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A Guide to Asbestos for Construction and Industry

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Allen Hughes, P.E.



Continuing Education and Development, Inc.

P: (877) 322-5800
info@cedengineering.com

This course was adapted from the “North Carolina Department of Labor (NCDOL)” Titled, “A Guide to Asbestos Construction and Industry”, which is in the public domain.

**N.C. Department of Labor
Occupational Safety and Health Program**

Cherie Berry
Commissioner of Labor
OSHA State Plan Designee

Allen McNeely
Deputy Commissioner for Safety and Health

Kevin Beauregard
Assistant Deputy Commissioner for Safety and Health

J. Edgar Geddie, Ph.D.
Reviewer

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The information in this guide was updated in 2013.

This guide is intended to be consistent with all existing OSHA standards; therefore, if an area is considered by the reader to be inconsistent with a standard, then the OSHA standard must be followed instead of this guide.

To obtain additional copies of this guide, or if you have questions about North Carolina occupational safety and health standards or rules, please contact:

**N.C. Department of Labor
Education, Training and Technical Assistance Bureau
1101 Mail Service Center
Raleigh, NC 27699-1101**

Phone: 919-807-2875 or 1-800-625-2267

Additional sources of information are listed on the inside back cover of this guide.

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Foreword

Once we thought asbestos was the perfect material to deal with many modern construction needs. Its tough, high-tensile strength and its ability to withstand heat and chemical stress were considered great assets.

Today we know that those desirable properties can come at a great health cost. We know now that inhaling asbestos fibers can cause disabling and fatal diseases. To protect workers from exposure to asbestos, employers are required to limit employee exposure to asbestos.

A Guide to Asbestos for Industry examines how to work around asbestos safely, particularly during abatement procedures. The seriousness of the threat that airborne asbestos poses to workers' health is also examined.

In North Carolina, the N.C. Department of Labor enforces the federal Occupational Safety and Health Act through a state plan approved by the U.S. Department of Labor. NCDOL offers many educational programs to the public and produces publications to help inform people about their rights and responsibilities regarding occupational safety and health.

When reading this guide, please remember the mission of the N.C. Department of Labor is greater than just regulatory enforcement. An equally important goal is to help citizens find ways to create safe workplaces. Everyone profits when managers and employees work together for safety. This booklet, like the other educational materials produced by the N.C. Department of Labor, can help.

Cherie Berry
Commissioner of Labor

Note

This guide is based upon the U.S. Department of Labor’s Occupational Safety and Health Administration’s booklets *Asbestos Standard for the Construction Industry* and *Asbestos Standard for General Industry*. Most of the material is taken directly from those publications, although some state specific changes have been made by J. Edgar Geddie, Ph.D., health standards officer with the NCDOL Occupational Safety and Health Division, to reflect the OSHA program in North Carolina. This booklet is intended to provide a generic overview of the standards-related topic and is not intended to alter or determine compliance responsibilities.

Generally speaking, 29 CFR 1910 standards apply to general industry and 29 CFR 1926 standards apply to the construction industry. However, in instances where there are gaps in coverage, standards may apply across boundaries.

The booklet is divided into two distinct parts. The first part discusses the “Asbestos Standard for the Construction Industry.” The second part follows with the “Asbestos Standard for General Industry.” The N.C. Department of Labor has combined the key parts of these two publications and offers them in this guide, *A Guide to Asbestos for Industry*. **This guide is intended to be consistent with all existing OSHA standards; therefore, if an area is considered by the reader to be inconsistent with a standard, then the OSHA standard should be followed.**

Part I

Asbestos Standard for the Construction Industry

Section 1

Important Facts About Asbestos

Background

Asbestos is the generic term for a group of naturally occurring fibrous minerals with high tensile strength, flexibility, and resistance to thermal, chemical and electrical conditions.

In the construction industry, asbestos is found in installed products such as shingles, floor tiles, cement pipe and sheet, roofing felts, insulation, ceiling tiles, fire-resistant drywall, and acoustical products. (See Table 1 for a partial list of asbestos-containing products and building materials that have been used over the last 80 years in the United States.) Very few asbestos-containing products are currently being installed. Consequently, most worker exposures occur during the removal of asbestos and the renovation and maintenance of buildings and structures containing asbestos.

Asbestos fibers enter the body by the inhalation or ingestion of airborne particles that become embedded in the tissues of the respiratory or digestive systems. Exposure to asbestos can cause disabling or fatal diseases, such as asbestosis, an emphysema-like condition; lung cancer; mesothelioma, a cancerous tumor that spreads rapidly in the cells of membranes covering the lungs and body organs; and gastrointestinal cancer. The symptoms of these diseases generally do not appear for 20 or more years after initial exposure.

OSHA began regulating workplace asbestos exposure in 1970, adopting a permissible exposure limit (PEL) to regulate worker exposures. Over the years, more information on the adverse health effects of asbestos exposure has become available, prompting the agency to revise the asbestos standard several times to better protect workers. On Aug. 10, 1994, OSHA issued a revised final standard regulating asbestos exposure in all industries. The newly revised standard for the construction industry lowered the PEL, cutting it in half from 0.2 fibers per cubic centimeter of air (f/cc) to 0.1 f/cc. The standard became effective Oct. 11, 1994; however, various provisions have later startup dates for compliance. (See “Occupational Exposure to Asbestos,” Title 29 Code of Federal Regulations (CFR) 1926.1101 for specific dates.)

Approximately 3.2 million workers in new construction, building renovation, and maintenance and custodial¹ work in buildings and industrial facilities are affected by the standard. OSHA estimates, conservatively, that about 42 additional cancer deaths per year will be avoided in all industries, in addition to the lives saved of those peripherally exposed to asbestos and the lives saved by earlier OSHA standards.

Regulatory Review

OSHA and the Environmental Protection Agency (EPA) have promulgated increasingly more stringent asbestos regulations. OSHA has revised the general industry standard (29 CFR 1910.1001) and the construction industry standard (29 CFR 1926.1101, referred to as the *asbestos standard* in this guide) for asbestos. These standards primarily address potential workplace exposures to asbestos, whether resulting from the manufacture of asbestos-containing products (29 CFR 1910.1101) or from the installation or removal of asbestos-containing building materials (29 CFR 1926.1101).

EPA standards have primarily addressed the removal of asbestos from school buildings through the Asbestos Hazard Emergency Response Act (AHERA) (40 CFR 763, Subpart E). AHERA requires specific inspection procedures, development of management plans, selection of response actions, recordkeeping and training. Individuals performing inspections, writing management plans, designing asbestos abatement projects, supervising asbestos removal projects or removing asbestos from school buildings must receive specific EPA-approved training and be accredited in the state where they perform the work. In North Carolina, standards at least as stringent as those in AHERA are enforced through the Asbestos Hazard Management Program (N.C. Gen. Stat. §§130A-444 et seq. (1989)).

The Asbestos Hazard Management Program (rules of operation appear at 10 NCAC 7C.0600 et seq.), is implemented by the N.C. Department of Health and Human Services, Division of Public Health. In addition to asbestos removal from schools, the law relates to asbestos control in other public areas not otherwise covered by OSHA. Basically, the program (1) limits asbestos in public areas more stringently than would OSHA regulations, (2) requires permits to be secured for each asbestos removal project, and (3) requires people engaged in asbestos management activities to be accredited.

1. Pure custodial work in manufacturing facilities is covered by the general industry asbestos standard.

Requirements for accreditation are specified for seven categories of asbestos management personnel. Additionally, North Carolina requires that all asbestos-related projects in state-owned or public school buildings follow the Specification for Asbestos Abatement plan developed by the N.C. Department of Administration, State Construction Office.

EPA standards regulate airborne asbestos fibers that may be released into the environment during manufacturing, building demolition or renovation activities as well as disposal of asbestos-containing waste materials. Air emission of asbestos is also regulated. Such regulation is through the National Emission Standards for Hazardous Air Pollutants (NESHAP) (40 CFR 61, Subparts A, B and M). The NESHAP is enforced in North Carolina by the Division of Public Health (see Additional Information in this publication). In particular, this program requires notification of all demolition work.

Work Classification

The original asbestos in construction standard (29 CFR 1926.58) had an exemption for “small-scale, short-duration activities” but did not define this term. This exemption permitted employers to perform certain activities without having to implement the extensive engineering controls that were required under paragraph (e)(6) of that standard.

The revised standard (29 CFR 1926.1101) eliminated the ambiguity associated with this exemption and classified asbestos construction work into one of four classes or categories. This classification scheme is based on the nature of the work activity and the type of asbestos material involved. The classification system for asbestos construction work clearly spells out mandatory, simple, technological work practices to follow to reduce worker exposures. Four classes of construction activity are matched with increasingly stringent control requirements.²

Class I asbestos work, the most potentially hazardous class of asbestos jobs, involves the removal of thermal system insulation and sprayed-on or troweled-on surfacing asbestos-containing materials or presumed asbestos-containing materials.³ Thermal system insulation includes asbestos-containing materials applied to pipes, boilers, tanks, ducts or other structural components to prevent heat loss or gain. Surfacing materials include decorative plaster on ceilings, acoustical asbestos-containing materials on decking or fireproofing on structural members.

Class II work includes the removal of other types of asbestos-containing materials that are not thermal system insulation, such as resilient flooring and roofing materials containing asbestos. Examples of Class II work include removal of floor or ceiling tiles, siding, roofing, or transite panels.

Class III asbestos work includes repair and maintenance operations where asbestos-containing or presumed asbestos-containing materials are disturbed.

Class IV operations include custodial activities where employees clean up asbestos-containing waste and debris. This includes dusting contaminated surfaces, vacuuming contaminated carpets, mopping floors, and cleaning up asbestos-containing or presumed asbestos-containing materials from thermal system insulation.

