, and who will therefore be included in their employer's medical surveillance program. Part 1 of the appendix contains the Initial Medical Questionnaire, which must be obtained for all new hires who will be covered by the medical surveillance requirements. Part 2 includes the abbreviated Periodical Medical Questionnaire, which must be administered to all employees who are provided periodic medical examinations under the medical surveillance provisions of the standard.

Part 1
INITIAL MEDICAL QUESTIONNAIRE

1. NAME _____

2. SOCIAL SECURITY # ___ ___ ___ ___ ___ ___ ___ ___ ___
(1 2 3 4 5 6 7 8 9)

3. CLOCK NUMBER ___ ___ ___ ___ ___ ___
(10 11 12 13 14 15)

4. PRESENT OCCUPATION _____

5. PLANT _____ _____

6. ADDRESS _____

7. _____
(Zip Code)

8. TELEPHONE NUMBER _____

9. INTERVIEWER _____

10. DATE _____ ___ ___ ___ ___ ___ ___
(16 17 18 19 20 21)

11. Date of Birth _____ ___ ___ ___ ___ ___ ___
Month Day Year (22 23 24 25 26 27)

12. Place of Birth _____

13. Sex
1. Male ___
2. Female ___

14. What is your marital status?
1. Single ___
2. Married ___
3. Widowed ___
4. Separated/Divorced ___

15. Race
1. White ___
2. Black ___
3. Asian ___
4. Hispanic ___
5. Indian ___
6. Other ___

16. What is the highest grade completed in school? _____
(For example 12 years is completion of high school)

OCCUPATIONAL HISTORY

17A. Have you ever worked full time (30 hours per week or more) for 6 months or more? 1. Yes ___ 2. No ___

IF YES TO 17A:

B. Have you ever worked for a year or more in any dusty job? 1. Yes ___ 2. No ___ 3. Does Not Apply ___

Specify job/industry _____ Total Years Worked ___

Was dust exposure: 1. Mild ___ 2. Moderate ___ 3. Severe ___

C. Have you ever been exposed to gas or chemical fumes in your work? 1. Yes ___ 2. No ___

Specify job/industry _____ Total Years Worked ___

Was exposure: 1. Mild ___ 2. Moderate ___ 3. Severe ___

[Sec. 1910.1001, Appendix D]

D. What has been your usual occupation or job--the one you have worked at the longest?

1. Job occupation _____

2. Number of years employed in this occupation _____

3. Position/job title _____

4. Business, field or industry _____

(Record on lines the years in which you have worked in any of these industries, e.g. 1960-1969)

Have you ever worked:

		YES	NO
E.	In a mine?	[ ]	[ ]
F.	In a quarry?	[ ]	[ ]
G.	In a foundry?	[ ]	[ ]
H.	In a pottery?	[ ]	[ ]
I.	In a cotton, flax or hemp mill?	[ ]	[ ]
J.	With asbestos?	[ ]	[ ]

18. PAST MEDICAL HISTORY

	YES	NO
A. Do you consider yourself to be in good health?	[ ]	[ ]
If "NO" state reason _____		
B. Have you any defect of vision?	[ ]	[ ]
If "YES" state nature of defect _____		
C. Have you any hearing defect?	[ ]	[ ]
If "YES" state nature of defect _____		
D. Are you suffering from or have you ever suffered from:		
a. Epilepsy (or fits, seizures, convulsions)?	[ ]	[ ]
b. Rheumatic fever?	[ ]	[ ]
c. Kidney disease?	[ ]	[ ]
d. Bladder disease?	[ ]	[ ]
e. Diabetes?	[ ]	[ ]
f. Jaundice?	[ ]	[ ]

19. CHEST COLDS AND CHEST ILLNESSES

19A. If you get a cold, does it usually go to your chest? (Usually means more than 1/2 the time) 1. Yes __ 2. No __ 3. Don't get colds __

20A. During the past 3 years, have you had any chest illnesses that have kept you off work, indoors at home, or in bed? 1. Yes __ 2. No __

If YES TO 20A:

B. Did you produce phlegm with any of these chest illnesses? 1. Yes __ 2. No __ 3. Does Not Apply __

C. In the last 3 years, how many such illnesses with (increased) phlegm did you have which lasted a week or more? Number of illnesses __ No such illnesses __

21. Did you have any lung trouble before the age of 16? 1. Yes __ 2. No __

22. Have you ever had any of the following?

1A. Attacks of bronchitis? 1. Yes __ 2. No __

If YES TO 1A:

B. Was it confirmed by a doctor? 1. Yes __ 2. No __ 3. Does Not Apply __

C. At what age was your first attack? Age in Years __ Does Not Apply __

2A. Pneumonia (include bronchopneumonia)? 1. Yes __ 2. No __

If YES TO 2A:

B. Was it confirmed by a doctor? 1. Yes __ 2. No __ 3. Does Not Apply __

C. At what age did you first have it? Age in Years __ Does Not Apply __

3A. Hay Fever? 1. Yes __ 2. No __

If YES TO 3A:

B. Was it confirmed by a doctor? 1. Yes __ 2. No __ 3. Does Not Apply __

C. At what age did it start? Age in Years __ Does Not Apply __

23A. Have you ever had chronic bronchitis? 1. Yes __ 2. No __

If YES TO 23A:

B. Do you still have it? 1. Yes __ 2. No __ 3. Does Not Apply __

C. Was it confirmed by a doctor? 1. Yes __ 2. No __ 3. Does Not Apply __

D. At what age did it start? Age in Years __ Does Not Apply __

24A. Have you ever had emphysema? 1. Yes __ 2. No __

If YES TO 24A:

B. Do you still have it? 1. Yes __ 2. No __ 3. Does Not Apply __

C. Was it confirmed by a doctor? 1. Yes __ 2. No __ 3. Does Not Apply __

D. At what age did it start? Age in Years __ Does Not Apply __

25A. Have you ever had asthma? 1. Yes __ 2. No __

If YES TO 25A:

B. Do you still have it? 1. Yes __ 2. No __ 3. Does Not Apply __

C. Was it confirmed by a doctor? 1. Yes __ 2. No __ 3. Does Not Apply __

D. At what age did it start? Age in Years __ Does Not Apply __

E. If you no longer have it, at what age did it stop? Age stopped __ Does Not Apply __

26. Have you ever had:

A. Any other chest illness? 1. Yes __ 2. No __

If yes, please specify _____

B. Any chest operations? 1. Yes __ 2. No __

If yes, please specify _____

C. Any chest injuries? 1. Yes __ 2. No __

If yes, please specify _____

27A. Has a doctor ever told you that you had heart trouble? 1. Yes __ 2. No __

IF YES TO 27A:

B. Have you ever had treatment for heart trouble in the past 10 years? 1. Yes __ 2. No __ 3. Does Not Apply __

28A. Has a doctor ever told you that you had high blood pressure? 1. Yes __ 2. No __

IF YES TO 28A:

B. Have you had any treatment for high blood pressure (hypertension) in the past 10 years? 1. Yes __ 2. No __ 3. Does Not Apply __

29. When did you last have your chest X-rayed? (Year) __ __ __ __ (25 26 27 28)

30. Where did you last have your chest X-rayed (if known)? _____

What was the outcome? _____

FAMILY HISTORY

31. Were either of your natural parents ever told by a doctor that they had a chronic lung condition such as:

	FATHER 1. Yes	2. No	3. Don't Know	MOTHER 1. Yes	2. No	3. Don't Know
A. Chronic Bronchitis?	__	__	__	__	__	__
B. Emphysema?	__	__	__	__	__	__
C. Asthma?	__	__	__	__	__	__
D. Lung cancer?	__	__	__	__	__	__
E. Other chest conditions	__	__	__	__	__	__
F. Is parent currently alive?	__	__	__	__	__	__
G. Please Specify	__ Age if Living __ Age at Death __ Don't Know			__ Age if Living __ Age at Death __ Don't Know		
H. Please specify cause of death	_____			_____		

COUGH

32A. Do you usually have a cough? (Count a cough with first smoke or on first going out of doors. Exclude clearing of throat.) [If no, skip to question 32C.] 1. Yes __ 2. No __

B. Do you usually cough as much as 4 to 6 times a day 4 or more days out of the week? 1. Yes __

C. Do you usually cough at all on getting up or first thing in the morning? 1. Yes __ 2. No __

D. Do you usually cough at all during the rest of the day or at night? 1. Yes __ 2. No __

IF YES TO ANY OF ABOVE (32A, B, C, or D), ANSWER THE FOLLOWING. IF NO TO ALL, CHECK DOES NOT APPLY AND SKIP TO NEXT PAGE

E. Do you usually cough like this on most days for 3 consecutive months or more during the year? 1. Yes __ 2. No __ 3. Does not apply __

F. For how many years have you had the cough? Number of years __ Does not apply __

33A. Do you usually bring up phlegm from your chest? (Count phlegm with the first smoke or on first going out of doors. Exclude phlegm from the nose. Count swallowed phlegm.) (If no, skip to 33C) 1. Yes __ 2. No __

B. Do you usually bring up phlegm like this as much as twice a day 4 or more days out of the week? 1. Yes __ 2. No __

C. Do you usually bring up phlegm at all on getting up or first thing in the morning? 1. Yes __ 2. No __

D. Do you usually bring up phlegm at all during the rest of the day or at night? 1. Yes __ 2. No __

IF YES TO ANY OF THE ABOVE (33A, B, C, or D), ANSWER THE FOLLOWING: IF NO TO ALL, CHECK DOES NOT APPLY AND SKIP TO 34A.

E. Do you bring up phlegm like this on most days for 3 consecutive months or more during the year? 1. Yes __ 2. No __ 3. Does not apply __

F. For how many years have you had trouble with phlegm? Number of years __ Does not apply __

EPISODES OF COUGH AND PHLEGM

34A. Have you had periods or episodes of (increased*) cough and phlegm lasting for 3 weeks or more each year?
*(For persons who usually have cough and/or phlegm) 1. Yes __ 2. No __

IF YES TO 34A

B. For how long have you had at least 1 such episode per year? Number of years __ Does not apply __

WHEEZING

35A. Does your chest ever sound wheezy or whistling

1. When you have a cold? 1. Yes __ 2. No __
2. Occasionally apart from colds? 1. Yes __ 2. No __
3. Most days or nights? 1. Yes __ 2. No __

IF YES TO 1, 2, or 3 in 35A

B. For how many years has this been present? — Number of years ___ Does not apply ___

36A. Have you ever had an attack of wheezing that has made you feel short of breath? — 1. Yes ___ 2. No ___

IF YES TO 36A

B. How old were you when you had your first such attack? — Age in years ___ Does not apply ___

C. Have you had 2 or more such episodes? — 1. Yes ___ 2. No ___ 3. Does not apply ___

D. Have you ever required medicine or treatment for (his/her) attack(s)? — 1. Yes ___ 2. No ___ 3. Does not apply ___

BREATHLESSNESS

37. If disabled from walking by any condition other than heart or lung disease, please describe and proceed to question 38A. Return of condition(s)_____

38A. Are you troubled by shortness of breath when hurrying on the level or walking up a slight hill? — 1. Yes ___ 2. No ___

IF YES TO 38A

B. Do you have to walk slower than people of your age on the level because of breathlessness? — 1. Yes ___ 2. No ___ 3. Does not apply ___

C. Do you ever have to stop for breath when walking at your own pace on the level? — 1. Yes ___ 2. No ___ 3. Does not apply ___

D. Do you ever have to stop for breath after walking about 100 yards (or after a few minutes) on the level? — 1. Yes ___ 2. No ___ 4. Does not apply ___

E. Are you too breathless to leave the house or breathless on dressing or climbing one flight of stairs? — 1. Yes ___ 2. No ___ 3. Does not apply ___

TOBACCO SMOKING

39A. Have you ever smoked cigarettes? (No means less than 20 packs of cigarettes or 12 oz. of tobacco in a lifetime or less than 1 cigarette a day for 1 year.) — 1. Yes ___ 2. No ___

IF YES TO 39A

B. Do you now smoke cigarettes (as of one month ago) — 1. Yes ___ 2. No ___ 4. Does not apply ___

C. How old were you when you first started regular cigarette smoking? — Age in years ___ Does not apply ___

D. If you have stopped smoking cigarettes completely, how old were you when you stopped? — Age stopped ___ Check if still smoking ___ Does not apply ___

E. How many cigarettes do you smoke per day now? — Cigarettes per day ___ Does not apply ___

F. On the average of the entire time you smoked, how many cigarettes did you smoke per day? — Cigarettes per day ___ Does not apply ___

G. Do or did you inhale the cigarette smoke? — 1. Does not apply ___ 2. Not at all ___ 3. Slightly ___ 4. Moderately ___ 5. Deeply ___

40A. Have you ever smoked a pipe regularly? (Yes means more than 12 oz. of tobacco in a lifetime.) — 1. Yes ___ 2. No ___

IF YES TO 40A:

FOR PERSONS WHO HAVE EVER SMOKED A PIPE

B. 1. How old were you when you started to smoke a pipe regularly? — Age ___

2. If you have stopped smoking a pipe completely, how old were you when you stopped? — Age stopped ___ Check if still smoking pipe ___ Does not apply ___

C On the average over the entire time you smoked a pipe, how much pipe tobacco did you smoke per week? — ___ oz. per week (a standard pouch of tobacco contains 1 1/2 oz.) ___ Does not apply

D. How much pipe tobacco are you smoking now? — oz. per week ___ Not currently smoking a pipe ___

E. Do you or did you inhale the pipe smoke? — 1. Never smoked ___ 2. Not at all ___ 3. Slightly ___ 4. Moderately ___ 5. Deeply ___

41A. Have you ever smoked cigars regularly? (Yes means more than 1 cigar a week for a year) — 1. Yes ___ 2. No ___

IF YES TO 41A

FOR PERSONS WHO HAVE EVER SMOKED CIGARS

B. 1. How old were you when you started smoking cigars regularly? — Age ___

2. If you have stopped smoking cigars completely, how old were you when you stopped. — Age stopped ___ Check if still smoking cigars ___ Does not apply ___

C. On the average over the entire time you smoked cigars, how many cigars did you smoke per week? — Cigars per week ___ Does not apply ___

D. How many cigars are you smoking per week now? — Cigars per week ___ Check if not smoking cigars currently ___

E. Do or did you inhale the cigar smoke? — 1. Never smoked ___ 2. Not at all ___ 3. Slightly ___ 4. Moderately ___ 5. Deeply ___

Signature _____ Date _____

Part 2
PERIODIC MEDICAL QUESTIONNAIRE

1. NAME _____

2. SOCIAL SECURITY # ___ ___ ___ ___ ___ ___ ___ ___ ___ ___
1 2 3 4 5 6 7 8 9

3. CLOCK NUMBER ___ ___ ___ ___ ___ ___ ___
10 11 12 13 14 15

4. PRESENT OCCUPATION _____

5. PLANT _____

6. ADDRESS _____

7. _____
(Zip Code)

8. TELEPHONE NUMBER _____

9. INTERVIEWER _____

10. DATE _____ ___ ___ ___ ___ ___ ___
16 17 18 19 20 21

11. What is your marital status? 1. Single ___ 2. Married ___ 3. Widowed ___ 4. Separated/Divorced ___

12. OCCUPATIONAL HISTORY

12A. In the past year, did you work full time (30 hours per week or more) for 6 months or more? 1. Yes ___ 2. No ___

IF YES TO 12A:

12B. In the past year, did you work in a dusty job? 1. Yes ___ 2. No ___ 3. Does Not Apply ___

12C. Was dust exposure: 1. Mild ___ 2. Moderate ___ 3. Severe ___

12D. In the past year, were you exposed to gas or chemical fumes in your work? 1. Yes ___ 2. No ___

12E. Was exposure: 1. Mild ___ 2. Moderate ___ 3. Severe ___

12F. In the past year, what was your: 1. Job/occupation? _____ 2. Position/job title? _____

13. RECENT MEDICAL HISTORY

13A. Do you consider yourself to be in good health? Yes ___ No ___

If NO, state reason _____

13B. In the past year, have you developed:

	Yes	No
Epilepsy?	___	___
Rheumatic fever?	___	___
Kidney disease?	___	___
Bladder disease?	___	___
Diabetes?	___	___
Jaundice?	___	___
Cancer?	___	___

14. CHEST COLDS AND CHEST ILLNESSES

14A. If you get a cold, does it usually go to your chest? (Usually means more than 1/2 the time) 1. Yes ___ 2. No ___ 3. Don't get colds ___

15A. During the past year, have you had any chest illnesses that have kept you off work, indoors at home, or in bed? 1. Yes ___ 2. No ___ 3. Does Not Apply ___

IF YES TO 15A:

15B. Did you produce phlegm with any of these chest illnesses? 1. Yes ___ 2. No ___ 3. Does Not Apply ___

15C. In the past year, how many such illnesses with (increased) phlegm did you have which lasted a week or more? Number of illnesses ___ No such illnesses ___

16. RESPIRATORY SYSTEM

In the past year have you had:

	Yes or No	Further Comment on Positive Answers
Asthma	___	
Bronchitis	___	
Hay Fever	___	
Other Allergies	___	

	Yes or No	Further Comment on Positive Answers
Pneumonia	___	
Tuberculosis	___	
Chest Surgery	___	
Other Lung Problems	___	
Heart Disease	___	

Do you have:

	Yes or No	Further Comment on Positive Answers
Frequent colds	___	
Chronic cough	___	
Shortness of breath when walking or climbing one flight of stairs	___	
Do you:		
Wheeze	___	
Cough up phlegm	___	
Smoke cigarettes	___	Packs per day ___ How many years ___

Date _____ Signature _____

Appendix E to § 1910.1001—Interpretation and Classification of Chest Roentgenograms—Mandatory

(a) Chest roentgenograms shall be interpreted and classified in accordance with a professionally accepted classification system and recorded on a Roentgenographic Interpretation Form. "Form CSD/NIOSH (M) 2.8.

(b) Roentgenograms shall be interpreted and classified only by a B-reader, a board eligible/certified radiologist, or an experienced physician with known expertise in pneumoconioses.

(c) All interpreters, whenever interpreting chest roentgenograms made under this section, shall have immediately available for reference a complete set of the ILO–U/C International Classification of Radiographs for Pneumoconioses, 1980.

Appendix F to § 1910.1001—Work Practices and Engineering Controls for Automotive Brake Repair Operations—Non-Mandatory

This appendix is intended as guidance for employers in the automotive brake and clutch repair industry who wish to reduce their employees' asbestos exposures during repair operations to levels below the new standard's action level (0.1 f/cc). OSHA believes that employers in this industry sector are likely to be able to reduce their employees' exposures to asbestos by employing the engineering and work practice controls described in Sections A and B of this appendix. Those employers who choose to use these controls and who achieve exposures below the action level will thus be able to avoid any burden that might be imposed by complying with such requirements as medical surveillance, recordkeeping, training, respiratory protection, and regulated areas, which are triggered when employee exposures exceed the action level or PEL.

Asbestos exposure in the automotive brake and clutch repair industry occurs primarily during the replacement of clutch plates and brake pads, shoes, and linings. Asbestos fibers may become airborne when an automotive mechanic removes the asbestos-containing residue that has been deposited as brakes and clutches wear. Employee exposures to asbestos occur during the cleaning of the brake drum or clutch housing.

Based on evidence in the rulemaking record (Exs. 84–74, 84–263, 90–148), OSHA believes that employers engaged in brake repair operations who implement any of the work practices and engineering controls described in Sections A and B of this appendix may be able to reduce their employees' exposures to levels below the action level (0.1 fiber/cc). These control methods and the relevant record evidence on these and other methods are described in the following sections.

A. Enclosed Cylinder/HEPA Vacuum System Method

The enclosed cylinder-vacuum system used in one of the facilities visited by representatives of the National Institute for Occupational Safety and Health (NIOSH) during a health hazard evaluation of brake repair facilities (Ex. 84–263) consists of three components:

(1) A wheel-shaped cylinder designed to cover and enclose the wheel assembly;

(2) A compressed-air hose and nozzle that fits into a port in the cylinder; and

(3) A HEPA-filtered vacuum used to evacuate airborne dust generated within the cylinder by the compressed air.

To operate the system, the brake assembly is enclosed in a cylinder that has viewing ports to provide visibility and cotton sleeves through which the mechanic can handle the brake assembly parts. The cylinder effectively isolates asbestos dust in the drum from the mechanic's breathing zone. The brake assembly isolation cylinder is available from the Nilfisk Company [1] and comes in two sizes to fit brake drums in the 7-to-12-inch size range common to automobiles and light trucks and the 12-to-19-inch size range common to large commercial vehicles. The cylinder is equipped with built-in compressed-air guns and a connection for a vacuum cleaner equipped with a High Efficiency Particulate Air (HEPA) filter. This type of filter is capable of removing all particles greater than 0.3 microns from the air. When the vacuum cleaner's filter is full, it must be replaced according to the manufacturer's instruction, and appropriate HEPA-filtered dual cartridge respirators should be worn during the process. The filter of the vacuum cleaner is assumed to be contaminated with asbestos fibers and should be handled carefully, wetted with a fine mist of water, placed immediately in a labelled plastic bag, and disposed of properly. When the cylinder is in place around the brake assembly and the HEPA vacuum is connected, compressed air is blown into the cylinder to loosen the residue from the brake assembly parts. The vacuum then evacuates the loosened material from within the cylinder, capturing the airborne material on the HEPA filter.

The HEPA vacuum system can be disconnected from the brake assembly isolation cylinder when the cylinder is not being used. The HEPA vacuum can then be used for clutch facing work, grinding, or other routine cleaning.

B. Compressed Air/Solvent System Method

A compressed-air hose fitted at the end with a bottle of solvent can be used to loosen the asbestos-containing residue and to capture the resulting airborne particles in the solvent mist. The mechanic should begin spraying the asbestos-contaminated parts with the solvent at a sufficient distance to ensure that the asbestos particles are not dislodged by the velocity of the solvent spray. After the asbestos particles are thoroughly wetted, the spray may be brought closer to the parts and the parts may be sprayed as necessary to remove grease and other material. The automotive parts sprayed with the mist are then wiped with a rag, which must then be disposed of appropriately. Rags should be placed in a labelled plastic bag or other container while they are still wet. This ensures that the asbestos fibers will not become airborne after the brake and clutch parts have been cleaned. (If cleanup rags are laundered rather than disposed of, they must be washed using methods appropriate for the laundering of asbestos-contaminated materials.)

OSHA believes that a variant of this compressed-air/solvent mist process offers advantages over the compressed-air/solvent mist technique discussed above, both in terms of costs and employee protection. The variant involves the use of spray cans filled with any of several solvent cleaners commercially available from auto supply stores. Spray cans of solvent are inexpensive, readily available, and easy to use. These cans will also save time, because no solvent delivery system has to be assembled, i.e., no compressed-air hose/mister ensemble. OSHA believes that a spray can will deliver solvent to the parts to be cleaned with considerably less force than the alternative compressed-air delivery system described above, and will thus generate fewer airborne asbestos fibers than the compressed-air method. The Agency therefore believes that the exposure levels of automotive repair mechanics using the spray can/solvent mist process will be even lower than the exposures reported by NIOSH (Ex. 84–263) for the compressed-air/solvent mist system (0.06 f/cc).

C. Information on the Effectiveness of Various Control Measures

The amount of airborne asbestos generated during brake and clutch repair operations depends on the work practices and engineering controls used during the repair or removal activity. Data in the rulemaking record document the 8-hour time-weighted averages (TWA_8) asbestos exposure levels associated with various methods of brake and clutch repair and removal.

NIOSH submitted a report to the record entitled "Health Hazard Evaluation for Automotive Brake Repair" (Ex. 84–263). In addition, Exhibits 84–74 and 90–148 provided exposure data for comparing the airborne concentrations of asbestos generated by the use of various work practices during brake repair operations. These reports present

[1] Mention of tradenames or commercial products does not constitute endorsement or recommendation for use.

exposure data for brake repair operations involving a variety of controls and work practices, including:

- Use of compressed air to blow out the brake drums;
- Use of a brush, without a wetting agent, to remove the asbestos-containing residue;
- Use of a brush dipped in water or a solvent to remove the asbestos-containing residue;
- Use of an enclosed vacuum cleaning system to capture the asbestos-containing residue; and
- Use of a solvent mixture applied with compressed air to remove the residue.

Prohibited Methods

The use of compressed air to blow the asbestos-containing residue off the surface of the brake drum removes the residue effectively but simultaneously produces an airborne cloud of asbestos fibers. According to NIOSH (Ex. 84-263), the peak exposures of mechanics using this technique were as high as 15 fibers/cc, and 8-hour TWA exposures ranged from 0.03 to 0.19 f/cc.

Dr. William J. Nicholson of the Mount Sinai School of Medicine (Ex. 84-74) cited data from Knight and Hickish (1970) that indicated that the concentration of asbestos ranged from 0.84 to 5.35 f/cc over a 60-minute sampling period when compressed air was being used to blow out the asbestos-containing residue from the brake drum. In the same study, a peak concentration of 87 f/cc was measured for a few seconds during brake cleaning performed with compressed air. Rohl et al. (1976) (Ex. 90-148) measured area concentrations (of unspecified duration) within 3-5 feet of operations involving the cleaning of brakes with compressed air and obtained readings ranging from 6.6 to 29.8 f/cc. Because of the high exposure levels that result from cleaning brake and clutch parts using compressed air, OSHA has prohibited this practice in the revised standard.

Ineffective Methods

When dry brushing was used to remove the asbestos-containing residue from the brake drums and wheel assemblies, peak exposures measured by NIOSH ranged from 0.61 to 0.81 f/cc, while 8-hour TWA levels were at the new standard's permissible exposure limit (PEL) of 0.2 f/cc (Ex. 84-263). Rohl and his colleagues (Ex. 90-148) collected area samples 1-3 feet from a brake cleaning operation being performed with a dry brush, and measured concentrations ranging from 1.3 to 3.6 f/cc; however, sampling times and TWA concentrations were not presented in the Rohl et al. study.

When a brush wetted with water, gasoline, or Stoddart solvent was used to clean the asbestos-containing residue from the affected parts, exposure levels (8-hour TWAs) measured by NIOSH also exceeded the new 0.2 f/cc PEL, and peak exposures ranged as high as 2.62 f/cc (Ex. 84-263).

Preferred Methods

Use of an engineering control system involving a cylinder that completely encloses the brake shoe assembly and a High Efficiency Particulate Air (HEPA) filter-equipped vacuum produced 8-hour TWA employee exposures of 0.01 f/cc and peak exposures ranging from nondetectable to 0.07 f/cc (Ex. 84-263). (Because this system achieved exposure levels below the standard's action level, it is described in detail below.) Data collected by the Mount Sinai Medical Center (Ex. 90-148) for Nilfisk of America, Inc., the manufacturer of the brake assembly enclosure system, showed that for two of three operations sampled, the exposure of mechanics to airborne asbestos fibers was nondetectable. For the third operator sampled by Mt. Sinai researchers, the exposure was 0.5 f/cc, which the authors attributed to asbestos that had contaminated the operator's clothing in the course of previous brake repair operations performed without the enclosed cylinder/vacuum system.

Some automotive repair facilities use a compressed-air hose to apply a solvent mist to remove the asbestos-containing residue from the brake drums before repair. The NIOSH data (Ex. 84-263) indicated that mechanics employing this method experienced exposures (8-hour TWAs) of 0.8 f/cc, with peaks of 0.25 to 0.66 f/cc. This technique, and a variant of it that OSHA believes is both less costly and more effective in reducing employee exposures, is described in greater detail above in Sections A and B.

D. Summary

In conclusion, OSHA believes that it is likely that employers in the brake and clutch repair industry will be able to avail themselves of the action level trigger built into the revised standard if they conscientiously employ one of the three control methods described above: the enclosed cylinder/HEPA vacuum system, the compressed air/solvent method, or the spray can/solvent mist system.

Appendix G to § 1910.1001—Substance Technical Information for Asbestos—Non-Mandatory

I. Substance Identification

A. Substance: "Asbestos" is the name of a class of magnesium-silicate minerals that occur in fibrous form. Minerals that are included in this group are chrysotile, crocidolite, amosite, tremolite asbestos, anthophyllite asbestos, and actinolite asbestos.

B. Asbestos, tremolite, anthophyllite, and actinolite are used in the manufacture of heat-resistant clothing, automotive brake and clutch linings, and a variety of building materials including floor tiles, roofing felts, ceiling tiles, asbestos-cement pipe and sheet, and fire-resistant drywall. Asbestos is also present in pipe and boiler insulation materials, and in sprayed-on materials located on beams, in crawlspaces, and between walls.

C. The potential for a product containing asbestos, tremolite, anthophyllite, and actinolite to release breatheable fibers depends on its degree of friability. Friable means that the material can be crumbled with hand pressure and is therefore likely to emit fibers. The fibrous or fluffy sprayed-on materials used for fireproofing, insulation, or sound proofing are considered to be friable, and they readily release airborne fibers if disturbed. Materials such as vinyl-asbestos floor tile or roofing felts are considered nonfriable and generally do not emit airborne fibers unless subjected to sanding or sawing operations. Asbestos-cement pipe or sheet can emit airborne fibers if the materials are cut or sawed, or if they are broken during demolition operations.

D. Permissible exposure: Exposure to airborne asbestos, tremolite, anthophyllite, and actinolite fibers may not exceed 0.2 fibers per cubic centimeter of air (0.2 f/cc) averaged over the 8-hour workday.

II. Health Hazard Data

A. Asbestos, tremolite, anthophyllite, and actinolite can cause disabling respiratory disease and various types of cancers if the fibers are inhaled. Inhaling or ingesting fibers from contaminated clothing or skin can also result in these diseases. The symptoms of these diseases generally do not appear for 20 or more years after initial exposure.

B. Exposure to asbestos, tremolite, anthophyllite, and actinolite has been shown to cause lung cancer, mesothelioma, and cancer of the stomach and colon. Mesothelioma is a rare cancer of the thin membrane lining of the chest and abdomen. Symptoms of mesothelioma include shortness of breath, pain in the walls of the chest, and/or abdominal pain.

III. Respirators and Protective Clothing

A. Respirators: You are required to wear a respirator when performing tasks that result in asbestos, tremolite, anthophyllite, and actinolite exposure that exceeds the permissible exposure limit (PEL) of 0.2 f/cc. These conditions can occur while your employer is in the process of installing engineering controls to reduce asbestos, tremolite, anthophyllite, and actinolite exposure, or where engineering controls are not feasible to reduce asbestos, tremolite, anthophyllite, and actinolite exposure. Air-purifying respirators equipped with a high-efficiency particulate air (HEPA) filter can be used where airborne asbestos, tremolite, anthophyllite, and actinolite fiber concentrations do not exceed 2 f/cc; otherwise, air-supplied, positive-pressure, full facepiece respirators must be used. Disposable respirators or dust masks are not

[Sec. 1910.1001, Appendix G]

permitted to be used for asbestos, tremolite, anthophyllite, and actinolite work. For effective protection, respirators must fit your face and head snugly. Your employer is required to conduct fit tests when you are first assigned a respirator and every 6 months thereafter. Respirators should not be loosened or removed in work situations where their use is required.

B. Protective Clothing: You are required to wear protective clothing in work areas where asbestos, tremolite, anthophyllite, and actinolite fiber concentrations exceed the permissible exposure limit (PEL) of 0.2 f/cc to prevent contamination of the skin. Where protective clothing is required, your employer must provide you with clean garments. Unless you are working on a large asbestos, tremolite, anthophyllite, and actinolite removal or demolition project, your employer must also provide a change room and separate lockers for your street clothes and contaminated work clothes. If you are working on a large asbestos, tremolite, anthophyllite, and actinolite removal or demolition project, and where it is feasible to do so, your employer must provide a clean room, shower, and decontamination room contiguous to the work area. When leaving the work area, you must remove contaminated clothing before proceeding to the shower. If the shower is not adjacent to the work area, you must vacuum your clothing before proceeding to the change room and shower. To prevent inhaling fibers in contaminated change rooms and showers, leave your respirator on until you leave the shower and enter the clean change room.

IV. Disposal Procedures and Cleanup

A. Wastes that are generated by processes where asbestos, tremolite, anthophyllite, and actinolite is present include:

1. Empty asbestos, tremolite, anthophyllite, and actinolite shipping containers.

2. Process wastes such as cuttings, trimmings, or reject material.

3. Housekeeping waste from sweeping or vacuuming.

4. Asbestos, tremolite, anthophyllite, and actinolite fireproofing or insulating material that is removed from buildings.

5. Building products that contain asbestos, tremolite, anthophyllite, and actinolite removed during building renovation or demolition.

6. Contaminated disposable protective clothing.

B. Empty shipping bags can be flattened under exhaust hoods and packed into airtight containers for disposal. Empty shipping drums are difficult to clean and should be sealed.

C. Vacuum logs or disposable paper filters should not be cleaned, but should be sprayed with a fine water mist and placed into a labeled waste container.

D. Process waste and housekeeping waste should be wetted with water or a mixture of water and surfactant prior to packaging in disposable containers.

E. Material containing asbestos, tremolite, anthophyllite, and actinolite that is removed from buildings must be disposed of in leak-tight 6-mil thick plastic bags, plastic-lined cardboard containers, or plastic-lined metal containers. These wastes, which are removed while wet, should be sealed in containers before they dry out to minimize the release of asbestos, tremolite, anthophyllite, and actinolite fibers during handling.

V. Access to Information

A. Each year, your employer is required to inform you of the information contained in this standard and appendices for asbestos, tremolite, anthophyllite, and actinolite. In addition, your employer must instruct you in the proper work practices for handling materials containing asbestos, tremolite, anthophyllite, and actinolite, and the correct use of protective equipment.

B. Your employer is required to determine whether you are being exposed to asbestos, tremolite, anthophyllite, and actinolite. You or your representative has the right to observe employee measurements and to record the results obtained. Your employer is required to inform you of your exposure, and, if you are exposed above the permissible limit, he or she is required to inform you of the actions that are being taken to reduce your exposure to within the permissible limit.

C. Your employer is required to keep records of your exposures and medical examinations. These exposure records must be kept for at least thirty (30) years. Medical records must be kept for the period of your employment plus thirty (30) years.

D. Your employer is required to release your exposure and medical records to your physician or designated representative upon your written request.

Appendix H to § 1910.1001—Medical Surveillance Guidelines for Asbestos Tremolite, Anthophyllite, and Actinolite Non-Mandatory

I. Route of Entry Inhalation, Ingestion

II. Toxicology

Clinical evidence of the adverse effects associated with exposure to asbestos, tremolite, anthophyllite, and actinolite, is present in the form of several well-conducted epidemiological studies of occupationally exposed workers, family contacts of workers, and persons living near asbestos, tremolite, anthophyllite, and actinolite mines. These studies have shown a definite association between exposure to asbestos, tremolite, anthophyllite, and actinolite and an increased incidence of lung cancer, pleural and peritoneal mesothelioma, gastrointestinal cancer, and asbestosis. The latter is a disabling fibrotic lung disease that is caused only by exposure to asbestos. Exposure to asbestos, tremolite, anthophyllite, and actinolite has also been associated with an increased incidence of esophageal, kidney, laryngeal, pharyngeal, and buccal cavity cancers. As with other known chronic occupational diseases, disease associated with asbestos, tremolite, anthophyllite, and actinolite generally appears about 20 years following the first occurrence of exposure. There are no known acute effects associated with exposure to asbestos, tremolite, anthophyllite, and actinolite.

Epidemiological studies indicate that the risk of lung cancer among exposed workers who smoke cigarettes is greatly increased over the risk of lung cancer among non-exposed smokers or exposed nonsmokers. These studies suggest that cessation of smoking will reduce the risk of lung cancer for a person exposed to asbestos, tremolite, anthophyllite, and actinolite but will not reduce it to the same level of risk as that existing for an exposed worker who has never smoked.

III. Signs and Symptoms of Exposure-Related Disease

The signs and symptoms of lung cancer or gastrointestinal cancer induced by exposure to asbestos, tremolite, anthophyllite, and actinolite are not unique, except that a chest X-ray of an exposed patient with lung cancer may show pleural plaques, pleural calcification, or pleural fibrosis. Symptoms characteristic of mesothelioma include shortness of breath, pain in the walls of the chest, or abdominal pain. Mesothelioma has a much longer latency period compared with lung cancer (40 years versus 15–20 years), and mesothelioma is therefore more likely to be found among workers who were first exposed to asbestos at an early age. Mesothelioma is always fatal.

Asbestosis is pulmonary fibrosis caused by the accumulation of asbestos fibers in the lungs. Symptoms include shortness of breath, coughing, fatigue, and vague feelings of sickness. When the fibrosis worsens, shortness of breath occurs even at rest. The diagnosis of asbestosis is based on a history of exposure to asbestos, the presence of characteristic radiologic changes, end-inspiratory crackles (rales), and other clinical features of fibrosing lung disease. Pleural plaques and thickening are observed on X-rays taken during the early stages of the disease. Asbestosis is often a progressive disease even in the absence of continued exposure, although this appears to be a highly individualized characteristic. In severe cases, death may be caused by respiratory or cardiac failure.

[Sec. 1910.1001, Appendix H]

IV. Surveillance and Preventive Considerations

As noted above, exposure to asbestos, tremolite, anthophyllite, and actinolite has been linked to an increased risk of lung cancer, mesothelioma, gastrointestinal cancer, and asbestosis among occupationally exposed workers. Adequate screening tests to determine an employee's potential for developing serious chronic diseases, such as cancer, from exposure to asbestos, tremolite, anthophyllite, and actinolite do not presently exist. However, some tests, particularly chest X-rays and pulmonary function tests, may indicate that an employee has been overexposed to asbestos, tremolite, anthophyllite, and actinolite, increasing his or her risk of developing exposure-related chronic diseases. It is important for the physician to become familiar with the operating conditions in which occupational exposure to asbestos, tremolite, anthophyllite, and actinolite is likely to occur. This is particularly important in evaluating medical and work histories and in conducting physical examinations. When an active employee has been identified as having been overexposed to asbestos, tremolite, anthophyllite, and actinolite, measures taken by the employer to eliminate or mitigate further exposure should also lower the risk of serious long-term consequences.

The employer is required to institute a medical surveillance program for all employees who are or will be exposed to asbestos, tremolite, anthophyllite, and actinolite at or above the action level (0.1 fiber per cubic centimeter of air) for 30 or more days per year and for all employees who are assigned to wear a negative-pressure respirator. All examinations and procedures must be performed by or under the supervision of a licensed physician, at a reasonable time and place, and at no cost to the employee.

Although broad latitude is given to the physician in prescribing specific tests to be included in the medical surveillance program, OSHA requires inclusion of the following elements in the routine examination:

(i) Medical and work histories with special emphasis directed to symptoms of the respiratory system, cardiovascular system, and digestive tract.

(ii) Completion of the respiratory disease questionnaire contained in Appendix D.

(iii) A physical examination including a chest roentgenogram and pulmonary function test that includes measurement of the employee's forced vital capacity (FVC) and forced expiratory volume at one second (FEV_1).

(iv) Any laboratory or other test that the examining physician deems by sound medical practice to be necessary.

The employer is required to make the prescribed tests available at least annually to those employees covered; more often than specified if recommended by the examining physician; and upon termination of employment.

The employer is required to provide the physician with the following information: A copy of this standard and appendices; a description of the employee's duties as they relate to asbestos exposure; the employee's representative level of exposure to asbestos tremolite, anthophyllite, and actinolite; a description of any personal protective and respiratory equipment used; and information from previous medical examinations of the affected employee that is not otherwise available to the physician. Making this information available to the physician will aid in the evaluation of the employee's health in relation to assigned duties and fitness to wear personal protective equipment, if required.

The employer is required to obtain a written opinion from the examining physician containing the results of the medical examination; the physician's opinion as to whether the employee has any detected medical conditions that would place the employee at an increased risk of exposure-related disease; any recommended limitations on the employee or on the use of personal protective equipment; and a statement that the employee has been informed by the physician of the results of the medical examination and of any medical conditions related to asbestos, tremolite, anthophyllite, and actinolite exposure that require further explanation or treatment. This written opinion must not reveal specific findings or diagnoses unrelated to exposure to asbestos, tremolite, anthophyllite, and actinolite, and a copy of the opinion must be provided to the affected employee.

[Sec. 1910.1001, Appendix H]

§ 1926.58 Asbestos, tremolite, anthophyllite, and actinolite.

[Sec. 1926.58 added by 51 FR 22756, June 20, 1986]

(a) *Scope and application.* This section applies to all construction work as defined in 29 CFR 1910.12(b), including but not limited to the following:

(1) Demolition or salvage of structures where asbestos, tremolite, anthophyllite, or actinolite is present;

(2) Removal or encapsulation of materials containing asbestos, tremolite, anthophyllite, or actinolite;

(3) Construction, alteration, repair, maintenance, or renovation of structures, substrates, or portions thereof, that contain asbestos, tremolite, anthophyllite, or actinolite;

(4) Installation of products containing asbestos, tremolite, anthophyllite, or actinolite;

(5) Asbestos, tremolite, anthophyllite, and actinolite spill/emergency cleanup; and

(6) Transportation, disposal, storage, or containment of asbestos, tremolite, anthophyllite, or actinolite or products containing asbestos, tremolite, anthophyllite, or actinolite on the site or location at which construction activities are performed.

(b) *Definitions.* "Action level" means an airborne concentration of asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals of 0.1 fiber per cubic centimeter (f/cc) of air calculated as an eight (8)-hour time-weighted average.

"Asbestos" includes chrysotile, amosite, crocidolite, tremolite asbestos, anthophyllite asbestos, actinolite asbestos, and any of these minerals that has been chemically treated and/or altered.

"Assistant Secretary" means the Assistant Secretary of Labor for Occupational Safety and Health, U.S. Department of Labor, or designee.

"Authorized person" means any person authorized by the employer and required by work duties to be present in regulated areas.

"Clean room" means an uncontaminated room having facilities for the storage of employees' street clothing and uncontaminated materials and equipment.

"Competent person" means one who is capable of identifying existing asbestos, tremolite, anthophyllite, or actinolite hazards in the workplace and who has the authority to take prompt corrective measures to eliminate them, as specified in 29 CFR 1926.32(f). The duties of the competent person include at least the following: establishing the negative-pressure enclosure, ensuring its integrity, and controlling entry to and exit from the enclosure; supervising any employee exposure monitoring required by the standard; ensuring that all employees working within such an enclosure wear the appropriate personal protective equipment, are trained in the use of appropriate methods of exposure control, and use the hygiene facilities and decontamination procedures specified in the standard; and ensuring that engineering controls in use are in proper operating condition and are functioning properly.

"Decontamination area" means an enclosed area adjacent and connected to the regulated area and consisting of an equipment room, shower area, and clean room, which is used for the decontamination of workers, materials, and equipment contaminated with asbestos, tremolite, anthophyllite, or actinolite.

"Demolition" means the wrecking or taking out of any load-supporting structural member and any related razing, removing, or stripping of asbestos, tremolite, anthophyllite, or actinolite products.

"Director" means the Director, National Institute for Occupational Safety and Health, U.S. Department of Health and Human Services, or designee.

"Employee exposure" means that exposure to airborne asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals, that would occur if the employee were not using respiratory protective equipment.

"Equipment room (change room)" means a contaminated room located within the decontamination area that is supplied with impermeable bags or containers for the disposal of contaminated protective clothing and equipment.

"Fiber" means a particulate form of asbestos, tremolite, anthophyllite, or actinolite, 5 micrometers or longer, with a length-to-diameter ratio of at least 3 to 1.

"High-efficiency particulate air (HEPA) filter" means a filter capable of trapping and retaining at least 99.97 percent of all monodispersed particles of 0.3 micrometers in diameter or larger.

"Regulated area" means an area established by the employer to demarcate areas where airborne concentrations of asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals exceed or can reasonably be expected to exceed the permissible exposure limit. The regulated area may take the form of (1) a temporary enclosure, as required by paragraph (e)(6) of this section, or (2) an area demarcated in any manner that minimizes the number of employees exposed to asbestos, tremolite, anthophyllite, or actinolite.

"Removal" means the taking out or stripping of asbestos, tremolite, anthophyllite, or actinolite or materials containing asbestos, tremolite, anthophyllite, or actinolite.

[Sec. 1926.58(b)]

"Renovation" means the modifying of any existing structure, or portion thereof, where exposure to airborne asbestos, tremolite, anthophyllite, actinolite may result.

"Repair" means overhauling, rebuilding, reconstructing, or reconditioning of structures or substrates where asbestos, tremolite, anthophyllite,or actinolite is present.

"Tremolite, anthophyllite and actinolite" means the non-asbestos form of these minerals, and any of these minerals that have been chemically treated and/or altered.

(c) *Permissible exposure limit (PEL).* The employer shall ensure that no employee is exposed to an airborne concentration of asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals in excess of 0.2 fiber per cubic centimeter of air as an eight (8) hour time-weighted average (TWA), as determined by the method prescribed in Appendix A of this section, or by an equivalent method.

(d) *Communication among employers.* On multi-employer worksites, an employer performing asbestos, tremolite, anthophyllite, or actinolite work requiring the establishment of a regulated area shall inform other employers on the site of the nature of the employer's work with asbestos, tremolite, anthophyllite, or actinolite and of the existence of and requirements pertaining to regulated areas.

(e) *Regulated areas*—(1) *General.* The employer shall establish a regulated area in work areas where airborne concentrations of asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals exceed or can reasonably be expected to exceed the permissible exposure limit prescribed in paragraph (c) of this section.

(2) *Demarcation.* The regulated area shall be demarcated in any manner that minimizes the number of persons within the area and protects persons outside the area from exposure to airborne concentrations of asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals in excess of the permissible exposure limit.

(3) *Access.* Access to regulated areas shall be limited to authorized persons or to persons authorized by the Act or regulations issued pursuant thereto.

(4) *Respirators.* All persons entering a regulated area shall be supplied with a respirator, selected in accordance with paragraph (h)(2) of this section.

(5) *Prohibited activities.* The employer shall ensure that employees do not eat, drink, smoke, chew tobacco or gum, or apply cosmetics in the regulated area.

(6) *Requirements for asbestos removal, demolition, and renovation operations.* (i) Wherever feasible, the employer shall establish negative-pressure enclosures before commencing removal, demolition, and renovation operations.

(ii) The employer shall designate a competent person to perform or supervise the following duties:

(A) Set up the enclosure;

(B) Ensure the integrity of the enclosure;

(C) Control entry to and exit from the enclosure;

(D) Supervise all employee exposure monitoring required by this section;

(E) Ensure that employees working within the enclosure wear protective clothing and respirators as required by paragraphs (i) and (h) of this section and;

(F) Ensure that employees are trained in the use of engineering controls, work practices, and personal protective equipment;

(G) Ensure that employees use the hygiene facilities and observe the decontamination procedures specified in paragraph (j) of this section; and

(H) Ensure that engineering controls are functioning properly.

(iii) In addition to the qualifications specified in paragraph (b) of this section, the competent person shall be trained in all aspects of asbestos, tremolite, anthophyllite, or actinolite abatement, the contents of this standard, the identification of asbestos, tremolite, anthophyllite, or actinolite and their removal procedures, and other practices for reducing the hazard. Such training shall be obtained in a comprehensive course, such as a course conducted by an EPA Asbestos Training Center, or an equivalent course.

(iv) *Exception:* For small-scale, short-duration operations, such as pipe repair, valve replacement, installing electrical conduits, installing or removing drywall, roofing, and other general building maintenance or renovation, the employer is not required to comply with the requirements of paragraph (e)(6) of this section.

(f) *Exposure monitoring*—(1) *General.* (i) Each employer who has a workplace or work operation covered by this standard shall perform monitoring to determine accurately the airborne concentrations of asbestos, tremolite, anthophyllite, actinolite or a combination of these minerals to which employees may be exposed.

(ii) Determinations of employee exposure shall be made from breathing zone air samples that are representative of the 8-hour TWA of each employee.

(iii) Representative 8-hour TWA employee exposure shall be determined on the basis of one or more samples representing full-shift exposure for employees in each work area.

(2) *Initial monitoring.* (i) Each employer who has a workplace or work operation covered by this standard, except as provided for in paragraph (f)(2)(ii) and (f)(2)(iii) of this section, shall perform initial monitoring at the initiation of each asbestos, tremolite, anthophyllite, actinolite job to accurately determine the airborne concentrations of asbestos, tremolite, anthophyllite, or actinolite to which employees may be exposed.

(ii) The employer may demonstrate that employee exposures are below the action level by means of objective data demonstrating that the product or material containing asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals cannot release airborne fibers in concentrations exceeding the action level under those work conditions having the greatest potential for releasing asbestos, tremolite, anthophyllite, or actinolite.

(iii) Where the employer has monitored each asbestos, tremolite, anthophyllite, or actinolite job, and the data were obtained during work operations conducted under workplace conditions closely resembling the processes, type of material, control methods, work practices, and environmental conditions used and prevailing in the employer's current operations, the employer may rely on such earlier monitoring results to satisfy the requirements of paragraph (f)(2)(i) of this section.

(3) *Periodic monitoring within regulated areas.* The employer shall conduct daily monitoring that is representative of the exposure of each employee who is assigned to work within a regulated area. *Exception:* When all employees within a regulated area are equipped with supplied-air respirators operated in the positive-pressure mode, the employer may dispense with the daily monitoring required by this paragraph.

(4) *Termination of monitoring.* If the periodic monitoring required by paragraph (f)(3) of this section reveals that employee exposures, as indicated by statistically reliable measurements, are below the action level, the employer may discontinue monitoring for those employees whose exposures are represented by such monitoring.

(5) *Method of monitoring.* (i) All samples taken to satisfy the monitoring requirements of paragraph (f) of this section shall be personal samples

[Sec. 1926.58(f)(5)(i)]

collected following the porocedures specified in Appendix A.

(ii) All samples taken to satisfy the monitoring requirements of paragraph (f) of this section shall be evaluated using the OSHA Reference Method (ORM) specified in Appendix A, or an equivalent counting method.

(iii) If an equivalent method to the ORM is used, the employer shall ensure that the method meets the following criteria:

(A) Replicate exposure data used to establish equivalency are collected in side-by-side field and laboratory comparisons;

(B) The comparison indicates that 90 percent of the samples collected in the range 0.5 to 2.0 times the permissible limit have an accuracy range of plus or minus 25 percent of the ORM results with a 95 percent confidence level as demonstrated by a statistically valid protocol; and

(C) The equivalent method is documented and the results of the comparison testing are maintained.

(iv) To satisfy the monitoring requirements of paragraph (f), employers shall rely on the results of monitoring analysis performed by laboratories that have instituted quality assurance programs that include the elements prescribed in Appendix A.

(6) *Employee notification of monitoring results.* (i) The employer shall notify affected employees of the monitoring results that represent that employee's exposure as soon as possible following receipt of monitoring results.

(ii) The employer shall notify affected employees of the results of monitoring representing the employee's exposure in writing either individually or by posting at a centrally located place that is accessible to affected employees.

(7) *Observation of monitoring.* (i) The employer shall provide affected employees or their designated representatives an opportunity to observe any monitoring of employee exposure to asbestos, tremolite, anthophyllite, or actinolite conducted in accordance with this section.

(ii) When observation of the monitoring of employee exposure to asbestos, tremolite, anthophyllite, or actinolite requires entry into an area where the use of protective clothing or equipment is required, the observer shall be provided with and be required to use such clothing and equipment and shall comply with all other applicable safety and health procedures.

(g) *Methods of compliance.*—(1) *Engineering controls and work practices.* (i) The employer shall use one or any combination of the following control methods to achieve compliance with the permissible exposure limit prescribed by paragraph (c) of this section:

(A) Local exhaust ventilation equipped with HEPA filter dust collection systems;

(B) General ventilation systems;

(C) Vacuum cleaners equipped with HEPA filters;

(D) Enclosure or isolation of processes producing asbestos, tremolite, anthophyllite, or actinolite dust;

(E) Use of wet methods, wetting agents, or removal encapsulants to control employee exposures during asbestos, tremolite, anthophyllite, or actinolite handling, mixing, removal, cutting, application, and cleanup;

(F) Prompt disposal of wastes contaminated with asbestos, tremolite, anthophyllite, or actinolite in leak-tight containers; or

(G) Use of work practices or other engineering controls that the Assistant Secretary can show to be feasible.

(ii) Wherever the feasible engineering and work practice controls described above are not sufficient to reduce employee exposure to or below the limit prescribed in paragraph (c), the employer shall use them to reduce employee exposure to the lowest levels attainable by these controls and shall supplement them by the use of respiratory protection that complies with the requirements of paragraph (h) of this section.

(2) *Prohibitions.* (i) High-speed abrasive disc saws that are not equipped with appropriate engineering controls shall not be used for work related to asbestos, tremolite, anthophyllite, or actinolite.

(ii) Compressed air shall not be used to remove asbestos, tremolite, anthophyllite, or actinolite or materials containing asbestos, tremolite, anthophyllite, or actinolite unless the compressed air is used in conjunction with an enclosed ventilation system designed to capture the dust cloud created by the compressed air.

(iii) Materials containing asbestos, tremolite, anthophyllite, or actinolite shall not be applied by spray methods.

(3) *Employee rotation.* The employer shall not use employee rotation as a means of compliance with the exposure limit prescribed in paragraph (c) of this section.

(h) *Respiratory protection.*—(1) *General.* The employer shall provide respirators, and ensure that they are used, where required by this section. Respirators shall be used in the following circumstances:

(i) During the interval necessary to install or implement feasible engineering and work practice controls;

(ii) In work operations such as maintenance and repair activities, or other activities for which engineering and work practice controls are not feasible;

(iii) In work situations where feasible engineering and work practice controls are not yet sufficient to reduce exposure to or below the exposure limit; and

(iv) In emergencies.

(2) *Respirator selection.* (i) Where respirators are used, the employer shall select and provide, at no cost to the employee, the appropriate respirator as specified in Table D–4, and shall ensure that the employee uses the respirator provided.

(ii) The employer shall select respirators from among those jointly approved as being acceptable for protection by the Mine Safety and Health Administration (MSHA) and the National Institute for Occupational Safety and Health (NIOSH) under the provisions of 30 CFR Part 11.

(iii) The employer shall provide a powered, air-purifying respirator in lieu of any negative-pressure respirator specified in Table D–4 whenever:

(A) An employee chooses to use this type of respirator; and

(B) This respirator will provide adequate protection to the employee.

TABLE D–4.—RESPIRATORY PROTECTION FOR ASBESTOS, TREMOLITE, ANTHOPHYLLITE, AND ACTINOLITE FIBERS

Airborne concentration of asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals	Required respirator
Not in excess of 2 f/cc (10 X PEL).	1. Half-mask air-purifying respirator equipped with high-efficiency filters.
Not in excess of 10 f/cc (50 X PEL).	1. Full facepiece air-purifying respirator equipped with high-efficiency filters.
Not in excess of 20 f/cc (100 X PEL).	1. Any powered air purifying respirator equipped with high efficiency filters. 2. Any supplied-air respirator operated in continuous flow mode.
Not in excess of 200 f/cc (1000 X PEL).	1. Full facepiece supplied-air respirator operated in pressure demand mode.
Greater than 200 f/cc (>1,000 X PEL) or unknown concentration.	1. Full facepiece supplied air respirator operated in pressure demand mode equipped with an auxiliary positive pressure self-contained breathing apparatus.

NOTE: a. Respirators assigned for higher environmental concentrations may be used at lower concentrations.

b. A high-efficiency filter means a filter that is at least 99.97 percent efficient against mono-dispersed particles of 0.3 micrometers in diameter or larger.

(3) *Respirator program.* (i) Where respiratory protection is used, the employer shall institute a respirator program in accordance with 29 CFR 1910.134(b), (d), (e), and (f).

(ii) The employer shall permit each employee who uses a filter respirator to

[Sec. 1926.58(h)(3)(ii)]

change the filter elements whenever an increase in breathing resistance is detected and shall maintain an adequate supply of filter elements for this purpose.

(iii) Employees who wear respirators shall be permitted to leave work areas to wash their faces and respirator facepieces whenever necessary to prevent skin irritation associated with respirator use.

(iv) No employee shall be assigned to tasks requiring the use of respirators if, based on his or her 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 of other employees will be impaired by the use of a respirator. Such employee shall be assigned to another job or given the opportunity to transfer to a different position the duties of which he or she is able to perform with the same employer, in the same geographical area, and with the same seniority, status, and rate of pay he or she had just prior to such transfer, if such a different position is available.

(4) *Respirator fit testing.* (i) The employer shall ensure that the respirator issued to the employee exhibits the least possible facepiece leakage and that the respirator is fitted properly.

(ii) Employers shall perform either quantitative or qualitative face fit tests at the time of initial fitting and at least every 6 months thereafter for each employee wearing a negative-pressure respirator. The qualitative fit tests may be used only for testing the fit of half-mask respirators where they are permited to be worn, and shall be conducted in accordance with Appendix C. The tests shall be used to select facepieces that provide the required protection as prescribed in Table 1.

(l) *Protective clothing*—(1) *General.* The employer shall provide and require the use of protective clothing, such as coveralls or similar whole-body clothing, head coverings, gloves, and foot coverings for any employee exposed to airborne concentrations of asbestos, tremolite, anthophyllite, actinolite or a combination of these minerals that exceed the permissible exposure limit prescribed in paragraph (c) of this section.

(2) *Laundering.* (i) The employer shall ensure that laundering of contaminated clothing is done so as to prevent the release of airborne asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals in excess of the exposure limit prescribed in paragraph (c) of this section.

(ii) Any employer who gives contaminated clothing to another person for laundering shall inform such person of the requirement in paragraph (l)(2)(i) of this section to effectively prevent the release of airborne asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals in excess of the exposure limit prescribed in paragraph (c) of this section.

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

(4) *Protective clothing for removal, demolition, and renovation operations.* (i) The competent person shall periodically examine worksuits worn by employees for rips or tears that may occur during performance of work.

(ii) When rips or tears are detected while an employee is working within a negative-pressure enclosure, rips and tears shall be immediately mended, or the worksuit shall be immediately replaced.

(j) *Hygiene facilities and practices*—(1) *General.* (i) The employer shall provide clean change areas for employees required to work in regulated areas or required by paragraph (l)(1) of this section to wear protective clothing. *Exception:* In lieu of the change area requirement specified in paragraph (j)(1)(i), the employer may permit employees engaged in small scale, short duration operations, as described in paragraph (e)(6) of this section, to clean their protective clothing with a portable HEPA-equipped vacuum before such employees leave the area where maintenance was performed.

(ii) The employer shall ensure that change areas are equipped with separate storage facilities for protective clothing and street clothing, in accordance with section 1910.141(e).

(iii) Whenever food or beverages are consumed at the worksite and employees are exposed to airborne concentrations of asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals in excess of the permissible exposure limit, the employer shall provide lunch areas in which the airborne concentrations of asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals are below the action level.

(2) *Requirements for removal, demolition, and renovation operations*—(i) *Decontamination area.* Except for small scale, short duration operations, as described in paragraph (e)(6) of this section, the employer shall establish a decontamination area that is adjacent and connected to the regulated area for the decontamination of employees contaminated with asbestos, tremolite, anthophyllite, or actinolite. The decontamination area shall consist of an equipment room, shower area, and clean room in series. The employer shall ensure that employees enter and exit the regulated area through the decontamination area.

(ii) *Clean room.* The clean room shall be equipped with a locker or appropriate storage container for each employee's use.

(iii) *Shower area.* Where feasible, shower facilities shall be provided which comply with 29 CFR 1910.141(d)(3). The showers shall be contiguous both to the equipment room and the clean change room, unless the employer can demonstrate that this location is not feasible. Where the employer can demonstrate that it is not feasible to locate the shower between the equipment room and the clean change room, the employer shall ensure that employees:

(A) Remove asbestos, tremolite, anthophyllite, or actinolite contamination from their worksuits using a HEPA vacuum before proceeding to a shower that is not contiguous to the work area; or

(B) Remove their contaminated worksuits, don clean worksuits, and proceed to a shower that is not contiguous to the work area.

(iv) *Equipment room.* The equipment room shall be supplied with impermeable, labeled bags and containers for the containment and disposal of contaminated protective clothing and equipment.

(v) *Decontamination area entry procedures.* (A) the employer shall ensure that employees:

(*1*) Enter the decontamination area through the clean room;

(*2*) Remove and deposit street clothing within a locker provided for their use; and

(*3*) Put on protective clothing and respiratory protection before leaving the clean room.

(B) Before entering the enclosure, the employer shall ensure that employees pass through the equipment room.

(vi) *Decontamination area exit procedures.* (A) Before leaving the regulated area, the employer shall ensure that employees remove all gross contamination and debris from their protective clothing.

(B) The employer shall ensure that employees remove their protective clothing in the equipment room and deposit the clothing in labeled impermeable bags or containers.

(C) The employer shall ensure that employees do not remove their respirators in the equipment room.

[Sec. 1926.58(j)(2)(vi)(C)]

(D) The employer shall ensure that employees shower prior to entering the clean room.

(E) The employer shall ensure that, after showering, employees enter the clean room before changing into street clothes.

(k) *Communication of hazards to employees*—(1) *Signs.* (i) Warning signs that demarcate the regulated area shall be provided and displayed at each location where airborne concentrations of asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals may be in excess of the exposure limit prescribed in paragraph (c) of this section. Signs shall be posted at such a distance from such a location that an employee may read the signs and take necessary protective steps before entering the area marked by the signs.

(ii) The warning signs required by paragraph (k)(1)(i) of this section shall bear the following information:

DANGER

ASBESTOS

CANCER AND LUNG DISEASE HAZARD

AUTHORIZED PERSONNEL ONLY

RESPIRATORS AND PROTECTIVE CLOTHING ARE REQUIRED IN THIS AREA

(iii) Where minerals in the regulated area are only tremolite, anthophyllite or actinolite, the employer may replace the term "asbestos" with the appropriate mineral name.

(2) *Labels.* (i) Labels shall be affixed to all products containing asbestos, tremolite, anthophyllite, or actinolite and to all containers containing such products, including waste containers. Where feasible, installed asbestos, tremolite, anthophyllite, or actinolite products shall contain a visible label.

(ii) Labels shall be printed in large, bold letters on a contrasting background.

(iii) Labels shall be used in accordance with the requirements of 29 CFR 1910.1200(f) of OSHA's Hazard Communication standard, and shall contain the folowing information:

DANGER

CONTAINS ASBESTOS FIBERS

AVOID CREATING DUST

CANCER AND LUNG DISEASE HAZARD

(iv) Where minerals to be labeled are only tremolite, anthophyllite and actinolite, the employer may replace the term "asbestos" with the appropriate mineral name.

(v) Labels shall contain a warning statement against breathing airborne asbestos, tremolite, anthophyllite, or actinolite fibers.

(vi) The provisions for labels required by paragraphs (k)(2)(i)–(k)(2)(iv) do not apply where:

(A) asbestos, tremolite, anthophyllite, or actinolite fibers have been modified by a bonding agent, coating, binder, or other material, provided that the manufacturer can demonstrate that, during any reasonably foreseeable use, handling, storage, disposal, processing, or transportation, no airborne concentrations of asbestos, tremolite, anthophyllite, actinolite, or a combination of these mineral fibers in excess of the action level will be released, or

(B) asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals is present in a product in concentrations less than 0.1 percent by weight.

(3) *Employee information and training.* (i) The employer shall institute a training program for all employees exposed to airborne concentrations of asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals in excess of the action level and shall ensure their participation in the program.

(ii) Training shall be provided prior to or at the time of initial assignment, unless the employee has received equivalent training within the previous 12 months, and at least annually thereafter.

(iii) The training program shall be conducted in a manner that the employee is able to understand. The employer shall ensure that each such employee is informed of the following:

(A) Methods of recognizing asbestos, tremolite, anthophyllite, and actinolite;

(B) The health effects associated with asbestos, tremolite, anthophyllite, or actinolite exposure;

(C) The relationship between smoking and asbestos, tremolite, anthophyllite, and actinolite in producing lung cancer;

(D) The nature of operations that could result in exposure to asbestos, tremolite, anthophyllite, and actinolite, the importance of necessary protective controls to minimize exposure including, as applicable, engineering controls, work practices, respirators, housekeeping procedures, hygiene facilities, protective clothing, decontamination procedures, emergency procedures, and waste disposal procedures, and any necessary instruction in the use of these controls and procedures;

(E) The purpose, proper use, fitting instructions, and limitations of respirators as required by 29 CFR 1910.134;

(F) The appropriate work practices for performing the asbestos, tremolite, anthophyllite, or actinolite job; and

(G) Medical surveillance program requirements.

(H) A review of this standard, including appendices.

(4) *Access to training materials.* (i) The employer shall make readily available to all affected employees without cost all written materials relating to the employee training program, including a copy of this regulation.

(ii) The employer shall provide to the Assistant Secretary and the Director, upon request, all information and training materials relating to the employee information and training program.

(l) *Housekeeping*—(1) *Vacuuming.* Where vacuuming methods are selected, HEPA filtered vacuuming equipment must be used. The equipment shall be used and emptied in a manner that minimizes the reentry of asbestos, tremolite, anthophyllite, or actinolite into the workplace.

(2) *Waste disposal.* Asbestos waste, scrap, debris, bags, containers, equipment, and contaminated clothing consigned for disposal shall be collected and disposed of in sealed, labeled, impermeable bags or other closed, labeled, impermeable containers.

(m) *Medical surveillance*—(1) *General*—(i) *Employees covered.* The employer shall institute a medical surveillance program for all employees engaged in work involving levels of asbestos, tremolite, anthophyllite, actinolite or a combination of these minerals, at or above the action level for 30 or more days per year, or who are required by this section to wear negative pressure respirators.

(ii) *Examination by a physician.* (A) The employer shall ensure that all medical examinations and procedures are performed by or under the supervision of a licensed physician, and are provided at no cost to the employee and at a reasonable time and place.

(B) Persons other than such licensed physicians who administer the pulmonary function testing required by this section shall complete a training course in spirometry sponsored by an appropriate academic or professional institution.

(2) *Medical examinations and consultations*—(i) *Frequency.* The employer shall make available medical examinations and consultations to each employee covered under paragraph

[Sec. 1926.58(m)(2)(i)]

(m)(1)(i) of this section on the following schedules:

(A) Prior to assignment of the employee to an area where negative-pressure respirators are worn;

(B) When the employee is assigned to an area where exposure to asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals may be at or above the action level for 30 or more days per year, a medical examination must be given within 10 working days following the thirtieth day of exposure;

(C) And at least annually thereafter.

(D) If the examining physician determines that any of the examinations should be provided more frequently than specified, the employer shall provide such examinations to affected employees at the frequencies specified by the physician.

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

(ii) *Content.* Medical examinations made available pursuant to paragraphs (m)(2)(i)(A)–(m)(2)(i)(C) of this section shall include:

(A) A medical and work history with special emphasis directed to the pulmonary, cardiovascular, and gastrointestinal systems.

(B) On initial examination, the standardized questionnaire contained in Appendix D, Part 1, and, on annual examination, the abbreviated standardized questionnaire contained in Appendix D, Part 2.

(C) A physical examination directed to the pulmonary and gastrointestinal systems, including a chest roentgenogram to be administered at the discretion of the physician, and pulmonary function tests of forced vital capacity (FVC) and forced expiratory volume at one second (FEV_1). Interpretation and classification of chest roentgenograms shall be conducted in accordance with Appendix E.

(D) Any other examinations or tests deemed necessary by the examining physician.

(3) *Information provided to the physician.* The employer shall provide the following information to the examining physician:

(i) A copy of this standard and Appendices D, E, and I;

(ii) A description of the affected employee's duties as they relate to the employee's exposure;

(iii) The employee's representative exposure level or anticipated exposure level;

(iv) A description of any personal protective and respiratory equipment used or to be used; and

(v) Information from previous medical examinations of the affected employee that is not otherwise available to the examining physician.

(4) *Physician's written opinion.* (i) The employer shall obtain a written opinion from the examining physician. This written opinion shall contain the results of the medical examination and shall include:

(A) The physician's opinion as to whether the employee has any detected medical conditions that would place the employee at an increased risk of material health impairment from exposure to asbestos, tremolite, anthophyllite, or actinolite;

(B) Any recommended limitations on the employee or on the use of personal protective equipment such as respirators; and

(C) A statement that the employee has been informed by the physician of the results of the medical examination and of any medical conditions that may result from asbestos, tremolite, anthophyllite, or actinolite exposure.

(ii) The employer shall instruct the physician not to reveal in the written opinion given to the employer specific findings or diagnoses unrelated to occupational exposure to asbestos, tremolite, anthophyllite, or actinolite.

(iii) The employer shall provide a copy of the physician's written opinion to the affected employee within 30 days from its receipt.

(n) *Recordkeeping*—(1) *Objective data for exempted operations.* (i) Where the employer has relied on objective data that demonstrate that products made from or containing asbestos, tremolite, anthophyllite, or actinolite are not capable of releasing fibers of asbestos, tremolite, anthophyllite, or actinolite or a combination of these minerals, in concentrations at or above the action level under the expected conditions of processing, use, or handling to exempt such operations from the initial monitoring requirements under paragraph (f)(2) of this section, the employer shall establish and maintain an accurate record of objective data reasonably relied upon in support of the exemption.

(ii) The record shall include at least the following information:

(A) The product qualifying for exemption;

(B) The source of the objective data;

(C) The testing protocol, results of testing, and/or analysis of the material for the release of asbestos, tremolite, anthophyllite, or actinolite;

(D) A description of the operation exempted and how the data support the exemption; and

(E) Other data relevant to the operations, materials, processing, or employee exposures covered by the exemption.

(iii) The employer shall maintain this record for the duration of the employer's reliance upon such objective data.

(2) *Exposure measurements.* (i) The employer shall keep an accurate record of all measurements taken to monitor employee exposure to asbestos, tremolite, anthophyllite, or actinolite as prescribed in paragraph (f) of this section.

Note: The employer may utilize the services of competent organizations such as industry trade associations and employee associations to maintain the records required by this section.

(ii) This record shall include at least the following information:

(A) The date of measurement;

(B) The operation involving exposure to asbestos, tremolite, anthophyllite, or actinolite that is being monitored;

(C) Sampling and analytical methods used and evidence of their accuracy;

(D) Number, duration, and results of samples taken;

(E) Type of protective devices worn, if any; and

(F) Name, social security number, and exposure of the employees whose exposures are represented.

(iii) The employer shall maintain this record for at least thirty (30) years, in accordance with 29 CFR 1910.20.

(3) *Medical surveillance.* (i) The employer shall establish and maintain an accurate record for each employee subject to medical surveillance by paragraph (m) of this section, in accordance with 29 CFR 1910.20.

(ii) The record shall include at least the following information:

(A) The name and social security number of the employee;

(B) A copy of the employee's medical examination results, including the medical history, questionnaire responses, results of any tests, and physician's recommendations.

(C) Physician's written opinions;

(D) Any employee medical complaints related to exposure to asbestos, tremolite, anthophyllite, or actinolite; and

(E) A copy of the information provided to the physician as required by paragraph (m) of this section.

(iii) The employer shall ensure that this record is maintained for the duration of employment plus thirty (30) years, in accordance with 29 CFR 1910.20.

[Sec. 1926.58(n)(3)(iii)]

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(4) *Training records.* The employer shall maintain all employee training records for one 1 year beyond the last date of employment by that employer.

(5) *Availability.* (i) The employer, upon written request, shall make all records required to be maintained by this section available to the Assistant Secretary and the Director for examination and copying.

(ii) The employer, upon request, shall make any exposure records required by paragraphs (f) and (n) of this section available for examination and copying to affected employees, former employees, designated representatives, and the Assistant Secretary, in accordance with 29 CFR 1910.20(a)–(e) and (g)–(i).

(iii) The employer, upon request, shall make employee medical records required by paragraphs (m) and (n) of this section available for examination and copying to the subject employee, anyone having the specific written consent of the subject employee, and the Assistant Secretary, in accordance with 29 CFR 1910.20.

(6) *Transfer of records.* (i) The employer shall comply with the requirements concerning transfer of records set forth in 29 CFR 1910.20 (h).

(ii) Whenever the employer ceases to do business and there is no successor employer to receive and retain the records for the prescribed period, the employer shall notify the Director at least 90 days prior to disposal and, upon request, transmit them to the Director.

(o) *Dates*—(1) *Effective date.* This section shall become effective [insert date 30 days from publication in the Federal Register]. The requirements of the asbestos standard issued in June 1972 (37 FR 11318), as amended, and published in 29 CFR 1910.1001 (1985) remain in effect until compliance is achieved with the parallel provisions of this standard.

(2) *Start-up dates.* (i) The requirements of paragraphs (c) through (n) of this section, including the engineering controls specified in paragraph (g)(1) of this section, shall be complied with by [insert date 210 days from publication in the Federal Register].

(p) *Appendices.* (1) Appendices A, C, D, and E to this section are incorporated as part of this section and the contents of these appendices are mandatory.

(2) Appendices B, F, G, H, and I to this section are informational and are not intended to create any additional obligations not otherwise imposed or to detract from any existing obligations.

Appendix A to § 1926.58—OSHA Reference Method—Mandatory

This mandatory appendix specifies the procedure for analyzing air samples for asbestos, tremolite, anthophyllite, and actinolite and specifies quality control procedures that must be implemented by laboratories performing the analysis. The sampling and analytical methods described below represent the elements of the available monitoring methods (such as the NIOSH P&CAM 400 method) which OSHA considers to be essential to achieve adequate employee exposure monitoring while allowing employers to use methods that are already established within their organizations. All employers who are required to conduct air monitoring under paragraph (f) of the standard are required to utilize analytical laboratories that use this procedure, or an equivalent method, for collecting and analyzing samples.

Sampling and Analytical Procedure

1. The sampling medium for air samples shall be mixed cellulose ester filter membranes. These shall be designated by the manufacturer as suitable for asbestos, tremolite, anthophyllite, and actinolite counting. See below for rejection of blanks.

2. The preferred collection device shall be the 25-mm diameter cassette with an open-faced 50-mm extension cowl. The 37-mm cassette may be used if necessary but only if written justification for the need to use the 37-mm filter cassette accompanies the sample results in the employee's exposure monitoring record.

3. An air flow rate between 0.5 liter/min and 2.5 liters/min shall be selected for the 25/mm cassette. If the 37-mm cassette is used, an air flow rate between 1 liter/min and 2.5 liters/min shall be selected.

4. Where possible, a sufficient air volume for each air sample shall be collected to yield between 100 and 1,300 fibers per square millimeter on the membrane filter. If a filter darkens in appearance or if loose dust is seen on the filter, a second sample shall be started.

5. Ship the samples in a rigid container with sufficient packing material to prevent dislodging the collected fibers. Packing material that has a high electrostatic charge on its surface (e.g., expanded polystyrene) cannot be used because such material can cause loss of fibers to the sides of the cassette.

6. Calibrate each personal sampling pump before and after use with a representative filter cassette installed between the pump and the calibration device.

7. Personal samples shall be taken in the "breathing zone" of the employee (i.e., attached to or near the collar or lapel near the worker's face).

8. Fiber counts shall be made by positive phase contrast using a microscope with an 8 to 10 X eyepiece and a 40 to 45 X objective for a total magnification of approximately 400 X and a numerical aperture of 0.65 to 0.75. The microscope shall also be fitted with a green or blue filter.

9. The microscope shall be fitted with a Walton-Beckett eyepiece graticule calibrated for a field diameter of 100 micrometers (+/− 2 micrometers).

10. The phase-shift detection limit of the microscope shall be about 3 degrees measured using the HSE phase shift test slide as outlined below.

a. Place the test slide on the microscope stage and center it under the phase objective.

b. Bring the blocks of grooved lines into focus.

Note.—The slide consists of seven sets of grooved lines (ca. 20 grooves to each block) in descending order of visibility from sets 1 to 7, seven being the least visible. The requirements for asbestos, tremolite, anthophyllite, and actinolite counting are that the microscope optics must resolve the grooved lines in set 3 completely, although they may appear somewhat faint, and that the grooved lines in sets 6 and 7 must be invisible. Sets 4 and 5 must be at least partially visible but may vary slightly in visibility between microscopes. A microscope that fails to meet these requirements has either too low or too high a resolution to be used for asbestos, tremolite, anthophyllite, and actinolite counting.

c. If the image deteriorates, clean and adjust the microscope optics. If the problem persists, consult the microscope manufacturer.

11. Each set of samples taken will include 10 percent blanks or a minimum of 2 blanks. The blank results shall be averaged and subtracted from the analytical results before reporting. Any samples represented by a blank having a fiber count in excess of 7 fibers/100 fields shall be rejected.

12. The samples shall be mounted by the acetone/triacetin method or a method with an equivalent index of refraction and similar clarity.

13. Observe the following counting rules.

a. Count only fibers equal to or longer than 5 micrometers. Measure the length of curved fibers along the curve.

b. Count all particles as asbestos, tremolite, anthophyllite, and actinolite that have a length-to-width ratio (aspect ratio) of 3:1 or greater.

c. Fibers lying entirely within the boundary of the Walton-Beckett graticule field shall receive a count of 1. Fibers crossing the boundary once, having one end within the circle, shall receive the count of one half (½). Do not count any fiber that crosses the graticule boundary more than once. Reject and do not count any other fibers even though they may be visible outside the graticule area.

d. Count bundles of fibers as one fiber unless individual fibers can be identified by observing both ends of an individual fiber.

e. Count enough graticule fields to yield 100 fibers. Count a minimum of 20 fields; stop counting at 100 fields regardless of fiber count.

14. Blind recounts shall be conducted at the rate of 10 percent.

Quality Control Procedures

1. Intralaboratory program. Each laboratory and/or each company with more than one microscopist counting slides shall establish a statistically designed quality assurance program involving blind recounts and

comparisons between microscopists to monitor the variability of counting by each microscopist and between microscopists. In a company with more than one laboratory, the program shall include all laboratories, and shall also evaluate the laboratory-to-laboratory variability.

2. Interlaboratory program. Each laboratory analyzing asbestos, tremolite, anthophyllite, and actinolite samples for compliance determination shall implement an interlaboratory quality assurance program that as a minimum includes participation of at least two other independent laboratories. Each laboratory shall participate in round robin testing at least once every 6 months with at least all the other laboratories in its interlaboratory quality assurance group. Each laboratory shall submit slides typical of its own workload for use in this program. The round robin shall be designed and results analyzed using appropriate statistical methodology.

3. All individuals performing asbestos, tremolite, anthophyllite, and actinolite analysis must have taken the NIOSH course for sampling and evaluating airborne asbestos, tremolite, anthophyllite, and actinolite dust or an equivalent course.

4. When the use of different microscopes contributes to differences between counters and laboratories, the effect of the different microscope shall be evaluated and the microscope shall be replaced, as necessary.

5. Current results of these quality assurance programs shall be posted in each laboratory to keep the microscopists informed.

Appendix B to § 1926.58—Detailed Procedure for Asbestos Tremolite, Anthophyllite, and Actinolite Sampling and Analysis—Non-Mandatory

This appendix contains a detailed procedure for sampling and analysis and includes those critical elements specified in Appendix A. Employers are not required to use this procedure, but they are required to use Appendix A. The purpose of Appendix B is to provide a detailed step-by-step sampling and analysis procedure that conforms to the elements specified in Appendix A. Since this procedure may also standardize the analysis and reduce variability, OSHA encourages employers to use this appendix.

Asbestos, Tremolite, Anthophyllite, and Actinolite Sampling and Analysis Method

Technique: Microscopy, Phase Contrast.

Analyte: Fibers (Manual count).

Sample Preparation: Acetone/triacetin method.

Calibration: Phase-shift detection limit about 3 degrees.

Range: 100 to 1300 fibers/mm² filter area.

Estimated Limit of Detection: 7 fibers/mm² filter area.

Sampler: Filter (0.8–1.2 um mixed cellulose ester membrane, 25-mm diameter).

Flow Rate: 0.5 l/min to 2.5 l/min (25-mm cassette); 1.0 l/min to 2.5 l/min (37-mm cassette).

Sample Volume: Adjust to obtain 100 to 1300 fibers/mm².

Shipment: Routine.

Sample Stability: Indefinite.

Blanks: 10% of samples (minimum 2).

Standard Analytical Error: 0.25.

Applicability: The working range is 0.02 f/cc (1920–L air sample) to 1.25 f/cc (400–L air sample). The method gives an index of airborne asbestos, tremolite, anthophyllite, and actinolite fibers but may be used for other materials such as fibrous glass by inserting suitable parameters into the counting rules. The method does not differentiate between asbestos, tremolite, anthophyllite, and actinolite and other fibers. Asbestos, tremolite, anthophyllite, and actinolite fibers less than ca. 0.25 um diameter will not be detected by this method.

Interferences: Any other airborne fiber may interfere since all particles meeting the counting criteria are counted. Chain-like particles may appear fibrous. High levels of nonfibrous dust particles may obscure fibers in the field of view and raise the detection limit.

Reagents

1. Acetone.

2. Triacetin (glycerol triacetate), reagent grade.

Special Precautions

Acetone is an extremely flammable liquid and precautions must be taken not to ignite it. Heating of acetone must be done in a ventilated laboratory fume hood using a flameless, spark-free heat source.

Equipment

1. Collection device: 25-mm cassette with 50-mm extension cowl with cellulose ester filter, 0.8 to 1.2 mm pore size and backup pad.

Note.—Analyze representative filters for fiber background before use and discard the filter lot if more than 5 fibers/100 fields are found.

2. Personal sampling pump, greater than or equal to 0.5 L/min, with flexible connecting tubing.

3. Microscope, phase contrast, with green or blue filter, 8 to 10X eyepiece, and 40 to 45X phase objective (total magnification ca 400X); numerical aperture = 0.65 to 0.75.

4. Slides, glass, single-frosted, pre-cleaned, 25 × 75 mm.

5. Cover slips, 25 × 25 mm, no. 1½ unless otherwise specified by microscope manufacturer.

6. Knife, #1 surgical steel, curved blade.

7. Tweezers.

8. Flask, Guth-type, insulated neck, 250 to 500 mL (with single-holed rubber stopper and elbow-jointed glass tubing, 16 to 22 cm long).

9. Hotplate, spark-free, stirring type; heating mantle; or infrared lamp and magnetic stirrer.

10. Syringe, hypodermic, with 22-gauge needle.

11. Graticule, Walton-Beckett type with 100 um diameter circular field at the specimen plane (area = 0.00785 mm²). (Type G–22).

Note.—The graticule is custom-made for each microscope.

12. HSE/NPL phase contrast test slide, Mark II.

13. Telescope, ocular phase-ring centering.

14. Stage micrometer (0.01 mm divisions).

Sampling

1. Calibrate each personal sampling pump with a representative sampler in line.

2. Fasten the sampler to the worker's lapel as close as possible to the worker's mouth. Remove the top cover from the end of the cowl extension (open face) and orient face down. Wrap the joint between the extender and the monitor's body with shrink tape to prevent air leaks.

3. Submit at least two blanks (or 10% of the total samples, whichever is greater) for each set of samples. Remove the caps from the field blank cassettes and store the caps and cassettes in a clean area (bag or box) during the sampling period. Replace the caps in the cassettes when sampling is completed.

4. Sample at 0.5 L/min or greater. Do not exceed 1 mg total dust loading on the filter. Adjust sampling flow rate, Q (L/min), and time to produce a fiber density, E (fibers/mm²), of 100 to 1300 fibers/mm² (3.85×10^4 to 5×10^4 fibers per 25-mm filter with effective collection area (A_c = 385 mm²)) for optimum counting precision (see step 21 below). Calculate the minimum sampling time, t_{min} (min) at the action level (one-half of the current standard), L (f/cc) of the fibrous aerosol being sampled:

$$t_{min} = \frac{(Ac)(E)}{(Q)(L)10^3}$$

5. Remove the field monitor at the end of sampling, replace the plastic top cover and small end caps, and store the monitor.

6. Ship the samples in a rigid container with sufficient packing material to prevent jostling or damage. NOTE: Do not use polystyrene foam in the shipping container because of electrostatic forces which may cause fiber loss from the sampler filter.

Sample Preparation

Note.—The object is to produce samples with a smooth (non-grainy) background in a medium with a refractive index equal to or less than 1.46. The method below collapses the filter for easier focusing and produces permanent mounts which are useful for quality control and interlaboratory comparison. Other mounting techniques meeting the above criteria may also be used, e.g., the nonpermanent field mounting technique used in P & CAM 239.

7. Ensure that the glass slides and cover slips are free of dust and fibers.

8. Place 40 to 60 ml of acetone into a Guth-type flask. Stopper the flask with a single-hole rubber stopper through which a glass tube extends 5 to 8 cm into the flask. The portion of the glass tube that exits the top of the stopper (5 to 10 cm) is bent downward in an elbow that makes an angle of 20 to 30 degrees with the horizontal.

9. Place the flask in a stirring hotplate or wrap in a heating mantle. Heat the acetone gradually to its boiling temperature (ca. 56°C).

Caution.—The acetone vapor must be generated in a ventilated fume hood away from all open flames and spark sources. Alternate heating methods can be used, providing no open flame or sparks are present.

[Sec. 1926.58, Appendix B]

10. Mount either the whole sample filter or a wedge cut from the sample filter on a clean glass slide.

a. Cut wedges of ca. 25 percent of the filter area with a curved-blade steel surgical knife using a rocking motion to prevent tearing.

b. Place the filter or wedge, dust side up, on the slide. Static electricity will usually keep the filter on the slide until it is cleared.

c. Hold the glass slide supporting the filter approximately 1 to 2 cm from the glass tube part where the acetone vapor is escaping from the heated flask. The acetone vapor stream should cause a condensation spot on the glass slide ca. 2 to 3 cm in diameter. Move the glass slide gently in the vapor stream. The filter should clear in 2 to 5 sec. If the filter curls, distorts, or is otherwise rendered unusable, the vapor stream is probably not strong enough. Periodically wipe the outlet part with tissue to prevent liquid acetone dripping onto the filter.

d. Using the hypodermic syringe with a 22-gauge needle, place 1 to 2 drops of triacetin on the filter. Gently lower a clean 25-mm square cover slip down onto the filter at a slight angle to reduce the possibility of forming bubbles. If too many bubbles form or the amount of triacetin is unsufficient, the cover slip may become detached within a few hours.

e. Glue the edges of the cover slip to the glass slide using a lacquer or nail polish.

Note.—If clearing is slow, the slide preparation may be heated on a hotplate (surface temperature 50°C) for 15 min to hasten clearing. Counting may proceed immediately after clearing and mounting are completed.

Calibration and Quality Control

11. Calibration of the Walton-Beckett graticule. The diameter, d_c (mm), of the circular counting area and the disc diameter must be specified when ordering the graticule.

a. Insert any available graticule into the eyepiece and focus so that the graticule lines are sharp and clear.

b. Set the appropriate interpupillary distance and, if applicable, reset the binocular head adjustment so that the magnification remains constant.

c. Install the 40 to 45 X phase objective.

d. Place a stage micrometer on the microscope object stage and focus the microscope on the graduated lines.

e. Measure the magnified grid length, L_e (um), using the stage micrometer.

f. Remove the graticule from the microscope and measure its actual grid length, L_a (mm). This can best be accomplished by using a stage fitted with verniers.

g. Calculate the circle diameter, d_c (mm), for the Walton-Beckett graticule:

$$d_c = \frac{L_a \times D}{L_e}$$

Example: If L_e = 108 um, L_a = 2.93 mm and D = 100 um, then d_c = 2.71 mm.

h. Check the field diameter, D (acceptable range 100 mm ± 2 mm) with a stage micrometer upon receipt of the graticule from the manufacturer. Determine field area (mm²).

12. Microscope adjustments. Follow the manufacturer's instructions and also the following:

a. Adjust the light source for even illumination across the field of view at the condenser iris.

Note.—Kohler illumination is preferred, where available.

b. Focus on the particulate material to be examined.

c. Make sure that the field iris is in focus, centered on the sample, and open only enough to fully illuminate the field of view.

d. Use the telescope ocular supplied by the manufacturer to ensure that the phase rings (annular diaphragm and phase-shifting element) are concentric.

13. Check the phase-shift detection limit of the microscope periodically.

a. Remove the HSE/NPL phase-contrast test slide from its shipping container and center it under the phase objective.

b. Bring the blocks of grooved lines into focus.

Note.—The slide consists of seven sets of grooves (ca. 20 grooves to each block) in descending order of visibility from sets 1 to 7. The requirements for counting are that the microscope optics must resolve the grooved lines in set 3 completely, although they may appear somewhat faint, and that the grooved lines in sets 6 to 7 must be invisible. Sets 4 and 5 must be at least partially visible but may vary slightly in visibility between microscopes. A microscope which fails to meet these requirements has either too low or too high a resolution to be used for asbestos, tremolite, anthophyllite, and actinolite counting.

c. If the image quality deteriorates, clean the microscope optics and, if the problem persists, consult the microscope manufacturer.

14. Quality control of filter counts.

a. Prepare and count field blanks along with the field samples. Report the counts on each blank. Calculate the mean of the field blank counts and subtract this value from each sample count before reporting the results.

Note 1.—The identity of the blank filters should be unknown to the counter until all counts have been completed.

Note 2.—If a field blank yields fiber counts greater than 7 fibers/100 fields, report possible contamination of the samples.

b. Perform blind recounts by the same counter on 10 percent of filters counted (slides relabeled by a person other than the counter).

15. Use the following test to determine whether a pair of counts on the same filter should be rejected because of possible bias. This statistic estimates the counting repeatability at the 95% confidence level. Discard the sample if the difference between the two counts exceeds 2.77 $(F)s_r$, where F = average of the two filter counts and S_r = relative standard deviation, which should be derived by each laboratory based on historical in-house data.

Note.—If a pair of counts is rejected as a result of this test, recount the remaining samples in the set and test the new counts against the first counts. Discard all rejected paired counts.

16. Enroll each new counter in a training course that compares performance of counters on a variety of samples using this procedure.

Note.—To ensure good reproducibility, all laboratories engaged in asbestos, tremolite, anthophyllite, and actinolite counting are required to participate in the Proficiency Analytical Testing (PAT) Program and should routinely participate with other asbestos, tremolite, anthophyllite, and actinolite fiber counting laboratories in the exchange of field samples to compare performance of counters.

Measurement

17. Place the slide on the mechanical stage of the calibrated microscope with the center of the filter under the objective lens. Focus the microscope on the plane of the filter.

18. Regularly check phase-ring alignment and Kohler illumination.

19. The following are the counting rules:

a. Count only fibers longer than 5 um. Measure the length of curved fibers along the curve.

b. Count only fibers with a length-to-width ratio equal to or greater than 3:1.

c. For fibers that cross the boundary of the graticule field, do the following:

1. Count any fiber longer than 5 um that lies entirely within the graticule area.

2. Count as ½ fiber any fiber with only one end lying within the graticule area.

3. Do not count any fiber that crosses the graticule boundary more than once.

4. Reject and do not count all other fibers.

d. Count bundles of fibers as one fiber unless individual fibers can be identified by observing both ends of a fiber.

e. Count enough graticule fields to yield 100 fibers. Count a minimum of 20 fields. Stop at 100 fields regardless of fiber count.

20. Start counting from one end of the filter and progress along a radial line to the other end, shift either up or down on the filter, and continue in the reverse direction. Select fields randomly by looking away from the eyepiece briefly while advancing the mechanical stage. When an agglomerate covers ca. ¼ or more of the field of view, reject the field and select another. Do not report rejected fields in the number of total fields counted.

Note.—When counting a field, continuously scan a range of focal planes by moving the fine focus knob to detect very fine fibers which have become embedded in the filter. The small-diameter fibers will be very faint but are an important contribution to the total count.

[Sec. 1926.58, Appendix B]

Calculations

21. Calculate and report fiber density on the filter, E (fibers/mm²); by dividing the total fiber count, F; minus the mean field blank count, B, by the number of fields, n; and the field area, A_f (0.00785mm² for a properly calibrated Walton-Beckett graticule):

$$E = \frac{F - B}{(n)(A_f)} \text{ fibers/mm}^2$$

22. Calculate the concentration, C (f/cc), of fibers in the air volume sampled, V (L), using the effective collection area of the filter, A_c (385 mm² for a 25-mm filter):

$$C = \frac{(E)(Ac)}{V(10^3)}$$

Note.—Periodically check and adjust the value of A_c if necessary.