Scope and Application

The asbestos standard for the construction industry (29 CFR 1926.1101) regulates asbestos exposure from activities including, but not limited to, the following:

- demolishing or salvaging structures where asbestos is present;
- removing or encapsulating asbestos-containing materials;
- constructing, altering, repairing, maintaining or renovating asbestos-containing structures or substrates;
- installing asbestos-containing products;
- cleaning up asbestos spills/emergencies; and
- transporting, disposing, storing, containing and housekeeping involving asbestos or asbestos-containing products on a construction site.

². See Appendix elsewhere in this publication for a list of provisions broken down by work classification.

³. This includes thermal system insulation and surfacing material found in buildings constructed before 1981.

Table 1
Asbestos-Containing Materials Found in Buildings

| Subdivision | Generic Name | Asbestos (%) | Dates of Use | Binder/Sizing |
|---------------------------------------|----------------------------------|---------------------|---------------------|---|
| Surfacing material | sprayed- or troweled-on | 1–95 | 1935–1970 | sodium silicate, portland cement, organic binders |
| Preformed thermal insulating products | batts, blocks, and pipe covering | | | |
| | 85% magnesia | 15 | 1926–1949 | magnesium carbonate |
| | calcium silicate | 6–8 | 1949–1971 | calcium silicate |
| Textiles | cloth | | | |
| | blankets (fire) | 100 | 1910–present | none |
| | felts: | 90–95 | 1920–present | cotton/wool |
| | blue stripe | 80 | 1920–present | cotton |
| | red stripe | 90 | 1920–present | cotton |
| | green stripe | 95 | 1920–present | cotton |
| | sheets | 50–95 | 1920–present | cotton/wool |
| | cord/rope/yarn | 80–100 | 1920–present | cotton/wool |
| | tubing | 80–85 | 1920–present | cotton/wool |
| | tape/strip | 90 | 1920–present | cotton/wool |
| | curtains (theater, welding) | 60–65 | 1945–present | cotton |
| Cementitious concrete-like products | extrusion panels: | 8 | 1965–1977 | portland cement |
| | corrugated | 20–45 | 1930–present | portland cement |
| | flat | 40–50 | 1930–present | portland cement |
| | flexible | 30–50 | 1930–present | portland cement |
| | flexible perforated | 30–50 | 1930–present | portland cement |
| | laminated (outer surface) | 35–50 | 1930–present | portland cement |
| | roof tiles | 20–30 | 1930–present | portland cement |
| | clapboard and shingles: | | | |
| | clapboard | 12–15 | 1944–1945 | portland cement |
| | siding shingles | 12–14 | unknown–present | portland cement |
| | roofing shingles | 20–32 | unknown–present | portland cement |
| | pipe | 20–15 | 1935–present | portland cement |
| | Paper products | corrugated: | | |
| high temperature | | 90 | 1935–present | sodium silicate |
| moderate temperature | | 35–70 | 1910–present | starch |
| indented | | 98 | 1935–present | cotton and organic binder |
| millboard | | 80–85 | 1925–present | starch, lime, clay |
| Roofing felts | smooth surface | 10–15 | 1910–present | asphalt |
| | mineral surface | 10–15 | 1910–present | asphalt |
| | shingles | 1 | 1971–1974 | asphalt |
| | pipeline | 10 | 1920–present | asphalt |

Section 2

Provisions of the Standard

OSHA sets out several provisions employers must follow to comply with the asbestos standard. The agency has established strict exposure limits and requirements for exposure assessment, medical surveillance, recordkeeping, “competent persons,”⁴ regulated areas and hazard communication.

Permissible Exposure Limit (PEL)

Employers must ensure that no employee is exposed to an airborne concentration of asbestos in excess of 0.1 f/cc as an 8-hour time-weighted average (TWA).

OSHA also established an excursion limit (EL) for asbestos. Employers must ensure that no employee is exposed to an airborne concentration of asbestos in excess of 1 f/cc as averaged over a sampling period of 30 minutes.

Exposure Assessments and Monitoring

Employers must assess all asbestos operations for their potential to generate airborne fibers. Employers must use exposure monitoring data to assess employee exposures.

Initial Exposure Assessments

The designated competent person must assess exposures immediately before or as the operation begins to determine expected exposures. The assessment must be done in time to comply with all standard requirements triggered by exposure data or the lack of a negative exposure assessment⁵ and to provide the necessary information to ensure all control systems are appropriate and work properly.

The initial exposure assessment must be based on the following:

- the results of employee exposure monitoring;⁶
- all observations, information or calculations indicating employee exposure to asbestos, including any previous monitoring; and
- the presumption that employees performing Class I asbestos work are exposed in excess of the PEL and EL until exposure monitoring proves they are not.

Negative Exposure Assessments

For any specific asbestos job that trained employees perform, employers may show that exposure will be below the PEL by performing an assessment and confirming it by the following:

- “objective data” demonstrating an asbestos-containing material or activities involving it cannot release airborne fibers in excess of the PEL and EL;
- “historical data” from prior monitoring for similar asbestos jobs performed within 12 months of the current job and obtained during work operations conducted under similar conditions;
- employees’ training and experience were no more extensive for previous jobs than training for current employees; and
- data show a high degree of certainty that employee exposures will not exceed the PEL and EL under current conditions, and current initial exposure monitoring used breathing zone air samples representing the 8-hour TWA and 30-minute short-term exposures for each employee in those operations most likely to result in exposure over the PEL for the entire asbestos job.

4. The standard defines *competent person* as one who can identify existing asbestos hazards in the workplace and who has the authority to correct these hazards.

5. A negative exposure assessment demonstrates that employee exposure during an operation is consistently below the PEL.

6. Unless there has been a negative exposure assessment. In certain less hazardous operations, the employer may be exempt from monitoring. See 29 CFR 1926.1101 for specific requirements.

Exposure Monitoring

Employee exposure measurements must be made from breathing zone air samples representing the 8-hour TWA and 30-minute short-term exposures for each employee.

Employers must take one or more samples representing full-shift exposure to determine the 8-hour TWA exposure in each work area. To determine short-term employee exposures, employers must take one or more samples representing 30-minute exposures for the operations most likely to expose employees above the EL in each work area.

Employers must allow affected employees and their designated representatives to observe any employee exposure monitoring. When observation requires entry into a regulated area, the employer must provide and require the use of protective clothing and equipment.

Periodic Monitoring

For Class I and II jobs, employers must monitor each employee working in a regulated area daily, unless a negative exposure assessment for the entire operation already exists and nothing has changed. When all employees use supplied-air respirators operated in positive-pressure mode, however, employers may discontinue daily monitoring. Note that for employees performing Class I work using control methods not recommended in the standard, employers must continue daily monitoring, even when employees use supplied-air respirators.

For operations other than Class I and Class II, employers must monitor all work where exposures can possibly exceed the PEL often enough to validate the exposure prediction.

If periodic monitoring shows employee exposures below the PEL and EL, the employer may discontinue monitoring for the represented employees.

Additional Monitoring

Changes in processes, control equipment, level of personnel experience or work practices that could result in new or additional exposures above the PEL or EL, regardless of a previous negative exposure assessment for a specific job, require additional monitoring.

Medical Surveillance

Employers must provide a medical surveillance program for all employees:

- who engage in Class I, II, or III work for a combined total of 30 or more days per year; or
- are exposed at or above the PEL or EL; or
- who wear negative-pressure respirators.

A licensed physician must perform or supervise all medical exams and procedures, provided at no cost to employees and at a reasonable time and place.

Employers must make medical exams and consultations available to employees:

- prior to employee assignment to an area where negative-pressure respirators are worn,
- within 10 working days after the 30th day of exposure for employees assigned to an area where exposure is at or above the PEL for 30 or more days per year,
- at least annually thereafter, and
- when the examining physician suggests them more frequently.

If the employee was examined within the past 12 months and that exam meets the criteria of the standard, another medical exam is not required.

Content of Medical Exam

Medical exams must include the following:

- a medical and work history,
- completion of a standardized questionnaire with the initial exam (See 29 CFR 1926.1101, Appendix D, Part 1) and an abbreviated standardized questionnaire with annual exams (See 29 CFR 1926.1101, Appendix D, Part 2),

- a physical exam focusing on the pulmonary and gastrointestinal systems, and
- any other exams or tests suggested by the examining physician.

Employers must provide the examining physician:

- a copy of OSHA's asbestos standard and its appendixes,
- a description of the affected employee's duties relating to exposure,
- the employee's representative exposure level or anticipated exposure level,
- a description of any personal protective equipment and respiratory equipment used, and
- information from previous medical exams not otherwise available.

It is the employer's responsibility to obtain the physician's written opinion, containing results of the medical exam and:

- any medical conditions of the employee that increase health risks from asbestos exposure,
- any recommended limitations on the employee or protective equipment used,
- a statement that the employee has been informed of the results of the medical exam and any medical conditions resulting from asbestos exposure, and
- a statement that the employee has been informed of the increased risk of lung cancer from the combined effect of smoking and asbestos exposure.

The physician must not reveal in the written opinion specific findings or diagnoses unrelated to occupational exposure to asbestos. The employer must provide a copy of the physician's written opinion to the affected employee within 30 days after receipt.

Recordkeeping

Objective Data Records

Where employers use objective data to demonstrate that products made from or containing asbestos cannot release fibers in concentrations at or above the PEL or EL, they must keep an accurate record for as long as it is relied on and include:

- the exempt product;
- the source of the objective data;
- the testing protocol, test results and analysis of the material for release of asbestos;
- a description of the exempt operation and support data; and
- other data relevant to operations, materials, processes or employee exposures.

Monitoring Records

Employers must keep records of all employee exposure monitoring for at least 30 years, including:

- the date of measurement;
- the operation involving asbestos exposure that was monitored;
- sampling and analytical methods used and evidence of their accuracy;
- the number, duration and results of samples taken;
- the type of protective devices worn; and
- the name, Social Security number, and exposures of the represented employees.

Employers must make exposure records available when requested by affected employees, former employees, their designated representatives, and the commissioner of labor or her designee.

Medical Surveillance Records

Employers must keep all medical surveillance records for the duration of the employee's employment plus 30 years, including:

- the employee's name and social security number;
- the employee's medical exam results, including the medical history, questionnaires, responses, test results, and physician's recommendations;
- the physician's written opinions;
- any employee medical complaints related to asbestos exposure; and
- a copy of the information provided to the examining physician.

Employee medical surveillance records must be available to the subject employee, anyone having specific written consent of that employee, and the commissioner of labor or her designee.

Other Recordkeeping Requirements

Employers must maintain all employee training records for one year beyond the last date of employment for each employee.

Where data demonstrate presumed asbestos-containing materials do not contain asbestos, building owners or employers must keep the records for as long as they rely on them. Building owners must maintain written notifications on the identification, location and quantity of any asbestos-containing or presumed asbestos-containing materials for the duration of ownership and transfer the records to successive owners.

When an employer ceases to do business without a successor to keep the records, the employer must notify current affected employees of their rights to access exposure and medical records at least three months prior to ceasing to do business.

Competent Person Requirements

On all construction sites with asbestos operations, employers must name a competent person, qualified and authorized to ensure worker safety and health, as required by Subpart C, General Safety and Health Provisions for Construction (29 CFR 1926.20). Under these requirements for safety and health prevention programs, the competent person must frequently inspect job sites, materials and equipment.

In addition, for Class I jobs the competent person must inspect onsite at least once during each work shift and upon employee request. For Class II and III jobs, the competent person must inspect often enough to assess changing conditions and upon employee request.

At worksites where employees perform Class I or II asbestos work, the competent person must supervise:

- the setup and ensure the integrity of regulated areas, enclosures, or other containments by onsite inspection;
- setup procedures to control entry to and exit from the enclosure or area;
- all employee exposure monitoring, ensuring it is properly conducted;
- use of required protective clothing and equipment by employees working within the enclosure or using glove bags;⁷
- proper setup, removal and performance of engineering controls, work practices and personal protective equipment through onsite inspections;
- employee use of hygiene facilities and required decontamination procedures; and
- notification requirements.

⁷ A plastic bag-like enclosure affixed around an asbestos-containing material, with glove-like appendages through which materials and tools may be handled.

The competent person must attend a comprehensive training course for contractors and supervisors certified by the U.S. Environmental Protection Agency (EPA) or a state-approved training provider or a course that is equivalent in length and content.

For Class III and IV asbestos work, training must include a course equivalent in length and content to the 16-hour “Operations and Maintenance” course developed by the EPA for maintenance and custodial workers.⁸

Regulated Areas

A regulated area is an area marked off to show where employees work with asbestos, including any adjoining area(s) where debris and waste from asbestos work accumulates or where airborne concentrations of asbestos exceed or can possibly exceed the PEL. All Class I, II, and III asbestos work or any other operations where airborne asbestos exceeds the PEL must be done within regulated areas. Only authorized personnel⁹ may enter. The designated competent person supervises all asbestos work performed in the area. (See the competent person requirements previously discussed in this section.)

Employers must mark off the regulated area in any manner that minimizes the number of people within the area and protects people outside the area from exposure to airborne asbestos. Critical barriers¹⁰ or negative-pressure enclosures may mark off the regulated area.

Posted warning signs demarcating the area must be easily readable and understandable. The signs must bear the following information:

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

Employers must supply a respirator to all people entering regulated areas. (See respiratory protection requirements in Section 3.) Employees must not eat, drink, smoke, chew tobacco or gum, or apply cosmetics in regulated areas.

An employer performing work in a regulated area must inform other employers onsite of the:

- nature of the work,
- regulated area requirements, and
- measures taken to protect onsite employees.

The contractor creating or controlling the source of asbestos contamination must abate the hazards. All employers with employees working near regulated areas must assess each day the enclosure’s integrity or the effectiveness of control methods to prevent airborne asbestos from migrating.

A general contractor on a construction project must oversee all asbestos work, even though he or she may not be the designated competent person. As supervisor of the entire project, the general contractor determines whether asbestos contractors comply with the standard and ensures they correct any problems.

8. For more specific information, see 40 CFR 763.92(a)(2).

9. Any person permitted by the employer and required by work duties to be present in regulated areas.

10. Plastic sheeting placed over all openings to the work area to prevent airborne asbestos from migrating to an adjacent area.

Communication of Hazards

Notification Requirements

The communication of asbestos hazards is vital to prevent further overexposure. Most asbestos-related construction involves previously installed building materials. Building owners often are the only or best source of information concerning them. The owners and employers of potentially exposed employees have specific duties under the standard.

Before beginning work, building owners must identify at the worksite all thermal system insulation, sprayed or troweled-on surfacing materials in buildings, and resilient flooring material installed before 1981 and presumed asbestos-containing material (PACM). Building owners also must notify, in writing, the following people of the presence, locations and quantity of asbestos-containing or presumed asbestos-containing materials:

- prospective employers applying or bidding for work in or adjacent to areas containing asbestos,
- the owner's employees who work in or nearby these areas,
- other employers on multi-employer worksites with employees working in or adjacent to the area, and
- tenants who will occupy the areas containing such materials.

All employers discovering asbestos-containing materials on a worksite must notify the building owner and other employers onsite within 24 hours of its presence, location and quantity. Employers also must inform building owners and employees working in nearby areas of the precautions taken to confine airborne asbestos. Within 10 days of project completion, employers must inform building owners and other employers onsite of the current locations and quantity of remaining asbestos-containing materials and any final monitoring results.

At any time, employers or building owners may demonstrate that a presumed asbestos-containing material does not contain asbestos by inspecting the material (conducted according to the requirements of the Asbestos Hazard Emergency Response Act (AHERA) (40 CFR 763, Subpart E)) and by performing tests to prove asbestos is not present.¹¹

Employers do not have to inform employees of the presence of asbestos-free building materials; however, employers must retain the information, data and analysis supporting the determination. (See recordkeeping requirements in Section 1 of this publication for more specific information.)

Signs

At the entrance to mechanical rooms or areas containing thermal system insulation and surfacing asbestos-containing materials, the building owner must post signs identifying the material present, its specific location and appropriate work practices that ensure it is not disturbed.

Employers must post warning signs in regulated areas to inform employees of the dangers and necessary protective steps to take before entering. (See the regulated area requirements elsewhere in this publication.)

Labels

Employers must attach warning labels to all products and containers of asbestos, including waste containers, and all installed asbestos products, when possible. Labels must be printed in large, bold letters on a contrasting background and used in accordance with OSHA's Hazard Communication Standard (29 CFR 1910.1200). All labels must contain a warning statement against breathing asbestos fibers and contain the following legend:

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

¹¹. See 29 CFR 1926.1101 for specific testing requirements.

Labels are not required where:

- asbestos is present in concentrations less than 1 percent by weight, or
- a bonding agent, coating or binder has altered asbestos fibers, prohibiting the release of airborne asbestos over the PEL or EL during reasonable use, handling, storage, disposal, processing or transportation.

When building owners or employers identify previously installed asbestos or presumed asbestos-containing materials, labels or signs must be attached or posted to inform employees which materials contain asbestos. Attached labels must be clearly noticeable and readable.

Employee Information and Training

General Training Requirements

Employers must, at no cost to employees, provide a training program for all employees installing and handling asbestos-containing products and for employees performing Class I through IV asbestos operations. Employees must receive training prior to or at initial assignment and at least annually thereafter.

Training courses must be easily understandable for employees and must inform them of:

- ways to recognize asbestos;
- the adverse health effects of asbestos exposure;
- the relationship between smoking and asbestos in causing lung cancer;
- operations that could result in asbestos exposure and the importance of protective controls to minimize exposure;
- the purpose, proper use, fitting instruction and limitations of respirators;
- the appropriate work practices for performing asbestos jobs and medical surveillance program requirements;
- the contents of the standard;
- the names, addresses and phone numbers of public health organizations that provide information and materials or conduct smoking cessation programs; and
- sign and label requirements and the meaning of legends on them.

The employer also must provide, at no cost to employees, written materials relating to employee training and self-help smoking cessation programs.

Additional Training Based on Work Class

For Class I operations and Class II operations that require the use of critical barriers (or equivalent isolation methods) or negative pressure enclosures, training must be equivalent in curriculum, method and length to the EPA Model Accreditation Plan (MAP) asbestos abatement worker training (40 CFR 763, Subpart E, Appendix C). For employees performing Class II operations involving one generic category of building materials containing asbestos (e.g., roofing, flooring or siding materials or transite panels), training may be covered in an eight-hour course that includes hands-on experience.

For Class III operations, training must be equivalent in curriculum and method to the 16-hour operations and maintenance course developed by EPA for maintenance and custodial workers whose work disturbs asbestos-containing materials (See 40 CFR 763.92). The course must include hands-on training on proper respirator use and work practices.

For Class IV operations, training must be equivalent in curriculum and method to EPA awareness training.¹² Training must focus on the locations of asbestos-containing or presumed asbestos-containing materials and the ways to recognize damage and deterioration and avoid exposure. The course must be at least two hours in length.

Employers must provide the commissioner of labor or her designee all information and training materials as requested.

¹². See 29 CFR 1926.1101 for more information.