Appendix C to § 1926.58—Qualitative and Quantitative Fit Testing Procedures—Mandatory

Qualitative Fit Test Protocols

I. Isoamyl Acetate Protocol

A. Odor threshold screening.

1. Three 1-liter glass jars with metal lids (e.g. Mason or Bell jars) are required.

2. Odor-free water (e.g. distilled or spring water) at approximately 25 °C shall be used for the solutions.

3. The isoamyl acetate (IAA) (also known as isopentyl acetate) stock solution is prepared by adding 1 cc of pure IAA to 800 cc of odor free water in a 1-liter jar and shaking for 30 seconds. This solution shall be prepared new at least weekly.

4. The screening test shall be conducted in a room separate from the room used for actual fit testing. The two rooms shall be well ventilated but shall not be connected to the same recirculating ventilation system.

5. The odor test solution is prepared in a second jar by placing 0.4 cc of the stock solution into 500 cc of odor free water using a clean dropper or pipette. Shake for 30 seconds and allow to stand for two to three minutes so that the IAA concentration above the liquid may reach equilibrium. This solution may be used for only one day.

6. A test blank is prepared in a third jar by adding 500 cc of odor free water.

7. The odor test and test blank jars shall be labelled 1 and 2 for jar identification. If the labels are put on the lids they can be periodically peeled, dried off and switched to maintain the integrity of the test.

8. The following instructions shall be typed on a card and placed on the table in front of the two test jars (i.e. 1 and 2): "The purpose of this test is to determine if you can smell banana oil at a low concentration. The two bottles in front of you contain water. One of these bottles also contains a small amount of banana oil. Be sure the covers are on tight, then shake each bottle for two seconds. Unscrew the lid of each bottle, one at a time, and sniff at the mouth of the bottle. Indicate to the test conductor which bottle contains banana oil."

9. The mixtures used in the IAA odor detection test shall be prepared in an area separate from where the test is performed, in order to prevent olfactory fatigue in the subject.

10. If the test subject is unable to correctly identify the jar containing the odor test solution, the IAA qualitative fit test may not be used.

11. If the test subject correctly identifies the jar containing the odor test solution, the test subject may proceed to respirator selection and fit testing.

B. Respirator Selection.

1. The test subject shall be allowed to pick the most comfortable respirator from a selection including respirators of various sizes from different manufacturers. The selection shall include at least five sizes of elastomeric half facepieces, from at least two manufacturers.

2. The selection process shall be conducted in a room separate from the fit-test chamber to prevent odor fatigue. Prior to the selection process, the test subject shall be shown how to put on a respirator, how it should be positioned on the face, how to set strap tension and how to determine a "comfortable" respirator. A mirror shall be available to assist the subject in evaluating the fit and positioning of the respirator. This instruction may not constitute the subject's formal training on respirator use, as it is only a review.

3. The test subject should understand that the employee is being asked to select the respirator which provides the most comfortable fit. Each respirator represents a different size and shape and, if fit properly and used properly will provide adequate protection.

4. The test subject holds each facepiece up to the face and eliminates those which obviously do not give a comfortable fit. Normally, selection will begin with a half-mask and if a good fit cannot be found, the subject will be asked to test the full facepiece respirators. (A small percentage of users will not be able to wear any half-mask.)

5. The more comfortable facepieces are noted; the most comfortable mask is donned and *worn at least five minutes* to assess comfort. All donning and adjustments of the facepiece shall be performed by the test subject without assistance from the test conductor or other person. Assistance in assessing comfort can be given by discussing the points in #6 below. If the test subject is not familiar with using a particular respirator, the test subject shall be directed to don the mask several times and to adjust the straps each time to become adept at setting proper tension on the straps.

6. Assessment of comfort shall include reviewing the following points with the test subject and allowing the test subject adequate time to determine the comfort of the respirator:

- Positioning of mask on nose.
- Room for eye protection.
- Room to talk.
- Positioning mask on face and cheeks.

7. The following criteria shall be used to help determine the adequacy of the respirator fit:

- Chin properly placed.
- Strap tension.
- Fit across nose bridge.
- Distance from nose to chin.
- Tendency to slip.
- Self-observation in mirror.

8. The test subject shall conduct the conventional negative and positive-pressure fit checks before conducting the negative- or positive-pressure test the subject shall be told to "seat" the mask by rapidly moving the head from side-to-side and up and down, while taking a few deep breaths.

9. The test subject is now ready for fit testing.

10. After passing the fit test, the test subject shall be questioned again regarding the comfort of the respirator. If it has become uncomfortable, another model of respirator shall be tried.

11. The employee shall be given the opportunity to select a different facepiece and be retested if the chosen facepiece becomes increasingly uncomfortable at any time.

C. Fit test.

1. The fit test chamber shall be similar to a clear 55 gal drum liner suspended inverted over a 2 foot diameter frame, so that the top of the chamber is about 6 inches above the test subject's head. The inside top center of the chamber shall have a small hook attached.

2. Each respirator used for the fitting and fit testing shall be equipped with organic vapor cartridges or offer protection against organic vapors. The cartridges or masks shall be changed at least weekly.

3. After selecting, donning, and properly adjusting a respirator, the test subject shall wear it to the fit testing room. This room shall be separate from the room used for odor threshold screening and respirator selection, and shall be well ventilated, as by an exhaust fan or lab hood, to prevent general room contamination.

4. A copy of the following test exercises and rainbow passage shall be taped to the inside of the test chamber:

Test Exercises

i. Breathe normally.

ii. Breathe deeply. Be certain breaths are *deep* and *regular*.

iii. Turn head all the way from one side to the other. Inhale on each side. Be certain movement is complete. Do not bump the respirator against the shoulders.

iv. Nod head up-and-down. Inhale when head is in the full up position (looking toward ceiling). Be certain motions are complete and made about every second. Do not bump the respirator on the chest.

v. Talking. Talk aloud and slowly for several minutes. The following paragraph is called the Rainbow Passage. Reading it will result in a wide range of facial movements, and thus be useful to satisfy this requirement.

[Sec. 1926.58, Appendix C]

APPENDIX C

Environmental Protection Agency (EPA)
National Emission Standard for Hazardous
Air Pollutants (NESHAPS) (40 CFR Part 61, Subpart M)
Amended November 11, 1990

February 4, 1991

Dear Asbestos Contractor or Owner:

On November 20, 1990, the Environmental Protection Agency (EPA) promulgated the revised National Emission Standards for Hazardous Air Pollutants: Asbestos NESHAP Revision. This final rule became effective on November 20, 1990. Therefore, you must immediately begin to comply with applicable sections of 40 CFR Parts 61.140 to 61.156 of the revised NESHAP Standard.

The revisions require each owner or operator of a demolition or renovation project to comply with the following:

A. 40CFR 61.145 (Standard for Demolition and Renovation)

1. Throughly inspect the affected facility or part of the facility where the demolition or renovation project will occur for the presence of friable and nonfriable asbestos containing materials.

2. Remove all regulated asbestos-containing materials (RACMs) from each effected facility if the amounts are equal to or, should exceed 260 LF, 160 SF or 35CF for EPA classified demolition projects. However, all asbestos containing materials must be removed prior to demolition and renovation activities which will disturb such materials under asbestos laws and regulations.

3. Submit written notifications for all demolition projects involving less than and more than 80 linear meters (260 LF), 15 square meters (160 SF), and 1 cubic meter (35 CF) and also if no asbestos is found;

4. Submit written notifications for all renovations projects involving at least 260 LF, 160 SF, and 35 CF;

5. Submit written notifications at least 10 working days before asbestos removal begins for renovation projects involving item NO. 4 above.

6. Submit written notifications at least 10 working days before asbestos removal begins for demolition projects involving item NO. 3 above;

7. Renotify the Administrator of all new start and completion dates if the original start and completion dates should change;

8. Provide a written notification of a new start date at least 10 working days before asbestos stripping removal work begins.

9. Utilize a certified person to supervise the asbestos project.

10. Keep a copy of the Administrator's written approval to employ another method to abate asbestos if wetting would result in equipment damage or a safety hazard. You must obtain prior approval before using an alternative method.

11. Record the temperature in the area containing the facility components at the beginning, middle, and end of each workday and keep daily temperature records, if wetting operations are suspended due to freezing temperatures. Keep the temperature records for 2 years.

12. Employ only an EPA/EPD trained on-site individual to monitor asbestos removal and disposal at each site.

13. Complete and return a copy of the Waste Shipment Record (within thirty-five (35) days) for asbestos waste and completion form to affected owner and Asbestos Licensing and Certification Unit.

14. Place wet asbestos waste into labeled leak-tight containers or leak-tight wrapping.

15. If asbestos nonfriable waste cannot be placed in leak-tight wrapping, such waste, while wet, may also be placed in prelined containers and transported and disposed of in bulk. Only adequately labeled, wet, and leak-tight wrapping may be placed in prelined containers.

16. Mark vehicles used to transport asbestos-containing waste materials during loading and unloading of the waste materials.

17. Provide a copy of the waste shipment record to the disposal site owners or operators at the same time as the asbestos-containing waste materials are being deposited at legal disposal site.

18. Obtain a copy of the signed waste shipment record and forward a signed copy to the Asbestos Licensing and Certification Unit and affected owner/generator.

19. Keep copies of waste shipment records on files for at least two (2) years.

20. Legally dispose of all asbestos-containing waste materials as soon as practical in an approved and permitted disposal site for such materials.

21. Provide a 45 day prior notification if you plan to excavate asbestos waste. If the date to begin excavation should change, a new 10 day written notification must be provided.

22. Obtain prior permission from the Administrator before using an alternative method or converting asbestos-containing waste into asbestos (asbestos free) materials (s) and before disposing of any converted asbestos waste.

23. Please review the following <u>new</u> definitions:

    - Adequately wetting
    - Nonfriable ACM
    - Category I and II nonfriable ACM
    - Fugitive sources and glovebag
    - Cutting and grinding of ACM
    - In poor condition and leak-tight
    - Malfunction and natural barrier
    - Nonscheduled renovation operations
    - Owners or operators
    - Regulated asbestos-containing material
    - Resilient floor covering
    - Waste generator and waste shipment record
    - Working day

You must also comply with all applicable sections of the revised NESHAP Asbestos Standard.

Should you have questions or need an interpretation of the November 20, 1990 revised NESHAP Asbestos Standard, please contact Mr.Alan W. Powell and Mr. John Hund of Region IV EPA at 404-347-5014 or contact the Asbestos Program at 404-656-4999.

Sincerely,

Marvin Bradford

Marvin Bradford
Program Manager
Asbestos Licensing & Certification Unit

MB:aj

Tuesday
November 20, 1990

Part III

Environmental Protection Agency

40 CFR Part 61

National Emission Standards for Hazardous Air Pollutants; Asbestos NESHAP Revision; Final Rule

ENVIRONMENTAL PROTECTION AGENCY

40 CFR Part 61

[AD-FRL-3814-7]

RIN 2060-AC57

National Emission Standards for Hazardous Air Pollutants; Asbestos NESHAP Revision

AGENCY: Environmental Protection Agency.

ACTION: Final rule.

SUMMARY: This Federal Register notice promulgates rules under section 112 of the Clean Air Act (CAA) for asbestos emissions and is based on the Administrator's determination that asbestos presents a significant risk to human health as a result of air emissions from one or more source categories and is therefore a hazardous air pollutant (*see* 36 FR 3031, March 31, 1971). The purpose of the revisions promulgated today is to enhance enforcement and promote compliance with the current standard without altering the stringency of existing controls. On January 10, 1989 the Environmental Protection Agency (EPA or the Agency) proposed amendments to the asbestos National Emission Standard for Hazardous Air Pollutants (NESHAP) that would require control device and fugitive emission monitoring, recordkeeping, and reporting for asbestos milling, manufacturing, and fabricating operations. For planned demolitions and renovations, revisions to the notification requirements were proposed, and safety was added as a reason for exemption from the use of wet removal methods. Recordkeeping requirements were proposed for asbestos waste disposal. Clarifying revisions to several definitions and provisions were also proposed. Numerous comments were received on the proposed revisions, and today's notice responds to those comments, and incorporates changes as a result of those comments.

EFFECTIVE DATE: November 20, 1990. Under section 307(b)(1) of the Clean Air Act, judicial review of the actions taken by this notice is available only by filing a petition for review in the United States Court of Appeals for the District of Columbia Circuit within 60 Days of today's publication of these rules. Under section 307(b)(2) of the Clean Air Act, the requirements that are the subject of today's notice may not be challenged later in civil or criminal proceedings brought by EPA to enforce these requirements.

ADDRESSES: *Background information document.* The background information document (BID) for the promulgated revisions may be obtained from the U.S. EPA Library (MD–35), Research Triangle Park, North Carolina, 27711, telephone no. (919) 541–2777. Please refer to "Background Information for Promulgated Asbestos NESHAP Revisions," (Publication No. EPA 450/3–90/017). The BID contains a summary of all the public comments made on the proposed revisions and the Administrator's responses to the comments.

Dockets. Docket No. A–88–28 contains supporting information used in developing the final revisions to the asbestos NESHAP and is available for public inspection and copying between 8:30 a.m. and 3:30 p.m., Monday through Friday, at EPA's Air Docket (LE–131), Room M–1500, 1st Floor, Waterside Mall, 401 M Street, SW., Washington, DC 20460. A reasonable fee may be charged for copying.

FOR FURTHER INFORMATION CONTACT: For further information and official interpretations of applicability, compliance requirements, and reporting aspects of the promulgated revisions, contact the appropriate Regional, State or local office contact as listed in 40 CFR 61.04. For further information on the background of the regulatory decisions in the promulated revisions, contact Mr. Sims Roy, Standards Development Branch, Emission Standards Division (MD–13), U.S. Environmental Protection Agency, Research Triangle Park, North Carolina 27711, telephone no. (919) 541–5263. For further information on the technical aspects of the promulgated revisions, contact Mr. Ronald Myers, Industrial Studies Branch, U.S. Environmental Protection Agency, Research Triangle Park, North Carolina 27711, telephone no. (919) 541–5407.

SUPPLEMENTARY INFORMATION:

I. The Standards

The promulgated revisions implement section 112 of the Clean Air Act (CAA) and are based on the Administrator's determination that asbestos presents a significant risk to human health as a result of air emissions from one or more source categories and is therefore a hazardous air pollutant (*see* 36 FR 3031 (March 31, 1971)). The revisions promulgated today amend the asbestos NESHAP to enhance enforcement and promote compliance with the current standard without altering the stringency of existing controls.

Milling, Manufacturing and Fabricating

The revisions to the standards require asbestos milling, manufacturing and fabricating sources to conduct daily monitoring for visible emissions. While the absence of visible emissions does not mean there are no asbestos fibers being emitted, the presence of visible emissions does indicate a serious control device malfunction. Because visible emissions monitoring is intended primarily to detect serious control device malfunctions, weekly inspections of air cleaning devices are also required. In addition, the revisions promulgated require these sources to maintain records of the results of visible emissions monitoring and control device inspections, and to submit quarterly a copy of visible emissions monitoring records of visible emissions occurred during the quarter. The revision requires owners or operators who install fabric filters after the effective date of this rule to provide for easy inspection of the bags.

Demolition and Renovation

The revisions require the owner or operator of a demolition or renovation activity to provide additional information in notifications, and to renotify EPA if the start date of a demolition or renovation changes from that given in the original notification. Another revision requires owners or operators to give a 10-day notice for renovations. A person trained in the provisions of this rule and the means of complying with them is required to be on site when asbestos-containing material (ACM) is stripped, removed or disturbed. When wetting is suspended due to freezing temperatures, owners or operators are required to measure air temperature in the work area three times during the workday and keep daily temperature records for at least 2 years. The revisions also clarify EPA's position regarding the handling and treatment of nonfriable asbestos materials such as resilient floor covering, including vinyl asbestos floor tile, and roofing material.

Waste Disposal

The revisions require vehicles used to transport asbestos-containing waste material to be marked with the sign prescribed by the Occupational Safety and Health Administration during loading and unloading to warn people of the presence of asbestos. For all asbestos-containing waste material transported offsite, the revisions require that a waste shipment record (WSR) be provided to the waste site owner or operator at the time that the waste is

delivered to the waste disposal site. If a copy of the WSR signed by the waste site owner or operator is not received within 35 days of the date the waste was accepted by the initial transporter, the revisions direct the waste generator to contact the transporter and/or disposal site owner or operator to determine the status of the waste shipment. The revisions further direct the waste generator to submit an exception report to EPA if a signed copy of the WSR is not received within 45 days of the date the waste was accepted by the initial transporter. Labels are required on containers of asbestos-containing waste material from manufacturing, fabricating, demolition and renovation activities indicating the name of the waste generator and the location where the waste was generated.

Inactive Waste Disposal Sites

The revisions require the owner or operator of an inactive waste disposal site for a milling, manufacturing or fabricating operation to notify the Administrator in writing prior to excavating or otherwise disturbing asbestos-containing waste material that has been deposited at the disposal site and to record on the deed to the property a notation that will inform future purchasers of the property that it has been used for the disposal of asbestos-containing waste material and that the survey plot and record of the location and quantity of such waste material are on file with the Administrator.

Active Waste Disposal Sites

The revisions require the owner or operator of an active waste disposal site to maintain WSRs and report in writing the receipt of a significant amount of improperly enclosed or uncovered waste to EPA by the following working day. The owner or operator of an active waste disposal site is required by the revisions promulgated today to send a signed copy of the WSR back to the waste generator no more than 30 days after receipt of the waste, to attempt to reconcile any discrepancy between the quantity given on the WSR and the quantity actually received and, failing to do so within 15 days after receiving the waste, to report the discrepancy and any attempts to reconcile it to the Administrator. The revisions promulgated today also require the owner or operator of an active disposal site to maintain records of the location, depth and area, and volume of asbestos-containing waste material within the disposal site on a map or diagram of the disposal area. Upon closure, the owner or operator must comply with all the rules promulgated for inactive waste disposal sites. A revision requires the owner or operator of an active waste disposal site to notify the Administrator in writing prior to excavating or otherwise disturbing asbestos-containing waste material that has been deposited at the disposal site and covered.

Asbestos Conversion Processes

A section is promulgated to clarify that operations that convert asbestos-containing waste material into nonasbestos (asbestos-free) material are covered by the NESHAP. The provisions promulgated require the owner or operator of such an operation to obtain prior written approval of the Administrator to construct the facility, and conduct a start-up performance test using specified analytical methods and procedures. Requirements for continuous monitoring during and after the initial 90 days of operation, emissions control, maintenance of records of test results on site, and reports to the Administrator are also promulgated today.

II. Environmental, Energy and Economic Impacts

The environmental, energy, and economic impacts of the revisions for demolition and renovation, including waste disposal, were estimated from two baselines. One is full compliance with the NESHAP, and the other is current use of engineering controls and work practices. Enforcement experience indicates that many asbestos removal operations related to demolition and the subsequent waste disposal operations are performed out of compliance with the NESHAP. The lack of compliance with the NESHAP removal provisions leads to the improper disposal of some waste, especially demolition waste, with the result that emissions from the disposal of demolition waste greatly exceed other emissions, including process emissions from milling, manufacturing, and fabricating. Liability and other considerations generally lead the owners of buildings being renovated to follow or even exceed the requirements of the NESHAP. Thus, the appropriate baseline for demolition is current use of work practices rather than full compliance. At asbestos milling, manufacturing, and fabricating facilities, the required air pollution control devices are generally in place. Thus, for milling, manufacturing, and fabricating, full compliance with the NESHAP, including the waste disposal requirements, is assumed for the baseline.

Few emission measurement data exit for asbestos sources. Thus, emissions were estimated using engineering methods and assumptions, which resulted in substantial uncertainty. A detailed description of the approaches used to estimate emissions is found in "Asbestos Emission Estimates for Milling, Manufacturing, Fabricating, Demolition, Renovation, and Waste Disposal," which is contained in Docket A–88–28. Estimated process emissions under the current NESHAP at full compliance for milling, manufacturing, and fabricating are approximately 7,400 kg/yr. Based on current practices, estimated emissions from the removal activities associated with demolition and renovation are approximately 1,300 kg/yr and estimated waste disposal emissions from all sources are 227,000 kg/yr. If demolition and renovation were in full compliance, estimated emissions from asbestos removal activities associated with demolition and renovation would be about 700 kg/yr. Estimated emissions from waste disposal, assuming full compliance with the NESHAP by all sources, would be about 600 kg/yr.

The costs of the revisions are expected to be small relative to normal operating costs for these industries. The revisions are intended to promote compliance and enhance enforceability. Small additional costs are associated with the recordkeeping and reporting requirements of the revisions. Economic impacts of the promulgated alternatives are expected to be minimal. Adverse impacts of the promulgated revisions on water, noise, and energy were considered. Due to the nature of the revisions, no significant adverse impacts on water, noise, or energy are anticipated.

III. Public Participation

The revisions were proposed and published in the Federal Register on January 10, 1989 (54 FR 912). The preamble to the proposed standards revisions noted the availability in the docket of the supporting information used in developing the proposed revisions. Public comments were solicited at the time of proposal.

To provide interested persons the opportunity for oral presentation of data, views, or arguments concerning the proposed revisions, a public hearing was held on February 8, 1989, at Research Triangle Park, North Carolina. The hearing was open to the public, and 6 persons presented comments.

The public comment period specified in the Federal Register notice was from January 10, 1989 to March 7, 1989. One

hundred comment letters were received in response to the Federal Register proposal. The comments have been carefully considered and, where determined to be appropriate by the Administrator, changes have been made to the proposed revisions.

IV. Significant Comments and Changes to the Proposed Revisions

Comments on the proposed revisions were received from industry, trade associations and regulatory agencies. A detailed discussion of these comments and responses can be found in the promulgation BID, which is referred to in the ADDRESSES section of this preamble. The comments and responses summarized in the BID serve as the basis for the changes that have been made to the revisions between proposal and promulgation. The major comments and responses are summarized in this preamble. Most of the comment letters contained multiple comments. Significant comments have been divided into the following areas: demolition and renovation, and waste disposal.

Demolition and Renovation

Nonfriable ACM

Comment: Several commenters argued that the rule should be modified to clarify that certain products are nonfriable and, therefore, not regulated. Asbestos cement (A/C) products, including transite and exterior shingles, should be included among nonfriable products according to commenters IV-D-49, IV-D-72, and IV-D-93. Asbestos-containing flooring products, such as tile and sheet vinyl flooring, were considered by several commenters (IV-D-15, IV-D-47, IV-D-48, IV-D-55, IV-D-84, and IV-D-95) to always be nonfriable and exempt from the rule, with the exception of flooring that was being sanded (IV-D-47, IV-D-48). Another commenter, IV-D-48, in reference to asbestos roofing products, argued that there is no basis in the record for saying that severely weathered asphaltic material could become brittle. Commenters IV-D-21, IV-D-31, IV-D-48, IV-D-49, and IV-D-93 recommended that the rule be clarified to exempt all nonfriable materials as the rule is currently understood. Commenter IV-D-93 argued that in present day ACM, the asbestos fibers are locked in cement or bituminous or resinous binders and that the materials can be removed and disposed of without any significant release to the environment.

Response: In 1973 when the asbestos NESHAP rules were first promulgated for the demolition of buildings, EPA's intention was to distinguish between materials that would readily release asbestos fibers when damaged or disturbed and those materials that were unlikely to result in the release of significant amounts of asbestos fibers. To accomplish this, EPA labeled as "friable" those materials that were likely to readily release fibers. Friable materials, when dry, could easily be crumbled, pulverized, or reduced to powder using hand pressure. The term "reduced to powder" is readily understood to mean that the affected material is changed to a dust or powder that can become airborne. "Pulverized" indicates that the resulting material will include dust as well as a large number of small pieces of the original material. The term "crumbled" indicates that the affected material is easily (i.e., using hand pressure) broken into a large number of small pieces. Although dust is likely to be produced as a result of crumbling, it is possible that there are some types of materials that can be crumbled without producing dust. It is also understood that crumbling refers to an action that occurs essentially in one effort and not to repeated attempts to crumble the material. For example, floor tile in good condition can be broken by hand into a few large pieces, but it is not easily broken in one effort into many small pieces. On the other hand, floor tile that has lost its structural matrix is in poor condition and can be broken into many small pieces in one effort.

Later, EPA realized that, in some instances, nonfriable materials that were subjected to intense forces, such as the intense mechanical forces encountered during demolition, could be crumbled, pulverized, or reduced to powder. In these instances, certain materials which had been considered nonfriable appeared capable of releasing significant amounts of asbestos fibers to the atmosphere. Examples of practices that were observed by EPA to reduce otherwise nonfriable asbestos material to dust capable of becoming airborne included the breaking of nonfriable insulation from steel beams by repeatedly running over the beams with a crawler tractor. In view of the damage done to these otherwise nonfriable materials and the resulting increased potential for fiber release, these and other similar practices involving nonfriable asbestos material were considered to render nonfriable ACM into dust capable of becoming airborne.

As a result, EPA issued a policy determination in 1985 regarding the removal of nonfriable asbestos material that was consistent with EPA's intent to distinguish between material that could release significant amounts of asbestos fibers during demolition and renovation operations and those that would not. This policy determination stated in essence that any ACM, whether originally friable or nonfriable that become (or are likely to become) crumbled, pulverized, or reduced to powder are covered by the NESHAP. Specifically, the determination stated that

> • • • even though the regulations address only material that is presently friable, it does not limit itself to material that is friable at the time of notification. Rather, if at any point during the renovation or demolition, additional friable asbestos material is • • • created from nonfriable forms, then this additional friable material becomes subject to the regulations from the time of creation • • •

The issuance of this determination did not alter the intent of the NESHAP, but was consistent with the intent of the standard that was written to prevent significant emissions of asbestos fibers. The intent of the policy determination was that it apply narrowly to specific instances where otherwise nonfriable materials would be damaged during demolition or renovation to the extent that significant amounts of asbestos fibers would be released to the atmosphere. A statement in the determination to the effect that some nonfriable materials may remain nonfriable throughout demolition and renovation is evidence that this determination was intended to be narrowly interpreted and not used to require removal of all nonfriable materials. For example, materials such as resilient floor covering, asphalt roofing products, packings, and gaskets would rarely, if ever, need to be removed because, even when broken or damaged, they would not release significant amounts of asbestos fibers. But, just as it is important to recognize that some nonfriable materials do not have to be removed prior to demolition, it is also important to recognize that some nonfriable materials should be removed prior to demolition if, as a result of the forces of demolition, nonfriable material is likely to become crumbled, pulverized, or otherwise reduced to powder. For example, the A/C siding on a building that is to be demolished using a wrecking ball is very likely to be crumbled or pulverized with increased potential for the release of significant levels of asbestos fibers. Such material in this instance should be removed prior to demolition.

Since this policy determination was made, there has been some confusion in

its application. As a result, contractors operating in more than one enforcement jurisdiction have encountered different interpretations for similar demolition operations. For example, there have been instances in which contractors are required, prior to demolition, to remove floor tile in one enforcement jurisdiction but not in another. Contractors and/or building owners and operators are unsure as to what materials must be removed and what materials can be left in place and are often hesitant to proceed without a ruling from EPA, which can involve significant delays.

As a consequence, EPA received a number of requests from State and regional enforcement agencies to clarify what is required under the NESHAP in dealing with nonfriable materials since the 1985 policy determination was issued. In response to these requests, a clarification of the nonfriable issue was included in the revisions proposed on January 10, 1989. These revisions were intended to clarify the intent of the original rule. Basically, EPA stated in the January 10, 1989, Federal Register notice that certain nonfriable materials, such as floor tile, roofing products, and packings and gaskets that are in good condition, can be left in buildings being demolished because fiber release from these materials, even if the materials are damaged, is relatively small compared to the fiber release from friable materials. Other nonfriable products such as A/C products have a greater potential to release asbestos fibers when heavily damaged and may have to be removed prior to demolition.

In response to the revisions proposed on January 10, 1989, numerous comments were submitted to EPA. Many of the commenters argued that EPA was attempting to regulate nonfriable materials, which were explicitly exempted in previous asbestos NESHAP rulemakings. Many comments stated that the proposed revisions did not help to clarify EPA's position on nonfriable material and may have made matters more confusing.

In responding to the comments, a literature survey was conducted to determine if it was possible to quantify the fiber release potential of nonfriable materials when they are damaged during demolition. All of the available data on fiber release from floor tile, roofing products, gaskets, packings, and A/C products was reviewed. In some instances, the fiber release data were measured during actual removal operations, while other data were from simulated removal activities in laboratory settings. For the materials evaluated, the potential for fiber release appeared minimal and substantially lower than for friable materials. These findings, while uncertain, support EPA's original argument that there is a basis for making a distinction between materials that readily release fibers and those that do not.

As a result of the comments received on this issue and the additional information gathered in response to comments, EPA has been able to compile a list of nonfriable ACM that, under normal conditions, do not have to be removed prior to demolition operations. These ACM are not expected to release significant amounts of asbestos fibers to the outside air during demolition and, consistent with the intent of the existing standards, are not being regulated. A definition of "category I nonfriable ACM" is added to the final rule, which lists resilient floor covering, roofing products, gaskets, and packings. However, if these materials are in poor condition and are friable or they are subjected to sanding, grinding, cutting, or abrading, they are to be treated as friable asbestos material. Category I nonfriable ACM that is in poor condition, but is not friable and will not be subjected to sanding, grinding, cutting, or abrading, is not subject to the NESHAP. "In poor condition" has been defined to mean that the binding of the material is losing its integrity as indicated by peeling, cracking, or crumbling of the material. Other nonfriable materials are identified as Category II nonfriable ACM and have to be evaluated on a case-by-case basis. Category II materials that become crumbled, pulverized, or reduced to powder during removal or during demolition are covered by the NESHAP.

Broken ACM

Comment: Commenters IV-D-47, IV-D-89, IV-D-93, and IV-D-95 explained that use of the term "broken" to describe materials that are subject to the rule is inconsistent with the current NESHAP and expands coverage of the NESHAP. These commenters stated that merely breaking nonfriable material does not equate to fiber release. One commenter, IV-D-89, noted that noncompliance may increase where nonfriable material is broken during demolition or renovation, but is not controlled or reported according to the NESHAP.

Response: After considering this issue, EPA agrees with commenters that retaining the word "broken" could be interpreted as substantially increasing the scope of the standard and, therefore, has removed it from the definition. Most nonfriable materials can be broken without releasing significant quantities of airborne asbestos fibers. It is only when the material is extensively damaged, *i.e.*, crumbled, pulverized, or reduced to powder, that the potential for significant fiber release is greatly increased. Also, in the definitions of "asbestos-containing waste material," "friable asbestos material," and elsewhere, the word "broken" is deleted. The EPA is planning to issue additional information in the future on this and other aspects of the NESHAP to help enforcement officials and the regulated community interpret and apply the NESHAP provisions.

Inspections

Comment. Three commenters argued that EPA should include mandatory asbestos surveys in the rule. Commenter IV-D-4 stated that EPA should require surveys for all buildings prior to and separate from any demolition or renovation activity. Commenter IV-D-4 stated that such building surveys could become part of a public record, making the absence of a survey a violation. Commenter IV-D-4 noted that, if the survey indicated that a structure was asbestos free, all notification and enforcement costs would be eliminated. Also, commenter IV-D-4 explained that a demolition without proper notification could be easily established later.

Commenters IV-D-57 and IV-D-84 stated that EPA's requirement to survey buildings prior to demolition and renovation is implicit and should be made explicit and require that surveys be performed by an accredited asbestos inspector. Commenter IV-D-57 also noted that OSHA requires a building survey by a competent person and stated that EPA should similarly require a site-specific survey before demolition, with details on how the building will be demolished and how the asbestos will be controlled.

Response: The EPA currently requires that a facility be inspected for asbestos prior to demolition or renovation. As a result of the survey, information on the asbestos material present, the nature of the demolition or renovation, and measures that will be taken to control emissions of asbestos must be reported to EPA. Commenters IV-D-57 and IV-D-84 are correct in saying that it is an implicit requirement and that it is not stated explicitly in the rule. The final rule expressly requires a facility survey for asbestos prior to demolition or renovation. Although previously implied, this revision clarifies EPA's position on the requirement to perform building surveys.

The EPA also considered the suggestion to require that surveys be

1. Air cleaning device designation or number _____

2. Date of inspection _____ _____ _____ _____

3. Time of inspection _____ _____ _____ _____

4. Is air cleaning device operating properly (yes/no) _____ _____ _____ _____

5. Tears, holes, or abrasions in fabric filter (yes/no) _____ _____ _____ _____

6. Dust on clean side of fabric filters (yes/no) _____ _____ _____ _____

7. Other signs of malfunctions or potential malfunctions (yes/no) _____ _____ _____ _____

8. Describe other malfunctions or signs of potential malfunctions. _____

_____

_____

9. Describe corrective action(s) taken. _____

_____

_____

10. Date and time corrective action taken _____ _____ _____ _____

11. Inspected by

(Print/Type Name)	(Title)	(Signature)	(Date)
(Print/Type Name)	(Title)	(Signature)	(Date)

Figure 2. Air Cleaning Device Inspection Checklist

BILLING CODE 6560-50-C

6. Section 61.143 is revised to read as follows:

§ 61.143 Standard for roadways.

No person may construct or maintain a roadway with asbestos tailings or asbestos-containing waste material on that roadway, unless, for asbestos tailings.

(a) It is a temporary roadway on an area of asbestos ore deposits (asbestos mine); or

(b) It is a temporary roadway at an active asbestos mill site and is encapsulated with a resinous or bituminous binder. The encapsulated road surface must be maintained at a minimum frequency of one per year to prevent dust emissions; or

(c) It is encapsulated in asphalt concrete meeting the specifications contained in section 401 of Standard Specifications for Construction of Roads and Bridges on Federal Highway Projects, FP-85, 1985, or their equivalent.

7. In § 61.144, paragraph (a)(9) and paragraphs (b) (1) and (2) are revised, and paragraphs (b)(3) through (b)(8) are added to read as follows:

§ 61.144 Standards for manufacturing.

(a) * * *

(9) The manufacture of chlorine utilizing asbestos diaphragm technology.

* * * * *

(b) * * *

(1) Discharge no visible emissions to the outside air from these operations or from any building or structure in which they are conducted or from any other fugitive sources; or

(2) Use the methods specified by § 61.152 to clean emissions from these operations containing particulate asbestos material before they escape to, or are vented to, the outside air.

(3) Monitor each potential source of asbestos emissions from any part of the manufacturing facility, including air cleaning devices, process equipment, and buildings housing material processing and handling equipment, at least once each day during daylight hours for visible emissions to the outside air during periods of operation. The monitoring shall be visual observation of at least 15 seconds duration per source of emissions.

(4) Inspect each air cleaning device at least once each week for proper operation and for changes that signal the potential for malfunctions, including, to the maximum extent possible without dismantling other than opening the device, the presence of tears, holes, and abrasions in filter bags and for dust deposits on the clean side of bags. For air cleaning devices that cannot be inspected on a weekly basis according to this paragraph, submit to the Administrator, and revise as necessary, a written maintenance plan to include, at a minimum, the following:

(i) Maintenance schedule.

(ii) Recordkeeping plan.

(5) Maintain records of the results of visible emission monitoring and air cleaning device inspections using a format similar to that shown in Figures 1 and 2 and include the following.

(i) Date and time of each inspection.

(ii) Presence or absence of visible emissions.

(iii) Condition of fabric filters, including presence of any tears, holes and abrasions.

(iv) Presence of dust deposits on clean side of fabric filters.

(v) Brief description of corrective actions taken, including date and time.

(vi) Daily hours of operation for each air cleaning device.

(6) Furnish upon request, and make available at the affected facility during normal business hours for inspection by the Administrator, all records required under this section.

(7) Retain a copy of all monitoring and inspection records for at least 2 years.

(8) Submit quarterly a copy of the visible emission monitoring records to the Administrator if visible emissions occurred during the report period. Quarterly reports shall be postmarked by the 30th day following the end of the calendar quarter.

8. Sections 61.146 and 61.147 are removed, and § 61.145 is revised to read as follows:

§ 61.145 Standard for demolition and renovation.

(a) *Applicability.* To determine which requirements of paragraphs (a), (b), and (c) of this section apply to the owner or operator of a demolition or renovation activity and prior to the commencement of the demolition or renovation, thoroughly inspect the affected facility or part of the facility where the demolition or renovation operation will occur for the presence of asbestos, including Category I and Category II nonfriable ACM. The requirements of paragraphs (b) and (c) of this section apply to each owner or operator of a demolition or renovation activity, including the removal of RACM as follows:

(1) In a facility being demolished, all the requirements of paragraphs (b) and (c) of this section apply, except as provided in paragraph (a)(3) of this section, if the combined amount of RACM is

(i) At least 80 linear meters (260 linear feet) on pipes or at least 15 square meters (160 square feet) on other facility components, or

(ii) At least 1 cubic meter (35 cubic feet) off facility components where the length or area could not be measured previously.

(2) In a facility being demolished, only the notification requirements of paragraphs (b)(1), (2), (3)(i) and (iv), and (4)(i) through (vii) and (4)(ix) and (xvi) of this section apply, if the combined amount of RACM is

(i) Less than 80 linear meters (260 linear feet) on pipes less than 15 square meters (160 square feet) on other facility components, and

(ii) Less than one cubic meter (35 cubic feet) off facility components where the length or area could not be measured previously or there is no asbestos.

(3) If the facility is being demolished under an order of a State or local government agency, issued because the facility is structurally unsound and in danger of imminent collapse, only the requirements of paragraphs (b)(1), (b)(2), (b)(3)(iii), (b)(4) (except (b)(4)(viii)), (b)(5), and (c)(4) through (c)(9) of this section apply.

(4) In a facility being renovated, including any individual nonscheduled renovation operation, all the requirements of paragraphs (b) and (c) of this section apply if the combined amount of RACM to be stripped, removed, dislodged, cut, drilled, or similarly disturbed is

(i) At least 80 linear meters (260 linear feet) on pipes or at least 15 square meters (160 square feet) on other facility components, or

(ii) At least 1 cubic meter (35 cubic feet) off facility components where the length or area could not be measured previously.

(iii) To determine whether paragraph (a)(4) of this section applies to planned renovation operations involving individual nonscheduled operations, predict the combined additive amount of RACM to be removed or stripped during a calendar year of January 1 through December 31.

(iv) To determine whether paragraph (a)(4) of this section applies to emergency renovation operations, estimate the combined amount of RACM to be removed or stripped as a result of the sudden, unexpected event that necessitated the renovation.

(5) Owners or operators of demolition and renovation operations are exempt from the requirements of §§ 61.05(a), 61.07, and 61.09.

(b) *Notification requirements.* Each owner or operator of a demolition or

renovation activity to which this section applies shall:

(1) Provide the Administrator with written notice of intention to demolish or renovate. Delivery of the notice by U.S. Postal Service, commercial delivery service, or hand delivery is acceptable.

(2) Update notice, as necessary, including when the amount of asbestos affected changes by at least 20 percent.

(3) Postmark or deliver the notice as follows:

(i) At least 10 working days before asbestos stripping or removal work or any other activity begins (such as site preparation that would break up, dislodge or similarly disturb asbestos material), if the operation is described in paragraphs (a) (1) and (4) (except (a)(4)(iii) and (a)(4)(iv)) of this section. If the operation is as described in paragraph (a)(2) of this section, notification is required 10 working days before demolition begins.

(ii) At least 10 working days before the end of the calendar year preceding the year for which notice is being given for renovations described in paragraph (a)(4)(iii) of this section.

(iii) As early as possible before, but not later than, the following working day if the operation is a demolition ordered according to paragraph (a)(3) of this section or, if the operation is a renovation described in paragraph (a)(4)(iv) of this section.

(iv) For asbestos stripping or removal work in a demolition or renovation operation, described in paragraphs (a) (1) and (4) (except (a)(4)(iii) and (a)(4)(iv)) of this section, and for a demolition described in paragraph (a)(2) of this section, that will begin on a date other than the one contained in the original notice, notice of the new start date must be provided to the Administrator as follows:

(A) When the asbestos stripping or removal operation or demolition operation covered by this paragraph will begin after the date contained in the notice,

(1) Notify the Administrator of the new start date by telephone as soon as possible before the original start date, and

(2) Provide the Administrator with a written notice of the new start date as soon as possible before, and no later than, the original start date. Delivery of the updated notice by the U.S. Postal Service, commercial delivery service, or hand delivery is acceptable.

(B) When the asbestos stripping or removal operation or demolition operation covered by this paragraph will begin on a date earlier than the original start date,

(1) Provide the Administrator with a written notice of the new start date at least 10 working days before asbestos stripping or removal work begins.

(2) For demolitions covered by paragraph (a)(2) of this section, provide the Administrator written notice of a new start date at least 10 working days before commencement of demolition. Delivery of updated notice by U.S. Postal Service, commercial delivery service, or hand delivery is acceptable.

(C) In no event shall an operation covered by this paragraph begin on a date other than the date contained in the written notice of the new start date.

(4) Include the following in the notice:

(i) An indication of whether the notice is the original or a revised notification.

(ii) Name, address, and telepbone number of both the facility owner and operator and the asbestos removal contractor owner or operator.

(iii) Type of operation: demolition or renovation.

(iv) Description of the facility or affected part of the facility including the size (square meters [square feet] and number of floors), age, and present and prior use of the facility.

(v) Procedure, including analytical methods, employed to detect the presence of RACM and Category I and Category II nonfriable ACM.

(vi) Estimate of the approximate amount of RACM to be removed from the facility in terms of length of pipe in linear meters (linear feet), surface area in square meters (square feet) on other facility components, or volume in cubic meters (cubic feet) if off the facility components. Also, estimate the approximate amount of Category I and Category II nonfriable ACM in the affected part of the facility that will not be removed before demolition.

(vii) Location and street address (including building number or name and floor or room number, if appropriate), city, county, and state, of the facility being demolished or renovated.

(viii) Scheduled starting and completion dates of asbestos removal work (or any other activity, such as site preparation that would break up, dislodge, or similarly disturb asbestos material) in a demolition or renovation; planned renovation operations involving individual nonscheduled operations shall only include the beginning and ending dates of the report period as described in paragraph (a)(4)(iii) of this section.

(ix) Scheduled starting and completion dates of demolition or renovation.

(x) Description of planned demolition or renovation work to be performed and method(s) to be employed, including demolition or renovation techniques to be used and description of affected facility components.

(xi) Description of work practices and engineering controls to be used to comply with the requirements of this subpart, including asbestos removal and waste-handling emission control procedures.

(xii) Name and location of the waste disposal site where the asbestos-containing waste material will be deposited.

(xiii) A certification that at least one person trained as required by paragraph (c)(8) of this section will supervise the stripping and removal described by this notification. This requirement shall become effective 1 year after promulgation of this regulation.

(xiv) For facilities described in paragraph (a)(3) of this section, the name, title, and authority of the State or local government representative who has ordered the demolition, the date that the order was issued, and the date on which the demolition was ordered to begin. A copy of the order shall be attached to the notification.

(xv) For emergency renovations described in paragraph (a)(4)(iv) of this section, the date and hour that the emergency occurred, a description of the sudden, unexpected event, and an explanation of how the event caused an unsafe condition, or would cause equipment damage or an unreasonable financial burden.

(xvi) Description of procedures to be followed in the event that unexpected RACM is found or Category II nonfriable ACM becomes crumbled, pulverized, or reduced to powder.

(xvii) Name, address, and telephone number of the waste transporter.

(5) The information required in paragraph (b)(4) of this section must be reported using a form similiar to that shown in Figure 3.

(c) *Procedures for asbestos emission control.* Each owner or operator of a demolition or renovation activity to whom this paragraph applies, according to paragraph (a) of this section, shall comply with the following procedures:

(1) Remove all RACM from a facility being demolished or renovated before any activity begins that would break up, dislodge, or similarly disturb the material or preclude access to the material for subsequent removal. RACM need not be removed before demolition if:

(i) It is Category I nonfriable ACM that is not in poor condition and is not friable.

(ii) It is on a facility component that encased in concrete or other similarly

hard material and is adequately wet whenever exposed during demolition; or

(iii) It was not accessible for testing and was, therefore, not discovered until after demolition began and, as a result of the demolition, the material cannot be safely removed. If not removed for safety reasons, the exposed RACM and any asbestos-contaminated debris must be treated as asbestos-containing waste material and adequately wet at all times until disposed of.

(iv) They are Category II nonfriable ACM and the probability is low that the materials will become crumbled, pulverized, or reduced to powder during demolition.

(2) When a facility component that contains, is covered with, or is coated with RACM is being taken out of the facility as a unit or in sections:

(i) Adequately wet all RACM exposed during cutting or disjoining operations; and

(ii) Carefully lower each unit or section to the floor and to ground level, not dropping, throwing, sliding, or otherwise damaging or disturbing the RACM.

(3) When RACM is stripped from a facility component while it remains in place in the facility, adequately wet the RACM during the stripping operation.

(i) In renovation operations, wetting is not required if:

(A) The owner or operator has obtained prior written approval from the Administrator based on a written application that wetting to comply with this paragraph would unavoidably damage equipment or present a safety hazard; and

(B) The owner or operator uses of the following emission control methods:

(*1*) A local exhaust ventilation and collection system designed and operated to capture the particulate asbestos material produced by the stripping and removal of the asbestos materials. The system must exhibit no visible emissions to the outside air or be designed and operated in accordance with the requirements in § 61.152.

(*2*) A glove-bag system designed and operated to contain the particulate asbestos material produced by the stripping of the asbestos materials.

(*3*) Leak-tight wrapping to contain all RACM prior to dismantlement.

(ii) In renovation operations where wetting would result in equipment damage or a safety hazard, and the methods allowed in paragraph (c)(3)(i) of this section cannot be used, another method may be used after obtaining written approval from the Administrator based upon a determination that it is equivalent to wetting in controlling emissions or to the methods allowed in paragraph (c)(3)(i) of this section.

(iii) A copy of the Administrator's written approval shall be kept at the worksite and made available for inspection.

(4) After a facility component covered with, coated with, or containing RACM has been taken out of the facility as a unit or in sections pursuant to paragraph (c)(2) of this section, it shall be stripped or contained in leak-tight wrapping, except as described in paragraph (c)(5) of this section. If stripped, either:

(i) Adequately wet the RACM during stripping; or

(ii) Use a local exhaust ventilation and collection system designed and operated to capture the particulate asbestos material produced by the stripping. The system must exhibit no visible emissions to the outside air or be designed and operated in accordance with the requirements in § 61.152.

(5) For large facility components such as reactor vessels, large tanks, and steam generators, but not beams (which must be handled in accordance with paragraphs (c)(2), (3), and (4) of this section), the RACM is not required to be stripped if the following requirements are met:

(i) The component is removed, transported, stored, disposed of, or reused without disturbing or damaging the RACM.

(ii) The component is encased in a leak-tight wrapping.

(iii) The leak-tight wrapping is labeled according to § 61.149(d)(1)(i), (ii), and (iii) during all loading and unloading operations and during storage.

(6) For all RACM, including material that has been removed or stripped:

(i) Adequately wet the material and ensure that it remains wet until collected and contained or treated in preparation for disposal in accordance with § 61.150; and

(ii) Carefully lower the material to the ground and floor, not dropping, throwing, sliding, or otherwise damaging or disturbing the material.

(iii) Transport the material to the ground via leak-tight chutes or containers if it has been removed or stripped more than 50 feet above ground level and was not removed as units or in sections.

(iv) RACM contained in leak-tight wrapping that has been removed in accordance with paragraphs (c)(4) and (c)(3)(i)(B)(*3*) of this section need not be wetted.

(7) When the temperature at the point of wetting is below 0 °C (32 °F):

(i) The owner or operator need not comply with paragraph (c)(2)(i) and the wetting provisions of paragraph (c)(3) of this section.

(ii) The owner or operator shall remove facility components containing, coated with, or covered with RACM as units or in sections to the maximum extent possible.

(iii) During periods when wetting operations are suspended due to freezing temperatures, the owner or operator must record the temperature in the area containing the facility components at the beginning, middle, and end of each workday and keep daily temperature records available for inspection by the Administrator during normal business hours at the demolition or renovation site. The owner or operator shall retain the temperature records for at least 2 years.

(8) Effective 1 year after promulgation of this regulation, no RACM shall be stripped, removed, or otherwise handled or disturbed at a facility regulated by this section unless at least one on-site representative, such as a foreman or management-level person or other authorized representative, trained in the provisions of this regulation and the means of complying with them, is present. Every 2 years, the trained on-site individual shall receive refresher training in the provisions of this regulation. The required training shall include as a minimum: applicability; notifications; material identification; control procedures for removals including, at least, wetting, local exhaust ventilation, negative pressure enclosures, glove-bag procedures, and High Efficiency Particulate Air (HEPA) filters; waste disposal work practices; reporting and recordkeeping; and asbestos hazards and worker protection. Evidence that the required training has been completed shall be posted and made available for inspection by the Administrator at the demolition or renovation site.

(9) For facilities described in paragraph (a)(3) of this section, adequately wet the portion of the facility that contains RACM during the wrecking operation.

(10) If a facility is demolished by intentional burning, all RACM including Category I and Category II nonfriable ACM must be removed in accordance with the NESHAP before burning.

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NOTIFICATION OF DEMOLITION AND RENOVATION

Operator Project #	Postmark	Date Received	Notification #

I. TYPE OF NOTIFICATION (O=Original R=Revised C=Cancelled):

II. FACILITY INFORMATION (Identify owner, removal contractor, and other operator)

OWNER NAME:

Address:

City: | State: | Zip:

Contact: | Tel:

REMOVAL CONTRACTOR:

Address:

City: | State: | Zip:

Contact: | Tel:

OTHER OPERATOR:

Address:

City: | State: | Zip:

Contact: | Tel:

III. TYPE OF OPERATION (D=Demo O=Ordered Demo R=Renovation E=Emer.Renovation):

IV. IS ASBESTOS PRESENT? (Yes/No)

V. FACILITY DESCRIPTION (Include building name, number and floor or room number)

Bldg Name:

Address:

City: | State: | County:

Site Location:

Building Size: | # of Floors: | Age in Years:

Present Use: | Prior Use:

VI. PROCEDURE, INCLUDING ANALYTICAL METHOD, IF APPROPRIATE, USED TO DETECT THE PRESENCE OF ASBESTOS MATERIAL:

VII. APPROXIMATE AMOUNT OF ASBESTOS, INCLUDING: 1. Regulated ACM to be removed 2. Category I ACM Not Removed 3. Category II ACM Not Removed	RACM To Be Removed	Nonfriable Asbestos Material Not To Be Removed		Indicate Unit of Measurement Below	
		Cat I	Cat II	UNIT	
Pipes				LnFt:	Ln m:
Surface Area				Sqft:	Sq m:
Vol RACM Of Facility Component				CuFt:	Cu m:

VIII. SCHEDULED DATES ASBESTOS REMOVAL (MM/DD/YY) Start: Complete:

IX. SCHEDULED DATES DEMO/RENOVATION (MM/DD/YY) Start: Complete:

Continued on page two

Figure 3. Notification of Demolition and Renovation

NOTIFICATION OF DEMOLITION AND RENOVATION (continued)

X. DESCRIPTION OF PLANNED DEMOLITION OR RENOVATION WORK, AND METHOD(S) TO BE USED:		
XI. DESCRIPTION OF WORK PRACTICES AND ENGINEERING CONTROLS TO BE USED TO PREVENT EMISSIONS OF ASBESTOS AT THE DEMOLITION AND RENOVATION SITE:		
XII. WASTE TRANSPORTER #1		
Name:		
Address:		
City:	State:	Zip:
Contact Person:		Telephone:
WASTE TRANSPORTER #2		
Name:		
Address:		
City:	State:	Zip:
Contact Person:		Telephone:
XIII. WASTE DISPOSAL SITE		
Name:		
Location:		
City:	State:	Zip:
Telephone:		
XIV. IF DEMOLITION ORDERED BY A GOVERNMENT AGENCY, PLEASE IDENTIFY THE AGENCY BELOW:		
Name:	Title:	
Authority:		
Date of Order (MM/DD/YY):	Date Ordered to Begin (MM/DD/YY):	
XV. FOR EMERGENCY RENOVATIONS		
Date and Hour of Emergency (MM/DD/YY):		
Description of the Sudden, Unexpected Event:		
Explanation of how the event caused unsafe conditions or would cause equipment damage or an unreasonable financial burden:		
XVI. DESCRIPTION OF PROCEDURES TO BE FOLLOWED IN THE EVENT THAT UNEXPECTED ASBESTOS IS FOUND OR PREVIOUSLY NONFRIABLE ASBESTOS MATERIAL BECOMES CRUMBLED, PULVERIZED, OR REDUCED TO POWDER.		
XVI. I CERTIFY THAT AN INDIVIDUAL TRAINED IN THE PROVISIONS OF THIS REGULATION (40 CFR PART 61, SUBPART M) WILL BE ON-SITE DURING THE DEMOLITION OR RENOVATION AND EVIDENC THAT THE REQUIRED TRAINING HAS BEEN ACCOMPLISHED BY THIS PERSON WILL BE AVAILABLE FOR INSPECTION DURING NORMAL BUSINESS HOURS. (Required 1 year after promulgation)		
_____ (Signature of Owner/Operator)		_____ (Date)
XVII. I CERTIFY THAT THE ABOVE INFORMATION IS CORRECT.		
_____ (Signature of Owner/Operator)		_____ (Date)

Figure 3. Notification of Demolition and Renovation

BILLING CODE 6560-50-C

9. Section 61.148 is redesignated as § 61.140 and is amended by revising paragraphs (a), the introductory text of (b), paragraph (b)(2), and paragraph (d) to read as follows:

§ 61.146 Standard for spraying.

* * * * *

(a) For spray-on application on buildings, structures, pipes, and conduits, do not use material containing more than 1 percent asbestos as determined using the method specified in appendix A, subpart F, 40 CFR part 763, section 1, Polarized Light Microscopy, except as provided in paragraph (c) of this section.

(b) For spray-on application of materials that contain more than 1 percent asbestos as determined using the method specified in appendix A, subpart F, 40 CFR part 763, section 1, Polarized Light Microscopy, on equipment and machinery, except as provided in paragraph (c) of this section:

* * * * *

(2) Discharge no visible emissions to the outside air from spray-on application of the asbestos-containing material or use the methods specified by § 61.152 to clean emissions containing particulate asbestos material before they escape to, or are vented to, the outside air.

* * * * *

(d) Owners or operators of sources subject to this paragraph are exempt from the requirements of §§ 61.05(a), 61.07 and 61.09.

10. Section 61.149 is redesignated as § 61.147, paragraphs (b) (1) and (2) are revised, and paragraphs (b)(3) through (b)(8) are added to read as follows:

§ 61.147 Standard for fabricating.

* * * * *

(b) * * *

(1) Discharge no visible emissions to the outside air from any of the operations or from any building or structure in which they are conducted or from any other fugitive sources; or

(2) Use the methods specified by § 61.152 to clean emissions containing particulate asbestos material before they escape to, or are vented to, the outside air.

(3) Monitor each potential source of asbestos emissions from any part of the fabricating facility, including air cleaning devices, process equipment, and buildings that house equipment for material processing and handling, at least once each day, during daylight hours, for visible emissions to the outside air during periods of operation. The monitoring shall be by visual observation of at least 15 seconds duration per source of emissions.

(4) Inspect each air cleaning device at least once each week for proper operation and for changes that signal the potential for malfunctions, including, to the maximum extent possible without dismantling other than opening the device, the presence of tears, holes, and abrasions in filter bags and for dust deposits on the clean side of bags. For air cleaning devices that cannot be inspected on a weekly basis according to this paragraph, submit to the Administrator, and revise as necessary, a written maintenance plan to include, at a minimum, the following:

(i) Maintenance schedule.

(ii) Recordkeeping plan.

(5) Maintain records of the results of visible emission monitoring and air cleaning device inspections using a format similar to that shown in Figures 1 and 2 and include the following:

(i) Date and time of each inspection.

(ii) Presence or absence of visible emissions.

(iii) Condition of fabric filters, including presence of any tears, holes, and abrasions.

(iv) Presence of dust deposits on clean side of fabric filters.

(v) Brief description of corrective actions taken, including date and time.

(vi) Daily hours of operation for each air cleaning device.

(6) Furnish upon request and make available at the affected facility during normal business hours for inspection by the Administrator, all records required under this section.

(7) Retain a copy of all monitoring and inspection records for at least 2 years.

(8) Submit quarterly a copy of the visible emission monitoring records to the Administrator if visible emissions occurred during the report period. Quarterly reports shall be postmarked by the 30th day following the end of the calendar quarter.

11. Section 61.150 is redesignated as § 61.148 and revised to read as follows:

§ 61.148 Standard for insulating materials.

No owner or operator of a facility may install or reinstall on a facility component any insulating materials that contain commercial asbestos if the materials are either molded and friable or wet-applied and friable after drying. The provisions of this section do not apply to spray-applied insulating materials regulated under § 61.146.

12. Section 61.151 is redesignated as § 61.149 and is amended by revising paragraphs (a), (b), introductory text of (c), (c)(1) (ii) and (iii), and (c)(2), and adding new paragraphs (d) through (f) to read as follows:

§ 61.149 Standard for waste disposal for asbestos mills.

* * * * *

(a) Deposit all asbestos-containing waste material at a waste disposal site operated in accordance with the provisions of § 61.154; and

(b) Discharge no visible emissions to the outside air from the transfer of control device asbestos waste to the tailings conveyor, or use the methods specified by § 61.152 to clean emissions containing particulate asbestos material before they escape to, or are vented to, the outside air. Dispose of the asbestos waste from control devices in accordance with § 61.150(a) or paragraph (c) of this section; and

(c) Discharge no visible emissions to the outside air during the collection, processing, packaging, or on-site transporting of any asbestos-containing waste material, or use one of the disposal methods specified in paragraphs (c) (1) or (2) of this section, as follows:

(1) * * *

(ii) Discharge no visible emissions to the outside air from the wetting operation or use the methods specified by § 61.152 to clean emissions containing particulate asbestos material before they escape to, or are vented to, the outside air.

* * * * *

(iii) Wetting may be suspended when the ambient temperature at the waste disposal site is less than −9.5 °C (15 °F), as determined by an appropriate measurement method with an accuracy of ± 1°C (± 2 °F). During periods when wetting operations are suspended, the temperature must be recorded at least at hourly intervals, and records must be retained for at least 2 years in a form suitable for inspection.

(2) Use an alternative emission control and waste treatment method that has received prior written approval by the Administrator. To obtain approval for an alternative method, a written application must be submitted to the Administrator demonstrating that the following criteria are met:

(i) The alternative method will control asbestos emissions equivalent to currently required methods.

(ii) The suitability of the alternative method for the intended application.

(iii) The alternative method will not violate other regulations.

(iv) The alternative method will not result in increased water pollution, land pollution, or occupational hazards.

(d) When waste is transported by vehicle to a disposal site:

(1) Mark vehicles used to transport asbestos-containing waste material during the loading and unloading of the waste so that the signs are visible. The markings must:

(i) Be displayed in such a manner and location that a person can easily read the legend.

(ii) Conform to the requirements for 51 cm × 36 cm (20 in × 14 in) upright format signs specified in 29 CFR 1910.145(d)(4) and this paragraph; and

(iii) Display the following legend in the lower panel with letter sizes and styles of a visibility at least equal to those specified in this paragraph.

Legend
DANGER
ASBESTOS DUST HAZARD
CANCER AND LUNG DISEASE HAZARD
Authorized Personnel Only
Notation
2.5 cm (1 inch) Sans Serif, Gothic or Block
2.5 cm (1 inch) Sans Serif, Gothic or Block
1.9 cm (¾ inch) Sans Serif, Gothic or Block
14 Point Gothic

Spacing between any two lines must be a least equal to the height of the upper of the two lines.

(2) For off-site disposal, provide a copy of the waste shipment record, described in paragraph (e)(1) of this section, to the disposal site owner or operator at the same time as the asbestos-containing waste material is delivered to the disposal site.

(e) For all asbestos-containing waste material transported off the facility site:

(1) Maintain asbestos waste shipment records, using a form similar to that shown in Figure 4, and include the following information:

(i) The name, address, and telephone number of the waste generator.

(ii) The name and address of the local, State, or EPA Regional agency responsible for administering the asbestos NESHAP program.

(iii) The quantity of the asbestos-containing waste material in cubic meters (cubic yards).

(iv) The name and telephone number of the disposal site operator.

(v) The name and physical site location of the disposal site.

(vi) The date transported.

(vii) The name, address, and telephone number of the transporter(s).

(viii) A certification that the contents of this consignment are fully and accurately described by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and government regulations.

(2) For waste shipments where a copy of the waste shipment record, signed by the owner or operator of the designated disposal site, is not received by the waste generator within 35 days of the date the waste was accepted by the initial transporter, contact the transporter and/or the owner or operator of the designated disposal site to determine the status of the waste shipment.

(3) Report in writing to the local, State, or EPA Regional office responsible for administering the asbestos NESHAP program for the waste generator if a copy of the waste shipment record, signed by the owner or operator of the designated waste disposal site, is not received by the waste generator within 45 days of the date the waste was accepted by the initial transporter. Include in the report the following information:

(i) A copy of the waste shipment record for which a confirmation of delivery was not received, and

(ii) A cover letter signed by the waste generator explaining the efforts taken to locate the asbestos waste shipment and the results of those efforts.

(4) Retain a copy of all waste shipment records, including a copy of the waste shipment record signed by the owner or operator of the designated waste disposal site, for at least 2 years.

(f) Furnish upon request, and make available for inspection by the Administrator, all records required under this section.

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Generator	1. Work site name and mailing address	Owner's name	Owner's telephone no.
	2. Operator's name and address		Operator's telephone no.
	3. Waste disposal site (WDS) name, mailing address, and physical site location		WDS phone no.
	4. Name, and address of responsible agency		
	5. Description of materials	6. Containers No. Type	7. Total quantity m^3 (yd^3)
	8. Special handling instructions and additional information		
	9. OPERATOR'S CERTIFICATION: I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and government regulations.		
	Printed/typed name & title	Signature	Month Day Year
Transporter	10. Transporter 1 (Acknowledgment of receipt of materials)		
	Printed/typed name & title Address and telephone no.	Signature	Month Day Year
	11. Transporter 2 (Acknowledgment of receipt of materials)		
	Printed/typed name & title Address and telephone no.	Signature	Month Day Year
Disposal Site	12. Discrepancy indication space		
	13. Waste disposal site owner or operator: Certification of receipt of asbestos materials covered by this manifest except as noted in item 12.		
	Printed/typed name & title	Signature	Month Day Year

(Continued)

Figure 4. Waste Shipment Record

INSTRUCTIONS

Waste Generator Section (Items 1-9)

1. Enter the name of the facility at which asbestos waste is generated and the address where the facility is located. In the appropriate spaces, also enter the name of the owner of the facility and the owner's phone number.

2. If a demolition or renovation, enter the name and address of the company and authorized agent responsible for performing the asbestos removal. In the appropriate spaces, also enter the phone number of the operator.

3. Enter the name, address, and physical site location of the waste disposal site (WDS) that will be receiving the asbestos materials. In the appropriate spaces, also enter the phone number of the WDS. Enter "on-site" if the waste will be disposed of on the generator's property.

4. Provide the name and address of the local, State, or EPA Regional office responsible for administering the asbestos NESHAP program.

5. Indicate the types of asbestos waste materials generated. If from a demolition or renovation, indicate the amount of asbestos that is

   - Friable asbestos material
   - Nonfriable asbestos material

6. Enter the number of containers used to transport the asbestos materials listed in item 5. Also enter one of the following container codes used in transporting each type of asbestos material (specify any other type of container used if not listed below):

   DM - Metal drums, barrels
   DP - Plastic drums, barrels
   BA - 6 mil plastic bags or wrapping

7. Enter the quantities of each type of asbestos material removed in units of cubic meters (cubic yards).

8. Use this space to indicate special transportation, treatment, storage or disposal or Bill of Lading information. If an alternate waste disposal site is designated, note it here. Emergency response telephone numbers or similar information may be included here.

9. The authorized agent of the waste generator must read and then sign and date this certification. The date is the date of receipt by transporter.

NOTE: The waste generator must retain a copy of this form.

(continued)

Figure 4. Waste Shipment Record

Transporter Section (Items 10 & 11)

10. & 11. Enter name, address, and telephone number of each transporter used, if applicable. Print or type the full name and title of person accepting responsibility and acknowledging receipt of materials as listed on this waste shipment record for transport. Enter date of receipt and signature.

NOTE: The transporter must retain a copy of this form.

Disposal Site Section (Items 12 & 13)

12. The authorized representative of the WDS must note in this space any discrepancy between waste described on this manifest and waste actually received as well as any improperly enclosed or contained waste. Any rejected materials should be listed and destination of those materials provided. A site that converts asbestos-containing waste material to nonasbestos material is considered a WDS.

13. The signature (by hand) of the authorized WDS agent indicates acceptance and agreement with statements on this manifest except as noted in item 12. The date is the date of signature and receipt of shipment.

NOTE: The WDS must retain a completed copy of this form. The WDS must also send a completed copy to the operator listed in item 2.

Figure 4. Waste Shipment Record

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13. Section 61.152 is redesignated as § 61.150 and is revised to read as follows:

§ 61.150 Standard for waste disposal for manufacturing, fabricating, demolition, renovation, and spraying operations.

Each owner or operator of any source covered under the provisions of §§ 61.144, 61.145, 61.146, and 61.147 shall comply with the following provisions:

(a) Discharge no visible emissions to the outside air during the collection, processing (including incineration), packaging, or transporting of any asbestos-containing waste material generated by the source, or use one of the emission control and waste treatment methods specified in paragraphs (a) (1) through (4) of this section.

(1) Adequately wet asbestos-containing waste material as follows:

(i) Mix control device asbestos waste to form a slurry; adequately wet other asbestos-containing waste material; and

(ii) Discharge no visible emissions to the outside air from collection, mixing, wetting, and handling operations, or use the methods specified by § 61.152 to clean emissions containing particulate asbestos material before they escape to, or are vented to, the outside air; and

(iii) After wetting, seal all asbestos-containing waste material in leak-tight containers while wet; or, for materials that will not fit into containers without additional breaking, put materials into leak-tight wrapping; and

(iv) Label the containers or wrapped materials specified in paragraph (a)(1)(iii) of this section using warning labels specified by Occupational Safety and Health Standards of the Department of Labor, Occupational Safety and Health Administration (OSHA) under 29 CFR 1910.1001(j)(2) or 1926.58(k)(2)(iii). The labels shall be printed in letters of sufficient size and contrast so as to be readily visible and legible.

(v) For asbestos-containing waste material to be transported off the facility site, label containers or wrapped materials with the name of the waste generator and the location at which the waste was generated.

(2) Process asbestos-containing waste material into nonfriable forms as follows:

(i) Form all asbestos-containing waste material into nonfriable pellets or other shapes;

(ii) Discharge no visible emissions to the outside air from collection and processing operations, including incineration, or use the method specified by § 61.152 to clean emissions containing particulate asbestos material before they escape to, or are vented to, the outside air.

(3) For facilities demolished where the RACM is not removed prior to demolition according to §§ 61.145(c)(1)(i), (ii), (iii), and (iv) or for facilities demolished according to § 61.145(c)(9), adequately wet asbestos-containing waste material at all times after demolition and keep wet during handling and loading for transport to a disposal site. Asbestos-containing waste materials covered by this paragraph do not have to be sealed in leak-tight containers or wrapping but may be transported and disposed of in bulk.

(4) Use an alternative emission control and waste treatment method that has received prior approval by the Administrator according to the procedure described in § 61.149(c)(2).

(5) As applied to demolition and renovation, the requirements of paragraph (a) of this section do not apply to Category I nonfriable ACM waste and Category II nonfriable ACM waste that did not become crumbled, pulverized, or reduced to powder.

(b) All asbestos-containing waste material shall be deposited as soon as is practical by the waste generator at:

(1) A waste disposal site operated in accordance with the provisions of § 61.154, or

(2) An EPA-approved site that converts RACM and asbestos-containing waste material into nonasbestos (asbestos-free) material according to the provisions of § 61.155.

(3) The requirements of paragraph (b) of this section do not apply to Category I nonfriable ACM that is not RACM.

(c) Mark vehicles used to transport asbestos-containing waste material during the loading and unloading of waste so that the signs are visible. The markings must conform to the requirements of §§ 61.149(d)(1)(i), (ii), and (iii).

(d) For all asbestos-containing waste material transported off the facility site:

(1) Maintain waste shipment records, using a form similar to that shown in Figure 4, and include the following information:

(i) The name, address, and telephone number of the waste generator.

(ii) The name and address of the local, State, or EPA Regional office responsible for administering the asbestos NESHAP program.

(iii) The approximate quantity in cubic meters (cubic yards).

(iv) The name and telephone number of the disposal site operator.

(v) The name and physical site location of the disposal site.

(vi) The date transported.

(vii) The name, address, and telephone number of the transporter(s).

(viii) A certification that the contents of this consignment are fully and accurately described by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and government regulations.

(2) Provide a copy of the waste shipment record, described in paragraph (d)(1) of this section, to the disposal site owners or operators at the same time as the asbestos-containing waste material is delivered to the disposal site.

(3) For waste shipments where a copy of the waste shipment record, signed by the owner or operator of the designated disposal site, is not received by the waste generator within 35 days of the date the waste was accepted by the initial transporter, contact the transporter and/or the owner or operator of the designated disposal site to determine the status of the waste shipment.

(4) Report in writing to the local, State, or EPA Regional office responsible for administering the asbestos NESHAP program for the waste generator if a copy of the waste shipment record, signed by the owner or operator of the designated waste disposal site, is not received by the waste generator within 45 days of the date the waste was accepted by the initial transporter. Include in the report the following information:

(i) A copy of the waste shipment record for which a confirmation of delivery was not received, and

(ii) A cover letter signed by the waste generator explaining the efforts taken to locate the asbestos waste shipment and the results of those efforts.

(5) Retain a copy of all waste shipment records, including a copy of the waste shipment record signed by the owner or operator of the designated waste disposal site, for at least 2 years.

(e) Furnish upon request, and make available for inspection by the Administrator, all records required under this section.

14. Section 61.153 is redesignated as § 61.151 and is amended by revising the introductory text, paragraphs (a)(2), (a)(4), and (b)(3), and adding paragraphs (d) and (e) to read as follows:

§ 61.151 Standard for inactive waste disposal sites for asbestos mills and manufacturing and fabricating operations.

Each owner or operator of any inactive waste disposal site that was operated by sources covered under

§§ 61.142, 61.144, or 61.147 and received deposits of asbestos-containing waste material generated by the sources, shall:

(a) * * *

(2) Cover the asbestos-containing waste material with at least 15 centimeters (6 inches) of compacted nonasbestos-containing material, and grow and maintain a cover of vegetation on the area adequate to prevent exposure of the asbestos-containing waste material. In desert areas where vegetation would be difficult to maintain, at least 8 additional centimeters (3 inches) of well-graded, nonasbestos crushed rock may be placed on top of the final cover instead of vegetation and maintained to prevent emissions; or

* * * * *

(4) For inactive waste disposal sites for asbestos tailings, a resinous or petroleum-based dust suppression agent that effectively binds dust to control surface air emissions may be used instead of the methods in paragraphs (a)(1), (2), and (3) of this section. Use the agent in the manner and frequency recommended for the particular asbestos tailings by the manufacturer of the dust suppression agent to achieve and maintain dust control. Obtain prior written approval of the Administrator to use other equally effective dust suppression agents. For purposes of this paragraph, any used, spent, or other waste oil is not considered a dust suppression agent.

(b) * * *

(3) When requesting a determination on whether a natural barrier adequately deters public access, supply information enabling the Administrator to determine whether a fence or a natural barrier adequately deters access by the general public.

* * * * *

(d) Notify the Administrator in writing at least 45 days prior to excavating or otherwise disturbing any asbestos-containing waste material that has been deposited at a waste disposal site under this section, and follow the procedures specified in the notification. If the excavation will begin on a date other than the one contained in the original notice, notice of the new start date must be provided to the Administrator at least 10 working days before excavation begins and in no event shall excavation begin earlier than the date specified in the original notification. Include the following information in the notice:

(1) Scheduled starting and completion dates.

(2) Reason for disturbing the waste.

(3) Procedures to be used to control emissions during the excavation, storage, transport, and ultimate disposal of the excavated asbestos-containing waste material. If deemed necessary, the Administrator may require changes in the emission control procedures to be used.

(4) Location of any temporary storage site and the final disposal site.

(e) Within 60 days of a site becoming inactive and after the effective date of this subpart, record, in accordance with State law, a notation on the deed to the facility property and on any other instrument that would normally be examined during a title search; this notation will in perpetuity notify any potential purchaser of the property that:

(1) The land has been used for the disposal of asbestos-containing waste material;

(2) The survey plot and record of the location and quantity of asbestos-containing waste disposed of within the disposal site required in § 61.154(f) have been filed with the Administrator; and

(3) The site is subject to 40 CFR part 61, subpart M.

15. Section 61.154 is redesignated as § 61.152 and amended by removing paragraph (a)(1)(i), redesignating paragraphs (a)(1)(ii)–(iv) as paragraphs (a)(1)(i)–(iii), redesignating paragraph (b)(2) as paragraph (b)(3), revising the introductory text of paragraph (a) and paragraphs (b)(1) and (b)(3), and adding paragraphs (a)(3) and (b)(2) to read as follows:

§ 61.152 Air cleaning.

(a) The owner or operator who uses air cleaning, as specified in §§ 61.142(a), 61.144(b)(2), 61.145(c)(3)(i)(B)(*1*), 61.145(c)(4)(ii), 61.145(c)(11)(i), 61.146(b)(2), 61.147(b)(2), 61.149(b), 61.149(c)(1)(ii), 61.150(a)(1)(ii), 61.150(a)(2)(ii), and 61.155(e) shall:

* * * * *

(3) For fabric filter collection devices installed after January 10, 1989, provide for easy inspection for faulty bags.

(b) * * *

(1) After January 10, 1989, if the use of fabric creates a fire or explosion hazard, or the Administrator determines that a fabric filter is not feasible, the Administrator may authorize as a substitute the use of wet collectors designed to operate with a unit contacting energy of at least 9.95 kilopascals (40 inches water gage pressure).

(2) Use a HEPA filter that is certified to be at least 99.97 percent efficient for 0.3 micron particles.

(3) The Administrator may authorize the use of filtering equipment other than described in paragraphs (a)(1) and (b)(1) and (2) of this section if the owner or operator demonstrates to the Administrator's satisfaction that it is equivalent to the described equipment in filtering particulate asbestos material.

16. Section 61.155 is redesignated as § 61.153 and amended by redesignating paragraphs (a)(3) and (a)(4) as paragraphs (a)(4) and (a)(5), respectively, revising the introductory text of paragraphs (a), (a)(4), and (a)(5) and revising paragraphs (a)(2), (a)(4)(ii) and (iii), and (b), and adding paragraph (a)(3) to read as follows:

§ 61.153 Reporting.

(a) Any new source to which this subpart applies (with the exception of sources subject to §§ 61.143, 61.146, and 61.148), which has an initial startup date preceding the effective date of this revision, shall provide the following information to the Administrator postmarked or delivered within 90 days of the effective date. In the case of a new source that does not have an initial startup date preceding the effective date, the information shall be provided, postmarked or delivered, within 90 days of the initial startup date. Any owner or operator of an existing source shall provide the following information to the Administrator within 90 days of the effective date of this subpart unless the owner or operator of the existing source has previously provided this information to the Administrator. Any changes in the information provided by any existing source shall be provided to the Administrator, postmarked or delivered, within 30 days after the change.

* * * * *

(2) If a fabric filter device is used to control emissions,

(i) The airflow permeability in $m^3/min/m^2$ ($ft^3/min/ft^2$) if the fabric filter device uses a woven fabric, and, if the fabric is synthetic, whether the fill yarn is spun or not spun; and

(ii) If the fabric filter device uses a felted fabric, the density in g/m^2 (oz/yd^2), the minimum thickness in millimeters (inches), and the airflow permeability in $m^3/min/m^2$ ($ft^3/min/ft^2$).

(3) If a HEPA filter is used to control emissions, the certified efficiency.

(4) For sources subject to §§ 61.149 and 61.150:

* * * * *

(ii) The average volume of asbestos-containing waste material disposed of, measured in m^3/day (yd^3/day); and

(iii) The emission control methods used in all stages of waste disposal; and

* * * * *

(5) For sources subject to §§ 61.151 and 61.154:

* * * * *

(b) The information required by paragraph (a) of this section must accompany the information required by § 61.10. Active waste disposal sites subject to § 61.154 shall also comply with this provision. Roadways, demolition and renovation, spraying, and insulating materials are exempted from the requirements of § 61.10(a). The information described in this section must be reported using the format of Appendix A of this part as a guide.

17. Section 61.156 is redesignated as § 61.151 and amended by revising the introductory text of § 61.154, paragraphs (c) and (d), and adding paragraphs (e) through (j) to read as follows:

§ 61.154 Standard for active waste disposal sites.

Each owner or operator of an active waste disposal site that receives asbestos-containing waste material from a source covered under §§ 61.149, 61.150, or 61.155 shall meet the requirements of this section:

* * * * *

(c) Rather than meet the no visible emission requirement of paragraph (a) of this section, at the end of each operating day, or at least once every 24-hour period while the site is in continuous operation, the asbestos-containing waste material that has been deposited at the site during the operating day or previous 24-hour period shall:

(1) Be covered with at least 15 centimeters (6 inches) of compacted nonasbestos-containing material, or

(2) Be covered with a resinous or petroleum-based dust suppression agent that effectively binds dust and controls wind erosion. Such an agent shall be used in the manner and frequency recommended for the particular dust by the dust suppression agent manufacturer to achieve and maintain dust control. Other equally effective dust suppression agents may be used upon prior approval by the Administrator. For purposes of this paragraph, any used, spent, or other waste oil is not considered a dust suppression agent.

(d) Rather than meet the no visible emission requirement of paragraph (a) of this section, use an alternative emissions control method that has received prior written approval by the Administrator according to the procedures described in § 61.149(c)(2).

(e) For all asbestos-containing waste material received, the owner or operator of the active waste disposal site shall:

(1) Maintain waste shipment records, using a form similar to that shown in Figure 4, and include the following information:

(i) The name, address, and telephone number of the waste generator.

(ii) The name, address, and telephone number of the transporter(s).

(iii) The quantity of the asbestos-containing waste material in cubic meters (cubic yards).

(iv) The presence of improperly enclosed or uncovered waste, or any asbestos-containing waste material not sealed in lead-tight containers. Report in writing to the local, State, or EPA Regional office responsible for administering the asbestos NESHAP program for the waste generator (identified in the waste shipment record), and, if different, the local, State, or EPA Regional office responsible for administering the asbestos NESHAP program for the disposal site, by the following working day, the presence of a significant amount of improperly enclosed or uncovered waste. Submit a copy of the waste shipment record along with the report.

(v) The date of the receipt.

(2) As soon as possible and no longer than 30 days after receipt of the waste, send a copy of the signed waste shipment record to the waste generator.

(3) Upon discovering a discrepancy between the quantity of waste designated on the waste shipment records and the quantity actually received, attempt to reconcile the discrepancy with the waste generator. If the discrepancy is not resolved within 15 days after receiving the waste, immediately report in writing to the local, State, or EPA Regional office responsible for administering the asbestos NESHAP program for the waste generator (identified in the waste shipment record), and, if different, the local, State, or EPA Regional office responsible for administering the asbestos NESHAP program for the disposal site. Describe the discrepancy and attempts to reconcile it, and submit a copy of the waste shipment record along with the report.

(4) Retain a copy of all records and reports required by this paragraph for at least 2 years.

(f) Maintain, until closure, records of the location, depth and area, and quantity in cubic meters (cubic yards) of asbestos-containing waste material within the disposal site on a map or diagram of the disposal area.

(g) Upon closure, comply with all the provisions of § 61.151.

(h) Submit to the Administrator, upon closure of the facility, a copy of records of asbestos waste disposal locations and quantities.

(i) Furnish upon request, and make available during normal business hours for inspection by the Administrator, all records required under this section.

(j) Notify the Administrator in writing at least 45 days prior to excavating or otherwise disturbing any asbestos-containing waste material that has been deposited at a waste disposal site and is covered. If the excavation will begin on a date other than the one contained in the original notice, notice of the new start date must be provided to the Administrator at least 10 working days before excavation begins and in no event shall excavation begin earlier than the date specified in the original notification. Include the following information in the notice:

(1) Scheduled starting and completion dates.

(2) Reason for disturbing the waste.

(3) Procedures to be used to control emissions during the excavation, storage, transport, and ultimate disposal of the excavated asbestos-containing waste material. If deemed necessary, the Administrator may require changes in the emission control procedures to be used.

(4) Location of any temporary storage site and the final disposal site.

18. Section 61.155 is added to subpart M to read as follows:

§ 61.155 Standard for operations that convert asbesto-containing waste material into nonasbestos (asbestos-free) material.

Each owner or operator of an operation that converts RACM and asbestos-containing waste material into nonasbestos (asbestos-free) material shall:

(a) Obtain the prior written approval of the Administrator to construct the facility. To obtain approval, the owner or operator shall provide the Administrator with the following information:

(1) Application to construct pursuant to § 61.07.

(2) In addition to the information requirements of § 61.07(b)(3), a

(i) Description of waste feed handling and temporary storage.

(ii) Description of process operating conditions.

(iii) Description of the handling and temporary storage of the end product.

(iv) Description of the protocol to be followed when analyzing output materials by transmission electron microscopy.

(3) Performance test protocol, including provisions for obtaining information required under paragraph (b) of this section.

(4) The Administrator may require that a demonstration of the process be performed prior to approval of the application to construct.

(b) Conduct a start-up performance test. Test results shall include:

(1) A detailed description of the types and quantities of nonasbestos material, RACM, and asbestos-containing waste material processed, *e.g.*, asbestos cement products, friable asbestos insulation, plaster, wood, plastic, wire, etc. Test feed is to include the full range of materials that will be encountered in actual operation of the process.

(2) Results of analyses, using polarized light microscopy, that document the asbestos content of the wastes processed.

(3) Results of analyses, using transmission electron microscopy, that document that the output materials are free of asbestos. Samples for analysis are to be collected as 8-hour composite samples (one 200-gram (7-ounce) sample per hour), beginning with the initial introduction of RACM or asbestos-containing waste material and continuing until the end of the performance test.

(4) A description of operating parameters, such as temperature and residence time, defining the full range over which the process is expected to operate to produce nonasbestos (asbestos-free) materials. Specify the limits for each operating parameter within which the process will produce nonasbestos (asbestos-free) materials.

(5) The length of the test.

(c) During the initial 90 days of operation,

(1) Continuously monitor and log the operating parameters identified during start-up performance tests that are intended to ensure the production of nonasbestos (asbestos-free) output material.

(2) Monitor input materials to ensure that they are consistent with the test feed materials described during start-up performance tests in paragraph (b)(1) of this section.

(3) Collect and analyze samples, taken as 10-day composite samples (one 200-gram (7-ounce) sample collected every 8 hours of operation) of all output material for the presence of asbestos. Composite samples may be for fewer than 10 days. Transmission electron microscopy (TEM) shall be used to analyze the output material for the presence of asbestos. During the initial 90-day period, all output materials must be stored on-site until analysis shows the material to be asbestos-free or disposed of as asbestos-containing waste material according to § 61.150.

(d) After the initial 90 days of operation,

(1) Continuously monitor and record the operating parameters identified during start-up performance testing and any subsequent performance testing. Any output produced during a period of deviation from the range of operating conditions established to ensure the production of nonasbestos (asbestos-free) output materials shall be:

(i) Disposed of as asbestos-containing waste material according to § 61.150, or

(ii) Recycled as waste feed during process operation within the established range of operating conditions, or

(iii) Stored temporarily on-site in a leak-tight container until analyzed for asbestos content. Any product material that is not asbestos-free shall be either disposed of as asbestos-containing waste material or recycled as waste feed to the process.

(2) Collect and analyze monthly composite samples (one 200-gram (7-ounce) sample collected every 8 hours of operation) of the output material. Transmission electron microscopy shall be used to analyze the output material for the presence of asbestos.

(e) Discharge no visible emissions to the outside air from any part of the operation, or use the methods specified by § 61.152 to clean emissions containing particulate asbestos material before they escape to, or are vented to, the outside air.

(f) Maintain records on-site and include the following information:

(1) Results of start-up performance testing and all subsequent performance testing, including operating parameters, feed characteristic, and analyses of output materials.

(2) Results of the composite analyses required during the initial 90 days of operation under § 61.155(c).

(3) Results of the monthly composite analyses required under § 61.155(d).

(4) Results of continuous monitoring and logs of process operating parameters required under § 61.155 (c) and (d).

(5) The information on waste shipments received as required in § 61.154(e).

(6) For output materials where no analyses were performed to determine the presence of asbestos, record the name and location of the purchaser or disposal site to which the output materials were sold or deposited, and the date of sale or disposal.

(7) Retain records required by paragraph (f) of this section for at least 2 years.

(g) Submit the following reports to the Administrator:

(1) A report for each analysis of product composite samples performed during the initial 90 days of operation.

(2) A quarterly report, including the following information concerning activities during each consecutive 3-month period:

(i) Results of analyses of monthly product composite samples.

(ii) A description of any deviation from the operating parameters established during performance testing, the duration of the deviation, and steps taken to correct the deviation.

(iii) Disposition of any product produced during a period of deviation, including whether it was recycled, disposed of as asbestos-containing waste material, or stored temporarily on-site until analyzed for asbestos content.

(iv) The information on waste disposal activities as required in § 61.154(f).

(h) Nonasbestos (asbestos-free) output material is not subject to any of the provisions of this subpart. Output materials in which asbestos is detected, or output materials produced when the operating parameters deviated from those established during the start-up performance testing, unless shown by TEM analysis to be asbestos-free, shall be considered to be asbestos-containing waste and shall be handled and disposed of according to §§ 61.150 and 61.154 or reprocessed while all of the established operating parameters are being met.

19. Section 61.156 is added to subpart M to read as follows:

§ 61.156 Cross-reference to other asbestos regulations.

In addition to this subpart, the regulations referenced in Table 1 also apply to asbestos and may be applicable to those sources specified in §§ 61.142 through 61.151, 61.154, and 61.155 of this subpart. These cross-references are presented for the reader's information and to promote compliance with the cited regulations.

20. Section 61.157 is added to subpart M to read as follows:

§ 61.157 Delegation of authority.

(a) In delegating implementation and enforcement authority to a State under section 112(d) of the Act, the authorities contained in paragraph (b) of this section shall be retained by the Administrator and not transferred to a State.

(b) Authorities that will not be delegated to States:

(1) Section 61.149(c)(2)
(2) Section 61.150(a)(4)
(3) Section 61.151(c)
(4) Section 61.152(b)(3)
(5) Section 61.154(d)
(6) Section 61.155(a).

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BILLING CODE 6560-50-M

TABLE 1.—CROSS-REFERENCE TO OTHER ASBESTOS REGULATIONS

Agency	CFR citation	Comment
EPA	40 CFR 763, Subpart E, F	Requires schools to inspect for asbestos and implement response actions and submit asbestos management plans to States. Specifies use of accredited inspectors, air sampling methods, and waste disposal procedures.
	40 CFR 427	Effluent standards for asbestos manufacturing source categories.
	40 CFR 763, Subpart G	Protects public employees performing asbestos abatement work in States not covered by OSHA asbestos standard.
OSHA	29 CFR 1910.1001	Worker protection measures—engineering controls, worker training, labeling, respiratory protection, bagging of waste, 0.2 f/cc permissible exposure level.
	29 CFR 1926.58	Worker protection measures for all construction work involving asbestos, including demolition and renovation—work practices, worker training, bagging of waste, 0.2 f/cc permissible exposure level.
MSHA	30 CFR 56, Subpart D	Specifies exposures limits, engineering controls, and respiratory protection measures for workers in surface mines.
	30 CFR 57, Subpart D	Specifies exposure limits, engineering controls, and respiratory protection measures for workers in underground mines.
DOT	49 CFR 171 and 172	Regulates the transportation of asbestos-containing waste material. Requires waste containment and shipping papers.

APPENDIX D

Occupational Safety and Health Administration (OSHA) Standard (29 CFR 1910.134) Respiratory Protection and Respiratory Protection Program

OCCUPATIONAL SAFETY AND HEALTH STANDARDS
SUBPART I — PERSONAL PROTECTIVE EQUIPMENT

(Code of Federal Regulations, Title 29, Chapter XVII, Part 1910, Subpart I; 36 FR 10466, May 29, 1971; amended at 36 FR 15105, August 13, 1971; 37 FR 22231, October 18, 1972; republished at 39 FR 23502, June 27, 1974; standard provision revoked at 43 FR 49726, October 24, 1978; amended at 49 FR 5322, February 10, 1984)

Subpart I—Personal Protective Equipment

§ 1910.132 General requirements.

(a) *Application.* Protective equipment, including personal protective equipment for eyes, face, head, and extremities, protective clothing, respiratory devices, and protective shields and barriers, shall be provided, used, and maintained in a sanitary and reliable condition wherever it is necessary by reason of hazards of processes or environment, chemical hazards, radiological hazards, or mechanical irritants encountered in a manner capable of causing injury or impairment in the function of any part of the body through absorption, inhalation or physical contact.

(b) *Employee-owned equipment.* Where employees provide their own protective equipment, the employer shall be responsible to assure its adequacy, including proper maintenance, and sanitation of such equipment.

(c) *Design.* All personal protective equipment shall be of safe design and construction for the work to be performed.

§ 1910.133 Eye and face protection.

(a) *General.* (1) Protective eye and face equipment shall be required where there is a reasonable probability of injury that can be prevented by such equipment. In such cases, employers shall make conveniently available a type of protector suitable for the work to be performed, and employees shall use such protectors. No unprotected person shall knowingly be subjected to a hazardous environmental condition. Suitable eye protectors shall be provided where machines or operations present the hazard of flying objects, glare, liquids, injurious radiation, or a combination of these hazards.

(2) Protectors shall meet the following minimum requirements:

(i) They shall provide adequate protection against the particular hazards for which they are designed.

(ii) They shall be reasonably comfortable when worn under the designated conditions.

(iii) They shall fit snugly and shall not unduly interfere with the movements of the wearer.

(iv) They shall be durable.

(v) They shall be capable of being disinfected.

(vi) They shall be easily cleanable.

(vii) Protectors should be kept clean and in good repair.

(3) Persons whose vision requires the use of corrective lenses in spectacles, and who are required by this standard to wear eye protection, shall wear goggles or spectacles of one of the following types:

(i) Spectacles whose protective lenses provide optical correction.

(ii) Goggles that can be worn over corrective spectacles without disturbing the adjustment of the spectacles.

(iii) Goggles that incorporate corrective lenses mounted behind the protective lenses.

(4) Every protector shall be distinctly marked to facilitate identification only of the manufacturer.

(5) When limitations or precautions are indicated by the manufacturer, they shall be transmitted to the user and care taken to see that such limitations and precautions are strictly observed.

(6) Design, construction, testing, and use of devices for eye and face protection shall be in accordance with American National Standard for Occupational and Educational Eye and Face Protection, Z87.1–1968.

§ 1910.134 Respiratory protection.

(a) *Permissible practice.* (1) In the control of those occupational diseases caused by breathing air contaminated with harmful dusts, fogs, fumes, mists, gases, smokes, sprays, or vapors, the primary objective shall be to prevent atmospheric contamination. This shall be accomplished as far as feasible by accepted engineering control measures (for example, enclosure or confinement of the operation, general and local ventilation, and substitution of less toxic materials). When effective engineering controls are not feasible, or while they are being instituted, appropriate respirators shall be used pursuant to the following requirements.