Section 3

Methods of Compliance

Control Measures

For all covered work, employers must use the following control methods to comply with the PEL and EL:

- local exhaust ventilation equipped with HEPA filter¹³ dust collection systems,
- enclosure or isolation of processes producing asbestos dust,
- ventilation of the regulated area to move contaminated air away from the employees' breathing zone and toward a filtration or collection device equipped with a HEPA filter, and
- feasible engineering and work practice controls to reduce exposure to the lowest possible levels, supplemented by respirators to reach the PEL or EL or lower.

Employers must use the following engineering controls and work practices for all operations regardless of exposure levels:

- vacuum cleaners equipped with HEPA filters to collect all asbestos-containing or presumed asbestos-containing debris and dust;
- wet methods or wetting agents to control employee exposures, except when infeasible (e.g., due to the creation of electrical hazards, equipment malfunction and slipping hazards); and
- prompt cleanup and disposal in leak-tight containers of asbestos-contaminated wastes and debris.

The following work practices and engineering controls are prohibited for all asbestos-related work or work that disturbs asbestos or presumed asbestos-containing materials, regardless of measured exposure levels or the results of initial exposure assessments:

- high-speed abrasive disc saws not equipped with a point-of-cut ventilator or enclosure with HEPA-filtered exhaust air;
- compressed air to remove asbestos or asbestos-containing materials, unless the compressed air is used with an enclosed ventilation system;
- dry sweeping, shoveling or other dry cleanup of dust and debris; and
- employee rotation to reduce exposure.

In addition, OSHA's asbestos standard established specific requirements for each class of asbestos work in construction.

Class I Work

A designated competent person must supervise all Class I work, including installing and operating the control system. Employers must place critical barriers over all openings to regulated areas or use another barrier or isolation method to prevent airborne asbestos from migrating for:

- all Class I jobs removing more than 25 linear or 10 square feet of thermal system insulation or surfacing material,
- all other Class I jobs without a negative exposure assessment, and
- where employees are working in areas adjacent to a Class I regulated area.

Otherwise, employers must perform perimeter area surveillance during each work shift. No asbestos dust should be visible. Perimeter monitoring must show that clearance levels are met (as contained in 40 CFR 763, Subpart E of the "EPA Asbestos in Schools" rule) or that perimeter area levels are no greater than background levels.

¹³ High-efficiency particulate air (HEPA) filter capable of trapping and retaining at least 99.97 percent of all monodispersed particles of 0.3 micrometers in diameter.

For all Class I jobs:

- HVAC systems must be isolated in the regulated area by sealing with a double layer of 6 mil plastic or the equivalent,
- impermeable dropcloths must be placed on surfaces beneath all removal activity,
- all objects within the regulated area must be covered with secured impermeable dropcloths or plastic sheeting, and
- for jobs without a negative exposure assessment or where exposure monitoring shows the PEL is exceeded, employers must ventilate the regulated area to move the contaminated air away from the employee breathing zone and toward a HEPA filtration or collection device.

In addition, employees performing Class I work must use one or more of the following control methods. (For the specifications, limitations and recommended work practices of these required control methods, refer to Occupational Exposure to Asbestos, 29 CFR 1926.1101.)

- negative-pressure enclosure systems must be used where the configuration of the work area makes it impossible to erect the enclosure,
- glove bag systems can be used to remove asbestos-containing or presumed asbestos-containing materials from straight runs of piping,
- glove bag systems can be used for piping bends if manufactured for that purpose,
- negative-pressure glove bag systems can be used to remove asbestos or presumed asbestos-containing materials from piping,
- negative-pressure glove box systems can be used to remove asbestos or presumed asbestos-containing materials from pipe runs,
- water spray process systems may be used to remove asbestos or presumed asbestos-containing materials from cold-line piping if employees carrying out the process have completed a 40-hour training course on its use in addition to training required for all employees performing Class I work, or
- a small walk-in enclosure that accommodates no more than two people (mini-enclosure) may be used if the disturbance or removal can be completely contained by the enclosure.

Employers may use different or modified engineering and work practice controls if the following provisions are met:

- the control method encloses, contains or isolates the process or source of airborne asbestos dust, or captures and redirects the dust before it enters into the employees' breathing zone;
- a certified industrial hygienist or licensed professional engineer qualified as a project designer evaluates the work area, the projected work practices and the engineering controls and certifies, in writing, that based on evaluations and data the planned control method adequately reduces direct and indirect employee exposure to or below the PEL under worst-case conditions. The planned control method also must prevent asbestos contamination outside the regulated area, as measured by sampling meeting the requirements of EPA's "Asbestos in Schools" rule or perimeter monitoring; and
- before using alternative methods to remove more than 25 linear or 10 square feet of thermal system insulation or surfacing material, employers must send a copy of the evaluation and certification to the N.C. Department of Labor, Occupational Safety and Health Division.

Class II Work

The competent person must supervise all Class II work. Employers must use critical barriers over all openings to the regulated area or another barrier or isolation method to prevent airborne asbestos from migrating for:

- all indoor Class II jobs without a negative exposure assessment,
- where changing conditions indicate exposure above the PEL, or
- where asbestos-containing materials are not removed substantially intact.

Otherwise, employers must perform perimeter area monitoring to verify that the barrier works properly. Impermeable dropcloths must be placed on all surfaces beneath removal activities.

All Class II asbestos work can use the same work practices and requirements as Class I asbestos jobs. Alternatively, Class II work can be performed more easily using simple work practices set out in the standard for specific jobs.

For removing vinyl and asphalt flooring materials containing asbestos or installed in buildings constructed before 1981 and not verified as asbestos-free, employers must ensure that employees:

- do not sand flooring or its backing,
- do not rip up resilient sheeting,
- do not dry sweep,
- do not use mechanical chipping unless performed in a negative-pressure enclosure,
- use vacuums equipped with HEPA filters to clean floors,
- use wet methods when removing resilient sheeting by cutting,
- use wet methods to scrape residual adhesives and backing,
- remove tiles intact, unless impossible,
- may omit wetting when tiles are heated and removed intact, and
- assume resilient flooring materials, including associated mastic and backing, are asbestos-containing, unless an industrial hygienist determines them to be asbestos-free.

To remove asbestos-containing roofing materials, employers must ensure that employees:

- remove them intact;
- use wet methods when possible;
- continuously mist cutting machines during use, unless the competent person determines misting to be unsafe;
- immediately HEPA vacuum all loose dust along the cut;
- lower as soon as possible or by the end of the work shift any unwrapped or unbagged roofing material to the ground via a covered, dust-tight chute, crane, or hoist;
- transfer unwrapped materials to a closed receptacle to prevent dispersing the dust when lowered; and
- isolate roof-level heating and ventilation air intake sources or shut down the ventilation system.

When removing cementitious asbestos-containing siding and shingles or transite panels, employers must ensure that employees:

- do not cut, abrade or break siding, shingles or transite panels unless methods less likely to result in asbestos fiber release cannot be used;
- spray each panel or shingle with amended water¹⁴ before removing;
- lower to the ground any unwrapped or unbagged panels or shingles via a covered dust-tight chute, crane or hoist, or place them in an impervious waste bag or wrap them in plastic sheeting, as soon as possible or by the end of the work shift; and
- cut nails with flat, sharp instruments.

When removing asbestos-containing gaskets, employers must ensure that employees:

- remove gaskets within glove bags if they are visibly deteriorated and unlikely to be removed intact,
- thoroughly wet the gaskets with amended water prior to removing,
- immediately place the wet gaskets in a disposal container, and
- scrape using wet methods to remove residue.

14. Water to which surfactant (a wetting agent) has been added to increase the ability of the liquid to penetrate and asbestos-containing material.

For removal of any other Class II asbestos-containing material, employers must ensure employees:

- do not cut, abrade or break the material unless methods less likely to result in asbestos fiber release cannot be used,
- thoroughly wet the material with amended water before and during removal,
- remove the material intact, if possible, and
- immediately bag or wrap removed asbestos-containing materials or keep them wet until transferred to a closed receptacle at the end of the work shift.

Employers may use different or modified engineering and work practice controls if:

- they can demonstrate by employee exposure data during the use of such methods and under similar conditions that employee exposure will not exceed the PEL under any anticipated circumstances, or
- the competent person evaluates the work area, the projected work practices and the engineering controls and certifies in writing that they will reduce all employee exposure to below the PEL under expected conditions. The evaluation must be based on exposure data for conditions closely resembling those of the current job and for employees with equivalent training and experience.

Class III Work

Employers must use wet methods and local exhaust ventilation, when feasible, during Class III work. Where drilling, cutting, abrading, sanding, chipping, breaking or sawing thermal system insulation or surfacing materials occurs, employers must use impermeable dropcloths as well as mini-enclosures, glove bag systems or other effective isolation methods. Where no negative exposure assessment exists or monitoring shows the PEL is exceeded, employers must contain the area with impermeable dropcloths and plastic barriers or other isolation methods and ensure that employees wear respirators. (See also respirator requirements elsewhere in this section.)

Class IV Work

Employees conducting Class IV asbestos work must have attended an asbestos awareness training program. Employees must use wet methods and HEPA vacuums to promptly clean asbestos-containing or presumed asbestos-containing debris. When cleaning debris and waste in regulated areas, employees must wear respirators. In areas where thermal system insulation or surfacing material is present, employees must assume that all waste and debris contain asbestos.

Respiratory Protection

Respirators must be used during

- all Class I asbestos jobs;
- all Class II work where an asbestos-containing material is not removed substantially intact;
- all Class II and III work not using wet methods;
- all Class II and III work without a negative exposure assessment;
- all Class III jobs where thermal system insulation or surfacing asbestos-containing or presumed asbestos-containing material is cut, abraded or broken;
- all Class IV work within a regulated area where respirators are required;
- all work where employees are exposed above the PEL or EL; and
- emergencies.

Employers must provide respirators at no cost to employees, selecting the appropriate type from among those approved by the National Institute for Occupational Safety and Health (NIOSH).

For all employees performing Class I work in regulated areas and for jobs without a negative exposure assessment, employers must provide full-facepiece supplied-air respirators operated in pressure-demand mode and equipped with an auxiliary positive-pressure, self-contained breathing apparatus.¹⁵

Employers must provide half-mask purifying respirators, *other than disposable respirators*, equipped with high-efficiency filters for Class II and III asbestos jobs without a negative exposure assessment and for Class III jobs where work disturbs thermal system insulation or surfacing asbestos-containing or presumed asbestos-containing materials.

If a particular job is not covered above and exposures are above the PEL or EL, the asbestos standard, Occupational Exposure to Asbestos, 29 CFR 1926.1101, contains a table specifying types of respirators to use.

Employers must institute a respiratory protection program in accordance with Respiratory Protection, 29 CFR 1910.134 (b)–(d) (except (d)(1)(iii)) and (f) through (m). Employers must permit employees using filter respirators to change the filter elements when breathing resistance increases; employers must maintain an adequate supply of filters for this purpose. Employers must permit employees wearing respirators to leave work areas to wash their faces and respirator facepieces as necessary to prevent skin irritation.

Employers must ensure that the respirators issued have the least possible facepiece leakage and fit properly. For employees wearing negative-pressure respirators, employers must perform either quantitative or qualitative face fit tests with the initial fitting and at least every 12 months following. The qualitative fit tests can be used only for fit testing half-mask respirators where they are permitted or for full-facepiece air-purifying respirators where they are worn at levels where half-facepiece air-purifying respirators are permitted. Employers must conduct qualitative and quantitative fit tests in accordance with the Respiratory Protection Standard (29 CFR 1910.134, Appendix A) and use the tests to select facepieces that provide the required protection. (See Table 2.)

Table 2

Assigned Protection Factors

| Type of Respirator ^{1,2} | Half Mask | Full Facepiece |
|---|-----------------|----------------|
| Air-purifying Respirator | 10 ³ | 50 |
| Powered Air-purifying Respirator | 50 | 1,000 |
| Supplied-air Respirator or Airline Respirator | | |
| Demand mode | 10 | 50 |
| Continuous flow mode | 50 | 1,000 |
| Pressure-demand or other positive-pressure mode | 50 | 1,000 |
| Self-Contained Breathing Apparatus (SCBA) | | |
| Demand mode | 10 | 50 |
| Pressure-demand or other positive-pressure mode (e.g., open/closed circuit) | – | 10,000 |

Notes:

1. Employers may select respirators assigned for use in higher workplace concentrations of a hazardous substance for use at lower concentrations of that substance, or when required respirator use is independent of concentration.
2. The assigned protection factors in this table are only effective when the employer implements a continuing effective respirator program as required by the respiratory protection standard, 29 CFR 1910.134, including training, fit testing, maintenance, and use requirements.
3. Employers may not select or use filtering facepieces to protect against asbestos fibers.

¹⁵ Unless the competent person determines wearing such a respirator is not feasible, in which case a tight-fitting powered air-purifying respirator may be worn.

Employers must not assign any employee, who based on the most recent physical exam and the examining physician's recommendations would be unable to function normally, to tasks requiring respirator use. Employers must assign such employees to other jobs or give them the opportunity to transfer to different positions in the same geographical area and with the same seniority, status, pay rate and job benefits as before transferring, if such positions are available.

Protective Clothing

Employers must 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 asbestos exceeding the PEL or EL,
- work without a negative exposure assessment, or
- any employee performing Class I work involving the removal of over 25 linear or 10 square feet of thermal system insulation or surfacing asbestos-containing or presumed asbestos-containing materials.

Employers must launder contaminated clothing to prevent the release of airborne asbestos in excess of the PEL or EL. Any employer who gives contaminated clothing to another person for laundering must inform him or her of the contamination.

Employers must transport contaminated clothing in sealed, impermeable bags or other closed impermeable containers bearing appropriate labels. (See the Communication of Hazards in Section 2 of this publication for label requirements.)

The competent person must examine employee worksuits at least once per workshift for rips or tears. Rips or tears found while the employee is working must be mended immediately or else the worksuits must be replaced immediately.

Hygiene Facilities

Decontamination Requirements for Class I Asbestos Work

For employees performing Class I asbestos jobs involving over 25 linear or 10 square feet of thermal system insulation or surfacing asbestos-containing or presumed asbestos-containing materials, employers must create a decontamination area adjacent to and connected with the regulated area. Employees must enter and exit the regulated area through the decontamination area.

The decontamination area must be composed of an equipment room, shower area and clean room in series. The equipment room must be supplied with impermeable, labeled bags and containers to store and dispose of contaminated protective equipment. Shower facilities must be adjacent to both the equipment and clean rooms, unless work is performed outdoors or this arrangement is impractical. If so, employers must ensure that employees remove asbestos contamination from their worksuits in the equipment room using a HEPA vacuum before proceeding to a shower nonadjacent to the work area; or remove their contaminated worksuits in the equipment room, don clean worksuits and proceed to a shower nonadjacent to the work area.

The clean room must have a locker or appropriate storage container for each employee unless work is performed outdoors or this arrangement is not possible. In such a case, employees may clean protective clothing with a portable HEPA vacuum before leaving the regulated area. Employees then must change into "street clothing" in clean change areas.

Before entering the regulated area, employees must enter the decontamination area through the clean room; remove and deposit street clothing within a provided locker; and put on protective clothing and respiratory protection before leaving the clean area. To enter the regulated area, employees must pass through the equipment room.

Before exiting the regulated area, employees must remove all gross contamination and debris and then remove their protective clothing in the equipment room, depositing the clothing in labeled, impermeable bags or containers. Employees must shower before entering the clean room to change into street clothing.

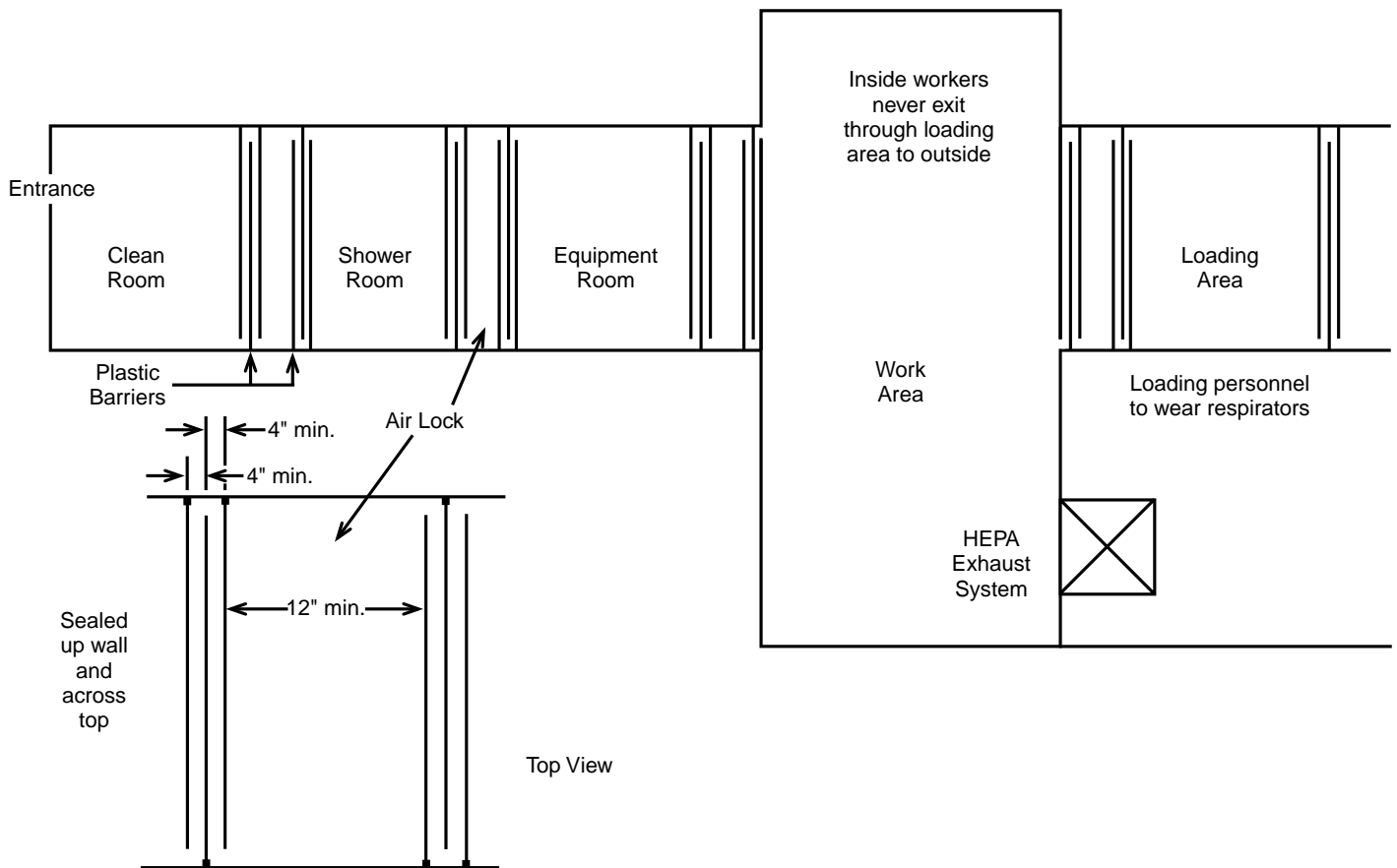
When employees consume food or beverages at the Class I worksite, employers must provide lunch areas with airborne asbestos levels below the PEL and EL.