(2) Respirators shall be provided by the employer when such equipment is necessary to protect the health of the employee. The employer shall provide the respirators which are applicable and suitable for the purpose intended. The employer shall be responsible for the establishment and maintenance of a respiratory protective program which shall include the requirements outlined in paragraph (b) of this section.

(3) The employee shall use the provided respiratory protection in accordance with instructions and training received.

(b) *Requirements for a minimal acceptable program.* (1) Written standard operating procedures governing the selection and use of respirators shall be established.

(2) Respirators shall be selected on the basis of hazards to which the worker is exposed.

(3) The user shall be instructed and trained in the proper use of respirators and their limitations.

(4) [Reserved] [1910.134(b)(4) deleted by 49 FR 5322, February 10, 1984]

(5) Respirators shall be regularly cleaned and disinfected. Those used by more than

one worker shall be thoroughly cleaned and disinfected after each use.
[1910.134(b)(5) amended by 49 FR 5322, February 10, 1984]

(6) Respirators shall be stored in a convenient, clean, and sanitary location.

(7) Respirators used routinely shall be inspected during cleaning. Worn or deteriorated parts shall be replaced. Respirators for emergency use such as self-contained devices shall be thoroughly inspected at least once a month and after each use.

(8) Appropriate surveillance of work area conditions and degree of employee exposure or stress shall be maintained.

(9) There shall be regular inspection and evaluation to determine the continued effectiveness of the program.

(10) Persons should not be assigned to tasks requiring use of respirators unless it has been determined that they are physically able to perform the work and use the equipment. The local physician shall determine what health and physical conditions are pertinent. The respirator user's medical status should be reviewed periodically (for instance, annually).

(11) Approved or accepted respirators shall be used when they are available. The respirator furnished shall provide adequate respiratory protection against the particular hazard for which it is designed in accordance with standards established by competent authorities. The U.S. Department of Interior, Bureau of Mines, and the U.S. Department of Agriculture are recognized as such authorities. Although respirators listed by the U.S. Department of Agriculture continue to be acceptable for protection against specified pesticides, the U.S. Department of the Interior, Bureau of Mines, is the agency now responsible for testing and approving pesticide respirators.

(c) *Selection of respirators.* Proper selection of respirators shall be made according to the guidance of American National Standard Practices for Respiratory Protection Z88.2–1969.

(d) *Air quality.* (1) Compressed air, compressed oxygen, liquid air, and liquid oxygen used for respiration shall be of high purity. Oxygen shall meet the requirements of the United States Pharmacopoeia for medical or breathing oxygen. Breathing air shall meet at least the requirements of the specification for Grade D breathing air as described in Compressed Gas Association Commodity Specification G–7.1–1966. Compressed oxygen shall not be used in supplied-air respirators or in open circuit self-contained breathing apparatus that have previously used compressed air. Oxygen must never be used with air line respirators.

(2) Breathing air may be supplied to respirators from cylinders or air compressors.

(i) Cylinders shall be tested and maintained as prescribed in the Shipping Container Specification Regulations of the Department of Transportation (49 CFR Part 178).

(ii) The compressor for supplying air shall be equipped with necessary safety and standby devices. A breathing air-type compressor shall be used. Compressors shall be constructed and situated so as to avoid entry of contaminated air into the system and suitable in-line air purifying sorbent beds and filters installed to further assure breathing air quality. A receiver of sufficient capacity to enable the respirator wearer to escape from a contaminated atmosphere in event of compressor failure, and alarms to indicate compressor failure and overheating shall be installed in the system. If an oil-lubricated compressor is used, it shall have a high-temperature or carbon monoxide alarm, or both. If only a high-temperature alarm is used, the air from the compressor shall be frequently tested for carbon monoxide to insure that it meets the specifications in subparagraph (1) of this paragraph.

(3) Air line couplings shall be incompatible with outlets for other gas systems to prevent inadvertent servicing of air line respirators with nonrespirable gases or oxygen.

(4) Breathing gas containers shall be marked in accordance with American National Standard Method of Marking Portable Compressed Gas Containers to Identify the Material Contained, Z48.1–1954; Federal Specification BB–A–1034a, June 21, 1968, Air, Compressed for Breathing Purposes; or Interim Federal Specification GG–B–00675b, April 27, 1965, Breathing Apparatus, Self-Contained.

(e) *Use of respirators.* (1) Standard procedures shall be developed for respirator use. These should include all information and guidance necessary for their proper selection, use, and care. Possible emergency and routine uses of respirators should be anticipated and planned for.

(2) The correct respirator shall be specified for each job. The respirator type is usually specified in the work procedures by a qualified individual supervising the respiratory protective program. The individual issuing them shall be adequately instructed to insure that the correct respirator is issued.
[1910.134(e)(2) amended by 49 FR 5322, February 10, 1984]

(3) Written procedures shall be prepared covering safe use of respirators in dangerous atmospheres that might be encountered in normal operations or in emergencies. Personnel shall be familiar with these procedures and the available respirators.

(i) In areas where the wearer, with failure of the respirator, could be overcome by a toxic or oxygen-deficient atmosphere, at least one additional man shall be present. Communications (visual, voice, or signal line) shall be maintained between both or all individuals present. Planning shall be such that one individual will be unaffected by any likely incident and have the proper rescue equipment to be able to assist the other(s) in case of emergency.

(ii) When self-contained breathing apparatus or hose masks with blowers are used in atmospheres immediately dangerous to life or health, standby men must be present with suitable rescue equipment.

(iii) Persons using air line respirators in atmospheres immediately hazardous to life or health shall be equipped with safety harnesses and safety lines for lifting or removing persons from hazardous atmospheres or other and equivalent provisions for the rescue of persons from hazardous atmospheres shall be used. A standby man or men with suitable self-contained breathing apparatus shall be at the nearest fresh air base for emergency rescue.

(4) Respiratory protection is no better than the respirator in use, even though it is worn conscientiously. Frequent random inspections shall be conducted by a qualified individual to assure that respirators are properly selected, used, cleaned, and maintained.

(5) For safe use of any respirator, it is essential that the user be properly instructed in its selection, use, and maintenance. Both supervisors and workers shall be so instructed by competent persons. Training shall provide the men an opportunity to handle the respirator, have it fitted properly, test its face-piece-to-face seal, wear it in normal air for a long familiarity period, and, finally, to wear it in a test atmosphere.

(i) Every respirator wearer shall receive fitting instructions including demonstrations and practice in how the respirator should be worn, how to adjust it, and how to determine if it fits properly. Respirators shall not be worn when conditions prevent a good face seal. Such conditions may be a growth of beard, sideburns, a skull cap that projects under the facepiece, or temple pieces on glasses. Also, the absence of one or both dentures can seriously affect the fit of a facepiece. The worker's diligence in observing these factors shall be evaluated by periodic check. To assure proper protection, the facepiece fit shall be checked by the wearer each time he puts on the respirator. This may be done by following the manufacturer's facepiece fitting instructions.

(ii) Providing respiratory protection for individuals wearing corrective glasses is a serious problem. A proper seal cannot be established if the temple bars of eye glasses extend through the sealing edge of the full facepiece. As a temporary measure, glasses with short temple bars or without temple bars may be taped to the wearer's head. Wearing of contact lenses in contaminated atmospheres with a respirator shall not be allowed. Systems have been developed for mounting corrective lenses inside full facepieces. When a workman must wear corrective lenses as part of the facepiece, the facepiece and lenses shall be fitted by qualified individuals to provide good vision, comfort, and a gas-tight seal.

(iii) If corrective spectacles or goggles are required, they shall be worn so as not to affect the fit of the facepiece. Proper selection of equipment will minimise or avoid this problem.

(f) *Maintenance and care of respirators.* (1) A program for maintenance and

§ 1910.135 Occupational head protection.

Helmets for the protection of heads of occupational workers from impact and penetration from falling and flying objects and from limited electric shock and burn shall meet the requirements and specifications established in American National Standard Safety Requirements for Industrial Head Protection, Z89.1–1969.

§ 1910.136 Occupational foot protection.

Safety-toe footwear for employees shall meet the requirements and specifications in American National Standard for Men's Safety-Toe Footwear, Z41.1–1967.

§ 1910.137 Electrical protective devices.

Rubber protective equipment for electrical workers shall conform to the requirements established in the American National Standards Institute Standards as specified in the following list:

Item	Standard
Rubber insulating gloves	J6.6–1967.
Rubber matting for use around electric apparatus	J6.7–1966 (R1968).
Rubber insulating blankets	J6.4–1970.
Rubber insulating hoods	J6.3–1966 (R1972).
Rubber insulating line hose	J6.1–1966 (R1972).
Rubber insulating sleeves	J6.5–1968.

§ 1910.138 Effective dates.

(a) The provisions of this Subpart I shall become effective on August 27, 1971, except that:

(1) Any provision in any other section of this subpart which contains in itself a specific effective date or time limitation shall become effective on such date or shall apply in accordance with such limitation; and

(2) If any standard in 41 CFR Part 50–204, other than a national consensus standard incorporated by reference in § 50–204.2(a)(1), is or becomes applicable at any time to any employment and place of employment by virtue of the Walsh-Healey Public Contracts Act, or the Service Contract Act of 1965, or the National Foundation on Arts and Humanities Act of 1965, any corresponding established Federal standard in this Subpart I which is derived from 41 CFR Part 50–204 shall also become effective, and shall be applicable to such employment and place of employment, on the same date.

§ 1910.139 Sources of standards.

Sec.	Source
1910.133	41 CFR 50–204.7.
1910.133(a)	ANSI Z87.1–1968, Eye and Face Protection.
1910.134	ANSI Z88.2–1969, Standard Practice for Respiratory Protection.
1910.134 Table I–L	ANSI K13.1–1967, Identification of Gas Mask Canister.
1910.135	ANSI Z89.1–1969, Safety Requirements for Industrial Head Protection.
1910.136	ANSI Z41.1–1967, Men's Safety-Toe Footwear.
1910.137	ANSI Z9.4–1968, Ventilation and Safe Practices of Abrasive Blasting Operations.

§ 1910.140 Standards organizations.

Specific standards of the following organization have been referenced in this part. Copies of the referenced materials may be obtained from the issuing organization.

American National Standards Institute, 1430 Broadway, New York, NY 10018.

RESPIRATORY PROTECTION PROGRAM

1.0 RESPIRATOR SELECTION

The OSHA standard states that respirators shall be selected according to the type and concentration of air contaminants to which workers are exposed, and that ANSI Z88.2-1969 shall be used for guidance in their selection. OSHA also requires that respirators approved or accepted by the National Institute for Occupational Safety and Health (NIOSH) or the Mine Safety and Health Administration (MSHA) be used.

Specific regulations concerning respirator approval can be found in the Code of Federal Regulations (30 CFR 11). All respirators must pass a fit test to determine that the face-to-facepiece seal is effective, and in the case of hoods and helmets, to ensure that they are not likely to develop a negative pressure during use. Detailed information on the products can be found in the most current edition of the NIOSH Certified Equipment List. Further current information can be obtained directly through NIOSH or OSHA.

2.0 EVALUATION OF RESPIRATORS

2.1 FIT-TESTING

Although manufacturers design facepieces to fit as broad a section of the working population as possible, no single respirator will fit everyone. Therefore, it is strongly suggested that many brands of a given type of respirator be purchased to take advantage of the different fitting characteristics of each. In this way, the chances of properly fitting all workers are increased. In addition, having more than one facepiece to choose from gives the worker a better chance of finding a respirator with a comfortable fit while providing adequate protection.

Determination of facepiece fit can involve either qualitative and quantitative tests. A qualitative test relies on the wearer's subjective response to a test atmosphere of irritant smoke or isoamyl acetate, for instance. Qualitative tests are fast and easily performed in the field and do not require complicated, expensive equipment (see Appendix A for examples). A quantitative test uses some other means of detecting facepiece leakage and requires expensive equipment that can be operated only by highly trained personnel. Special consideration should be given to hiring consultants if quantitative tests are desired. OSHA currently requires fit testing of all negative pressure respirators, including single-use respirators. OSHA requires that a test atmosphere be applied to assess the quality of fit using recognized qualitative or quantitative procedures.

2.2 MEDICAL EVALUATION

Each employee using respiratory protection must be evaluated by a physician to determine his or her ability to wear a respirator without adverse health effects. This evaluation generally involves the use of pulmonary function testing to screen employees for pre-existing respiratory or cardiac conditions which may be aggravated by the use of a respirator. A statement by the physician that the employee is capable of wearing a respirator should be on file for each employee required to wear a respirator.

2.3 EMPLOYEE TRAINING

It is important that employees be trained to use respirators correctly for them to be effective. This training should include:

- Putting on the respirator properly
- Adjusting for a secure fit
- Discussion of respirator capabilities and limitations
- Proper storage and maintenance of respirators (see next section)

3.0 RESPIRATOR MAINTENANCE

3.1 STORAGE

When not in use, it is important that respirators be stored where they will not be damaged or contaminated. OSHA requires that respirators be stored to protect against dust, sunlight, heat, extreme cold, excessive moisture, and damaging chemicals. Leaving a respirator unprotected, such as on a workbench or in a tool cabinet or toolbox among heavy wrenches, may damage it.

It is strongly recommended that freshly cleaned respirators be placed in heat-sealed or reusable plastic bags until reissue. They should be stored in a clean, dry location away from direct sunlight. They should be stored in a single layer with the facepiece and exhalation valve in a more or less normal position to prevent the rubber plastic from taking a permanent distorted "set". All respirators kept ready for nonroutine or emergency use must be stored in a cabinet with compartments built for that purpose.

3.2 INSPECTION

Respirators used routinely should be inspected before and after each use. Respirators used for emergency escape or rescue purposes must be inspected after each use, and at least monthly. The OSHA respirator standard requires that respirator inspection include a check of the tightness of connections and check of the facepiece, valves, connecting tubes, and canisters. These should be

inspected for breaks, frays, tears, melting, stiffening, dust or dirt on valves, missing parts, etc.

A supply of spare parts should be available to replace worn or broken parts.

3.3 CLEANING

All respirators should be cleaned following each day's use. NIOSH suggests the following procedures:

- Remove the air-purifying element and the valve flaps.

- Do not attempt to remove paint, varnish, or lacquer from cartridges or filters. When these air-purifying elements contain accumulations of paint, enamel, or lacquer they must be discarded.

- Other surfaces of the respirator facepiece covered with accumulations of paint, enamel, or lacquer may be wiped with a cloth that has been soaked with an appropriate cleaning agent. If found effective, mineral spirits, turpentine, or naphtha may be used. After cleaning, the agent is wiped from the facepiece with a dry cloth.

- An organic solvent or stripping agent never should be used for soaking the respirator parts. Plastic or rubber components will be adversely affected.

- Water-based paints or enamels may be removed with a cloth soaked in a soap and water solution.

- The respirator then should be washed in warm water, about 140 ^{o}F. Detergents containing a bactericide are preferred. The facepiece and parts should be scrubbed with a soft brush to ensure that all foreign matter is removed from surfaces containing the wearer's face.

- If the detergent used in washing does not contain a bactericide, a disinfecting rinse must follow. Reliable disinfectants may be made from some simple household solutions. Two tablespoons of chlorine bleach added to a gallon of water will produce a hypochlorite solution that disinfects respirators effectively with a simple immersion. An aqueous solution of iodine made by adding one teaspoon of tincture of iodine per gallon of water will serve as an adequate disinfectant, and will not damage the rubber or plastic in respirator facepieces. Again, simply immersing the unit is sufficient.

- After washing and disinfecting, the respirator must be rinsed in clean, warm water. Recommended temperatures vary from 120 ^{o}F to a maximum of 160 ^{o}F. Manufactuer's instructions should be followed. All traces of detergent and sanitizer must be removed to prevent dermatitis.

- The respirator should be allowed to air-dry on a clean surface, or by hanging from a wire. When dry, new air-purifying elements should be attached. Valve flaps should be replaced as necessary.

APPENDIX E

National Institute for Occupational Safety and Health (NIOSH), Method 7400 Air Sampling Method For Asbestos

ASBESTOS FIBERS IN AIR

National Institute for Occupational Safety and Health

Analytical Method

Analyte:	Asbestos fibers	**Method No.:**	P&CAM 239
Matrix:	Air	**Range:**	0.1-60 fibers/cm^3
Procedure:	Filter collection, microscopic count	**Precision (CV_T):**	0.24 to 0.38
Date Issued:	3/30/77	**Classification:**	D (Operational)
Date Revised:			

1. Principle of the Method

1.1 This method describes the equipment and procedures for collecting, mounting, and counting asbestos fibers on cellulose ester membrane filters in the evaluation of personal samples of airborne asbestos fibers. The purpose of the method is to determine an employee's index of exposure to airborne asbestos fibers. The method is primarily a personal monitoring technique, but can be used for area monitoring.

1.2 The sample is collected by drawing air through a membrane filter by means of a battery powered personal sampling pump. The filter is transformed from an opaque solid membrane to a transparent optically homogeneous gel. The fibers are sized and counted using a phase-contrast microscope at 400-450X magnification.

1.3 Definitions. Asbestos fiber, for counting purposes, means a particulate which has a physical dimension longer than 5 micrometers and with a length to diameter ratio of 3 to 1 or greater. Asbestos includes chrysotile, cummingtonite-grunerite (amosite), crocidolite, fibrous tremolite, fibrous anthophyllite, and fibrous actinolite.

1.4 Any laboratory attempting to use this procedure should have at least one counter attend a training course conducted by an experienced, proficient laboratory. Novice, untutored counters, using only published instructions, can easily obtain counts of half those performed by experienced, proficient counters. Large differences between laboratories can be caused by: 1) differences in technique and observing ability among counters and 2) small, but significant, differences between microscopes meeting the basic specifications of Section 6.2. The following procedures are recommended:

1.4.1 All microscopists who perform asbestos counting should meet together for an "asbestos counting workshop" at least quarterly. This is best accomplished with counters from several laboratories using their own microscopes.

1.4.2 Each microscopist should count the same series of slides and with the results being compared.

1.4.3 Differences between counters should be resolved with side-by-side counting of the fields by the different counters.

1.4.4 Individuals who are found to be persistent outliers over several sessions should be encouraged to seek other tasks in their respective laboratories.

2. Range and Sensitivity

2.1 The usable range is primarily a function of sample volume, microscope count field area, and background airborne particulates. The influence of these variables is discussed in 8.1.3. For a microscope count field area of 0.003 mm^2 (see Figure 1) and a pump flow rate of 1.7 lpm, the optimal fiber densities would be produced over the range of 0.4 fiber/cm^3 (8-hour sample) to about 60 fibers cm^3 (15-minute sample). For a field area of 0.006 mm^2 (see Figure 2) and a pump flow rate of 1.7 lpm, the optimal range is 0.2 fiber/cm^3 (8-hour sample) to about 30 fibers cm^3 (15-minute sample). In each case, the optimal detection limits are inversely proportional to pump flow rate.

The upper detection limit can be extended by using sample times less than 15 minutes or using lower flow rates. The lower detection limit can be extended by increasing the flow rate up to about 2.5 lpm. Filter surface fiber densities less than optimal (less than about 0.5 to 1.0 fiber per count field) are still adequate, but will lead to decreased precision for the method (increased coefficient of variation, see Section 4).

The minimum total fiber count in 100 fields considered adequate for reliable quantitation is 10 fibers. Thus, the lower limit of reliable quantitation is 0.1 fiber/cm^3 (100,000 fibers/m^3). For this level, a flow rate of about 2.5 lpm is recommended. For a field area of 0.003 mm^2, the minimum sample time would be about 2 hours. For a field area of 0.006 mm^2, the minimum sample time would be about 1 hour.

2.2 This method considers only fibers with a length to diameter ratio of 3 to 1 or greater and a length greater than 5 micrometers.

3. Interferences

In an atmosphere known to contain asbestos, all particulates with a length to diameter ratio of 3 to 1 or greater, and a length greater than 5 micrometers should, in the absence of other information, be considered to be asbestos fibers and counted as such.

4. Precision and Accuracy

4.1 In the past decade, there have appeared a number of articles examining sources of variation in the asbestos sampling and counting procedure. These include: Lynch et al. (11.1), Weidner and Ayer (11.2), Conway and Holland (11.3), Leidel and Busch (11.4), Beckett and Attfield (11.5), and Rajhans and Bragg (11.6). The sources of variation will be discussed by stages in the membrane filter evaluation procedure.

4.2 **Sources of Variation in the Sampling Process.** These include variations in pump flow rate, proximity of the filter to the employee's body, and filter location (left to right) in the employee's breathing zone.

4.2.1 Section 9.1 requires that the personal sampling pump be calibrated with sufficient accuracy such that the 95% confidence limits on the flow rate are ± 10%. This is equivalent to a coefficient of variation (CV) of about 5%. However, this CV makes a negligible contribution to the total CV for the method due to the relatively large CV of the counting procedure.

4.2.2 Conway and Holland (11.3) concluded that positioning of the filter cassette on the wearer (regarding the angular portions of the filter and their proximity to the wearer) is not a significant factor in determining the fiber distribution on filters.

4.2.3 Weidner and Ayer (11.2) concluded that there is no appreciable difference between samples collected on either the right or left sides of a breathing zone or between samples collected side-by-side, especially for samples with concentrations less than 2.5 fibers cm^3.

4.3 Sources of Variation in the Counting Procedure

4.3.1 Random variations exist in the fiber distribution on a filter wedge (intra-wedge variability). The industrial hygiene literature has seen considerable debate in the last 20 years concerning whether or not the distribution of mineral dust or asbestos fibers on a filter surface is adequately described by a Poisson distribution probability density function. Leidel and Busch (11.4) found excellent agreement between empirical error variance and theoretical variance calculated from the assumption of Poisson distributed true counts. They concluded that there was not excessive variation among count fields for a filter wedge and that clumping of fibers (non-random coalescence) did not occur.

4.3.2 Variations exist in the fiber distribution on the total filter surface (inter-wedge variability) due to the random or non-random distribution of fibers across the total surface of the filter. This type of variation is easily confused with intra-wedge variations. The count procedure does not require counting of multiple sectors of the filter. There may be significant differences between average counts for different wedges, or the fiber distribution variations for the total filter surface may be greater than the variations of the Poisson distribution. If either of these occur experimentally, one must use the experimental variations to estimate the minimum precision of the count procedure. The minimum precision is governed by the variations of the fiber distribution on the total surface of the filter.

Conway and Holland (11.3) concluded the distribution of fibers on filters is not uniform and the distribution of fiber counts is more disperse than Poisson. For their filters which had significant variations in fiber concentrations between sectors (as much as 50-60% of the total filter mean), they described the following relation for the standard deviation of the total number of fibers counted on a wedge (N)

$$\text{empirical } s(N) = 1.6\ (N)^{1/2}$$

where N is about 100. The Poisson standard deviation would be:

$$\text{Poisson } \sigma(N) = (N)^{1/2}$$

Rajhans and Bragg (11.6) in Series I of their study found significant variation between filter segments and rejected the Poisson distribution for the total filter surface. However, in Series II of their study, utilizing various experimental modifications, they found no significant variation between filter segments and no reason to reject the assumption of Poisson distributed fiber counts.

4.3.3 Systematic variations due to differences between microscopes were studied by Leidel and Busch (11.4). In their study using five different brands of microscopes, they found no significant differences among four, but the fifth gave counts approximately 45% higher on the average than the other four.

4.3.4 Variations due to differences between counters should be examined at three levels: experienced counters occasionally counting, experienced counters routinely counting, and inexperienced (new or untutored) counters. Leidel and Busch (11.4) studied five experienced counters, with one counting only occasionally. There were no significant differences among three of the counters, but a fourth was 16% lower than the first three. The fifth, who occasionally counted, averaged 27% higher than the first three. Conway and Holland (11.3) studied three experienced counters and three inexperienced counters. They found statistically significant differences between the means of both the experienced and inexperienced counters that typically were in the range plus or minus 5 to 15%. They concluded that experience as a fiber counter is not a significant parameter affecting intercounter variations.

Rajhans and Bragg (11.6) found no significant differences among means of five experienced counters in Series I of their study. But in their carefully controlled Series II, an analysis of variance showed significant variations between counters that were plus or minus 1 to 15%.

4.3.5 Variations between laboratories are most likely due to systematic biases and are not a significant additional source of random variations. Any additional variations are most likely due to differences in counting technique. Beckett and Attfield (11.5) observed that standard counters improved greatly after personal instruction; also new counters, after instruction, tended to overcompensate and get exceedingly high counts. Additionally, they found that counts from an experienced laboratory that had not had contact with other laboratories performing the same analysis were as far from the standard values as were the counts by new counters.

4.4 Sources of variations between samples taken at different times on one employee during one work shift can affect the exposure estimate for that employee. These are primarily due to a) differences in exposure concentrations during the day, b) differences in location of the employee within the plant, and c) differences in work operation performed by the employee during the day. These sources of variation can be controlled by proper choice of sampling strategy. Refer to Leidel and Busch (11.7) and Leidel, Busch, and Lynch (11.8) for an extended discussion of sampling strategies. Interday temporal variations can affect the exposure estimates obtained on different days. Refer to Leidel, Busch, and Crouse (11.9) for a discussion of this type of variation.

4.5 Until recently, the total coefficient of variation (CV_T) for the sampling and counting procedure was best estimated from the work of Conway and Holland (11.3). The conclusions of their study included:

4.5.1 The precision of their procedure for filters not containing an abundance of fine fibers can be estimated by a coefficient of variation of 16.2%. This value includes variation among counters and observed interaction effects.

4.5.2 The accuracy of the procedure for similar filters may be estimated for a 100-fiber count by a coefficient of variation of 21.4%. This assumes that the contribution of the overall variance from the nonuniform fiber distribution is additive.

4.5.3 A high percentage of very fine fibers on the filter can significantly affect the standard deviation and confidence limits for counts by different counters. After combining variations in fiber concentrations over the entire filter with those for different counters, it was concluded:

a. For filters with a low concentration of fine fibers, the coefficient of variation is estimated at 21% and the 95% confidence interval is ± 43%.

b. For filters with a high concentration of fine fibers, the coefficient of variation is estimated at 25% and the 95% confidence interval is ± 50%.

Lynch, Kronoveter, and Leidel (11.1) have also reported on variations of the method. Their intralaboratory study utilized the data from a large number of dust counts made by different methods by experienced counters over a period of years in an epidemiologic study of the asbestos products industry. They concluded that the standard deviation of counts of fibers longer than 5 micrometers on membrane filters could be estimated from the relation $\sigma = kN^{0.5}$. Thus for counts of about 100 fibers, the coefficient of variation could be estimated at about 15.2% and the 95% confidence limits at ± 30.4%. These values are lower than the values reported by Conway and Holland (11.3).

Recently, the Johns-Manville Corporation conducted an in-house investigation of the asbestos count method (11.10). The study data contained total fiber counts for over

100 filters with each filter counted by two to five counters. From the Johns-Manville data, NIOSH calculated over 100 estimates of the count CV for the method (11.11). The NIOSH CV estimates included random intrafilter variations and intercounter variations, but did not include random pump flow rate variations. It was found that the count coefficient of variation (all random variations except for pump variations) was a function of the total fiber count. NIOSH then included a CV of 0.05 for random pump variations (see Section 9.1) in the CV-estimator equation to obtain a CV_T-estimator. The CV_T-estimator line is plotted on Figure 3 for total fiber counts in the range 10 to 100 fibers. Or the following equation can be used:

$$CV_T = [\text{antilog}_{10}(-0.215 - 0.203\,(\log_{10}FB)) + 0.0025]^2$$

where FB is total fiber count as discussed in Section 10.

Figure 3 demonstrates that for a total fiber count of 100, the best CV_T is attainable with the appropriate sampling times given in 8.1.3 and the count rules in 8.3.9. When making decisions regarding compliance with the OSHA asbestos exposure standards in 29 CFR 1910.1001, the statistical procedures given in Leidel et al. (11.11) should be followed. The procedures are based on statistical theory and assumptions given in References 11.12, 11.13.

Because of the possibility of systematic biases due to differences between microscopes, counters, and laboratories as discussed above, it is strongly recommended that any laboratory counting asbestos should participate in an interlaboratory quality control program that includes the counting of standard reference filters. These standard filters are available from NIOSH through the Proficiency Analytical Testing (PAT) Program. The PAT Program is used by the American Industrial Hygiene Association (AIHA) as part of its Laboratory Accreditation Program. Each laboratory's quality control program must include protocols for routinely adjusting and calibrating sampling and counting equipment plus training and evaluation programs for counters.

5. Advantages and Disadvantages of the Method

5.1 The method is intended to give an index of employee exposure to airborne asbestos fibers of specified dimensional characteristics.

5.2 It is not meant to count all asbestos fibers in all size ranges or to differentiate asbestos from other fibrous particulates.

6. Apparatus

6.1 Sampling Equipment

The personal sampling equipment train consists of 1) personal sampling pump, 2) tubing, 3) clothing spring clip, 4) tubing-to-field monitor metal adaptor, and 5) field monitor (filter and holder).

6.1.1 Personal Sampling Pump. The pump must be capable of sampling at 1.0 to 2.5 liters per minute (lpm) against a flow resistance of 7.5 inches of water (1.4 cm Hg) for 8 continuous hours on a fully charged battery.

6.1.2 Tubing. Laboratory tubing such as rubber or plastic with 6-mm bore and about 100 cm length.

6.1.3 Clothing Spring Clip. The clip attaches the rubber tubing to the lapel or shirt of the individual being monitored.

6.1.4 Tubing-to-field Monitor Adaptor. A short metal adaptor with ridges on one end to grip the inside of the tubing. The other end is designed for a pressure fit into the field monitor.

6.1.5 Field Monitor (Filter and Holder). The only field monitor currently considered acceptable by NIOSH is manufactured by the Millipore Corporation. The unit con-

sists of 1) a three section styrene plastic case designated Millipore Aerosol Monitor Case, 2) a 37-mm diameter plain white cellulose ester membrane filter designated Millipore AA (pore size of 0.8 micrometer), 3) a support pad, and 4) plastic sealing caps. If a large number of samples are to be taken, it may be less expensive to reuse the plastic cases. Great care must be taken in the cleaning and reassembly process. The outside mating surfaces of the field monitors may be covered with a "shrink-fit" band to provide proper sealing and a writing surface for filter identification.

6.2 **Optical Equipment and Microscope Features**

6.2.1 Microscope body with binocular head.

6.2.2 10X Huygenian eyepieces are recommended. Other eyepieces can be substituted if necessary. Wide field eyepieces can be used; however, wide field eyepieces may yield a count field area less than 0.003 mm^2 with the Porton reticle. This is not always desirable from the standpoint of obtaining optimum sampling times (see Section 8.1.3). If wide field eyepieces are used, it is preferable to use the Patterson Globe and Circle reticle to obtain a larger count field area.

6.2.3 Koehler illumination (preferably built-in with provisions for adjusting light intensity).

6.2.4 A Porton reticle is recommended. Others such as the Patterson Globe and Circle can be substituted.

6.2.5 Mechanical stage.

6.2.6 Phase-Contrast condenser with a numerical aperture (N.A.) equal to or greater than the N.A. of the objective.

6.2.7 40–45X phase contrast achromatic objective (N.A. 0.65 to 0.75).

6.2.8 Phase-ring centering telescope or Bertrand lens.

6.2.9 Green or blue filter, if recommended by microscope manufacturer.

6.2.10 Stage micrometer with 0.01 mm subdivisions.

6.2.11 For general guidance on phase contrast microscopy, consult Needham (11.12), Clark (11.15) and McCrone (11.14).

6.3 **Filter Mounting Equipment.** Experience has shown that certain equipment is useful for efficient sample mounting. The following items are recommended for extracting and mounting a portion of the filter for counting.

6.3.1 Microscope slides. 2.5 by 7.5 cm glass slides are most commonly used. Sample number, data, initials, etc., can be conveniently written on a frosted end slide.

6.3.2 Cover Slips. Cover slips are a necessary part of the slide mount and optical system. The shape should be appropriate for the size of the filter wedge. The appropriate cover slip depends upon the objective to be used. Ordinarily, objectives are optically corrected for a #1½ (0.17 millimeter) thickness cover slip. Improper cover glass thickness will detract from the final image quality.

6.3.3 Scalpel. A scalpel is needed to cut out a portion of the filter to be examined. A number-ten curved blade scalpel is recommended.

6.3.4 Tweezers. A pair of fine-tipped tweezers is used to remove the membrane filter slice from the field monitor and place it upon the slide.

6.3.5 Lens Tissue. To insure cleanliness, a lint-free tissue is recommended. This tissue should also be used for wiping mounting tools and for cleaning slides and cover slips.

6.3.6 Glass Rod. A fire-polished glass rod may be used to spread the mounting solution on the slide.

6.3.7 Wheaton Balsam Bottle. This special glass container has a glass top which prevents contamination of the mounting solution. A glass rod is included for dispensing the solution.

7. Reagents

Chemicals should be reagent grade, free from particles and color, conforming to the specifications of the Committee on Analytical Reagents of the American Chemical Society, where such specifications are available.

7.1 Dimethyl phthalate

7.2 Diethyl oxalate

Avoid getting the mounting solution on the skin. Wash skin promptly with soap and water if skin contact occurs.

8. Procedure

8.1 Sampling

8.1.1 General Information

Guidelines for the monitoring of employee exposures to industrial atmospheres are given in Reference 11.8. The Federal requirements for monitoring employee exposure to airborne asbestos are found in 29 CFR 1910.1001.

8.1.2 Mounting the Sampling Pump on the Worker

Fasten the sampling pump to the worker's belt and fasten the field monitor to the lapel or shirt front (as close to the breathing zone as is practical). Remove the top cover of the plastic monitor, then invert the monitor making certain the exposed filter is facing downward. Turn the pump on and adjust to the calibrated flow rate (1.0 to 2.5 lpm). Record the following information in a logbook.

1. Filter number
2. Pump start time and date
3. Flow rate
4. Subject's name and job title
5. Type of operation or process
6. Ventilation controls and is the worker wearing a respirator approved for asbestos?

The pump should be checked periodically during the sampling period for proper operation and flow rate.

8.1.3 Optimum Sampling Times

The requirement for the minimum count of 100 fibers or 20 fields in 8.3.9 was determined to be the best compromise to achieve adequate precision for the airborne fiber estimate and reasonable counting times. An optimum fiber density of about 1 to 5 fibers per microscope count field is recommended. To estimate appropriate sampling times for feasible counting and optimal counting, one must consider the following constraints:

1. microscope count field area (generally 0.003 to 0.006 mm^2)
2. pump flow rate (typically 2.5 lpm maximum)
3. average airborne fiber concentrations
4. counting rule range of 20 to 100 fields
5. adequate fiber density to obtain a minimum count of 10 fibers in 100 fields, which is the least total fiber count that yields an acceptable count precision
6. background airborne particulate levels that can reduce the count precision due to an obscuring of fibers on the filter surface

mounting solution of Section 8.2.1 should also be examined for contamination and/or crystal growth.

8.1.6 Shipping

The field monitors in which the samples are collected should be shipped in a rigid container with sufficient packing material to prevent crushing.

8.1.7 Numbers of Samples

When sampling for the Federal ceiling standard of 10 fibers (>5μm) cm^{-3}, [29 CFR 1910.1001(b) (3), effective July 7, 1972], only one sample (15 minutes maximum duration) is necessary, theoretically. However, several samples should be taken during expected periods of peak air concentrations to allow for detection of gross sampling or counting errors.

When sampling for determination of noncompliance with the Federal 8-hour TWA standard of 2 fibers (>5μm) cm^{-3}, [29 CFR 1910.1001(b) (2)], one should continuously sample as large a portion of the work day as is feasible for airborne concentrations of about 2 to 10 fibers·cm^{-3}. However, for a lower airborne concentration such as 0.5 fiber cm^{-3}, one sample might require 4 to 8 hours sampling time in order to get the proper filter fiber density (Section 8.1.3). For this situation, the 8-hour TWA exposure would be determined from one 8-hour or two 4-hour samples as appropriate.

8.2 Sample Preparation

8.2.1 Preparation of Mounting Solution

A very important part of the sample evaluation is the mounting process. This process involves a special mounting medium of prescribed viscosity. The proper viscosity is important in order to expedite filter dissolving and still minimize particle migration. After the sample has been mounted, an elapsed time of approximately sixty minutes is needed before the sample is ready for evaluation.

Combine the dimethyl phthalate and diethyl oxalate in a one to one ratio by volume and pour into a Wheaton balsam bottle. Add approximately 0.05 ($\pm$ 0.005) grams of new membrane filter per milliliter of solution to reach the necessary viscosity. The mixture must be stirred periodically until the filters have dissolved and a homogeneous mixture is formed. The normal shelf life of the mounting solution is about three months. Twenty milliliters of mounting solution will prepare approximately 300 samples.

8.2.2 Sample Mounting

Cleanliness is important! A dirty working area may result in sample contamination and erroneous counts. The following steps should be followed when mounting a sample.

1. Clean the slides and cover slips with lens tissue. Lay each slide down on a clean surface with the frosted end up. It is a good practice to rest one edge of the cover slip on the slide and the other edge on the working surface. By doing this, you keep the bottom surface (the one which contacts the filter) from becoming contaminated.
2. Wipe all the mounting tools clean with lens tissue and place them on a clean surface (such as lens tissue). All tools should be wiped clean prior to mounting each sample.
3. Using the glass rod supplied with the Wheaton balsam bottle, apply a drop of mounting solution onto the center of the slide. It may be necessary to adjust the quantity of solution so that after the cover slip has been placed on top, the solution extends only slightly beyond the filter boundary. If the quantity is greater than this, particle migration may occur.

4. Using another glass rod, spread the mounting media into a triangular shape. The size of this triangle should coincide with the dimension of the filter wedge.
5. Separate the middle and bottom sections of the field monitor case to expose the filter. Cut a triangular wedge from the center to the edge of the filter using the scalpel. The size of the wedge should approximate one-eighth of the filter surface. The filter can be very carefully removed from the cassette for cutting, but this should only be done with great care.
6. Grasp the filter wedge with the tweezers on the perimeter of the filter which was clamped between the monitor case sections. Do not touch the filter with your fingers. Place the wedge, **sample side up**, upon the mounting medium.
7. Pick up a clean cover slip with tweezers and carefully place it on the filter wedge. Once this contact has been made, **do not reposition the cover slip.**
8. Label the slide with the sample number and current date before proceeding to the next filter. On the bottom (backside) of the slide, trace the perimeter of the filter wedge with a felt tip marking pen. This will enable the counter, after the filter has become transparent, to stay within the filter perimeter when counting.
9. The sample should become transparent within fifteen minutes. If the filter appears cloudy, it may be necessary to press very lightly on the cover slip. This is rarely necessary; however, counting should not be started until an hour after the mounting. This allows the microscopic texture of the filter to become invisible to microscope viewing.
10. Discard the sample mount after two days if it has not been counted. Crystals appearing similar to asbestos fibers may begin to grow at the mounting media 'air interfaces. They seldom present any problems if the slide is examined before two days. In any case, stay away from the filter's edges when counting and sizing.

Counting of Fibers

8.3.1 Place the slide on the mechanical stage of the microscope and position the center of the wedge under the objective lens and focus upon the sample. Start counting from one end of the wedge and progress along a radial line to the other end (count in either direction from perimeter to wedge tip). Random fields are selected, without looking into the eyepieces, by slightly advancing the slide in one direction with the mechanical stage control.

8.3.2 It is essential to continually scan over a range of focal planes (generally the upper 10 to 15 micrometers of the filter surface) with the fine focus control during each field count. This is especially necessary for asbestos fibers due to their impaction into the filter matrix.

8.3.3 On most airborne samples, asbestos fibers will generally have fiber diameters less than one micrometer. Therefore, it is necessary to look carefully for faint fiber images.

8.3.4 Regularly check phase ring alignment.

8.3.5 When an agglomerate (mass of material) covers a significant portion of the field of view (approx 1/6 or greater) reject the field and select another. (Do not include it in the number of fields counted.) However, report the fact as it may have meaning on other data collection.

8.3.6 Bundles of fibers are counted as one fiber unless both ends of the fiber can be clearly resolved.

8.3.7 Count only fibers with a length to width ratio greater than or equal to 3:1.

8.3.8 Count only fibers greater than 5 micrometers in length. (Be as accurate as possible in accepting fibers near this length.) Measure curved fibers along the curve to estimate the total length.

8.3.9 Count as many fields as necessary to yield a total count of at least 100 fibers. Exceptions: a) count at least 20 fields even if you count more than 100 fibers, and b) stop at 100 fields even if you haven't reached 100 fibers.

8.3.10 For fibers that cross either one or two sides of the counting field, the following procedure is used to obtain a representative count.

COUNT any fiber greater than 5 micrometers in length, that lies entirely within the counting area. COUNT as "½ fiber" any fiber with only one end lying within the counting area. DO NOT COUNT any fiber crossing any two sides.

Reject and do not count all other fibers. Refer to Figures 5 through 10. Note that the fibers in Figures 5 through 10 **are not representative** of the appearance of most asbestos fibers. Most fibers have a very faint image.

9. Calibration and Standards

9.1 Sampling Train Calibration

The accurate calibration of the sampling pump is essential to the correct calculation of the air volume sampled. The frequency of calibration is dependent on the use, care, and handling to which the pump is subjected. Pumps must be recalibrated if they have just been repaired, misused, or received from the manufacturer. If the pump receives hard usage, more frequent calibration may be necessary. Ordinarily, pumps should be calibrated in the laboratory both before they are used in the field and after they have been used to collect a large number of field samples.

The accuracy of calibration is dependent upon the type of instrument used as a reference. The choice of a calibration instrument will depend largely on where the calibration is performed. For laboratory testing, a 1-liter buret used as a soap bubble flow meter or wet-test meter is recommended. Other standard calibrating instruments, such as a spirometer, Marriott's bottle, or dry gas meter can be used. The calibration should be of sufficient precision that the 95% confidence limits on the flow rate are ± 10% (95% of the flow rates will fall within ± 10% of the calibrated value).

Instructions for calibration with the soap bubble flow meter follow. The sampling train used (pump, hose, filter cassette) in the pump calibration should be the same as the one used in the field.

9.1.1 Check the voltage of the pump battery with a voltmeter both with the pump off and while it is operating to assure adequate voltage for calibration. If necessary, charge the battery to manufacturer's specifications.

9.1.2 Fill a beaker with 10 ml of soap solution.

9.1.3 Connect the filter cassette inlet to the top of the buret with a length of hose.

9.1.4 Turn the pump on and moisten the inside of the soap bubble meter by immersing the open end of the buret into the soap solution and drawing bubbles up the inside of the buret. Perform this task until the bubbles are able to travel the entire length of the buret without breaking.

9.1.5 Adjust the pump rotameter to provide a flow between 1.5 to 2.5 lpm.

9.1.6 With a water manometer, check that the pressure drop across the filter is less than 13 inches of water (about 1 inch of mercury).

9.1.7 Start a soap bubble up the buret and measure the time it takes for the bubble to travel a minimum volume of 1 liter.

9.1.8 Repeat the procedure in 9.1.7 at least three times, average the results, and calculate the calibrated flow rate by dividing the volume traveled by the soap bubble by the elapsed time. If the range between the highest and lowest of the three flow rates is greater than about 0.33 lpm, then the calibration should be repeated since it is likely that the precision is not adequate.

[redacted].9 Data required for the calibration include the volume measured, elapsed time pressure drop, air temperature, atmospheric pressure (or elevation), pump serial number, date, and name of person performing the calibration.

[redacted].10 Corrections to the flow rate for pumps with rotameters may be necessary if the pressure (elevation) or temperature where the samples are collected (actual flow rate) differs significantly from that where the calibration was performed (indicated flow rate). Actual flow rates at time of sampling may be calculated for a linear scale rotameter by using the following correction formula:

$$Q_{actual} = Q_{indicated} \sqrt{\frac{P_{cal}}{P_{actual}} \cdot \frac{T_{actual}}{T_{cal}}}$$

where both pressure (P) and temperature (T) are in absolute units such as:

psia = psig + 14.7
deg Rankin = deg Fahrenheit + 460
deg Kelvin = deg Celsius + 273

[redacted] Microscope Setup

9.2.1 Porton Reticle and the Counting Field

The asbestos fiber count procedure consists of comparing fiber length to the diameters of calibrated circles of a Porton reticle, and counting all fibers greater than 5 micrometers in length lying within a given counting field area. The Porton reticle is a glass plate inscribed with a series of circles and rectangles. The left half of the reticle is divided into six rectangles constituting the counting field. The counting field is illustrated in Figures 5 through 10.

9.2.2 Placement in Eyepiece

The Porton reticle is placed inside the Huygenian eyepiece where it rests on the field-limiting diaphragm. If other types of eyepieces are used, it may be necessary to insert a counting collar for retaining the reticle. The reticle should always be kept clean, since dirt on the reticle is in focus and could complicate the counting and sizing process.

9.2.3 Stage Micrometer

The Porton reticle cannot be used for counting until it has been properly calibrated with a stage micrometer. Most stage micrometer scales are approximately two millimeters long and are divided into units of one-hundredth of a millimeter (ten micrometers).

9.2.4 Microscope Adjustment

When adjusting the microscope, follow the manufacturer's instructions while observing the following guidelines.

1. The light source image must be in focus and centered on the condenser iris or annular diaphragm.
2. The particulate material to be examined must be in focus.
3. The illuminator field iris must be in focus, centered on the sample, and opened only to the point where the field of view is illuminated.
4. The phase rings (annular diaphragm and phase-shifting element) must be concentric.

9.2.5 Porton Reticle Calibration Procedure

Each eyepiece-objective-reticle combination on the microscope must be calibrated. Should any of the three be changed (disassembly, replacement, zoom adjustment, etc.), the combination must be recalibrated. Calibration may change if interpupillary dis-

tance is changed. For proper calibration, the following procedure should be followed closely.