**Decontamination Requirements for Other Class I and Class II and III Asbestos Work
Without a Negative Exposure Assessment and Where Exposures Exceed the PEL**

Employers must establish an equipment area adjacent to the regulated area for the decontamination of employees and their equipment. The area must be covered by an impermeable dropcloth on the floor or horizontal work surface and must be large enough to accommodate equipment cleaning and personal protective equipment removal without spreading contamination beyond the area. Before removing work clothing, employees must clean it with a HEPA vacuum. All equipment and the surfaces of containers filled with asbestos-containing materials must be cleaned prior to removal. Employers must ensure employees enter and exit the regulated area through the equipment area.

Figure 1

Decontamination Area Arrangement



Decontamination Requirements for Class IV Work

Employers must ensure employees performing Class IV work within a regulated area comply with the hygiene practices required of employees performing work with higher classifications in that regulated area. Otherwise, employees cleaning up thermal system insulation or asbestos-containing debris must use decontamination facilities required for Class II and III work where exposure exceeds the PEL or no negative exposure assessment exists.

Smoking

Employers must ensure that employees performing any class of asbestos work do not smoke in any work area with asbestos exposure.

Housekeeping

Asbestos waste, scrap, debris, bags, containers, equipment and contaminated clothing consigned for disposal must be collected and disposed of in sealed, labeled, impermeable bags or other closed, labeled impermeable containers. Employees must use HEPA-filtered vacuuming equipment and must empty it so as to minimize asbestos reentry into the workplace.

All vinyl and asphalt flooring material must remain intact unless the building owner demonstrates that the flooring does not contain asbestos. Sanding flooring material is prohibited. Employees stripping finishes must use wet methods and low abrasion pads at speeds lower than 300 revolutions per minute. Burnishing or dry buffing may be done only on flooring with enough finish that the pad cannot contact the flooring material. Employees must not dust, sweep or vacuum without a HEPA filter in an area containing thermal system insulation or surfacing material or visibly deteriorated asbestos-containing materials. Employees must promptly clean and dispose of dust and debris in leak-tight containers.

Part II

Asbestos Standard for General Industry

Section 1

Important Facts about Asbestos

Introduction

Asbestos is a widely used, mineral-based material that is resistant to heat and corrosive chemicals. Depending on the chemical composition, fibers may range in texture from coarse to silky. The properties that make asbestos fibers so valuable to industry are its high-tensile strength, flexibility, heat and chemical resistance, and good frictional properties. (See Table 1 for a partial list of asbestos-containing products and building materials that have been used during the last 100 years in the United States.)

Asbestos fibers enter the body by inhalation of airborne particles or by ingestion and can become embedded in the tissues of the respiratory or digestive systems. Years of exposure to asbestos can cause numerous disabling or fatal diseases. Among these diseases are asbestosis, an emphysema-like condition; lung cancer; mesothelioma, a cancerous tumor that spreads rapidly in the cells of membranes covering the lungs and body organs; and gastrointestinal cancer.

Since 1972, however, the Occupational Safety and Health Administration (OSHA) has regulated asbestos exposure in general industry, thereby causing a significant decline in exposures resulting from the use of asbestos-containing materials. The revised standard continues to protect workers, in general, who are exposed to asbestos-containing materials but now includes provisions that apply to workers performing brake and clutch repair and to those doing housekeeping in buildings and facilities where asbestos-containing materials exist.

This portion of the booklet contains an overview of OSHA's worker protection requirements for exposure to asbestos in general industry and describes the steps an employer must take to reduce the levels of asbestos in the workplace. The revised rule lowers the permissible exposure limit (PEL), contains mandatory methods of control for brake and clutch repairs, and provides training provisions for maintenance and custodial workers. (OSHA has developed a separate standard for asbestos in the construction industry; see Part I of this guide.)

Scope and Application

OSHA's revised standards for asbestos were developed in recognition of the vastly different conditions prevailing in the workplaces for general industry (29 Code of Federal Regulations (CFR) Part 1910.1001), for the shipyard industry (29 CFR Part 1915), and for the construction industry (29 CFR Part 1926.1101). The information in this section applies to all occupational exposure to asbestos in general industry.

More than 685,000 workers in general industry, mostly in auto repair, are affected by the new standard. OSHA estimates, conservatively, that about 42 additional cancer deaths per year will be avoided in all industries, in addition to the lives saved of those peripherally exposed to asbestos and the lives saved by earlier OSHA standards.

Section 2

Provisions of the Standard

OSHA sets out several provisions employers must follow to comply with the asbestos standard. The agency has established strict exposure limits and guidelines for exposure monitoring, medical surveillance, recordkeeping, regulated areas and communication of hazards.

Permissible Exposure Limits (PELs)

Time-Weighted Average (TWA)—The employer shall ensure that no employee is exposed to an airborne concentration of asbestos in excess of 0.1 fiber per cubic centimeter of air (0.1 f/cc) as averaged over an 8-hour day.

Excursion Limit (EL)—The employer shall ensure that no employee is exposed to an airborne concentration of asbestos in excess of 1.0 fiber per cubic centimeter of air (1 f/cc) as averaged over a sampling period of 30 minutes.

OSHA has adopted the term “excursion limit” to refer to the short-term permissible exposure limit to be consistent with the terminology used by the American Conference of Governmental Industrial Hygienists (ACGIH).

Exposure Monitoring

Except for brake and clutch repair where a “preferred” control method is used, each employer who has a workplace or work operation covered by this standard must assess all asbestos operations for their potential to generate airborne fibers. Where exposure may exceed the PEL, employee exposure measurements must be made from breathing zone air samples representing the 8-hour TWA and 30-minute EL for each employee.

Initial monitoring also must be performed for all employees who are, or may reasonably be expected to be, exposed to airborne concentrations of asbestos at or above the PEL and/or EL unless: (1) monitoring results conducted after March 31, 1992, meet all other standard-related requirements; and (2) the collected data demonstrate that asbestos is not capable of being released in airborne concentrations at or above the PEL and/or EL when materials are being processed, use, or handled. If initial monitoring indicates that exposures are above the PEL and/or EL, periodic monitoring must be conducted at intervals no greater than every six months. If either initial or periodic monitoring statistically indicates that employee exposures are below the PEL and/or EL, the employer may discontinue monitoring for those employees whose exposures are represented by such monitoring.

The employer must reinstate monitoring whenever there has been a change in the production, process, control equipment, personnel or work practices that may result in new or additional exposures to asbestos above the PEL and/or EL, or when the employer has reason to suspect that a change may result in new or additional exposures above the PEL and/or EL.

Affected employees and their representatives must be allowed to observe monitoring and must be notified in writing, either individually or by posting results in an accessible location within 15 working days after the receipt of the results of monitoring. This written notification must contain the corrective action being taken by the employer to reduce employee exposure to asbestos on or below the PEL and/or EL wherever monitoring results indicate that the PEL and/or EL has been exceeded. If monitoring is being observed in a regulated area, the observer must be provided proper protective clothing and equipment.

Medical Surveillance

The employer must institute a medical surveillance program for all employees who are or will be exposed to airborne concentrations of asbestos at or above the PEL and/or EL. All medical examinations and procedures must be performed by or under the supervision of a licensed physician. Such exams must occur at a reasonable time and place and must be provided at no cost to the employee. At a minimum, such examinations must include a medical and work history; a complete physical examination with emphasis on the respiratory system, the cardiovascular system and the digestive tract; a chest X-ray; pulmonary function tests; respiratory disease standardized questionnaire as set forth in 29 CFR 1910.1001 Appendix D, Part 1, of the standard; and any additional tests deemed appropriate by the examining physician. These examinations must be made available annually. Chest roentgenograms must be conducted in accordance with Table 3.

Table 3
Frequency of Chest Roentgenogram

| 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 |

Also, an abbreviated standardized questionnaire (see 29 CFR Part 1910.1001, Appendix D, Part 2, of the standard) must also be administered to the employee as part of the periodic (annual) medical examination. Upon termination of employment, the employer must provide a termination of employment medical exam to the employee within 30 calendar days before or after the date of termination.

If adequate records exist that show the employee has been examined in accordance with the standard within the past year, no additional medical examination is required. A pre-employment medical examination may not be used to meet this requirement unless the employer pays for it.

The employer must provide the examining physician with a copy of the standard and Appendixes D and E; a description of the affected employee’s duties as they relate to his or her asbestos exposure; the employee’s actual or anticipated exposure level; a description of any personal protective and respiratory equipment used or to be used; and information from previous medical examinations. Once the physician has completed the exam, the employer must obtain a written signed opinion from the physician. It must contain the results of the medical examination and the physician’s opinion as to whether the employee has any detailed medical conditions that would place the employee at an increased risk from exposure to asbestos, any recommended limitations on the employee or upon the use of personal protective equipment such as respirators, a statement that the employee has been informed by the physician of the results of the examination, and a statement that the employee has been informed by the physician of the increased risk of lung cancer attributable to the combined effect of smoking and asbestos exposure.

The physician is not to reveal in the written opinion given to the employer specific findings or diagnoses unrelated to occupational exposure to asbestos. The employer must provide a copy of the physician’s written opinion to the affected employee within 30 days of its receipt.

Recordkeeping

The employer must keep an accurate record of all exposure measurements taken to monitor employee exposure to asbestos. This record must be kept for 30 years. The employer also must maintain an accurate record for each employee subject to medical surveillance.

This record must be maintained for the duration of employment plus 30 years. In addition, the employer must maintain all employee training records for one year beyond the last date of employment by the employee.

All records must be made available to the commissioner of labor, affected employees, former employees and designated representatives in accordance with 29 CFR Part 1910.1020. When the employer ceases to do business and there is no successor to receive the records for the prescribed period, the employer must notify the director of NIOSH at least 90 days prior to the disposal of records.

Also, if handling, using or processing any products made from or containing asbestos are exempted, the employer must establish and maintain accurate records of objective data that exempt these products. These records must be kept for the duration of the employer’s reliance upon the data.

Building and facility owners also are required to maintain records about the presence, location and quantity of asbestos-containing material and presumed asbestos-containing material in the building or facility. These records must be kept for the duration of ownership and must be transferred to the successive owners.

Regulated Areas

The employer must establish and set apart a regulated area wherever airborne concentrations of asbestos and/or presumed asbestos-containing material exceed the PEL and/or EL. Only authorized personnel may enter regulated areas. All people entering a regulated area must be supplied with and are required to use an appropriate respirator.

No smoking, eating, drinking, chewing tobacco or gum, or applying cosmetics is permitted in regulated areas.

Warning signs must be provided and displayed at each regulated area and must be posted at all approaches to regulated areas. Where necessary, signs must bear pictures or graphics, or be written in appropriate language so that all employees understand them. These signs must bear the following information by June 1, 2015:

DANGER
ASBESTOS
MAY CAUSE CANCER
CAUSE DAMAGE TO LUNGS
AUTHORIZED PERSONNEL ONLY
WEAR RESPIRATORY PROTECTION AND
PROTECTIVE CLOTHING IN THIS AREA

In addition, warning labels must be affixed to all asbestos products (raw materials, mixtures, scrap) and to all containers of asbestos products, including waste containers, that may be in the workplace. The labels must comply with the requirements of 29 CFR 1910.1200(j) of OSHA's Hazard Communication Standard and must include the following information by June 1, 2015:

DANGER
CONTAINS ASBESTOS FIBERS
MAY CAUSE CANCER
CAUSES DAMAGE TO LUNGS
DO NOT BREATHE DUST
AVOID CREATING DUST

Labels or safety data sheets (SDSs) are not required where asbestos fibers have been modified by a bonding agent, coating, binder or other materials, if the manufacturer can demonstrate that during handling, storing, disposing, processing or transporting no airborne concentrations of fibers of asbestos in excess of PEL and/or EL will be released or if asbestos is present in a product in a concentration of less than 1 percent.

Communication of Hazards

Building/Facility Owners Duties

The communication of asbestos hazards is vital. Employees engaged in housekeeping activities in public and commercial buildings with installed asbestos-containing materials may be exposed to asbestos fibers. Building owners are often the only and/or best source of information concerning the presence of previously installed asbestos-containing building materials. The standard requires building owners and employers of potentially exposed employees to institute the following practices:

- In buildings built before 1980, treat thermal system insulation and sprayed-on and troweled-on surfacing materials as asbestos-containing materials, unless properly analyzed and found not to contain more than 1 percent asbestos.
- Train employees who may come in contact with asbestos-containing materials to deal safely with them.
- Treat asphalt and vinyl flooring materials installed no later than 1980 as asbestos-containing, unless properly analyzed and found to contain no more than 1 percent asbestos.

- Inform employers of employees performing housekeeping activities of the presence and location of asbestos-containing materials and presumed asbestos-containing materials that may have contaminated the area.

Keep records of the presence, location and quantity of asbestos-containing materials and presumed asbestos-containing materials present in the building for the duration of ownership and transfer these records to a successive owner.

Information and Training

Employers must develop a training program for all employees who are exposed to airborne concentrations of asbestos at or above the PEL and/or EL. Training must be provided prior to or at the time of initial assignment and at least yearly thereafter. The training program must inform employees about ways in which they can safeguard their health.

In addition, employers must provide an awareness training course for employees who do housekeeping operations in facilities where asbestos-containing materials or presumed asbestos-containing materials are present. The elements of the course must include the health effects of asbestos; locations; signs of damage and deterioration of asbestos-containing materials and presumed asbestos-containing materials; the proper response to fiber release episodes; and where the housekeeping requirements are found in the standard. This training must be held annually and conducted so that all employees understand it. Also, all training materials must be available to the employees without cost and, upon request, to the commissioner of labor or her designee.

Section 3

Methods of Compliance

Control Methods

To the extent feasible, engineering and work practice controls must be used to reduce and maintain employee exposure at or below the PEL and/or EL. The standard, therefore, requires the employer to institute the following measures:

- Design, construct, install and maintain local exhaust ventilation and dust collection systems according to the American National Standard Fundamentals Governing the Design and Operation of Local Exhaust Systems, ANSI Z9.2-1979.
- Provide a local exhaust ventilation system for all hand-operated and power-operated tools such as saws, scorers, abrasive wheels, and drills that produce or release fibers of asbestos.
- Handle, mix, apply, remove, cut, score or work asbestos in a wet state to prevent employee exposure.
- Do not remove cement, mortar, coating, grout, plaster or similar materials containing asbestos from bags, cartons or other containers that are being shipped without wetting, enclosing or ventilating them.
- Do not sand floors containing asbestos.
- Do not use compressed air to remove asbestos or materials containing asbestos unless the compressed air is used in conjunction with a ventilation system designed to capture the dust cloud created by the compressed air.
- Use a negative-pressure enclosure/HEPA¹ vacuum system or a low-pressure/wet cleaning method during automotive brake and clutch inspection, disassembly, repair, and assembly operations. An equivalent method also can be used if the employer demonstrates that the method being used achieves the required exposure reductions. (See 29 CFR Part 1910.1001 Appendix F, Part C, of the standard.)
- Where no more than five pairs of brakes or five clutches are inspected, disassembled, repaired or assembled weekly, the employer may use the control methods or work practices as set forth in 29 CFR Part 1910.1001 Appendix F, Paragraph D, of the standard.
- Where engineering and work practice controls have been instituted but are insufficient to reduce exposure to the required level, the employer must supplement them by using respiratory protection. Where the PEL and/or EL is exceeded, the employer must establish and implement a written program to reduce employee exposure to or below the PEL and to or below the EL by means of engineering and work practice controls and by the use of respirators where required and permitted.

Written plans for the program must be available upon request to the commissioner of labor or his designee, and employees and their representatives. These plans must be reviewed and updated, as necessary, to reflect significant changes in the compliance program.

Employee rotation *cannot* be used as a means of compliance with the PEL and/or the EL.

Respiratory Protection

Respirators must be selected, provided and used in the following circumstances:

- while feasible engineering and work practice controls are being installed or implemented;
- during maintenance and repair activities, or other activities where engineering and work practice controls are not feasible;
- in work situations where feasible engineering and work practice controls are not yet sufficient to reduce exposure to or below the PEL and/or EL; and ●in emergencies.

¹. High-efficiency particulate air (HEPA) filter capable of trapping and retaining at least 99.97 percent of all monodispersed particles of 0.3 micrometer in diameter.

Respirators must be selected from among those approved by NIOSH under the provisions of Title 42, CFR Part 84. The employer must also provide a powered, air-purifying respirator in lieu of any negative-pressure respirator when the employee chooses it and when the respirator provides adequate protection. And, where respiratory protection is required, the employer must develop a respiratory protection program in accordance with 29 CFR 1910.134 (b)–(d) (except (d)(1)(iii)) and (f) through (m). The respirators and the respiratory protection program must be provided to employees free of charge.

Employees who use a filter respirator must use a high-efficiency filter and must change filters whenever an increase in breathing resistance is detected. Employees who wear respirators must be allowed to wash their faces and respirator facepieces whenever necessary to prevent skin irritation associated with respirator use. An employee must not be assigned to tasks requiring the use of respirators if a physician determines that the employee is unable to function normally wearing a respirator or that the employee’s safety and health or that of others would be affected by the employee’s use of a respirator. In this case, the employer must assign the employee to another job or give the employee the opportunity to transfer to a different job that does not require the use of a respirator. The job must be with the same employer, in the same geographical area, and with the same seniority, status, and rate of pay, if such a position is available.

The employer must ensure that a respirator issued to an employee fits properly and exhibits minimum facepiece leakage. Employers also must perform quantitative or qualitative fit tests, whichever are appropriate, at the time of initial fitting and at least every year for each employee wearing tight-fitting respirators. Protocols for fit tests are set forth in 29 CFR 1910.134, Appendix A, of the standard. Tests must be used to select facepieces that provides required protection. (See Table 4.)

Table 4
Assigned Protection Factors

| Type of Respirator ^{1,2} | Half Mask | Full Facepiece |
|---|-----------------|----------------|
| Air-purifying Respirator | 10 ³ | 50 |
| Powered Air-purifying Respirator | 50 | 1,000 |
| Supplied-air Respirator or Airline Respirator | | |
| Demand mode | 10 | 50 |
| Continuous flow mode | 50 | 1,000 |
| Pressure-demand or other positive-pressure mode | 50 | 1,000 |
| Self-Contained Breathing Apparatus (SCBA) | | |
| Demand mode | 10 | 50 |
| Pressure-demand or other positive-pressure mode (e.g., open/closed circuit) | – | 10,000 |

Notes:

1. Employers may select respirators assigned for use in higher workplace concentrations of a hazardous substance for use at lower concentrations of that substance, or when required respirator use is independent of concentration.
2. The assigned protection factors in this table are only effective when the employer implements a continuing effective respirator program as required by the respiratory protection standard, 29 CFR 1910.134, including training, fit testing, maintenance, and use requirements.
3. Employers may not select or use filtering facepieces to protect against asbestos fibers.

Protective Clothing

For any employee exposed to airborne concentrations of asbestos that exceed the PEL and/or EL, the employer must provide at no cost to the employee, and require the use of, protective clothing, such as coveralls or similar full-body clothing, head coverings, gloves and foot coverings. In addition, wherever the possibility of eye irritation exists, face shields, vented goggles or other appropriate protective equipment must be provided and worn.