With a 10X objective in place, place the stage micrometer on the mechanical stage, focus the millimeter scale, and center the image. Change to the 40-45X objective and adjust the first millimeter scale division to coincide with the left boundary of the Porton rectangle. Measure the distance between the left and extreme right boundaries of the Porton rectangle, estimating any portion of the final division. This measurement represents 200 L units. The rectangle is 100 L units on the short vertical dimension. The calculated "L" is inserted into the formula $D = L(2^N)^{1/2}$ where "N" is the circle number (indicated on the reticle) and "D" is the circle diameter. Since the circle diameters vary logarithmically, every other circle doubles in diameter. For example, circle number three is twice the diameter of number one; number four is twice the diameter of number two. When the circle sizes have been determined, the counting field area which consists of the left six smaller rectangles can be calculated from the relation $10{,}000\ L^2$. This completes the reticle calibration for this specific objective-eyepiece-reticle combination.

Example for Porton Reticle

The following calibration was obtained for a pair of 10X Huygenian eyepieces and a 43X objective:

200 L = 0.148 mm = 148 micrometers

100 L = 0.074 mm = 74 micrometers

One L-unit = 0.74 micrometers

Thus Circle #1 has a diameter $D = L(2^N)^{1/2} = 0.74(2^1)^{1/2} = 0.74\ (1.414) = 1.05$ micrometers.

Then our circle diameter calibration table looks like:

Diameter of Circle #1 = 1.05 micrometers
#2 = 1.48
#3 = 2.09
#4 = 2.96
#5 = 4.19
#6 = 5.92

Field area = (10,000) (L^2) = (100 L) (100 L) = (0.074) (0.074) = 0.0055 mm^2

Thus fibers with a length greater than a distance halfway between the diameters of the #5 and #6 circles would be counted.

If a Patterson Globe and Circle reticle is used, a different calculation procedure is required. The circle diameters are related as follows. The #25 circle diameter is (0.1) (reticle length).

The circle diameters are proportional to the ratio of their numbers. Thus the #20 circle diameter is (20/25) or 0.8 times the #25 circle diameter.

10. Calculations

10.1 The average airborne asbestos fiber concentration estimated by the filter sample may be calculated from the following formula:

$$AC = \frac{[(FB\ FL) - (BFB\ BFL)]\ (ECA)}{(1000)\ (FR)\ (T)\ (MFA)}$$

where:

AC = Airborne fiber concentration in (fibers > 5 μm) cm^{-3}.
BFB = Total number of fibers counted in the BFL fields of the blank or control filters in fibers > 5 μm.
BFL = Total number of fields counted on the blank or control filters.
ECA = Effective collecting area of filter (855 mm^2 for a 37-mm filter with effective diameter of 33 mm).
FR = Pump flow rate in liters min (lpm).
FB = Total number of fibers counted in the FL fields in fibers > 5 μm.
FL = Total number of fields counted on the filter.
MFA = Microscope count field area in mm^2 (generally 0.003 to 0.006).
T = Sample collection time in minutes.

10.2 Recount criteria. It is very desirable for a counter to conduct a "blind recount" for about 1 in every 10 filter wedges (slides) counted. Alternatively, a second counter could perform the blind recount. In training sessions for novice counters, the trainee should conduct a blind recount for filter wedges counted by an experienced, proficient counter. In all cases, we will observe differences between the first and second counts of the same filter wedge. Most of these differences will be due to chance alone, that is, due to the random variability (precision) of the count method. Statistical recount criteria enable us to decide whether observed differences can reasonably be explained due to chance alone or are probably due to systematic differences between counters or microscopes or due to some other biasing factor.
The following recount criterion is for a pair of counts that estimate some airborne fiber concentration (AC) in fibers cm^{-3}. The criterion is given at the type-I error level. That is, there is a 5% maximum risk that we will reject a pair of counts for the reason that one might be biased, when the large observed difference is really due to chance.
Reject a pair of counts because one might be biased if:

$$(AC_2 - AC_1) \text{ exceeds } 2.77(\overline{AC})(CV_{FB})$$

where:

AC_1 = lower estimated airborne fiber concentration
AC_2 = higher estimated airborne fiber concentration
$\overline{AC}$ = average of the two airborne concentration estimates
CV_{FB} = average CV for the two concentration estimates which are a function of the total fiber count (FB) in each case. Use the relation in Section 4 or Figure 3.

For a pair of counts on the same filter, reject the pair because one might be biased if:

$$(FB_2 - FB_1) \text{ exceeds } 2.77(\overline{FB})(CV_{\overline{FB}})$$

where:

FB_1 = lower fiber count on the filter (total fibers)
FB_2 = higher fiber count on the filter (total fibers)
$\overline{FB}$ = average of the two total fiber counts
$CV_{\overline{FB}}$ = CV, for the value $\overline{FB}$. Use the relation in Section 4 or Figure 3.

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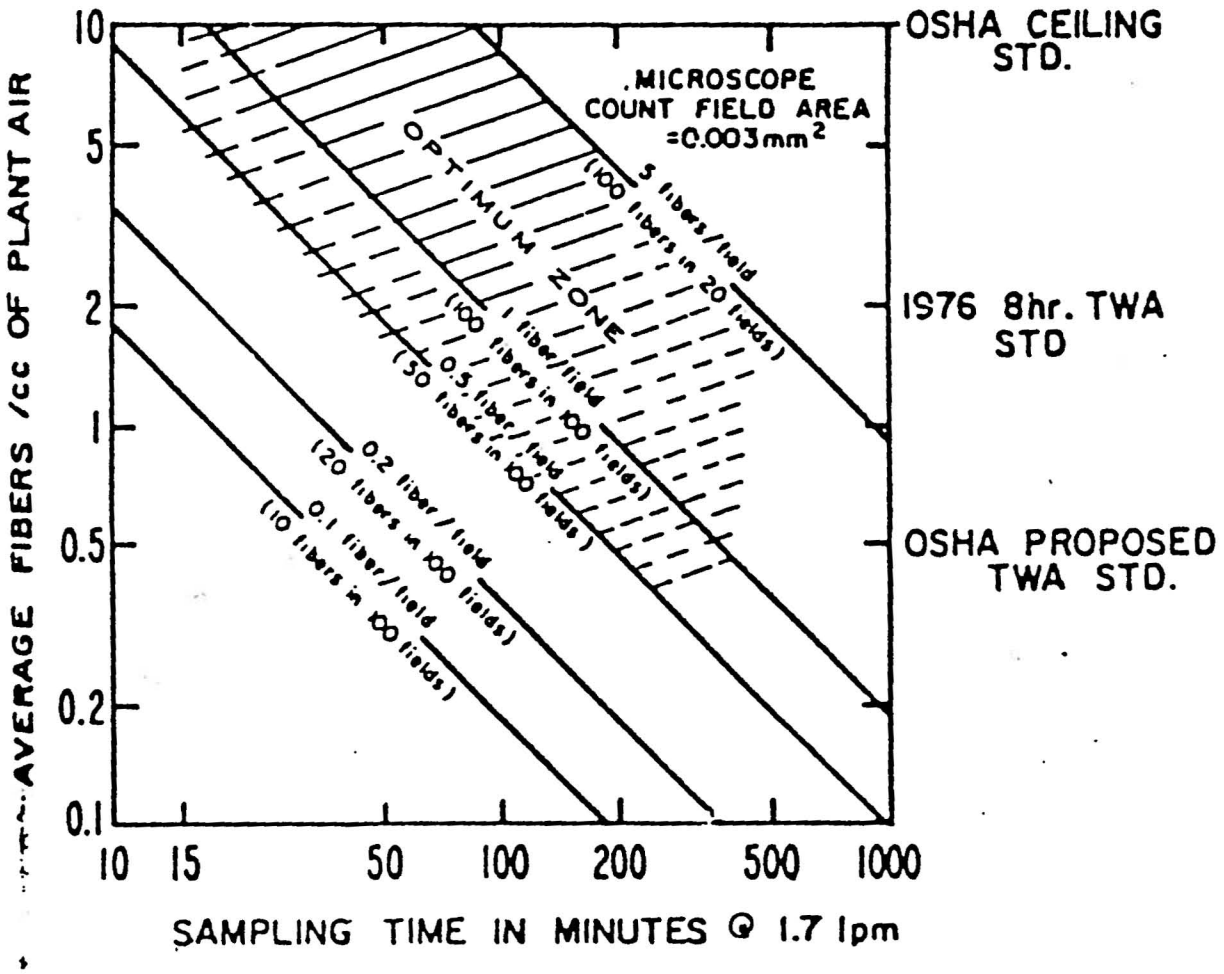

FIGURE 1. Optimum Sampling Times for airborne asbestos where microscopic field area = 0.003 mm²

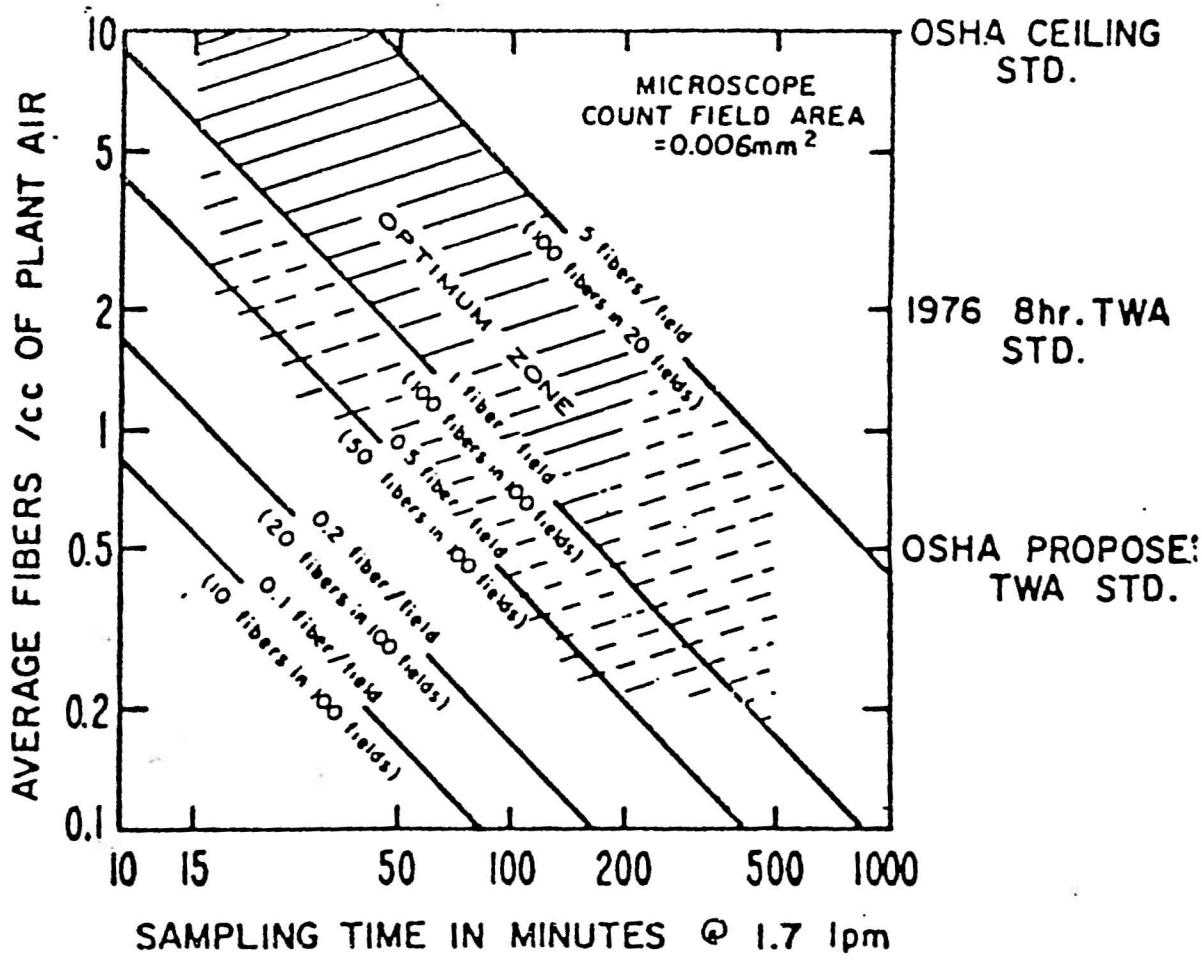

FIGURE 2. Optimum sampling times for airborne asbestos where microscopic field area = 0.006 mm^2

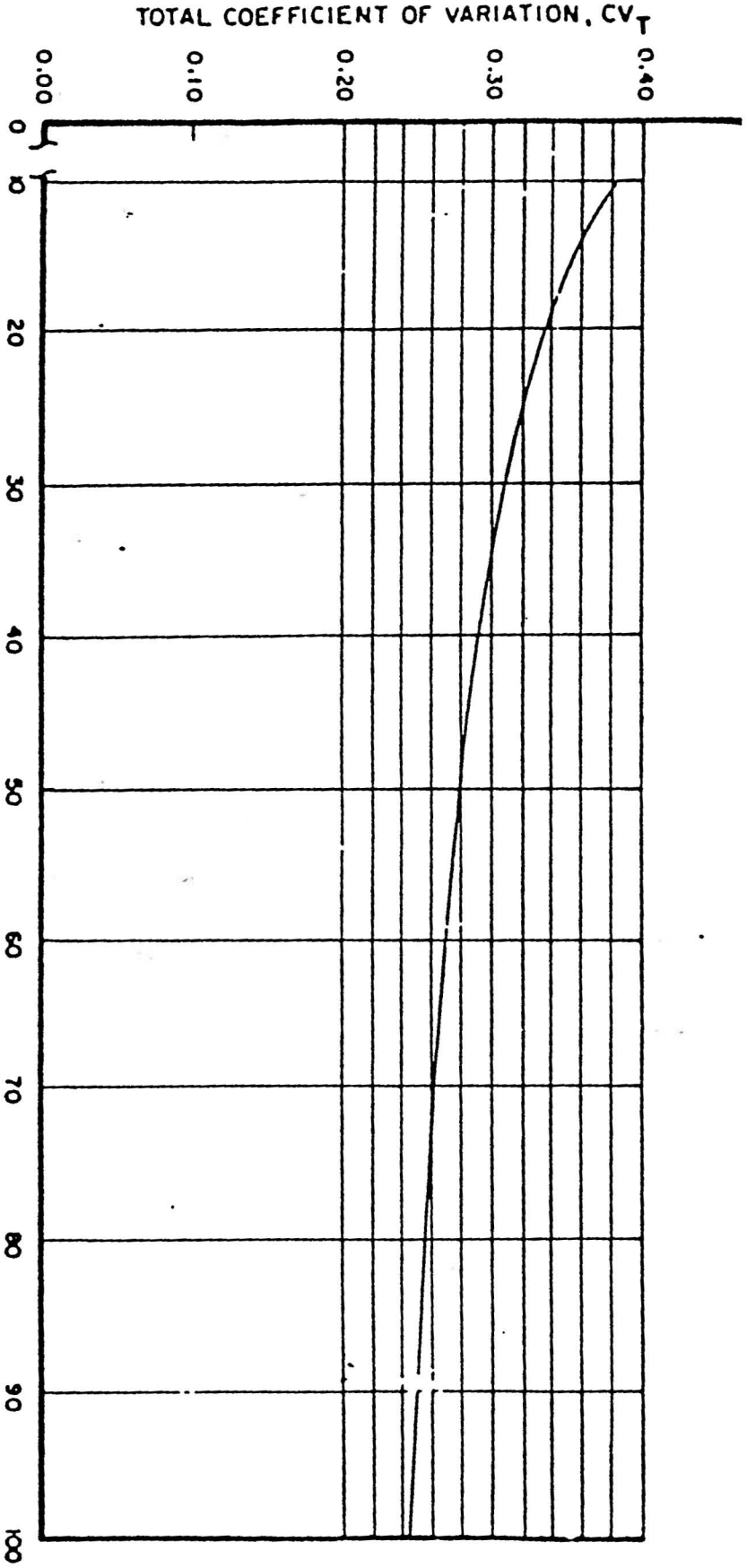

FIGURE 3. Total coefficient of v[illegible]ion as a function of total fiber count

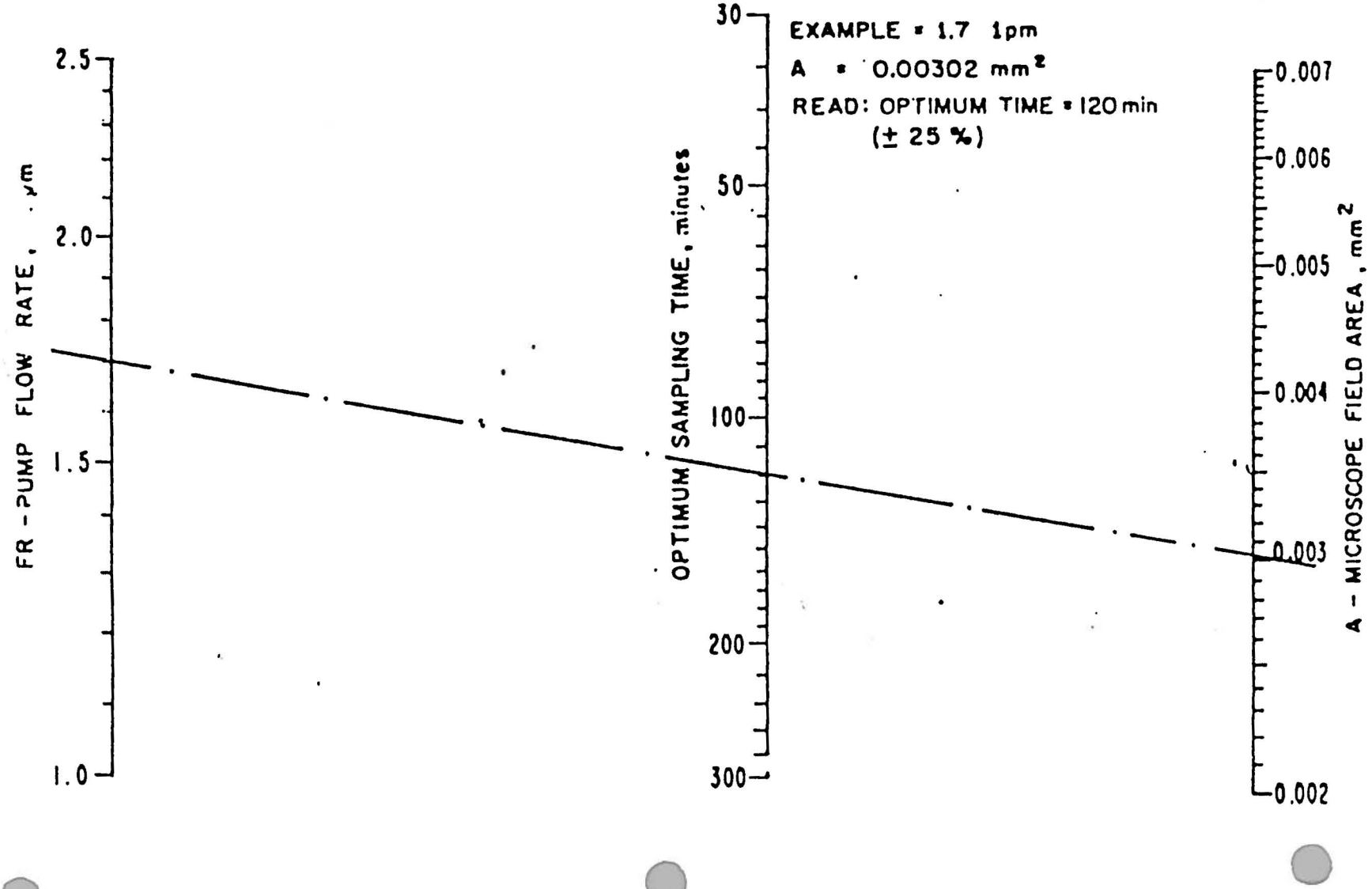

FIGURE 4. Nomogram of optimum sampling [illegible] airborne asbestos fibers in [illegible]
1 to 10 fibers/[illegible]

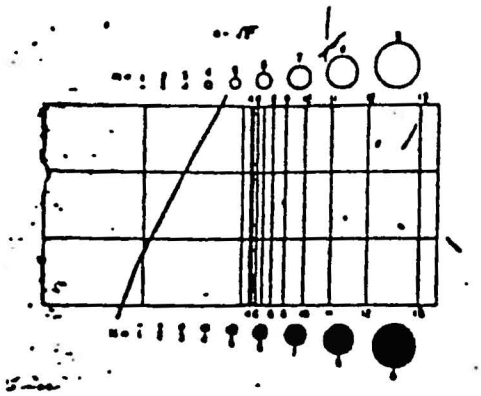

FIGURE 5

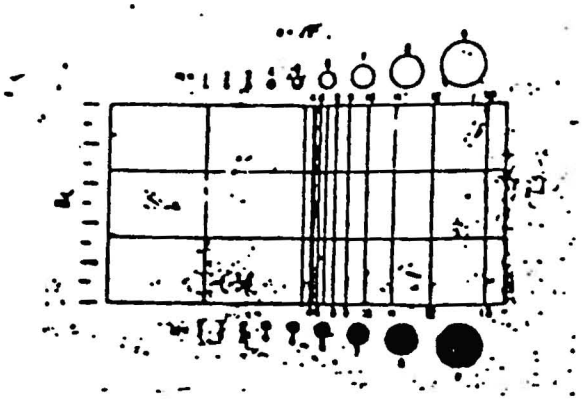

FIGURE 6

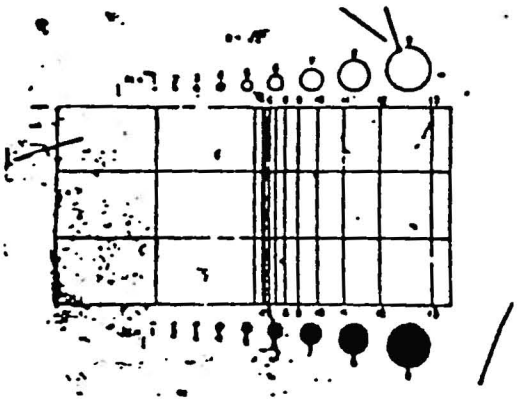

FIGURE 7

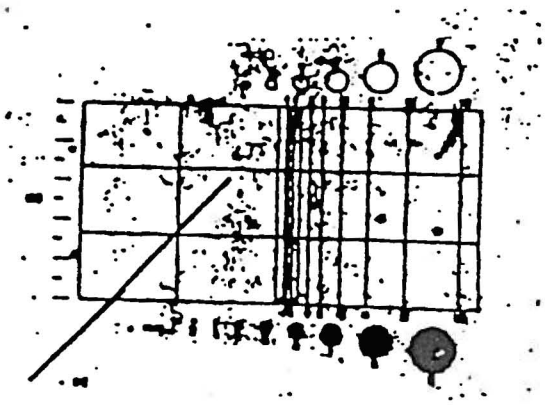

FIGURE 8

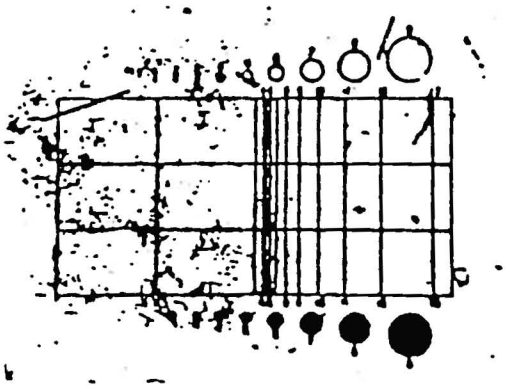

FIGURE 9

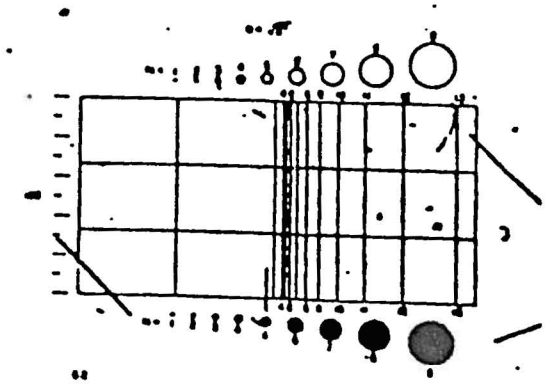

FIGURE 10

LIST OF FIGURES

(5 through 10)

FIGURE 5. DO NOT COUNT. Fiber crosses top and bottom sides.

FIGURE 6. COUNT. One fiber.

FIGURE 7. COUNT. One-half fiber. Fiber crosses left side and one end lies within count area.

FIGURE 8. COUNT. One-half fiber. Fiber crosses bottom side and one end lies within count area.

FIGURE 9. DO NOT COUNT. Fiber crosses two sides.

FIGURE 10. DO NOT COUNT. Fiber crosses two sides (bottom left corner).
COUNT. One-half fiber. Fiber crosses bottom side and one end lies within count area.
COUNT. One fiber (top right corner).

FORMULA: various

M.W.: various

FIBERS

METHOD: 7400
ISSUED: 2/15/84
REVISION #1: 5/15/85

OSHA: 0.5 asbestos fibers (> 5 μm long)/mL
NIOSH: 0.1 asbestos f/mL [1]; 3 glass fibers (>10 μm x <3.5 μm)/mL [2]
ACGIH: 0.2 crocidolite; 0.5 amosite; 2 chrysotile and other asbestos, f/mL

PROPERTIES: solid, fibrous

SYNONYMS: asbestos (actinolite [CAS #13768-00-8], grunerite (amosite) [CAS #12172-73-5], anthophyllite [CAS #17068-78-9], chrysotile [CAS #12001-29-5], crocidolite [CAS #12001-28-4], tremolite [CAS #14567-73-8]); fibrous glass.

SAMPLING

SAMPLER: FILTER
(0.8 to 1.2 μm cellulose ester membrane, 25-mm diameter; foil-wrapped cassette)

FLOW RATE*: ≥ 0.5 L/min (see Step 5)

VOL-MIN*: 400 L @ 0.1 fiber/mL
-MAX*: 2000 L
*Adjust for 100 to 1300 fibers/mm² (step 5)

SHIPMENT: routine

SAMPLE STABILITY: stable

FIELD BLANKS: 10% (≥2) of samples

ACCURACY

RANGE STUDIED: 80 to 100 fibers counted

BIAS: EVALUATION OF METHOD

OVERALL PRECISION (s_r): 0.115 to 0.13 (A Rules) [3]

MEASUREMENT

TECHNIQUE: MICROSCOPY, POSITIVE PHASE CONTRAST

ANALYTE: fibers (manual count)

SAMPLE PREPARATION: acetone/triacetin method

COUNTING RULES: Set A (P&CAM 239 [3,4]) or Set B (modified CRS [5])

EQUIPMENT: 1. positive phase-contrast microscope
2. Walton-Beckett graticule (100 μm field diameter): A Rules use G-22; B Rules use Type G-24
3. phase-shift test slide (HSE/NPL)

CALIBRATION: phase-shift detection limit about 3 degrees [7]

RANGE: 100 to 1300 fibers/mm² filter area [6]

ESTIMATED LOD: 7 fibers/mm² filter area

PRECISION: 0.10 to 0.12 (A Rules) [3]

APPLICABILITY: The working range is 0.02 fiber/mL (1920-L air sample) to 1.25 fibers/mL (400-L air sample). The method gives an index of airborne asbestos fibers but may be used for other materials such as fibrous glass by inserting suitable parameters into the counting rules. The method does not differentiate between asbestos and other fibers. Asbestos fibers less than ca. 0.25 μm diameter will not be detected by this method [7].

INTERFERENCES: Any other airborne fiber may interfere since all particles meeting the counting criteria are counted. Chain-like particles may appear fibrous. High levels of non-fibrous dust particles may obscure fibers in the field of view and increase the detection limit.

OTHER METHODS: This method introduces changes for improved sensitivity and reproducibility. It also replaces P&CAM 239 [3,4] and Method 7400 (dated 2/15/84).

REAGENTS:

1. Acetone.*
2. Triacetin (glycerol triacetate), reagent grade.

*See SPECIAL PRECAUTIONS.

EQUIPMENT:

1. Sampler: field monitor, 25-mm, three-piece cassette with 50-mm extension coul with cellulose ester filter, 0.8- to 1.2-µm pore size and backup pad.
   NOTE 1: Analyze representative filters for fiber background before use and discard the filter lot if more than 5 fibers/100 fields are found.
   NOTE 2: An electrically conductive extension coul is recommended to reduce electrostatic effects on fiber sampling.
   NOTE 3: Extension coul not required for area or ambient air sampling.
2. Personal sampling pump, ≥0.5 L/min (see step 5 for flow rate), with flexible connecting tubing.
3. Microscope, positive phase contrast, with green or blue filter, 8 to 10X eyepiece, and 40 to 45X phase objective (total magnification ca. 400X); numerical aperture = 0.65 to 0.75.
4. Slides, glass, single-frosted, pre-cleaned, 25 x 75 mm.
5. Cover slips, 22 x 22 mm, No. 1-1/2, unless otherwise specified by microscope manufacturer.
6. Lacquer or nail polish.
7. Knife, #10 surgical steel, curved blade.
8. Tweezers.
9. Flask, Guth-type, insulated neck, 250- to 500-mL (with single-holed rubber stopper and elbow-jointed glass tubing, 16 to 22 cm long).
10. Hotplate, spark-free, stirring type; heating mantle; or infrared lamp and magnetic stirrer.
11. Micropipets, 5-µL.
12. Graticule, Walton-Beckett type with 100-µm diameter circular field at the specimen plane (area = 0.00785 mm^2) (Type G-22 for A Rules; Type G-24 for B Rules). Available from PTR Optics Ltd., 145 Newton Street, Waltham, MA 02154 (Telephone [617] 891-6000).
    NOTE: The graticule is custom-made for each microscope. Specify disc diameter needed to fit exactly the ocular of the microscope and the diameter (mm) of the circular counting area (see step 12).
13. HSE/NPL phase contrast test slide, Mark II. Available from PTR Optics Ltd.
14. Telescope, ocular phase-ring centering.
15. Stage micrometer (0.01-mm divisions).
16. Aluminum foil.

SPECIAL PRECAUTIONS: Acetone is an extremely flammable liquid and precautions must be taken not to ignite it. Heating of acetone must be done in a ventilated laboratory fume hood using a flameless, spark-free heat source.

SAMPLING:

1. Calibrate each personal sampling pump with a representative sampler in line [3].
2. Fasten the sampler to the worker's lapel as close as possible to the worker's mouth. Remove the top cover from the end of the cowl extension (open face) and orient face down. Wrap the joint between the extender and monitor body with shrink tape to prevent air leaks.
3. Wrap the cassette tightly in aluminum foil being sure not to obstruct airflow into the open end.
   NOTE: This step is not necessary if an electrically conductive cowl is used.
4. Submit at least two field blanks (or 10% of the total samples, whichever is greater) for each set of samples. Remove the caps from the field blank cassettes and store the caps and cassettes in a clean area (bag or box) during the sampling period. Replace the caps in the cassettes when sampling is completed.
5. Sample at 0.5 L/min or greater [8]. Adjust sampling flow rate, Q (L/min), and time, t (min), to produce a fiber density, E (fibers/mm^2), of 100 to 1300 fibers/mm^2 [$3.85 \cdot 10^4$ to $5 \cdot 10^5$ fibers per 25-mm filter with effective collection area (A_c= 385 mm^2)] for optimum counting precision (step 22). Do not exceed 1 mg total dust loading on the filter. These variables are related to the action level (one-half the current standard), L (fibers/mL), of the fibrous aerosol being sampled by:

$$t = \frac{(A_c)(E)}{(Q)(L)10^3}.$$

   NOTE: A sampling flow rate of 1 to 4 L/min for 8 hrs is appropriate in non-dusty atmospheres containing ca. 0.1 fiber/mL. Dusty atmospheres require smaller sample volumes; ambient, clean atmospheres require larger air samples for optimum counting precision.
6. Remove the field monitor at the end of sampling, replace the plastic top cover and small end caps, and store the monitor.
7. Ship the samples, still wrapped in aluminum foil, in a rigid container with sufficient packing material to prevent jostling or damage.
   NOTE: Do not use polystyrene foam in the shipping container because electrostatic forces may cause fiber loss from the sampler filter.

SAMPLE PREPARATION:

NOTE: The object is to produce samples with a smooth (non-grainy) background in a medium with a refractive index equal to or less than 1.46. The method below collapses the filter for easier focusing and produces permanent mounts which are useful for quality control and interlaboratory comparison. Other mounting techniques meeting the above criteria may also be used (e.g., the non-permanent field mounting technique used in P&CAM 239 [1,3,4]).

8. Ensure that the glass slides and cover slips are free of dust and fibers.
9. Place 40 to 60 mL of acetone into a Guth-type flask. Stopper the flask with a single-hole rubber stopper through which a glass tube extends 10 to 12 cm into the flask. The portion of the glass tube which exits the top of the stopper (8 to 10 cm) is bent downward in an elbow which makes an angle of 20 to 30° with the horizontal.
10. Place the flask on a stirring hotplate or wrap in a heating mantle. Heat the acetone gradually to its boiling temperature (ca. 58 °C).
    CAUTION: The acetone vapor must be generated in a ventilated fume hood away from all open flames and spark sources. Alternate heating methods can be used, providing no open flame or sparks are present.
11. Mount a wedge cut from the sample filter on a clean glass slide.
    a. Cut wedges of ca. 25% of the filter area with a curved blade steel surgical knife using a rocking motion to prevent tearing.

b. Place the filter or wedge, dust side up, on the slide. Static electricity will usually keep the filter on the slide until it is cleared.
c. Hold the glass slide supporting the filter ca. 1 cm from the glass tube port where the acetone vapor is escaping from the heated flask. The acetone vapor stream should cause a condensation spot on the glass slide ca. 2 to 3 cm in diameter. Move the glass slide gently in the vapor stream. The filter should clear in 2 to 5 sec. If the filter curls, distorts, or is otherwise rendered unusable, the vapor stream is probably not strong enough. Periodically wipe the outlet port with tissue to prevent liquid acetone dripping onto the filter.
d. Using the 5-µL micropipet, place 3.0 to 3.5 µL triacetin on the filter. Gently lower a clean cover slip down onto the filter at a slight angle to reduce the possibility of forming bubbles.
   NOTE: If too many bubbles form or the amount of triacetin is insufficient, the cover slip may become detached within a few hours. If excessive triacetin remains in contact with the edge of the filter under the cover slip, fiber migration may occur at the edges.
e. Glue the edges of the cover slip to the glass slide using a lacquer or nail polish [9].
   NOTE: If clearing is slow, the slide may be warmed on a hotplate (surface temperature 50 °C) for 15 min to hasten clearing. Counting may proceed immediately after clearing and mounting are completed.

CALIBRATION AND QUALITY CONTROL:

12. Calibration of the Walton-Beckett graticule to obtain a counting area (D) 100 µm in diameter at the image plane. The diameter, d_c (mm), of the circular counting area and the disc diameter must be specified when ordering the graticule.
    a. Insert any available graticule into the eyepiece and focus so that the graticule lines are sharp and clear.
    b. Set the appropriate interpupillary distance and, if applicable, reset the binocular head adjustment so that the magnification remains constant.
    c. Install the 40 to 45X phase objective.
    d. Place a stage micrometer on the microscope object stage and focus the microscope on the graduated lines.
    e. Measure the magnified grid length of the graticule, L_o (µm), using the stage micrometer.
    f. Remove the graticule from the microscope and measure its actual grid length, L_a (mm). This can best be accomplished by using a stage fitted with verniers.
    g. Calculate the circle diameter, d_c (mm), for the Walton-Beckett graticule:

$$d_c = \frac{L_a}{L_o} \times D.$$

    Example: If L_o = 108 µm, L_a = 2.93 mm and D = 100 µm, then d_c = 2.71 mm.
    h. Check the field diameter, D (acceptable range 100 µm ± 2 µm) with a stage micrometer upon receipt of the graticule from the manufacturer. Determine field area (mm^2).
13. Microscope adjustments. Follow the manufacturer's instructions and also the following:
    a. Adjust the light source for even illumination across the field of view at the condenser iris.
       NOTE: Köhler illumination is preferred, where available.
    b. Focus on the particulate material to be examined.
    c. Make sure that the field iris is in focus, centered on the sample, and open only enough to fully illuminate the field of view.

d. Use the telescope ocular supplied by the manufacturer to ensure that the phase rings (annular diaphragm and phase-shifting elements) are concentric.

14. Check the phase-shift detection limit of the microscope periodically.
    a. Remove the HSE/NPL phase-contrast test slide from its shipping container and center it under the phase objective.
    b. Bring the blocks of grooved lines into focus.
       NOTE: The slide consists of seven sets of grooves (ca. 20 grooves to each block) in descending order of visibility from sets 1 to 7. The requirements for asbestos counting are that the microscope optics must resolve the grooved lines in set 3 completely, although they may appear somewhat faint, and that the grooved lines in sets 6 and 7 must be invisible. Sets 4 and 5 must be at least partially visible but may vary slightly in visibility between microscopes. A microscope which fails to meet these requirements has either too low or too high a resolution to be used for asbestos counting.
    c. If the image quality deteriorates, clean the microscope optics. If the problem persists, consult the microscope manufacturer.
15. Quality control of fiber counts.
    a. Prepare and count field blanks along with the field samples. Report the counts on each blank. Calculate the mean of the field blank counts and subtract this value from each sample count before reporting the results.
       NOTE 1: The identity of the blank filters should be unknown to the counter until all counts have been completed.
       NOTE 2: If a field blank yields fiber counts greater than 7 fibers/100 fields, report possible contamination of the samples.
    b. Perform blind recounts by the same counter on 10% of filters counted (slides relabeled by a person other than the counter).
16. Use the following test to determine whether a pair of counts on the same filter should be rejected because of possible bias. This statistic estimates the counting repeatability at the 95% confidence level. Discard the sample if the difference between the two counts exceeds $2.77\ (F)s_r$, where F = average of the two fiber counts and s_r = relative standard deviation, which should be derived by each laboratory based on historical in-house data.
    NOTE: If a pair of counts is rejected as a result of this test, recount the remaining samples in the set and test the new counts against the first counts. Discard all rejected paired counts.
17. Enroll each new counter in a training course which compares performance of counters on a variety of samples using this procedure.
    NOTE: To ensure good reproducibility, all laboratories engaged in asbestos counting should participate in an asbestos proficiency testing program such as the NIOSH Proficiency Analytical Testing (PAT) Program and routinely participate with other asbestos fiber counting laboratories in the exchange of field samples to compare performance of counters.

MEASUREMENT:

18. Place the slide on the mechanical stage of the calibrated microscope with the center of the filter under the objective lens. Focus the microscope on the plane of the filter.
19. Regularly check phase-ring alignment and Köhler illumination [7].

20. Select one of the following sets of counting rules:
    NOTE: The two sets of rules have been demonstrated to produce equivalent mean counts on a variety of asbestos sample types [5] and must be strictly followed in order to obtain valid results. No hybridizing of the two sets of rules is permitted. The calibration of the microscope with the HSE/NPL test slide determines the minimum detectable fiber diameter (ca. 0.25 µm).
    a. A Rules (same as P&CAM 239 rules [1,3,4]).
        1. Count only fibers longer than 5 µm. Measure the length of curved fibers along the curve.
        2. Count only fibers with a length-to-width ratio equal to or greater than 3:1.
        3. For fibers which cross the boundary of the graticule field, do the following:
            a. Count any fiber longer than 5 µm which lies entirely within the graticule area.
            b. Count as 1/2 fiber any fiber with only one end lying within the graticule area.
            c. Do not count any fiber which crosses the graticule boundary more than once.
            d. Reject and do not count all other fibers.
        4. Count bundles of fibers as one fiber unless individual fibers can be identified by observing both ends of a fiber.
        5. Count enough graticule fields to yield 100 fibers. Count a minimum of 20 fields. Stop at 100 fields regardless of fiber count.
    b. B Rules
        NOTE: The B Rules are preferred analytically because of their demonstrated ability to improve the reproducibility of fiber counts [5].
        1. Count only ends of fibers. Each fiber must be longer than 5 µm and less than 3 µm diameter.
        2. Count only ends of fibers with a length-to-width ratio equal to or greater than 5:1.
        3. Count each fiber end which falls within the graticule area as one end, provided that the fiber meets rules b.1 and b.2.
        4. Count visibly free ends which meet rules b.1 and b.2 when the fiber appears to be attached to another particle, regardless of the size of the other particle.
        5. Count the free ends of fibers emanating from large clumps and bundles up to a maximum of 10 ends (5 fibers), provided that each segment meets rules b.1 and b.2.
        6. Count enough graticule fields to yield 200 ends. Count a minimum of 20 fields. Stop at 100 fields, regardless of the fiber count.
        7. Divide the total end count by 2 to yield fiber count.
            NOTE: Split fibers will normally be counted as more than two ends if the free ends meet rules b.1. and b.2.
21. Start counting from one end of the filter and progress along a radial line to the other end, shift either up or down on the filter, and continue in the reverse direction [10]. Select fields randomly by looking away from the eyepiece briefly while advancing the mechanical stage. When an agglomerate covers ca. 1/6 or more of the field of view, reject the field and select another. Do not report rejected fields in the number of total fields counted.
    NOTE: When counting a field, continuously scan a range of focal planes by moving the fine focus knob to detect very fine fibers which have become embedded in the filter. The small-diameter fibers will be very faint but are an important contribution to the total count.

CALCULATIONS:

22. Calculate and report fiber density on the filter, E (fibers/mm^2), by dividing the total fiber count, F, minus the mean field blank count, B, by the number of fields, n, and the field area, A_f (0.00785 mm^2 for a properly calibrated Walton-Beckett graticule):

$$E = \frac{(F - B)}{(n)(A_f)} \cdot \text{ fibers/mm}^2.$$

23. Calculate the concentration, C (fibers/mL), of fibers in the air volume sampled, V (L), using the effective collection area of the filter, A_c (385 mm^2 for a 25-mm filter):

$$C = \frac{(E)(A_c)}{V \cdot 10^3}.$$

NOTE: Periodically check and adjust the value of A_c, if necessary.

EVALUATION OF METHOD:

This method is a revision of NIOSH Method P&CAM 239 [1,3,4]. A summary of the revisions is as follows:

A. Sampling:

The change from a 37-mm to a 25-mm filter size was incorporated to improve sensitivity and reduce problems associated with non-uniform fiber loading reported on the 37-mm filters [10]. The change in flow rates allows for 2 m^3 full-shift samples to be taken, providing that the filter is not overloaded with non-fibrous particulates. The collection efficiency of the sampler is not affected by changes in flow rate in the range 0.5 to 16 L/min [8].

B. Sample Preparation Technique:

The acetone vapor-triacetin preparation technique has been incorporated in the method as a faster, more permanent mounting technique than the dimethyl phthalate/diethyl oxalate method of P&CAM 239 [1,3,4,11].

C. Measurement:

1. The inclusion of the Walton-Beckett graticule in the method was made to standardize the field area observed through the eyepiece [6,11].
2. The introduction of the HSE/NPL test slide was made to standardize microscope optics for sensitivity to fiber diameter [7,11].
3. An international collaborative study involved 16 laboratories using prepared slides from the asbestos, cement, milling, mining, textile, and friction material industries [5]. The relative levels of count by different counting rules were:

Sample Type	Number of Samples	Aspect Ratio > 3:1 AIA	Aspect Ratio > 3:1 Mod. CRS*	Aspect Ratio > 5:1 AIA	Aspect Ratio > 5:1 Mod. CRS*
Mining	10	100	127	74	92
Milling	10	100	112	84	95
Asbestos Cement	14	100	146	90	137
Textile Chrysotile	10	100	109	89	99
Friction Material	10	100	130	87	116
Others (Insulation, Amosite)	6	100	127	92	118
TOTAL:	60	MEAN: 100	125	86	110

*Arithmetic means of counts made by different laboratories relative to the AIA counts.

The modified CRS (NIOSH B) Rules were found to be more precise than the AIA (NIOSH A)* Rules. The ranges of relative standard deviations (s_r) which varied with sample type and laboratory were:

	s_T		
	Intralaboratory	Interlaboratory	Overall
AIA (NIOSH A Rules)*	0.12 to 0.40	0.27 to 0.85	0.46
Modified CRS (NIOSH B Rules)	0.11 to 0.29	0.20 to 0.35	0.25

*Under AIA rules, only fibers having a diameter less than 3 μm are counted and fibers attached to particles larger than 3 μm are not counted. NIOSH A Rules are otherwise similar to the AIA rules.

The B Rules have also been favorably received by analysts as less ambiguous and simpler to use; these rules also showed the least bias relative to AIA rules in the collaborative study. An independent NIOSH laboratory study using amosite fibers reported a relative standard deviation, including within- and between-sample variability, of 0.157 for the B Rules [12]. Adding an estimated sampling pump error of 0.05 [13] to the within-sample variability in this study results in an estimate of overall precision, s_T, of 0.102 for the B Rules.

4. Because of past inaccuracies associated with low fiber counts, the minimum loading has been increased to 100 fibers/mm^2 filter area (80 fibers total count). This level yields an overall s_T = 0.13, as indicated in Figure 3 (revised) of P&CAM 239 [3,4] which corresponds to a measurement s_T = 0.12 after removal of pump error [13]. Similarly, at the maximum count of 100 fibers, overall s_T = 0.115 and measurement s_T = 0.10 are obtained.

D. Evaluation of the method using the A and B counting rules will proceed on a continuing basis through the NIOSH Proficiency Analytical Testing (PAT) Program. The new PAT reporting form allows for reporting of results by either set of rules as of January, 1984.

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METHOD REVISED BY: James W. Carter, David G. Taylor, Ph.D., CIH, and Paul A. Baron, Ph.D., NIOSH/DPSE; based on the revised Method P&CAM 239 [1,3,4].

APPENDIX F

SOUTHNAVFACENGCOM Guide Specification, NFGS-02080B, Removal and Disposal of Asbestos Materials

DEPARTMENT OF THE NAVY
NAVAL FACILITIES
ENGINEERING COMMAND
GUIDE SPECIFICATION

NFGS-02080B
28 February 1991

Superseding NFGS-02080A (06/90)

NFGS-02080B

REMOVAL AND DISPOSAL OF ASBESTOS MATERIALS

	Typed Name & Reg.	Signature	Date
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AMSC N/A AREA FACR

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SECTION 02080

REMOVAL AND DISPOSAL OF ASBESTOS MATERIALS
02/91

NOTE: This guide specification covers \@safety procedures and requirements for the demolition, removal and disposal of friable material containing asbestos.@\ Nonfriable asbestos containing materials normally do not require special handling. However, during demolition and removal of this material dust and airborne asbestos fibers will sometimes be released. If the project contains nonfriable asbestos which may release fibers when demolished and removed, the nonfriable asbestos shall be removed in the same way as friable asbestos.

On small asbestos removal operations a full containment type asbestos control area may not be required. The location of the area, type of material, and potential hazard must be reviewed and a judgement made by the designer as to whether or not "glovebag" or "outdoor" techniques may be safely and legally used. In a case where an enclosed area is not required, many of the requirements in this specification should be deleted.

In accordance with 40 CFR 763, we must eliminate the use of materials containing asbestos in compliance with the schedule listed therein. The specifier must strive to avoid the use of asbestos containing materials in accordance with this federal law.

The limits of asbestos removal must be indicated on the drawings or in the specification in sufficient detail for the Contractor to submit an accurate bid. Portions of the building where asbestos work will take place must be unoccupied during the removal operation. It is highly recommended in order to reduce exposure risk to occupants of the building that the entire building be unoccupied during asbestos removal operations. If portions of the building where asbestos removal is not taking place must remain occupied, additional requirements must be added for providing temporary heating/cooling and other utilities to the occupied portions of the

building. The building heating/cooling system for example cannot be operated in the asbestos control area and due to wet removal procedures, electrical service to the asbestos control area may need to be shut off.

Reference to the inclusion of this section (Section 02080) shall be made in Section 02050, "Demolition and Removal" regarding the removal and disposal of materials containing asbestos.

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NOTE: This revision "B" to NFGS-02080 follows a complete review of the previous version. The text is revised throughout, according to that review.

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NOTE: The following information shall be shown on the project drawings:

1. The project drawings shall clearly show location, extent and form of asbestos materials to be removed or in contact with other removals or new work.

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PART 1 GENERAL

1.1 SUMMARY

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NOTE: The article "Summary" is not used by the Naval Facilities Engineering Command, except in specialized cases. Delete this article when editing for project specifications.

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1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

\-ANSI Z9.2-\ 1979 Fundamentals Governing The Design and Operation of Local Exhaust Systems

\-ANSI Z88.2-\ 1980 Practices for Respiratory Protection

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

\-ASTM C 732-\ 1982 (R 1987) Aging Effects of Artificial

Weathering on Latex Sealants

\-ASTM D 522-\ 1988 Mandrel Bend Test of Attached Organic Coatings

\-ASTM D 1331-\ 1989 Surface and Interfacial Tension of Solutions of Surface-Active Agents

\-ASTM D 2794-\ 1984 Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)

\-ASTM E 84-\ 1989 (Rev. A) Surface Burning Characteristics of Building Materials

\-ASTM E 96-\ 1990 Water Vapor Transmission of Materials

\-ASTM E 119-\ 1988 Fire Tests of Building Construction and Materials

\-ASTM E 736-\ 1986 Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members

CODE OF FEDERAL REGULATIONS (CFR)

\-29 CFR 1910.134-\ 1988 Respiratory Protection

\-29 CFR 1910.141-\ Sanitation

\-29 CFR 1910.145-\ Accident Prevention Signs and Tags

\-29 CFR 1910.1200-\ 1988 Hazard Communications

\-29 CFR 1926.58-\ Asbestos, Tremolite, Anthophyllite, Actinolite

\-40 CFR 61, SUBPART A-\ General Provisions

\-40 CFR 61, SUBPART M-\ National Emission Standard for Asbestos

\-40 CFR 763-\ Asbestos Containing Material in Schools

ENVIRONMENTAL PROTECTION AGENCY (EPA)

\-EPA 560/5-85-024-\ Guidance for Controlling Asbestos Containing Materials in Buildings

NAVY DIRECTIVES (ND)

\-ND OPNAVINST 5100.23-\ (Rev. B) Navy Occupational Safety and Health (NAVOSH) Program Manual

UNDERWRITERS LABORATORIES INC. (UL)

1.3 DEFINITIONS

1.3.1 Action Level

An airborne concentration of asbestos fibers, in the breathing zone of a worker equaling 0.1 fibers per cubic centimeter of air calculated as an 8-hour time weighted average.

1.3.2 *Amended Water*\

Water containing a wetting agent or surfactant with a surface tension of 29 dynes per square centimeter when tested in accordance with \-ASTM D 1331-\.

1.3.3 Area Sampling

Sampling of asbestos fiber concentrations within the asbestos control area and outside the asbestos control area which approximates the concentrations of asbestos in the theoretical breathing zone but is not actually collected in the breathing zone of an employee.

1.3.4 Asbestos

The term asbestos includes chrysotile, amosite, crocidolite, tremolite, anthophyllite, and actinolite and any of these minerals that has been chemically treated or altered. Materials are considered to contain asbestos if the asbestos content is at least one percent of the material by area.

1.3.5 Asbestos Control Area

That area where asbestos removal operations are performed which is isolated by physical boundaries which assist in the prevention of the uncontrolled release of asbestos dust, fibers, or debris. Two examples of an asbestos control area are: a full containment and a "glovebag."

1.3.6 Asbestos Fibers

Those fibers having an aspect ratio of at least 3:1 and longer than 5 micrometers as determined by National Institute for Occupational Safety and Health (NIOSH) Method 7400.

1.3.7 Asbestos Permissible Exposure Limit

0.2 fibers per cubic centimeter of air as an 8-hour time weighted average as defined by \-29 CFR 1926.58-\ or other federal legislation having legal jurisdiction for the protection of workers health.

1.3.8 Background

Normal airborne asbestos concentration in an area similar to the asbestos abatement area but in an uncontaminated (with asbestos) state.

1.3.9 Contractor

The Contractor is that individual, or entity under contract to the Navy to perform the herein listed work.

1.3.10 Encapsulants

Specific materials in various forms used to chemically entrap asbestos fibers in various configurations to prevent these fibers from becoming airborne. There are four types of encapsulants as follows which must comply with performance requirements as specified herein.

a. Removal Encapsulant (can be used as a wetting agent)

b. Bridging Encapsulant (used to provide a tough, durable surface coating to asbestos containing material)

c. Penetrating Encapsulant (used to penetrate the asbestos containing material down to substrate, encapsulating all asbestos fibers)

d. Lock-Down Encapsulant (used to seal off or "lock-down" minute asbestos fibers left on surfaces from which asbestos containing material has been removed)

1.3.11 Friable Asbestos Material

Material that contains more than one percent asbestos by area and that can be crumbled, pulverized, or reduced to powder by hand pressure when dry.

1.3.12 Glovebag Technique

Those asbestos removal and control techniques put forth in \-29 CFR 1926.58-\ Appendix G, III-A, B, C, D and Figure G-1.

1.3.13 HEPA Filter Equipment

High efficiency particulate air (HEPA) filtered vacuum and/or exhaust ventilation equipment with a filter system capable of collecting and retaining asbestos fibers. Filters shall retain 99.97 percent of particles 0.3 microns or larger as indicated in \-UL 586-\.

1.3.14 Navy Industrial Hygienist (NIH)

That industrial hygienist employed by the Navy to monitor, sample, and/or inspect the work separate from the original construction contract. The NIH can be either a Federal civil servant or a private consultant as determined by the Navy. In some instances the NIH shall perform assigned duties vicariously through a trained subordinate but only with the specific consent of the Contracting Officer.

1.3.15 Nonfriable Asbestos Material

Material that contains asbestos in which the fibers have been temporarily locked in by a bonding agent, coating, binder, or other material so that the asbestos is well bound and will not normally release asbestos fibers

during any appropriate use, handling, storage or transportation. It is understood that asbestos fibers will be released under other conditions such as demolition or removal.

1.3.16 Personal Sampling

Air sampling to determine asbestos fiber concentrations within the breathing zone of a specific employee, performed in accordance with \-29 CFR 1926.58-\.

1.3.17 Private Industrial Hygienist (PIH)

That industrial hygienist hired by the Contractor to perform the herein listed industrial hygiene tasks. In some instances, the PIH can perform this role vicariously through a trained subordinate, but only with the specific consent of the Contracting Officer.

1.3.18 TEM

Refers to Transmission Electron Microscopy

1.3.19 Time Weighted Average (TWA)

The TWA is an 8-hour time weighted average airborne concentration of asbestos fibers. At least three full shift samples per person are required to establish that person's TWA exposure.

1.3.20 Wetting Agent

That specific agent used to reduce airborne asbestos levels by physically bonding asbestos fibers to material to be removed. An equivalent wetting agent must have a surface tension of at least 29 dynes per square centimeter as tested in accordance with \-ASTM D 1331-\.

1.4 REQUIREMENTS

1.4.1 Description of Work

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NOTE: Specify the form, condition and quantity (square feet or linear feet) of asbestos material to be removed in the first blank and the location of the material in the second blank. Example: "The asbestos work includes the demolition and removal of 300 feet of 8 inch diameter asbestos insulation located on existing steam piping indicated to be removed in the boiler room."

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NOTE: Include reference to 40 CFR 763 when asbestos work occurs in a school environment.

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NOTE: Include "Under normal....specified herein." if material traditionally defined as non-friable asbestos materials are to be removed.
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NOTE: Full containment, glovebag, and outdoor techniques pertain to the three most general but yet essentially different asbestos control techniques used for asbestos removal. The appropriate technique depends on existing conditions, but must be that technique that provides the best control during abatement at most reasonable cost.
****

The work covered by this section includes the handling of asbestos containing materials which are encountered during repair, construction and demolition projects and describes some of the resultant procedures and equipment required to protect workers and occupants of the building or area, or both, from contact with airborne asbestos fibers. The work also includes the disposal of the generated asbestos containing materials. More specific operational procedures will be outlined in the Asbestos Hazard Abatement Plan called for elsewhere in this specification. The asbestos work includes the demolition and removal of [_____] located [_____] [which is governed by \-40 CFR 763-\]. [Under normal conditions non-friable or chemically bound materials containing asbestos would not be considered hazardous; however, this material will release airborne asbestos fibers during demolition and removal and therefore must be handled in accordance with the removal and disposal procedures as specified herein.] Provide [full containment] [glovebag] [outdoor] techniques as outlined in this specification.

1.4.2 Medical Requirements

\-29 CFR 1926.58-\.

1.4.2.1 Medical Examinations

****
NOTE: Edit this paragraph in accordance with the most stringent, applicable law.
****

Before exposure to airborne asbestos fibers, provide workers with a comprehensive medical examination as required by \-29 CFR 1926.58-\ or other pertinent state or local directives. This requirement must have been satisfied within the past year. The same medical examination shall be given on an annual basis to employees engaged in an occupation involving asbestos and within 30 calendar days before or after the termination of employment in such occupation. Specifically identify x-ray films of asbestos workers to the consulting radiologist and mark medical record jackets with the word "ASBESTOS."

1.4.2.2 Medical Records

****
NOTE: Medical records shall be retained at least 50 years. Some states require longer retention periods. Check with the state in which the project is located for the required retention time.
****

Maintain complete and accurate records of employees' medical examinations, medical records, and exposure data for a period of [50 years] [indefinite time] after termination of employment and make records of the required medical examinations and exposure data available for inspection and copying to: The Assistant Secretary of Labor for Occupational Safety and Health (OSHA), or authorized representatives of them, and an employee's physician upon the request of the employee or former employee.

1.4.3 Training

Within one year prior to assignment to asbestos work, each employee shall be instructed by the PIH with regard to the hazards of asbestos, safety and health precautions, the use and requirements for protective clothing, equipment, and respirators, and the association of cigarette smoking and asbestos-related disease, and all additional requirements of \-29 CFR 1926.58-\. Furnish each employee with a respirator fit test administered by the PIH as required by \-29 CFR 1926.58-\. Fully cover engineering and other hazard control techniques and procedures. In addition, train all personnel involved in the asbestos removal in accordance with United States Environmental Protection Agency (USEPA) or state criteria whichever is more stringent. The Contractor shall document the training by providing: dates of training, training entity, course outline, names of instructors, and qualifications of instructors upon request by the Contracting Officer.

1.4.4 Permits [, Licenses,] and Notifications

****
NOTE: The USEPA has delegated the responsibility of notification requirements to most states. Verify with the state and local authorities where the project is located whether the city, county, state, and/or USEPA has jurisdiction and whether a licence is required.
****

Obtain necessary permits [and licenses] in conjunction with asbestos removal, hauling, and disposition, and furnish timely notification of such actions required by Federal, state, regional, and local authorities. Notify the [Regional Office of the United States Environmental Protection Agency (USEPA)] [state's environmental protection agency] [local air pollution control district/agency] and the Contracting Officer in writing 10 days prior to the commencement of work in accordance with \-40 CFR 61, SUBPART M-\.

1.4.5 Safety and Health Compliance

****
NOTE: The designer shall research the state, regional and local laws, regulations, statutes, etc., and list by authority and document number in the blank spaces provided those which apply to the asbestos work to be performed by the Contractor.
****

In addition to detailed requirements of this specification, comply with those applicable laws, ordinances, criteria, rules, and regulations of federal, state, regional, and local authorities regarding handling, storing, transporting, and disposing of asbestos waste materials. Comply with the applicable requirements of the current issue of \-29 CFR 1926.58-\, \-40 CFR 61, SUBPART A-\, \-40 CFR 61, SUBPART M-\, and \-ND OPNAVINST 5100.23-\. Submit matters of interpretation of standards to the appropriate administrative agency for resolution before starting the work. Where the requirements of this specification, applicable laws, rules, criteria, ordinances, regulations, and referenced documents vary, the most stringent requirement as defined by the Contracting Officer shall apply. The following laws, ordinances, criteria, rules and regulations regarding removal, handling, storing, transporting and disposing of asbestos materials apply:

a. [_____]

b. [_____]

c. [_____]

1.4.6 Respiratory Protection Program

Establish and implement a respirator program as required by \-ANSI Z88.2-\ and \-29 CFR 1910.134-\.

1.4.7 Industrial Hygienist (IH)

****
NOTE: See Note A located at rear of text.
****

Conduct [personal] [area/environmental] air sampling and training under the direction of an Industrial Hygienist currently certified for comprehensive practice by the American Board of Industrial Hygiene. For the purpose of this contract, the Contractor shall retain the services of an industrial hygienist (PIH) to perform [the Contractor's industrial hygiene tasks] [Occupational Safety and Health Administration (OSHA) related sampling only. The Navy will retain an industrial hygienist (NIH) for all other sampling and to [assist] [represent] the Contracting Officer].

1.4.8 Hazard Communication

Adhere to all parts of \-29 CFR 1910.1200-\ and provide the Contracting Officer with a copy of the *Material Safety Data Sheets (MSDS) for all

materials*\ brought to the site.

1.5 SUBMITTALS

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NOTE: The submittals required for each project are very dependent upon the removal method to be used. Edit the submittals paragraph accordingly.
****

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NOTE: The "G" in asterisk tokens following each submittal item indicates Government approval and should be retained. Add "G" in asterisk tokens following any added submittals that are determined to require Government approval. Submittal items not designated with a "G" will be approved by the CQC organization.
****

Submit the following in accordance with Section \=01300=\, "Submittals."

1.5.1 *SD-02, Manufacturer's Catalog Data*\

a. *Local exhaust equipment*\ *G*\

b. *Vacuums*\ *G*\

c. *Respirators*\ *G*\

d. *Pressure differential automatic recording instrument*\ *G*\

e. *Amended water*\ *G*\

f. *Glovebag*\ *G*\

g. *Material Safety Data Sheets (MSDS) for all materials*\ proposed for transport to the project site *G*\

1.5.2 *SD-08, Statements*\

a. *Asbestos hazard abatement plan*\ *G*\

b. *Testing laboratory*\ *G*\

c. *Industrial hygienist certification*\ *G*\

d. *Landfill approval*\ *G*\

e. *Employee training*\ *G*\

f. *Medical certification*\ requirements *G*\

1.5.2.1 *Asbestos Hazard Abatement Plan*\

Submit a detailed plan of the safety precautions and work procedures to be used in the removal [and demolition] of materials containing asbestos. The plan shall be prepared, signed, and sealed, including certification number and date, by the PIH. Such plan shall include but not be limited to the precise personal protective equipment to be used, the location of asbestos control areas including clean and dirty areas, buffer zones, showers, storage areas, change rooms, removal method, interface of trades involved in the construction, sequencing of asbestos related work, disposal plan, type of wetting agent and asbestos sealer to be used, locations of local exhaust equipment, planned air monitoring strategies, and a detailed description of the method to be employed in order to control pollution. The plan shall also include (both fire and medical emergency) response plans. This plan must be approved in writing prior to the start of any asbestos work. The Contractor and PIH shall meet with the Contracting Officer prior to beginning work, to discuss in detail the asbestos plan, including work procedures and safety precautions. Once approved by the Contracting Officer, the plan will be enforced as if an addition to the specification. Any changes required in the specification as a result of the plan shall be identified specifically in the plan to allow for free discussion and approval by the Contracting Officer prior to the start of work.

1.5.2.2 *Testing Laboratory*\

Submit the name, address, and telephone number of the testing laboratory selected for the [sampling,] analysis, and reporting of airborne concentrations of asbestos fibers along with certification that persons counting the samples have been judged proficient by successful participation within the last year in the American Industrial Hygiene Association (AIHA) Proficiency Analytical Testing (PAT) Program. Where analysis to determine asbestos content in bulk materials is required, submit evidence that the laboratory is accredited by the National Institute of Science and Technology (NIST) under National Voluntary Laboratory Accreditation Program (NVLAP) for asbestos analysis.

1.5.2.3 *Industrial Hygienist Certification*\

Submit the name, address, and telephone number of the Industrial Hygienist (PIH) selected to prepare the Asbestos Hazard Abatement Plan, direct monitoring and training, and documented evidence that the Industrial Hygienist is currently certified in comprehensive practice by the American Board of Industrial Hygiene, including certification number and date. Personnel performing any industrial hygiene function under the direction of the PIH shall be employed by the PIH's company.

1.5.2.4 *Landfill Approval*\

****

NOTE: The USEPA has delegated the responsibility of approving landfills for the disposal of asbestos to most states. Verify with the state in which the project is located whether the state or USEPA has jurisdiction and what laws apply.

****

Submit written evidence that the landfill for disposal is approved for asbestos disposal by the [USEPA] [and] [state] [and] [local] regulatory agency(s). Submit detailed delivery tickets, prepared, signed and dated by an agent of the landfill, certifying the amount of asbestos materials delivered to the landfill, within 3 days after delivery. In those states that require a hazardous waste manifest the Contractor shall submit, within 3 days, signed copies of such to the Contracting Officer.

1.5.2.5 *Employee Training*\

Submit certificates signed by each employee indicating that the employee has received training in the proper handling of materials that contain asbestos; understands the health implications and risks involved, including the illnesses possible from exposure to airborne asbestos fibers; understands the use and limits of the respiratory equipment to be used; and understands the results of monitoring of airborne quantities of asbestos as related to health and respiratory equipment as indicated in \-29 CFR 1926.58-\ on an initial and annual basis.

1.5.2.6 *Medical Certification*\

Provide a written certification signed by a licensed physician that all workers and supervisors have met or exceeded all of the medical prerequisites listed herein and in \-29 CFR 1926.58-\ and \-29 CFR 1910.134-\.

1.5.3 *SD-12, Field Test Reports*\

a. *Air sampling results*\ *G*\

b. *Pressure differential recordings for local exhaust system*\ *G*\

c. *Asbestos disposal quantity report*\ *G*\

1.5.3.1 *Air Sampling Results*\

****
NOTE: See Note A located at rear of text.
****

Complete fiber counting and provide results to the [PIH] [and] [NIH] for review within 16 hours. Notify the Contracting Officer immediately of any airborne levels of asbestos fibers in excess of the acceptable limits. Submit sampling results to the Contracting Officer and the affected Contractor employees within 3 working days, signed by the testing laboratory employee performing air sampling, the employee that analyzed the sample, and the [PIH] [and] [NIH].

1.5.3.2 *Pressure Differential Recordings for Local Exhaust System*\

****
NOTE: When an enclosed full containment is not required, delete the requirements for the local

exhaust system and pressure differential recording.
****

****
NOTE: See Note A located at rear of text.
****

Provide a local exhaust system that creates a negative pressure of at least 0.02 inches of water relative to the pressure external of the enclosure and operate it continuously, 24 hours a day, until the enclosure of the asbestos control area is removed. Submit pressure differential recordings for each work day to the [PIH] [and] [NIH] for review and to the Contracting Officer within 24 hours from the end of each work day. Notify the Contractor and the Contracting Officer immediately of any variance in the pressure differential which could cause adjacent unsealed areas to have asbestos fiber concentrations in excess of 0.01 fibers per cubic centimeter or background whichever is higher. In no circumstance shall levels exceed 0.1 fibers per cubic centimeter.

1.5.4 *SD-13, Certificates*\

a. *Vacuums*\ *G*\

b. *Water filtration equipment*\ *G*\

c. *Ventilation systems*\ *G*\

d. Other *equipment required to contain airborne asbestos fibers*\ *G*\

e. Chemical *encapsulants*\/sealers *G*\

Show compliance with \-ANSI Z9.2-\ by providing manufacturers' certifications.

1.5.5 *SD-18, Records*\

a. *Notifications*\ *G*\

b. *Rental equipment*\ *G*\

c. *Respirator program records*\ *G*\

1.5.5.1 *Notifications*\

Notify the Contracting Officer in writing 10 working days prior to the start of asbestos work. [Notify the local fire department 3 days prior to removing fire-proofing material from the building including notice that the material contains asbestos.]

1.5.5.2 *Rental Equipment*\

Provide a copy of the written notification to the rental company concerning the intended use of the equipment and the possibility of asbestos contamination of the equipment.

1.5.5.3 *Respirator Program Records*\

Submit records of the respirator program as required by \-ANSI Z88.2-\, \-29 CFR 1910.134-\, \-29 CFR 1926.58-\.

PART 2 PRODUCTS

2.1 *ENCAPSULANTS*\

Shall conform to current USEPA requirements, shall contain no toxic or hazardous substances, no solvents and shall conform to the following performance requirements.

2.1.1 Removal Encapsulants

Requirement	Test Standard
Flame Spread - 25, Smoke Emission - 50	\-ASTM E 84-\
Combustion Toxicity Zero Mortality	University of Pittsburgh Protocol
Life Expectancy - 20 years	\-ASTM C 732-\, Accelerated Aging Test
Permeability - Minimum 0.4 perms	\-ASTM E 96-\

2.1.2 Bridging Encapsulant

Requirement	Test Standard
Flame Spread - 25, Smoke Emission - 50	\-ASTM E 84-\
Combustion Toxicity Zero Mortality	University of Pittsburgh Protocol
Life Expectancy - 20 years	\-ASTM C 732-\, Accelerated Aging Test
Permeability - Minimum 0.4 perms	\-ASTM E 96-\
Cohesion/Adhesion Test - 50 pounds of force/foot	\-ASTM E 736-\
Fire Resistance - Negligible affect on fire resistance rating over 3 hour test (Classified by UL for use over fibrous and cementitious sprayed fireproofing)	\-ASTM E 119-\
Impact Resistance - Minimum 43 in/lb	\-ASTM D 2794-\ Gardner Impact Test

Requirement	Test Standard
Flexibility - no rupture or cracking	\-ASTM D 522-\ Mandrel Bend Test

2.1.3 Penetrating Encapsulant

Requirement	Test Standard
Flame Spread - 25, Smoke Emission - 50	\-ASTM E 84-\
Combustion Toxicity Zero Mortality	University of Pittsburgh Protocol
Life Expectancy - 20 years	\-ASTM C 732-\ Accelerated Aging Test
Permeability - Minimum 0.4 perms	\-ASTM E 96-\
Cohesion/Adhesion Test - 50 pounds of force/foot	\-ASTM E 736-\
Fire Resistance - Negligible affect on fire resistance rating over 3 hour test (Classified by UL for use over fibrous and cementitious sprayed fireproofing)	\-ASTM E 119-\
Impact Resistance - Minimum 43 in/lb	\-ASTM D 2794-\ Gardner Impact Test
Flexibility - no rupture or cracking	\-ASTM D 522-\ Mandrel Bend Test

2.1.4 Lock-down Encapsulant

Requirement	Test Standard
Flame Spread - 25, Smoke Emission - 50	\-ASTM E 84-\
Combustion Toxicity Zero Mortality	University of Pittsburgh Protocol
Life Expectancy - 20 years	\-ASTM C 732-\ Accelerated Aging Test
Permeability - Minimum 0.4 perms	\-ASTM E 96-\
Fire Resistance - Negligible affect on fire resistance rating over 3 hour test (Tested with fireproofing over encapsulant applied directly	\-ASTM E 119-\

Requirement	Test Standard
to steel member)	
Bond Strength - 100 pounds of force/ foot (Tests compatibility with cementitious and fibrous fire-proofing)	\-ASTM E 736-\

PART 3 EXECUTION

3.1 EQUIPMENT

****
NOTE: Modify the number of sets of protective equipment as required, depending on the size of the asbestos removal project.
****

Make available to the Contracting Officer or the Contracting Officer's Representative, two complete sets of personal protective equipment as required herein for entry to the asbestos control area at all times for inspection of the asbestos control area. Provide equivalent training to the Contracting Officer or a designated representative as provided to Contractor employees in the use of the required personal protective equipment. Provide manufacturer's certificate of compliance for all *equipment required to contain airborne asbestos fibers*\.

3.1.1 Respirators

Select respirators from those approved by the National Institute for Occupational Safety and Health (NIOSH), Department of Health and Human Services.

3.1.1.1 *Respirators*\ for Handling Asbestos

Provide personnel engaged in the removal and demolition of asbestos materials with Type C supplied-air respirators, in the pressure/demand mode with an auxiliary self contained breathing apparatus. The use of any other type of respiratory protection must be requested in writing by the PIH. The request shall identify the specific type of respiratory protection requested and the reasoning behind the choice. Forward the request to the Contracting Officer who will consult with the NIH and provide a written response to the request. A different request shall be filed for each type of operation. All respiratory protection shall comply with the spirit and letter of \-29 CFR 1926.58-\ and \-29 CFR 1910.134-\. Use of other than Type C supplied-air respirators, in the pressure/demand mode with an auxiliary self contained breathing apparatus is prohibited unless approved by the Contracting Officer.

3.1.2 Exterior Whole Body Protection

3.1.2.1 Protective Clothing

Provide personnel exposed to asbestos with disposable protective whole body clothing, head coverings, gloves, and foot coverings. Provide disposable plastic or rubber gloves to protect hands. Cloth gloves may be worn inside the plastic or rubber gloves for comfort, but shall not be used alone. Make sleeves secure at the wrists, make foot coverings secure at the ankles, and make clothing secure at the neck by the use of tape.

3.1.2.2 Work Clothing

Provide cloth work clothes for wear under the disposable protective coveralls and foot coverings and either dispose of or properly launder them as recommended by the [NIH] [PIH] after use.

3.1.2.3 Decontamination Unit

Provide a temporary, negative pressure unit with a separate decontamination locker room and a clean locker room with a shower that complies with \-29 CFR 1910.141-\(d)(3) in between for personnel required to wear whole body protective clothing. Provide two separate lockers for each asbestos worker, one in each locker room. Keep street clothing and street shoes in the clean locker. HEPA vacuum and remove asbestos contaminated disposable protective clothing while still wearing respirators at the boundary of the asbestos work area and seal in impermeable bags or containers for disposal. Do not wear work clothing between home and work. Locate showers between the decontamination locker room and the clean locker room and require that all employees shower before changing into street clothes. Collect used shower water and filter to remove asbestos contamination with an approved *water filtration equipment*\. Dispose of filters and residue as asbestos waste. Discharge clean water to the sanitary system. Dispose of asbestos contaminated work clothing as asbestos contaminated waste. Decontamination units shall be physically attached to the asbestos control area. Build both a personnel decontamination unit and an equipment decontamination unit onto and integral with each asbestos control area.

3.1.2.4 Eye Protection

Provide goggles to personnel engaged in asbestos operations when the use of a full face respirator is not required.

3.1.3 Warning Signs and Labels

Provide [bilingual] warning signs [printed in English and [_____] at all approaches to asbestos control areas containing concentrations of airborne asbestos fibers. Locate signs at such a distance that personnel may read the sign and take the necessary protective steps required before entering the area. Provide labels and affix to all asbestos materials, scrap, waste, debris, and other products contaminated with asbestos.

3.1.3.1 Warning Sign

Provide vertical format conforming to \-29 CFR 1910.145-\(d)(4), and \-29 CFR 1926.58-\(k) minimum 20 by 14 inches displaying the following legend in the lower panel:

Legend	Notation
Danger	1-inch Sans Serif Gothic or Block
Asbestos	1-inch Sans Serif Gothic or Block
Cancer and Lung Disease Hazard	1/4-inch Sans Serif Gothic or Block
Authorized Personnel Only	1/4-inch Gothic
Respirators and Protective Clothing are Required in this Area	1/4-inch Gothic

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

3.1.3.2 Warning Labels

Provide labels conforming to \-29 CFR 1926.58-\(k) of sufficient size to be clearly legible, displaying the following legend:

DANGER

CONTAINS ASBESTOS FIBERS

AVOID CREATING DUST

CANCER AND LUNG DISEASE HAZARD

BREATHING ASBESTOS DUST MAY
CAUSE SERIOUS BODILY HARM

3.1.4 Local Exhaust System

****

NOTE: When an enclosed full containment is not required, delete the requirements for the local exhaust system and pressure differential recording.

****

Provide a local exhaust system in the asbestos control area in accordance with \-ANSI Z9.2-\ and \-29 CFR 1926.58-\ that will provide at least four air changes per hour inside of the containment. Local exhaust shall be operated 24 hours per day, until the asbestos control area is removed and shall be leak proof to the filter and equipped with HEPA filters. *Local exhaust equipment*\ shall be sufficient to maintain a minimum pressure differential of minus 0.02 inch of water column relative to adjacent, unsealed areas. Provide continuous 24-hour per day monitoring of the pressure differential with a *pressure differential automatic recording instrument*\. In no case shall the building ventilation system be used as the local exhaust system for the asbestos control area. Filters on exhaust equipment shall conform to \-ANSI Z9.2-\ and \-UL 586-\. The local exhaust system shall terminate out of doors.

3.1.5 Tools

Vacuums\ shall be leak proof to the filter and equipped with HEPA filters. Filters on vacuums shall conform to \-ANSI Z9.2-\ and \-UL 586-\. Do not use power tools to remove asbestos containing materials unless the tool is equipped with effective, integral HEPA filtered exhaust *ventilation systems*\. Remove all residual asbestos from reusable tools prior to storage or reuse.

3.1.6 Rental Equipment

If rental equipment is to be used, furnish written notification to the rental agency concerning the intended use of the equipment and the possibility of asbestos contamination of the equipment.

3.2 WORK PROCEDURE

****
NOTE: See Note B located at rear of text.
****

****
NOTE: Full containment, glovebag, and outdoor techniques pertain to the three most general but yet essentially different asbestos control techniques used for asbestos removal. The appropriate technique depends on existing conditions, but must be that technique that provides the best control during abatement at most reasonable cost.
****

Perform asbestos related work in accordance with \-29 CFR 1926.58-\ and as specified herein. Use [wet] [or] [if given prior EPA approval, dry] removal procedures and [full containment] [glovebag] [outdoor] techniques. Personnel shall wear and utilize protective clothing and equipment as specified herein. Eating, smoking, drinking, or applying cosmetics shall not be permitted in the asbestos work or control areas. Personnel of other trades not engaged in the removal and demolition of asbestos shall not be exposed at any time to airborne concentrations of asbestos unless all the personnel protection provisions of this specification are complied with by the trade personnel. Shut down the building heating, ventilating, and air conditioning system, cap the openings to the system, [and provide temporary [heating,] [and] [ventilation,] [and] [air conditioning]] prior to the commencement of asbestos work. [Disconnect electrical service when wet removal is performed and provide temporary electrical service prior to the use of any water.] If an asbestos spill occurs outside of the asbestos control area, stop work immediately, correct the condition to the satisfaction of the Contracting Officer including clearance sampling, prior to resumption of work.

3.2.1 Protection of Existing Work to Remain

****
NOTE: See Note A located at rear of text.

****

Perform demolition work without damage or contamination of adjacent work. Where such work is damaged or contaminated as verified by the Contracting Officer using visual inspection or sample analysis, it shall be restored to its original condition or decontaminated by the Contractor at no expense to the Government as deemed appropriate by the Contracting Officer. This includes inadvertent spill of dirt, dust, or debris in which it is reasonable to conclude that asbestos may exist. When these spills occur, stop work immediately. Then clean up the spill. When satisfactory visual inspection and air sampling results are obtained from the [PIH] [NIH] work may proceed.

3.2.2 Furnishings

****

NOTE: Choose one of the following options. In most projects, the Government will remove furniture and equipment before the Contractor begins work. In this case the first paragraph should be used. The third paragraph should only be used when existing furnishings have been contaminated with asbestos fibers and the Contractor will be required to clean these items. When the third paragraph is used, identify the furnishings and indicate the quantity of each.

****

[Furniture [,(_____)] and equipment will be removed from the area of work by the Government before asbestos work begins.]

[Furniture [,(_____)] and equipment will remain in the building. Cover and seal furnishings with 6-mil plastic sheet or remove from the work area and store in a location on site approved by the Contracting Officer.]

[Furnishings listed below and located in the work area are considered to be contaminated with asbestos fibers. Transfer these items to an area on site approved by the Contracting Officer, decontaminate (wet methods where possible), and then store until the room from which they came is declared clean and safe for entry. [Carpets, draperies, and other items which may not be suitable for on-site wet cleaning methods shall be properly laundered as recommended by the [NIH] [PIH] so as to remove all asbestos contamination or disposed of at the Contracting Officer's discretion.] At the conclusion of the asbestos removal work and cleanup operations, transfer all objects so removed and cleaned back to the area from which they came and re-install them. Base bids on decontaminating:

a. [_____] Desks

b. [_____] Filing cabinets

c. [_____] Linear feet of shelving

d. [_____] Cubic Feet of books, papers, files, etc.

e. [_____]]

3.2.3 Precleaning

Wet wipe and HEPA vacuum all surfaces with asbestos debris prior to establishment of a containment.

3.2.4 Asbestos Control Area Requirements

****
NOTE: When an enclosed full containment is infeasible, use paragraph entitled "Glovebag" or "Outdoor" as appropriate and delete paragraph entitled "Full Containment." If the project has both areas which can be enclosed and areas which cannot be enclosed, retain the appropriate paragraphs and identify the areas which must be enclosed and the areas which cannot be enclosed.
****

3.2.4.1 Full Containment

Block and seal openings in areas where the release of airborne asbestos fibers can be expected. Establish an asbestos containment with the use of curtains, portable partitions, or other enclosures in order to prevent the escape of asbestos fibers from the contaminated asbestos work area. Containment development shall include protective covering of walls, and ceilings with a continuous membrane of two layers of minimum 4-mil plastic sheet sealed with tape to prevent water or other damage. Provide two layers of 6-mil plastic sheet over floors and extend a minimum of 12 inches up walls. Seal all joints with tape. Provide local exhaust system in the asbestos control area. Openings will be allowed in enclosures of asbestos control areas for the supply and exhaust of air for the local exhaust system. Replace filters as required to maintain the efficiency of the system.

3.2.4.2 *Glovebag*\

****
NOTE: Specify the asbestos material to be removed in the first blank and identify the location of the area which cannot be enclosed in the second blank.
****

****
NOTE: See Note A located at rear of text.
****

The construction of an enclosed asbestos containment is infeasible for the removal of [_____] located [_____]. Use glovebag techniques as indicated in \-29 CFR 1926.58-\ Appendix G, III-A, B, C, D and Figure G-1. Establish designated limits for the asbestos work area with the use of rope or other continuous barriers, maintain all other requirements for asbestos control areas except for local exhaust. Also, where an enclosure is not provided, conduct area monitoring of airborne asbestos fibers during the work shift

at the designated limits [downwind] of the asbestos work area at such frequency as recommended by the [PIH] [and] [NIH] and conduct personal samples of each worker engaged in asbestos handling (removal, disposal, transport and other associated work). If the quantity of airborne asbestos fibers monitored at the breathing zone of the workers or designated limits at any time exceeds background or 0.01 fibers per cubic centimeter whichever is lesser, stop work, evacuate personnel in adjacent areas or provide personnel with approved protective equipment at the discretion of the Contracting Officer. This sampling may be duplicated by the government at the discretion of the Contracting Officer. If the air sampling results obtained by the government differ from those obtained by the Contractor, the government results shall prevail. If adjacent areas are contaminated as determined by the Contracting Officer, clean the contaminated areas, monitor, and visually inspect the area as specified herein.

3.2.4.3 Outdoor

****
NOTE: Specify the asbestos material to be removed in the first blank and identify the location of the area which cannot be enclosed in the second blank.
****

****
NOTE: See Note C located at rear of text.
****

****
NOTE: See Note A located at rear of text.
****

The construction of an enclosed asbestos containment is infeasible for the removal of [_____] located [_____]. Establish designated limits for the asbestos work area with the use of rope or other continuous barriers, and maintain all other requirements for asbestos control areas except for local exhaust. [_____.] Also, where an enclosure is not provided, conduct area monitoring of airborne asbestos fibers during the work shift at the designated limits [downwind] of the asbestos work area at such frequency as recommended by the [PIH] [and] [NIH] and conduct personal samples of each worker engaged in asbestos handling (removal, disposal, transport and other associated work). If the quantity of airborne asbestos fibers monitored at the breathing zone of the workers or designated limits at any time exceeds background or 0.01 fibers per cubic centimeter whichever is lesser, stop work, evacuate personnel in adjacent areas or provide personnel with approved protective equipment at the discretion of the Contracting Officer. This sampling may be duplicated by the Government at the discretion of the Contracting Officer. If the air sampling results obtained by the Government differ from those obtained by the Contractor, the Government results shall prevail. If adjacent areas are contaminated as determined by the Contracting Officer, clean the contaminated areas, monitor, and visually inspect the area as specified herein.

3.2.5 Asbestos Handling Procedures

3.2.5.1 General Procedures

[Wet asbestos material with a fine spray of [amended water] [specific wetting agent] during removal, cutting, or other handling so as to reduce the emission of airborne fibers.] Remove material and immediately place in 6 mil plastic disposal bags. Where unusual circumstances prohibit the use of 6 mil plastic bags, submit an alternate proposal for containment of asbestos fibers to the Contracting Officer for approval. For example, in the case where both piping and insulation are to be removed, the Contractor may elect to wet the insulation and wrap the pipes and insulation in plastic and remove the pipe by sections.

3.2.5.2 Sealing Contaminated Items Designated for Disposal

****

NOTE: Use this paragraph only when asbestos contaminated items are also designated for removal and disposal.

****

Remove contaminated architectural, mechanical, and electrical appurtenances such as venetian blinds, full-height partitions, carpeting, duct work, pipes and fittings, radiators, light fixtures, conduit, panels, and other contaminated items designated for removal by completely coating the items with an asbestos lockdown encapsulant at the demolition site before removing the items from the asbestos control area. These items need not be vacuumed. The asbestos lockdown encapsulant shall be tinted a contrasting color. It shall be spray-applied by airless method. Thoroughness of sealing operation shall be visually gauged by the extent of colored coating on exposed surfaces. Lockdown encapsulants shall comply with the performance requirements specified herein.

3.2.5.3 Exposed Pipe Insulation Edges

Contain edges of asbestos insulation to remain that are exposed by a removal operation. Wet and cut the rough ends true and square with sharp tools and then encapsulate the edges with a 1/4-inch-thick layer of non-asbestos containing insulating cement troweled to a smooth hard finish. When cement is dry, lag the end with a layer of non-asbestos lagging cloth, overlapping the existing ends by 4 inches. When insulating cement and cloth is an impractical method of sealing a raw edge of asbestos, take appropriate steps to seal the raw edges as approved by the Contracting Officer.

3.2.6 Air Sampling

****

NOTE: Air sampling regimen is very dependent on removal method and applicable laws, edit accordingly.

****

****

NOTE: See Note A located at rear of text.
****

Sampling of airborne concentrations of asbestos fibers shall be performed in accordance with \-29 CFR 1926.58-\ and as specified herein. Sampling performed in accordance with \-29 CFR 1926.58-\ shall be performed by the PIH. [Sampling performed for environmental and quality control reasons shall be performed by the [PIH] [NIH].] Unless otherwise specified, use NIOSH Method 7400 for sampling and analysis. Monitoring may be duplicated by the Government at the discretion of the Contracting Officer. If the air sampling results obtained by the Government differ from those results obtained by the Contractor, the Government results shall prevail.

3.2.6.1 Sampling Prior to Asbestos Work

****
NOTE: The designer shall research the state, regional and local laws, regulations, statutes, etc., to determine whether "aggressive" air sampling is required.
****

Provide area air sampling and establish the baseline one day prior to the masking and sealing operations for each [demolition] [removal] site. Establish the background by performing area sampling in similar but uncontaminated sites in the building.

3.2.6.2 Sampling During Asbestos Work

****
NOTE: Choose one of the following options. See Note A located at rear of text.
****

****
NOTE: When an "enclosed" asbestos control area is not required, retain the appropriate portion in brackets.
****

[The PIH shall provide personal and area sampling as indicated in \-29 CFR 1926.58-\ and governing environmental regulations. Thereafter, provided the same type of work is being performed, provide area sampling at least once every work shift close to the work inside the containment, outside the clean room entrance to the containment, and at the exhaust opening of the local exhaust system. If sampling outside the containment shows airborne levels have exceeded background or 0.01 fibers per cubic centimeter, whichever is greater, stop all work, correct the condition(s) causing the increase, and notify the Contracting Officer immediately. [In areas where the construction of a containment is not required, after initial TWAs are established and provided the same type of work is being performed, provide sampling at the designated limits of the asbestos work area at such frequency as recommended by the PIH.] [Where glovebag methods are used, perform personal and area air sampling at locations and frequencies that will accurately characterize the evolving airborne asbestos levels.]]

[The PIH shall provide personal sampling as indicated in \-29 CFR 1926.58-\. At the same time the NIH will provide area sampling close to the work inside the containment, outside the clean room entrance to the containment, and at the exhaust opening of the local exhaust system. Thereafter, provided the same type of work is being performed, the NIH will provide area sampling once every work shift close to the work inside the containment, outside the clean room entrance to the containment, and at the exhaust opening of the local exhaust system. If sampling outside the containment shows airborne levels have exceeded background or 0.01 fibers per cubic centimeter, whichever is greater, stop all work, correct the condition(s) causing the increase, and notify the Contracting Officer immediately. [In areas where the construction of a containment is not required, after initial TWAs are established and provided the same type of work is being performed, the NIH will provide sampling at the designated limits of the asbestos work area at such frequency as recommended by the NIH.] [Where glovebag methods are used, perform personal and area air sampling at locations and frequencies that will accurately characterize the evolving airborne asbestos levels.]]

3.2.6.3 Sampling After Final Clean-Up (Clearance Sampling)

****
NOTE: The designer shall research the state, regional and local laws, regulations, statutes, etc., to determine whether "aggressive" air sampling is required.
****

****
NOTE: See Note A located at rear of text.
****

****
NOTE: The designer shall research the state, regional and local laws, regulations, statutes, etc., to determine whether TEM analysis is required.
****

Provide area sampling of asbestos fibers [using aggressive air sampling techniques as defined in the \-EPA 560/5-85-024-\] and establish an airborne asbestos concentration of less than 0.01 fibers per cubic centimeter after final clean-up but before removal of the containment or the asbestos work control area. After final cleanup and the asbestos control area is dry but prior to clearance sampling, the [PIH] [NIH] shall perform a visual inspection to insure that the asbestos control and work area is free of any accumulations of dirt, dust, or debris. [Perform at least [_____] samples.] [Use transmission electron microscopy (TEM) to analyze clearance samples and report the results in accordance with current NIOSH criteria.] The asbestos fiber counts from these samples shall be less than 0.01 fibers per cubic centimeter or be not greater than the background, whichever is greater. Should any of the final samples indicate a higher value, the Contractor shall take appropriate actions to re-clean the area and shall repeat the sampling and [TEM] analysis at the Contractor's expense.

3.2.7 Lock Down

Prior to removal of plastic barriers and after pre-clearance clean up of gross contamination, a visual inspection by the [PIH] [NIH], of all areas affected by the removal of the asbestos contaminated materials for any visible fibers, shall be conducted and approved by the [PIH] [NIH]. A post removal (lock down) encapsulant shall then be spray applied to ceiling, walls, floors and other areas exposed in the removal area. The exposed area shall include but not be limited to plastic barriers, furnishings and articles to be discarded as well as dirty change room, air locks for bag removal and decon chambers.

3.2.8 Site Inspection

While performing asbestos removal work, the Contractor shall be subject to on-site inspection by the Contracting Officer who may be assisted by or represented by safety or industrial hygiene personnel. If the work is found to be in violation of this specification, the Contracting Officer or his representative will issue a stop work order to be in effect immediately and until the violation is resolved. Standby time required to resolve the violation shall be at the Contractor's expense.

3.3 CLEAN-UP AND DISPOSAL

3.3.1 Housekeeping

Essential parts of asbestos dust control are housekeeping and clean-up procedures. Maintain surfaces of the asbestos control area free of accumulations of asbestos fibers. Give meticulous attention to restricting the spread of dust and debris; keep waste from being distributed over the general area. Use HEPA filtered vacuum cleaners. Do not blow down the space with compressed air. When asbestos removal is complete, all asbestos waste is removed from the work-site, and final clean-up is completed, the Contracting Officer will certify the area as safe before the signs can be removed. After final clean-up and acceptable airborne concentrations are attained but before the HEPA unit is turned off and the containment removed, remove all pre-filters on the building HVAC system and provide new pre-filters. Dispose of filters as asbestos-contaminated materials. Reestablish HVAC mechanical, and electrical systems in proper working order. The Contracting Officer will visually inspect all surfaces within the containment for residual material or accumulated dust or debris. The Contractor shall re-clean all areas showing dust or residual materials. If re-cleaning is required, air sample and establish an acceptable asbestos airborne concentration after re-cleaning. The Contracting Officer will certify that the area is safe in writing before unrestricted entry is permitted. The Government shall have the option to perform monitoring to certify the areas are safe before entry is permitted.

3.3.2 Title to Materials

All materials resulting from demolition work, except as specified otherwise, shall become the property of the Contractor and shall be disposed of as specified in applicable local, state, and Federal regulations and herein.

3.3.3 Disposal of Asbestos

****
NOTE: Disposal procedures and sites for asbestos materials vary considerably with each location. Contact local station Public Works and the NAVFAC Engineering Field Division Hazardous Waste Manager or Industrial Hygienist for local procedures.
****

3.3.3.1 Procedure for Disposal

Collect asbestos waste, asbestos contaminated water, scrap, debris, bags, containers, equipment, and asbestos contaminated clothing which may produce airborne concentrations of asbestos fibers and place in sealed fiberproof, waterproof, non-returnable containers (e.g. double plastic bags 6 mils thick, cartons, drums or cans). Wastes within the containers must be wetted to insure the security of the material in case of container breeching. Affix a warning and Department of Transportation (DOT) label to each bag or use at least 6 mil thick bags with the approved warnings and DOT labeling preprinted on the bag. Dispose of waste asbestos material at an Environmental Protection Agency (EPA) or state-approved asbestos landfill off Government property. For temporary storage, store sealed impermeable bags in asbestos waste drums or skids. An area for interim storage of asbestos waste-containing drums or skids will be assigned by the Contracting Officer or his authorized representative. Procedure for hauling and disposal shall comply with \-40 CFR 61, SUBPART M-\, state, regional, and local standards. Sealed plastic bags may be dumped from drums into the burial site unless the bags have been broken or damaged. Damaged bags shall remain in the drum and the entire contaminated drum shall be buried. Uncontaminated drums may be recycled. Workers unloading the sealed drums shall wear appropriate respirators and personal protective equipment when handling asbestos materials at the disposal site.

3.3.3.2 *Asbestos Disposal Quantity Report*\

****
NOTE: See Note A located at rear of text.
****

[Direct the PIH to record and report, to the Contracting Officer, the amount of asbestos containing material removed and released for disposal. Deliver the report for the previous day at the beginning of each day shift with amounts of material removed during the previous day reported in linear feet or square feet as described initially in this specification and in cubic feet for the amount of asbestos containing material released for disposal.]

[Allow the NIH to inspect, record and report the amount of asbestos containing material removed and released for disposal on a daily basis.]

-- End of Section --

NOTE A: Normal practice is to have the Contractor hire one independent Industrial Hygienist (the PIH) to perform all required functions. However, some applicable laws forbid this approach and will dictate when the PIH, the NIH or both will be required to perform the function involved. However, the Contractor shall always hire a PIH.

NOTE B: Use wet removal procedures in most cases. Wet removal is the preferred method and the least hazardous. Dry removal as an option can be used to allow the Contractor to use dry removal where wet removal may damage adjacent areas. Dry removal as the only method of removal should only be specified if severe water damage to equipment, etc., would occur during wet removal. If dry removal alone is allowed, carefully edit the specification to remove all reference to amended water and wetting down procedures and to include a requirement for a written variance submitted by the Contractor along with the written approval of any regulatory authority having jurisdiction.

NOTE C: Requirements for demolition or removal of asbestos outdoors varies considerably with the work and the location involved. This paragraph specifies minimum requirements (which may or may not entirely apply) for demolition or removal of asbestos outdoors where construction of a containment may or may not be practical. The designer shall provide specific requirements necessary for the particular project best suited to prohibit or reduce asbestos exposure to other Contractor employees, Navy resources and the general public.

NOTE D: Suggestions for improvement of this specification will be welcomed using the "Agency Response Form" located in SPECSINTACT under "System Directory" or DD Form 1426. Suggestions should be forwarded to:

Commanding Officer
Naval Construction Battalion Center
Civil Engineer Support Office
Code DS03
Port Hueneme, CA 93043-5000

-- End --

GENERAL NOTES

The following is provided as guidance for use of this Naval Facilities Guide Specification (NFGS):

1. **The NFGS is in the three-part Section format established by the Construction Specifications Institute and adopted by the Department of the Navy. The specification is in the SPECSINTACT format to accommodate editing the magnetic media edition using the SPECSINTACT Computer System to produce the project specification section.**

2. **Technical Notes are interspersed in the body of the specification, if they are ten lines or less, and are separated from the text by a line of asterisks above and below the note. Technical Notes more than ten lines or repeated more than three times remain at the end of the specification under the heading "Criteria Notes," with a notation in the text. All Technical Notes and Criteria Note notations immediately precede the text to which they apply. DO NOT PRINT CRITERIA (TECHNICAL) NOTES OR NOTATIONS IN THE FINAL MANUSCRIPT OF THE PROJECT SPECIFICATION SECTION CREATED FROM THIS GUIDE SPECIFICATION. (Notes can be deleted automatically when using SPECSINTACT.)**

3. **Do not refer to this guide specification in the project specification. Use it as a manuscript to prepare the project specifications. Edit and modify this guide specification to meet project requirements. Where "as shown," "as indicated," "as detailed," or words of similar import are used, include all requirements so designated on the project drawings.**

4. **Do not include the following parts of this NFGS in the project specification:**

    a. Signature Sheet
    b. Table of Contents
    c. Notes or Criteria Notes
    d. Sketches, if any
    e. General Notes
    f. Other supplemental information, if any, attached to this guide specification.

    Use all parts listed above in the editing process but, when working with printed copy, detach them (where possible) as the first step in editing this guide specification for inclusion in a project specification. (All parts listed above are automatically deleted when printing without notes in SPECSINTACT.) If required for the construction contract, sketches and figures shall be placed on the project drawings. Where there are no project drawings, sketches and figures may be included as a part of the project specification, if required.

5. Project title shall be placed in the upper left corner of each page and is limited to 66 character spaces on one line. (Automatically printed when using SPECSINTACT if the project title is entered as the title in the Job Set-Up Screen).

6. Project specification number shall be placed in the upper right corner of each page. (Automatically printed when using SPECSINTACT if the project specification number is entered as the job name in the Job Set-Up Screen.)

7. Project specification section number and page number shall be centered at the bottom of each page of the section created from this guide specification. (Automatically printed when using SPECSINTACT.)

8. Where numbers, symbols, words, phrases, clauses, sentences, or paragraphs in this guide specification are enclosed in brackets, [], a choice or modification must be made; delete inapplicable portion(s) and brackets. Where blank spaces enclosed in brackets occur, insert appropriate data. Delete inapplicable text and, if not using SPECSINTACT, renumber subsequent articles, paragraphs, sub-paragraphs, accordingly. (Renumbering is done automatically during the print process when using SPECSINTACT.)

9. In compliance with CSI format, article 1.1 SUMMARY has been added to the specification. Use of this article is considered optional by CSI. NAVFAC does not use this article. Article 1.1 shall be deleted for a project specification, but must be present in all guide specifications.

10. Article title has been changed to "REFERENCES" and is always numbered 1.2. This article contains no numbered paragraphs or subparagraphs. Each organization's publications are listed beneath the organization name. Revision letters or dates identifying the current edition of the publication appear in the column with the title.

11. The latest issue of the referenced publications shall be used, but only after reviewing the latest issue to ensure that it will satisfy the minimum essential requirements of the project. If the latest issue of a referenced publication does not satisfy project requirements:

    1. Use the issue shown; or
    2. Select and refer to a document which does; or
    3. Incorporate the pertinent requirements from the document into the project specification.

    Inform the Preparing Activity and NAVFACENGCOM if the latest issue of a referenced publication is not compatible with this guide specification. Delete those publications not referred to in the text of this section created from this guide specification.

12. The "SUBMITTALS" article in Part 1 of the section includes a coding system on the magnetic media edition. This provides a project "Submittals List" automatically when editing the magnetic media edition utilizing the SPECSINTACT computer programs on appropriate hardware. The coding system prints two letters and two numbers on the hard copy

for each Submittal type (i.e. SD-14 for "Samples"). The letters and number (i.e., SD-14 for "Samples") are Submittal Descriptions defined in Section 01300, "Submittals."

13. Specifications shall not repeat information shown on the drawings. Specifications shall establish the quality of materials and workmanship, methods of installation, equipment functions, and testing required for the project. Drawings shall indicate dimensions of construction, relationship of materials, quantities, and location and capacity of equipment.

14. CAUTION: Coordination of this section with other sections of the project specification and with the drawings is mandatory. If materials or equipment are to be furnished under this section and installed under other sections or are indicated on the drawings, state that fact clearly for each type of material and item of equipment. Review the entire project specification and drawings to ensure that language is included to provide complete and operational systems and equipment.

15. Any changes or revisions to this document, since the date of the original approval for NAVFAC, have been performed by the Guide Specifications Division (Code DS03) located at the Naval Construction Battalion Center at Port Hueneme, California 93043-5000. (Phone: 805 982-6103)

16. Suggestions for improvement of this specification will be welcomed using the "Agency Reponse Form" located in SPECSINTACT under "System Directory" or DD Form 1426. Suggestions should be forwarded to:

    Commanding Officer
    Naval Construction Battalion Center
    Civil Engineer Support Office
    Code DS03
    Port Hueneme, CA 93043-5000

-- End of General Notes --

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.
2. The submitter of this form must complete blocks 4, 5, 6, and 7.
3. The preparing activity must provide a reply within 30 days from receipt of the form.

NOTE: This form may not be used to request copies of documents, nor to request waivers, or clarification of requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

I RECOMMEND A CHANGE:	1. DOCUMENT NUMBER	2. DOCUMENT DATE (YYMMDD)

3. DOCUMENT TITLE

4. NATURE OF CHANGE (*Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.*)

5. REASON FOR RECOMMENDATION

6. SUBMITTER

a. NAME (*Last, First, Middle Initial*)	b. ORGANIZATION	
c. ADDRESS (*Include Zip Code*)	d. TELEPHONE (*Include Area Code*) (1) Commercial (2) AUTOVON (*If applicable*)	7. DATE SUBMITTED (YYMMDD)

8. PREPARING ACTIVITY

a. NAME	b. TELEPHONE (*Include Area Code*) (1) Commercial	(2) AUTOVON
	(805) 984-8025	551-5801/ext: 450
c. ADDRESS (*Include Zip Code*) Civil Engineer Support Office (Code 158A) Naval Construction Battalion Center Port Hueneme, CA 93043-5000	IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT: Defense Quality and Standardization Office 5203 Leesburg Pike, Suite 1403, Falls Church, VA 22041-3466 Telephone (703) 756-2340 AUTOVON 289-2340	

APPENDIX G

Asbestos Glossary

ASBESTOS GLOSSARY

Sources of Definitions:

AHERA Inspecting Buildings for Asbestos-Containing Materials Coarse,
Georgia Institute of Technology
Atlanta, GA
November 16-18, 1987

and

Environmental Institute
Cobb Corporate Center/300
350 Franklin Road
Marietta, GA 30067
June 1990, 6th Edition

Abatement - Procedures to control or otherwise limit fiber release from asbestos-containing or contaminated building materials. Includes stripping, removal, encapsulation, disposal, wet cleaning, etc.

ABIH - American Board of Industrial Hygiene

Acoustical Insulation - The general application or use of asbestos for the control of sound due to its lack of reverberant surfaces.

Acoustical Tile - The general application or use of asbestos for the control of sound due to its lack of reverberant surfaces.

Actinolite - One of six naturally-occurring asbestos minerals. It is not normally used commercially.

Action Level - A level of airborne fibers specified by OSHA as a warning or alert level. It is 0.1 fibers per cubic centimeter of air, 8-hour time-weighted average, as measured by phase contrast microscopy. EPA has currently proposed to lower the time-weighted average to 0.1 fibers per cubic centimeter of air and getting rid of the action level, but it has not been passed as of February 1991.

Addenda - Changes made to working drawings and specifications before the work is bid.

Aggressive Sampling	-	An air sampling technique typically used for final clearance air sampling wherein the area and surfaces surrounding the air sampling equipment are agitated, brushed, blown with air jets or mechanical fans or otherwise disturbed in an effort to resuspend any settled dust. This technique greatly extends the sensitivity of final clearance air sampling to the presence of residual asbestos fibers and thereby provides a potent means of assessing the thoroughness of project cleanup efforts.
AHERA	-	Asbestos Hazard Emergency Response Act; passed in 1986 to ensure all kindergarten through 12th grade schools are surveyed for asbestos and to have an operations and maintenance plan implemented to monitor the asbestos and its conditions.
AIA	-	Asbestos Information Association
AIA	-	American Institute of Architects
AIA	-	American Insurance Association
AIHA	-	American Industrial Hygiene Association
AIHA Accredited Laboratory	-	A certification given by the AIHA to an analytical laboratory that has successfully participated in the "Proficiency Analytical Testing" program for quality control as established by the National Institute for Occupational Safety and Health.
Air Diffuser	-	A device designed to disperse an air stream throughout a given area.
Air Lock	-	A system for permitting entrance or exit air movement between a contaminated area and an uncontaminated area, typically consisting of two curtained doorways at least 3 feet apart.
Air Man	-	An industrial hygienist or other qualified individual who collects air samples and monitors the asbestos abatement worksite.
Air Monitoring	-	The process of measuring the airborne fiber concentration of a specific quantity or air over a given amount of time.

Air Plenum	-	Any space used to convey air in a building or structure. The space above a suspended ceiling is often used as an air plenum.
Air Sampling	-	The process of measuring the fiber content of particulate mass of a specific volume of air in a stated period of time.
Air Sampling Technician	-	A person experienced, trained and tested in appropriate air sampling techniques (particularly NIOSH P&CM 239 and Method 7400 procedures) and in the operation and maintenance of air sampling equipment.
Airborne Asbestos Analysis	-	Determination of the amount of asbestos fibers suspended in a given amount of air.
Alveolar Macrophages	-	Highly specialized mobile cells in the lungs that attempt to engulf and digest such lung hazards as dusts or fibers.
Alveoli	-	Located in clusters around the respiratory bronchioles of the lungs, this is the area in which true respiration takes place.
Ambient Air	-	The surrounding air or atmosphere in a given area under normal conditions.
Amended Water	-	Water to which an appropriate surfactant has been added. This surfactant must, at least, meet the minimum specifications set forth by the U.S. Environmental Protection Agency. EPA recommends a wetting agent consisting of 50% polyethylene ester and 50% polyethylene ether in a ratio of 1 ounce to 5 gallons of water. This wetting agent is not as effective with materials which contain a high percentage of amosite asbestos because amphiboles (i.e. amosite) are hydrophobic.
Amosite (Brown Asbestos)	-	An Asbestiform mineral of the amphibole group. It is the second most commonly used form of asbestos in the U.S., containing approximately 50% silicon and 40% Iron (II) oxide, and is made up of straight, brittle fibers, light grey to pale brown in color.
Amphibole	-	One of the two major groups of minerals from which the asbestiform minerals are derived--distinguished by their chain-like crystal structure and chemical composition. Amosite and crocidolite are examples of amphibole minerals.

ANSI	-	American National Standards Institute
Anthophyllite	-	One of six naturally-occurring asbestos minerals. It is of limited commercial value.
Approved Landfill	-	A site for the disposal of asbestos-containing and other hazardous wastes that has been given EPA approval.
As-Built Drawings	-	Drawings and specifications which reflect the way a building was actually constructed.
Asbestiform Minerals	-	Minerals which, due to their crystal structures and chemical composition, tend to be separated into fibers and can be classified as a form of asbestos.
Asbestos	-	A generic name given to a number of naturally-occurring hydrated mineral silicates that possess a unique crystalline structure, are incombustible in air, and are separable into fibers. Asbestos includes the asbestiform varieties of chrysotile (serpentine), crocidolite (riebeckite), amosite (cummingtonite-grunerite), anthophyllite, antinolite, and tremolite.
Asbestos Bodies	-	Coated asbestos fibers often seen in the lungs of asbestos-exposure victims.
Asbestos-Containing Building Material (ACBM)	-	Surfacing ACM, thermal system insulation ACM, or miscellaneous ACM that is found in or on interior structural members or other parts of a school building (AHERA Definition).
Asbestos-Containing Material (ACBM)	-	Any material or product which contains more than one (1) percent asbestos (EPA Definition).
Asbestos-Contaminated Elements	-	Any objects that have been exposed to airborne asbestos fibers without being sealed off or isolated.
Asbestos Contaminated Material	-	Any materials, substance or item containing asbestos.
Asbestos Control	-	Minimizing the generation of airborne asbestos fibers until a permanent solution is developed.

Asbestos Exposure Assessment System	-	A decision tool which can be used to determine the extent of the asbestos hazard that exists in a building, and which can also be used to develop actions.
Asbestos Fibers	-	Fibers with their length being greater than five microns (length to width ratio of 5:1), generated from an asbestos-containing material.
Asbestos Filtration Device (AFD)	-	Filtered exhaust ventilation equipment used for drawing inside enclosed work areas. Such equipment shall have at least three filter stages, including readily accessible pre- and secondary filters, and a final filter which shall be a high efficiency particulate air (HEPA) filter rated 99.97 percent effective in capturing particles having diameters of 0.3 micrometers. Electrostatic precipator AFDS are permitted only if the exhaust is HEPA-filtered.
Asbestos Standard	-	Reference to the OSHA requirements in the general industry standards regarding asbestos exposure (29 CFR 1910.1001 and 1926.58), and EPA National Emission Standard for Hazardous Air Pollutants (NESHAP) 40 CFR 61, subpart M).
Asbestosis	-	A scarring of the lungs caused by exposure to asbestos. Continued exposure may lead to degeneration of lung function and death.
Aspect Ratio	-	The length of a fiber vs. its width.
Atmospheres Immediately Dangerous to Life or Death	-	A hazardous atmosphere to which exposure exposure will result in serious injury or death in a matter of minutes, or cause serious delayed effects.
Atmosphere Supplying Respirators	-	Respiratory protection devices which exclude workplace air altogether and provide clean air from some independent source.
Barrier	-	Polyethylene sheeting and/or other materials which, when used in conjunction with the existing floors, ceilings, and walls of the structure, form the enclosed work area. The barrier separates the contaminated work environment from the uncontaminated environment.
Bid	-	A statement of the price at which a contractor will complete a given project.

"Blue Book"	-	EPA publication of March 1983 titled, "Guidance for Controlling Friable Asbestos-Containing Materials in Buildings." Now replaced by 1985 revised edition.
Breeching	-	A duct that transports combustion gases from a boiler or heater to a chimney or stack. Also called a flue.
Bridging Encapsulant	-	The application of a sealant over the surface of asbestos-containing material to prevent the release of asbestos fibers.
Bronchi	-	Primary branches of the trachea (windpipe).
Bronchogenic Cancer	-	An abnormal cell growth in the primary branches of the trachea (windpipe).
Bulk Samples	-	Samples of bulk material, in the case of asbestos, suspect material.
Cancer	-	A cellular tumor which normally leads to premature death of its host unless controlled.
Carbon Monoxide	-	A highly toxic colorless and odorless gas.
Ceiling Concentration	-	The maximum allowable level of toxic material that can be present at any given point in time.
Cementitious	-	Asbestos-containing materials that are densely packed, granular and are friable.
CFM	-	Cubic feet per minute.
Chain-of-Custody	-	Formal procedures for tracking samples and insuring their integrity.
Change Order	-	A change to construction documents after a contract for construction has been signed.
Chrysotile (White Asbestos)	-	The only asbestiform mineral of the serpentine group, which contains approximately 40% each of silica and magnesia oxide. It is the most common form of asbestos used in buildings. Recent studies have found this form of asbestos to pose little hazard to humans, however, the contaminate tremolite, an inseparable asbestos form with chupatile, has a large potential for bodily harm in humans.

CIH	-	An industrial hygienist who has been granted certification by the American Board of Industrial Hygiene, used to supervise surveys and design for asbestos abatements.
Cilia	-	Tiny hair-like structures in the windpipe and bronchi of the lung passages that help force undesirable particles and liquids up and out of the lungs.
Claims-Made Insurance	-	A form of insurance in which a claim is allowed only if the insurance is in effect when the claim is made, that is, when the injury of effect is observed.
Claustrophobia	-	The fear of being in enclosed or narrow spaces.
Clean Room (Clean Area)	-	An uncontaminated area or room outside the enclosed work area and part of the work area isolation structure, with provisions for storage of workers' street clothes and protection equipment.
Clerk of the Works	-	A person who coordinates and oversees all activities on an asbestos abatement job site.
Closed Circuit SCBA	-	A self-contained respiratory protection device in which the air is rebreathed after the exhaled carbon dioxide has been removed and the oxygen content restored.
Columns	-	The building components which support the structural beams.
Compressed Oxygen Cylinder Type Close Circuit SCBA	-	A self-contained respiratory protection device in which air is supplied from a compressed air cylinder. The exhaled air is filtered to remove carbon dioxide, and additional breathing air is provided.
Concrete-like Asbestos	-	Hard, non-friable asbestos-containing material that requires a mechanical force to penetrate its surface.
Continuous Flow Airline Device	-	A respirator that maintains a constant air-flow to the wearer.
Contract Documents	-	Legally binding building drawings and specifications. Also called construction documents.

Contract Specifications - A set of guidelines that a contractor must follow when conducting an asbestos abatement job.

CPSC - Consumer Product Safety Commission.

Criteria Document - NIOSH publications that address toxic materials, analytical methods, personal protective equipment, etc.

Crocidolite Blue Asbestos - Strongest of asbestos minerals. An asbestiform mineral of the amphibole group. It is of minor commercial value in the U.S.

Curtained Doorway - A device designed to restrict air movement between areas, typically constructed by placing three overlapping sheets of polyethylene film over an existing or temporarily framed doorway, securing all sheets using a plier stapler, along the top of the doorway, securing the vertical edge of the outside sheet along one vertical side of the doorway, the second sheet along the doorway vertical edge opposite the first, and the third sheet around the entire doorway (including base).

Damaged Friable Surfacing Material - Friable surfacing ACM which has deteriorate or sustained physical injury such that the internal structure (cohesion) of the material is inadequate or, if applicable, which has delaminated such that the bond to the substrate (adhesion) is inadequate or which for any other reason lacks fiber cohesion or adhesion qualities. Such damage or deterioration may be illustrated by the separation of ACM into layers; separation of ACM from the substrate; flaking, blistering, or crumbling of ACM surface; water damage; significant or repeated water stains, scrapes, gauges, mars or other signs of physical injury on the ACM. Asbestos debris originating from the ACBM in question may also indicate damage (AHERA Definition).

Damaged or Significantly Damaged Thermal System Insulation - Thermal system insulation on pipes, boilers, tanks, ducts, and other thermal system insulation equipment in which the insulation has lost its structural integrity, or its covering, in whole or in part, is crushed, water-stained, gouged, punctured, missing, or not intact such that it is not able to contain fibers. Damage

may be further illustrated by occasional punctures, gouges, or other signs of physical injury to ACM; occasional water damage on the protective coverings\ jackets; or exposed ACM ends or joints. Asbestos debris, originating from the ACBM in question may also indicate damage (AHERA Definition).

Decontamination Enclosure System - A series of connected rooms with airlocks for the purpose of preventing contamination of areas adjacent to the work area.

Demand Airline Device - A respirator in which air enters the facepiece only when the wearer breathes in.

Dirty Area - Any area in which the concentration of airborne asbestos fibers exceeds 0.01 f/cc, or where there is visible asbestos residue.

Dispersion Staining - Used in conjunction with polarized light to identify bulk samples. A particle (fiber) identification technique based on the difference between light dispersion of a particle (fiber) and a liquid medium in which it is immersed.

Disposal - All procedures necessary to transport and deposit the asbestos contaminated waste materials stripped and/or removed from the building in an approved waste disposal site in compliance with Sections 61.152 and 156 of the EPA Regulations (40 CFR 61) and Sections 172.101 and 173.1090 of the DOT Regulations (49 CFR).

Dose-Response Effect - The relationship between the amount of pollutant a person is exposed to (dose) and the increase risk of disease (effect). Usually, the greater the dose, the greater the effect.

Duct Tape - Heavy gauge tape capable of sealing joints or adjacent sheets of polyethylene.

Dust Mask - Single use or disposable dust respirator with a low protection factor.

Electrical Systems - The system of wires, lights, power generation equipment, and related facilities to produce, convey, and utilize electrical power in a building.

Electron Microscopy - A method of asbestos sample analysis which utilizes an electron beam to differentiate between fibers.

Employee Notification - Informing employees or building occupants if asbestosis present in the building, also informing them of the hazards associated with asbestos exposure, what is being done to eliminate the problem, etc.

Employer's Liability - Legal responsibility imposed on an employer requiring him/her to pay damages to an injured employee.

Encapsulant (Sealant) - A liquid material which can be applied to friable asbestos-containing materials and which controls the possible release of asbestos fibers from the material either by creating a membrane over the surface (bridging encapulant) or by penetrating into the material and binding its components together (penetrating encapsulant).

Encapsulation - All specified procedures necessary to coat asbestos-containing or asbestos contaminated materials with an encapsulant to control the possible release of asbestos fibers into the ambient air; all specified procedures necessary to render inaccessible asbestos-containing materials non-friable and incapable of releasing asbestos fibers in to the ambient air by using a penetrating encapsulant.

Enclosed Work Area - An isolated area of the facility where abatement activities are performed.

Enclosure - A resilient structure, built (or sprayed) around ACM designed to prevent disturbance and contain released fibers.

EPA - Environmental Protection Agency.

EPA Regulations - Regulatory standards which cover emissions to the outside environment from a workplace and disposal of hazardous wastes from job sites.

Epidemiology - The study of causes, occurrence and distribution of disease throughout a population.

Equipment Room - A contaminated area or room inside the work area which is part of the work area isolation structure, with provisions for storage of contaminated clothing and equipment.

Establishing Responsibility - An asbestos program manager is designated and is given the responsibility for directing and managing asbestos control program activities.

Eyepiece - A component of a full facepiece respirator which is a gas-tight transparent window through which the wearer may see.

Facepiece - The portion of a respirator which covers the wearer's nose, mouth, and eyes in a full facepiece.

Fallout - The intermittent release of fibers which occurs as a result of weakened bonds in the material, or because of deterioration.

F/CC - Fibers per cubic centimeters of air.

FEV_1 - The maximum volume of air than can be forced from an individual's fully inflated lungs in one second (Forced Expiratory Volume - one second).

Fiber Containment - Enclosing or sealing off an area having airborne asbestos fibers present so that the fibers will not migrate resulting in contamination of other areas.

Fiber Control - Minimizing the amount of airborne fiber generation through the application of amended water onto asbestos-containing material, or enclosure (isolation) of the material.

Fiber Releasability - The potential for generation of airborne fibers from an asbestos-containing source.

Fiber Reynolds Number - Refers to the diameter of a fiber.

Fibrosis - A condition of the lungs caused by the inhalation of excessive amounts of fibrous dust marked by the presence of scar tissue.

Fibrous - Composed almost entirely of fibers.

Fibrous Aerosol Monitor (FAM) - A portable survey instrument with the capability of providing instantaneous airborne fiber concentration readings.

Fireproofing - Spray- or trowel-applied fire-resistant materials.

Friable - Material that can be crumbled or reduced to powder by hand pressure.

Full Facepiece Respirator - A respirator which covers the wearer's entire face from the hairline to below the chin.

Functional Spaces - Spatially-distinct units within a building which contain identifiable populations of building occupants or building uses.

FVC - Forced Vital Capacity. The measured quantity of air that can be forcibly exhaled from a person's lungs after full inhalation.

Green Book - EPA publication of July 1990 titled "Managing Asbestos in Place: A Building Owner's Guide to Operations and Maintenance Programs for Asbestos-Containing Materials, 1990.

Glovebag - Plastic bag-type enclosure placed around asbestos-containing pipe lagging so that it may be removed without generating airborne fibers into the atmosphere.

Glove-box (bag) - Plastic enclosure placed around a specific operation such as a valve to contain small areas of materials for asbestos removal.

Grade D Air - Breathing air which has between 19.5% - 23% oxygen, no more than 5 mg/m^3 of condensed hydrocarbons, no more than 20 ppm of carbon monoxide, no pronounced odor, and a maximum of 1,000 ppm carbon dioxide.

Ground Fault Circuit Interrupter - A circuit breaker that is sensitive to very low levels of current leakage from a fault in an electrical system.

Ground Fault Interrupter - A device which automatically de-energizes any high voltage system component which has developed a fault in the ground line.

Half Mask- High Efficiency	-	A respirator which covers one-half of the wearer's face and is equipped with filters capable of screening out 99.97% of all particles larger than 0.3 microns.
Heat Cramps	-	Painful spasms of heavily used skeletal muscles such as hands, arms, legs, and abdomen which are sometimes accompanied by dilated pupils and weak pulse resulting from depletion of the salt content of the body.
Heat Exhaustion	-	A condition resulting from dehydration and/or salt depletion, or lack of blood circulation which is usually accompanied by fatigue, nausea, headache, giddiness, clammy skin, and a pale appearance.
Heat Stress	-	A bodily disorder associated with exposure to excessive heat.
Heat Stroke	-	The most severe of the heat stress disorders resulting from the loss of the body's ability to sweat which is characterized by hot dry skin, dizziness, nausea, severe headache, confusion, delirium, loss of consciousness, convulsion, and coma.
HEPA Vacuum Equipment	-	High efficiency particular air, filtered vacuuming equipment with a filter system capable of collecting and retaining asbestos equipment with a filter system capable of collecting and retaining asbestos fibers. Filters must have a retention efficiency of 99.97 percent or greater for particles having diameters of 0.3 micrometers.
High Efficiency Particulate Air (HEPA)	-	A type of filter which is 99.97% efficient at filtering particles of 0.3 micrometersin diameter.
Holding Area	-	The room between the washroom and the truck loading area where decontaminated waste is stored.
Homogeneous	-	Evenly mixed and similar in appearance and texture throughout.
Homogeneous Areas	-	An area which contains material that is uniform in color, texture, and appears identical in every other respect.

Hose Masks - Respirators that supply air from an uncontaminated source through a strong, large diameter hose to the facepiece that does not use compressed air or have any pressure regulating devices.

HVAC Systems - Heating, ventilating and air conditioning; all building mechanical equipment including supply and return ductwork, unit ventilators, fan-coil units, blower cabinets and fans, control devices, damper assemblies and other similar mechanical equipment.

Indemnify - To pay for or pay back. Indemnification clauses in contacts are intended to cover the cost of judgments and/or legal defenses in the event of litigation.

Independent Testing - A qualified organization capable of performing necessary air sampling and analysis and other testing requirements of asbestos projects. The laboratory should successfully participate in the National Voluntary Laboratory Accreditation Program (NVLAP) for bulk sample analysis conducted by the National Institute for Standards and Technology (NIST) and the National Institute for Occupational Safety and Health (NIOSH) Proficiency in Analytical Testing (PAT) program, and have on staff at least one American Board of Industrial Hygiene certified industrial hygienist and be accredited by the American Industrial Hygiene Association.

Industrial Hygienist - A person having a college or university degree or degrees in engineering, chemistry, physics, medicine or related physical and biological sciences who, by virtue of special studies and training, has acquired competence in industrial hygiene.

Joists - The structural building component which the flooring or roof rests on.

Local Exhaust Ventilation - The mechanical removal of air contaminants from a point of operation.

Lagging - Insulation used to prevent heat loss from pipes, boilers and similar mechanical equipment.

Latency Period - The time between first exposure to a disease-causing agent and the appearance of the disease.

Liability - Being subject to legal action for one's behavior.

Logbook - An official record of all activities which occurred during a removal project.

Lung Cancer - A malignant growth of tissue in the lungs, specifically of the bronchi covering.

Make-up Air - Supplied or recirculated air to offset that which has already been exhausted from an area.

MCEF - Mixed Cellulose Ester Filter which is one of several different types of media used to collect asbestos air samples.

Mechanical Filter Respirator - A respiratory protection device which offers protection against airborne particulates including dusts, mists, metal fumes, and smokes.

Mechanical Systems - See HVAC Systems.

Medical Examinations - An evaluation of a person's health status conducted by a medical doctor.

Medical History - A record of a person's past health record, including all the hazardous materials that they have been exposed to and also any injuries or illnesses which might dictate their future health status.

Mesothelioma - A rare cancer of the lining around the lungs (pleura) or the abdomen (peritoneum). It is almost always caused by exposure to asbestos.

Method 7400 - NIOSH sampling and analytical method for fibers using phase-contrast microscopy. Replaces method P&CAM 239.

Micron - One millionth of a meter.

Mil - Prefix meaning one-thousandth.

Millimeter - One-thousandth of a meter.

Mineral Wool - A commonly used substitute for asbestos.

Miscellaneous Material	-	Interior building material on structural components, structural members or fixtures, such as floor and ceiling tiles, and does not include surfacing material or thermal system insulation (AHERA Definition).
MSDS	-	Material Safety Data Sheet.
MSHA	-	Mine Safety and Health Administration.
Negative Pressure	-	An atmosphere created in a work area enclosure such that airborne fibers will tend to be drawn through the filtration system rather than leak out into the surrounding areas. The air pressure inside the work area is less than that outside the work area.
Negative Pressure Respirator	-	Respirators which function by the wearer breathing in air through a filter.
Negative Pressure	-	A form of qualitative fit testing in which the wearer covers the filters of a negative pressure, air-purifying respirator to check for leaks around the face seal.
NESHAP	-	National Emission Standards for Hazardous Air Pollutants--EPA Regulation 40 CFR subpart M, part 61.
NIOSH	-	The National Institute for Occupational Safety and Health which was established by the Occupational Safety and Health act of 1970.
NIOSH/MSHA	-	The official approving agencies for respiratory protective equipment who test and certify respirators.
NIOSH Method 7400	-	NIOSH proposed sampling and analytical method for asbestos in air, No. 7400, "NIOSH Manual of Analytic Methods, Third Edition."
Numerical Value	-	Refers to the types and percentages of asbestos present in a given samples.
Occurrence Insurance	-	A form of insurance in which a claim is allowed regardless of when the claim is filed. For asbestos insurance, the "occurrence" could be the time of first exposure.

Oilless Compressor	-	An air compressor that is not oil lubricated, which does not allow carbon monoxide to be formed in the breathing air.
Open Circuit SCBA	-	A type of self-contained breathing unit which exhausts the exhaled air to the atmosphere instead of recirculating it.
Operations and Maintenance Plan (OMP)	-	Specific procedures and practices developed for the interim control of asbestos-containing materials in buildings until it is removed.
"Orange Booklets"	-	EPA publications issued in March 1979 titled: Asbestos-Containing Materials in School Buildings: A Guidance Document, parts I and II.
OSHA	-	The Occupational Safety and Health Administration which was created by the Occupational Safety and Health Act of 1970; serves as the enforcement agency for safety and health in the workplace environment.
Oxygen Deficient Atmosphere	-	Any atmosphere containing less than 19.5% oxygen.
P&CAM 239	-	NIOSH approved sampling and analytical method for asbestos in air, published in the "NIOSH Manual of Analytical Methods, Second Edition."
PF	-	Protection factor as provided by a respirator which is determined by dividing the airborne fiber concentration outside of the mask by the concentration inside the mask.
PAT Samples	-	Proficiency Analytical Testing of asbestos samples conducted through NIOSH for laboratories involved with the analysis of asbestos samples.
Particulate Contaminants	-	Minute airborne particles given off in the form of dusts, smokes, fumes, or mists.
PEL	-	Permissable Exposure Limit as stated by OSHA.
Penetrating Encapsulant	-	Liquid material applied to asbestos-containing material to control airborne fiber release by penetrating into the material and binding its components together.

Peritoneum - The thin membrane that lines the surface of the abdominal cavity.

Permissible Exposure Level (PEL) - A level of airborne fibers specified by OSHA as an occupation exposure standard for asbestos. It is 0.2 fibers per cubic centimeter of air, 8-hour time-weighted average, as measured by phase contrast microscopy.

Personal Protective Equipment (PPE) - Any material or device worn to protect a worker from exposure to, or contact with, any harmful material or force.

Personal Sample - An air sample taken with the sampling pump directly attached to the worker with the collecting filter placed in the worker's breathing zone.

Personnel Protection - Notification and instruction of all workers prior to the beginning of a project as to the hazards associated with the job and what they can do to protect themselves from these hazards.

Phase Contrast Microscopy (PCM) - An optical microscopic technique used for the counting of fibers in air samples, but which does not distinguish fiber types.

Physical Assessment - Assessing suspect material to determine the current condition of the material.

Pipe Lagging - The insulation or wrapping around a pipe.

Plenum - A horizontal space designed to transport air in a building. Plenum are commonly the space between a suspended ceiling and the floor above.

Pleura - The membrane encasing each lung.

Plumbing System - The system of pipes, valves, fittings and related components designed to convey liquid or gas fluids throughout a building. Some piping may also be part of the HVAC system.

Pneumoconiosis - A condition in the lungs which is a result of having inhaled various dusts and particles for a prolonged period of time.

Polarized Light Microscopy (PLM) - A method of analyzing bulk samples for asbestos in which the sample is illuminated with polarized light (light which vibrates in only one plane) and viewed under a light microscope.

Polyethylene - Plastic sheeting which is often used to seal off an area in which asbestos removal is taking place for the purpose of preventing contamination of other areas.

Positive Pressure Respirators - Respirators which function by blowing air or providing pressurized air to the wearer.

Positive Pressure Respirator Check - A form of qualitative fit testing in which the wearer covers the exhalation valve of a negative pressure, air-purifying respirator to check for leaks around the face seal.

Posting - Refers to caution or warning signs which should be posed in any area in which asbestos removal is taking place, or where airborne fiber levels may present a health hazard.

Powered Air Purifying Respiratory (PAPR) - Either a full facepiece, helmet, or hooded respirator that has the breathing air powered to the wearer after it has been purified through a filter.

Pre-Construction Conference - A meeting held before any work begins between the contractor and the building owner at which time the job specifications are discussed and all details of the work agreed upon.

Pre-Employment Physical - Complete medical examination of an employee before the job begins to determine whether or not he/she is fit to perform the functions of their employment.

Pressure Demand Airline Devices - A respiratory protection device which has a regulator and valve design such that there is a continuous flow of air into the facepiece at all times.

Prevalent Levels - Levels of airborne contaminants occurring under normal conditions.

Prevalent Samples - Air samples taken under normal conditions (background samples).

Professional Industrial Hygienist - A person possessing either a baccalaureate degree in engineering, chemistry or physics, or a baccalaureate degree in a closely related biological or physical science from an accredited college or university and who also has a minimum of three years of individual hygiene experience.

Progress Payments - A pre-work agreement whereby the building owner pays the contractor after completion of certain phases of the project.

Protection Factor (PF) - A number which reflects the degree of protection provided by a respirator. It is calculated by dividing the concentration of contaminant outside the mask by the concentration inside the mask.

Protective Clothing - Protective, lightweight garments worn by workers performing asbestos abatement to keep gross contamination off the body.

Pulmonary - Pertaining to, or affecting the lungs, or some portion thereof.

Pulmonary Function Tests - A part of the medical examination required to determine the health status of a person's lungs.

Purple Book - EPA publication of June 1985 titled, "Guidance for Controlling Asbestos-Containing Materials in Building, 1985 Edition." This document is a revision of the "Blue Book."

Qualitative Fit Test - A method of testing a respirator's face-to-facepiece seal by covering the inhalation or exhalation valves and either breathing in or out to determine the presence of any leaks.

Quality Assurance - A program for collecting and analyzing additional samples of suspect material to check on the reliability of procedures.

Quantitative Fit Testing - Testing the fit of a respirator by calculating concentrations of contaminants inside and outside the mast. This requires the use of instruments.

Rales - An abnormal cracking sound heard from the lungs which does not necessarily indicate any specific disease.

Random Sample	-	A sample drawn in such a way that there is no set pattern and is designed to give a true representation of the entire population or area.
Recordkeeping	-	Detailed documentation of all program activities, decisions, analyses, and any other pertinent information to a project.
Regulated Areas	-	Areas where fiber levels may exceed OSHA's permissible exposure limit.
Removal	-	All specified procedures necessary to remove and properly dispose of ACM.
Resolution	-	The ability to distinguish between individual objects, as with a microscope.
Respiration	-	The exchange of gases in the lungs.
Respirator Program	-	A written program established by an employer which provides for the safe use of respirators on their job sites.
Respiratory Protection Program	-	A set of procedures and equipment required by OSHA if employees wear negative pressure respirators or if fiber levels are above the PEL.
Respiratory Tract	-	The organs of the body which convey air to the blood, allow exchange of gases, and remove carbon dioxide.
Resuspension	-	The secondary dispersal or re-entrainment of settled fibers which have previously been released by impact or fallout.
Rip-Out	-	The uncontrolled removal of asbestos-containing materials from a building.
Risk	-	The likelihood or probability of developing a disease, or being hurt, as the result of exposure to a contaminant or a condition.
SCBA	-	Self-Contained Breathing Apparatus
Safety Glasses	-	Protective eye equipment.

Scanning Electron Microscopy (SEM)	-	A method of microscopic analysis which utilizes an electron beam directed at the sample and then collects the beams that are reflected to produced an image from which fibers can be identified and counted.
Scanning Transmission Electron Microscopy (STEM)	-	A combination of a transmission electron microscope with scanning and focusing coils so that a beam of electrons can be scanned over the sample or pinpointed in a particular area.
Serpentine	-	One of the two major groups of minerals from which the asbestiform minerals are derived, distinguished by their tubular structure and chemical composition.
Shop Drawings	-	Detailed drawings of selected items used in the construction of a building.
Shower Room	-	A room between the clean room and the equipment room in a worker decontamination system in which workers take showers when leaving the work area.
Significantly Damaged Friable Surfacing Material	-	Friable surfacing ACM in a functional space where damage is extensive and severe (AHERA definition).
Specifications	-	A written set of standards, procedures, and materials for the construction of a building.
Spirometer	-	An instrument which measures the volume of air being expired from the lungs.
Steel Beams	-	Building components which support the joists.
Stripping	-	All specified procedures necessary to remove asbestos-containing materials or asbestos-contaminated materials from their substrate or from any component or structure of the building.
Structural Steel	-	A building component which is designed to support other structural members in a building.
Substrate	-	The material or existing surface located under or behind the asbestos-containing material.

Supplied Air Respirator - A respirator that has a central source of breathing air which is supplied to the wearer by way of an airline.

Surface Sample - Wipe or bulk sample taken from the suspect surface to ascertain presence of asbestos fibers.

Surfacing Material - Material in a building that is sprayed-on, troweled-on, or otherwise applied to surfaces, such as acoustical plaster on ceilings and fireproofing materials on structural members or other materials on surfaces for acoustical, fireproofing, or other purposes (AHERA definition).

Surfactant - A chemical wetting agent added to water to reduce its surface tension and thereby improve its penetrating capabilities into asbestos-containing materials.

Synergistic - The combination of two effects which is greater than the sum of the two independent effects.

TLV - Levels of contaminants established by the American Conference of Governmental Industrial Hygienists to which it is believed that workers can be exposed to with minimal adverse health effects. (Threshold Limit Values)

TWA - Time-Weighted Average, as in air sampling.

Thermal System Insulation - Material applied to pipes, fittings, boilers, breeching, tanks, ducts, or other interior, structural components to prevent heat loss or gain, or water condensation, or for other purposes.

Tort - A legal wrong, sometimes referred to as negligence.

Transite - A trade name for asbestos cementitious products.

Transmission Electron Microscopy (TEM) - A method of microscopic analysis which utilizes an electron beam that is focused onto a thin sample. As the beam penetrates (transmits) through the sample, the difference in densities produces an image on a fluorescent screen from which samples can be identified and counted.

Treated Cellulose	-	An insulation material made of paper or wood products with fire-retarding treatment added.
Tremolite	-	One of six naturally-occurring asbestos minerals. Tremolite has few commercial uses.
Type B Reader	-	A physician who is specialized training in reading x-rays, specifically in recognizing lung disorders.
Type C Supplied Air Respirator	-	A respirator designed to provide a very high level of protection which supplies air to the wearer from an outside source such as a compressor.
USEPA	-	United States Environmental Protection Agency.
Vermiculite	-	A micaceous mineral that is sometimes used as a substitute for asbestos which is lightweight and highly water-absorbent.
Visible Emissions	-	Airborne fibers given off from an asbestos-containing source that are visible to the human eye.
Visual Inspection	-	A walk-through type inspection of the work area to detect incomplete work, damage, or inadequate clean up of a worksite.
WBGT	-	Wet Bulb Globe Temperature, a heat stress index.
Wash Room	-	A room between the work area and the holding room in the equipment decontamination structure, with hot and cold or warm running water and suitably arranged for complete equipment and waste cleaning. Waste water must be either filtered or disposed of as asbestos contaminated waste.
Water Damage	-	Deterioration or delamination of ceiling or wall materials due to leaks from plumbing or cracks in the roof.
Wet Cleaning	-	The process of removing asbestos-contamination from building surfaces, equipment, objects, tools, disposal containers, etc. This may be accomplished by washing with cloths, mops, sponges, or brushes, or by showering with water in the wash room.

Wetting Agents	-	Materials that are added to water which is used for wetting the asbestos-containing material in order for the water to penetrate more effectively.
Work Area Isolation Structure	-	A series of connected rooms, typically consisting of a clean room, shower room and equipment room. It permits equipment and personnel movement to and from the enclosed work area while preventing air flow from the work area. It is also used for the decontamination of workers, materials and equipment.
Working Drawings	-	A set of drawings which reflect the intended construction and appearance of the building. Also known as building plans.
Workmen's Compensation	-	A system of insurance required in some states by law, financed by employers, which provides payments to employees or their families for occupational injuries, illnesses, or fatalities resulting in loss of wage or income incurred while at work.
8-Hour TWA	-	The time-weighted average for an 8-hour day; used in expressing airborne asbestos fiber concentrations.