Asbestos-contaminated work clothing must be removed in change rooms and placed and stored in closed, labeled containers that prevent dispersion of the asbestos into the ambient environment. Protective clothing and equipment must be cleaned, laundered, repaired or replaced to maintain effectiveness.

The employer must provide clean protective clothing and equipment at least weekly to each affected employee. The employer must inform any person who launders or cleans asbestos-contaminated clothing or equipment of the potentially harmful effects of exposure to asbestos. In addition, the employer must be certain that the person doing the cleaning or laundering has been properly instructed on how to effectively prevent the release of airborne fibers in excess of the permissible exposure limits. For example, asbestos must never be removed from protective clothing by means of blowing or shaking.

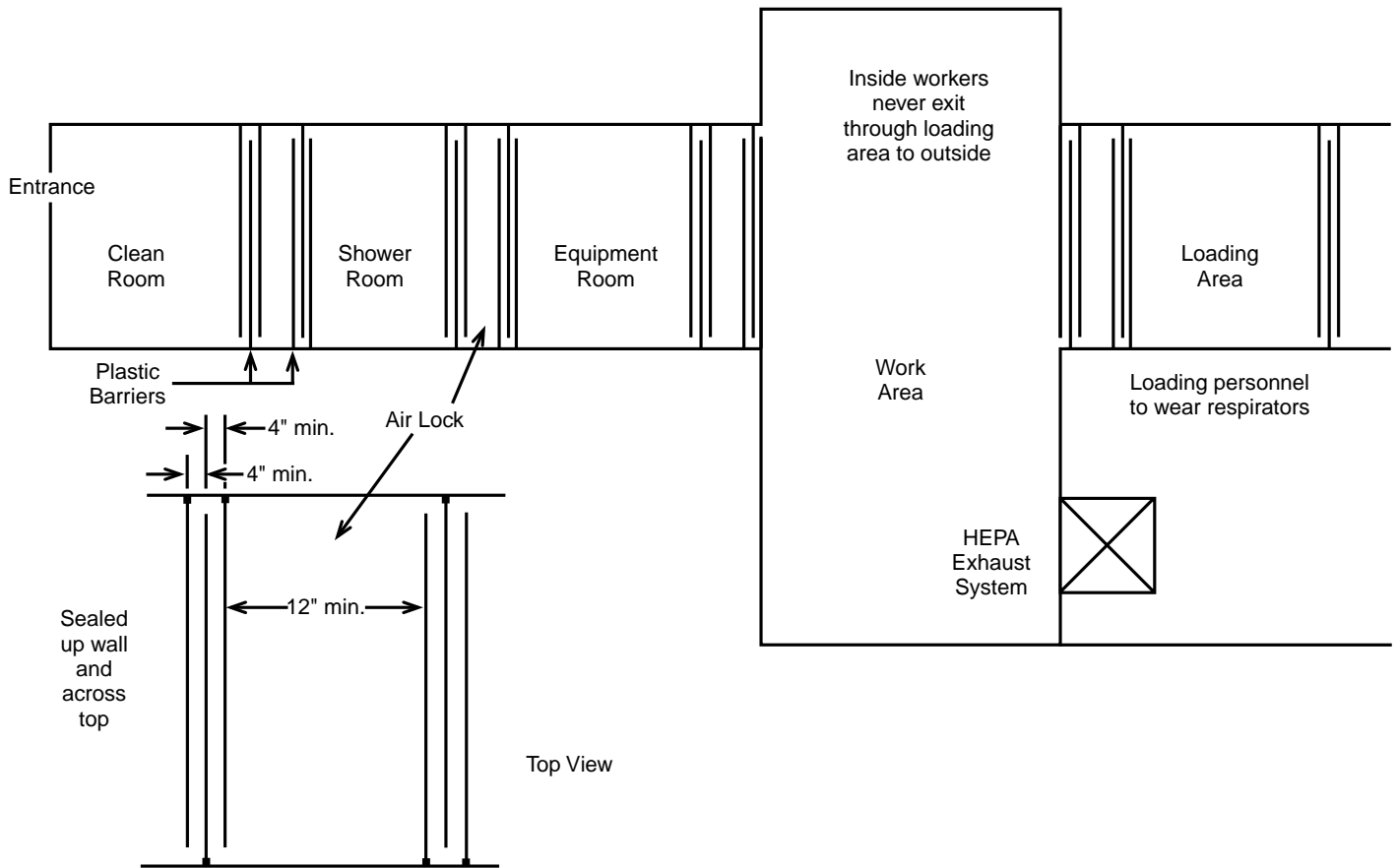
Contaminated clothing and equipment taken out of change rooms or the workplace for cleaning, maintenance or disposal must be transported in sealed impermeable bags or other closed impermeable containers and must be appropriately labeled.

Hygiene Facilities and Practices

Employees who are required to work in regulated areas must be provided with clean change rooms, shower facilities and lunchrooms. Change rooms must have two separate lockers or storage facilities—one for contaminated clothing, the other for street clothing. They must be far enough apart to prevent accidental contamination of the employee's street clothes. Employees must shower at the end of the shift and cannot leave the workplace wearing any clothing or equipment worn during the work shift. Lunchroom facilities must have a positive-pressure filtered air supply and must be readily accessible to employees. See Figure 1.

Figure 1

Decontamination Area Arrangement



The employer must ensure that employees do not enter lunchroom facilities with protective work clothing or equipment unless surface asbestos fibers have been removed by vacuuming or some other method that removes dust without causing the asbestos to become airborne. The employer also must ensure that employees wash their hands prior to eating, drinking, or smoking. Smoking is prohibited in regulated areas.

Housekeeping

All surfaces must be maintained as free as possible of accumulations of waste containing asbestos or asbestos dust. The preferred methods of cleanup are wet cleaning and/or vacuuming with HEPA-filtered vacuuming equipment. Compressed air may not be used to clean surfaces contaminated by asbestos at any time. Whichever cleanup method is chosen, the equipment must be used and emptied in a manner that minimizes the reentry of asbestos into the workplace.

The employer also must ensure that all spills and sudden releases of asbestos-containing materials are immediately cleaned up, that sanding asbestos-containing floors is prohibited, and that low abrasion pads at speeds lower than 300 rpm and wet methods are used. If the floor has sufficient finish, brushing or dry buffing is permissible. If workers are required to buff or wax asbestos-containing resilient floors, building and facility owners must identify the installed material and inform employees and employers of employees doing such housekeeping work.

Asbestos waste, scrap, debris, bags, containers, equipment and asbestos-contaminated clothing consigned for disposal must be collected and disposed of in sealed, labeled, impermeable bags or other closed, labeled impermeable containers.

Glossary

The following terms are used in this document but are not elsewhere defined:

Air-purifying respirator: a respirator with an air-purifying filter, cartridge or canister that removes specific air contaminants by passing ambient air through the air-purifying element.

Asbestos-containing: having an asbestos content of greater than 1 percent.

ACM: asbestos-containing material.

Atmosphere-supplying respirator or supplied-air respirator: A respirator that supplies the respirator user with breathing air from a source independent of the ambient atmosphere. This type includes supplied-air respirators (SARs) and self-contained breathing apparatus (SCBA) units.

Excursion limit (EL): The maximum concentration of an air contaminant to which an employee may be exposed for 30 minutes without regard to the use of a respirator.

Exposure or occupational exposure: Occurs when a person comes into contact with a chemical in the environment. May involve oral ingestion, inhalation, and absorption through the skin or the mucus membranes of the eyes, nose or mouth.

Glove bag: Glove bags are approximately 40-inch-wide times 64-inch-long bags fitted with arms through which the work can be performed. 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. 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 spun-bonded polyolefin material (the same material used to make the disposable protective suits used in major asbestos removal, renovation and demolition operations and in protective gloves).

Mesothelioma: 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.

Negative-pressure respirator: A tight-fitting respirator in which the air pressure inside the facepiece is negative during inhalation with respect to the ambient air pressure outside the respirator.

Objective data: data that demonstrates that the product or material containing asbestos minerals or the activity involving such product or material cannot release airborne fibers in concentrations in excess of the PEL under those work conditions having the greatest potential for releasing asbestos. The employer may use data derived from other employers' jobs. The data should reflect worst case conditions in a variety of occupational settings.

PACM: Presumed asbestos-containing material

Powered air-purifying respirator: a device equipped with: a facepiece, hood or helmet; breathing tube; canister, cartridge, filter, canister with filter or cartridge with filter; and a blower.

Presumed asbestos-containing material: thermal system insulation and surfacing material found in buildings constructed before 1981. The designation of a material as "PACM" may be rebutted pursuant to paragraph (k)(5) of 29 CFR 1926.1101.

Permissible exposure limit (PEL): An exposure limit that is published and enforced by OSHA as a legal standard. The asbestos standard has both an 8-hour time-weighted average (TWA) permissible exposure limit (0.1 fiber per cubic centimeter) and a 30-minute TWA excursion limit (1.0 fiber per cubic centimeter).

Regulated area: an area established by the employer to demarcate areas where Class I, II and III asbestos work is conducted, and any adjoining area where debris and waste from such asbestos work accumulate; and a work area within which airborne concentrations of asbestos exceed or there is a reasonable possibility they may exceed the permissible exposure limit.

Respirator: any device designed to provide the wearer with respiratory protection against inhalation of a hazardous atmosphere.

Tensile strength: the greatest longitudinal stress a substance can bear without tearing apart.

Additional Information

For questions regarding asbestos and the material discussed in this booklet, please contact the agencies listed below.

1. Specifications for Asbestos Hazard Management Program, including the Asbestos Hazard Emergency Response Act, and asbestos abatement requirements of the N.C. Department of Administration, Division of State Construction, and N.C. Department of Public Instruction for asbestos removal projects in state-owned and public school buildings:

Asbestos Program
Health Hazards Control Unit
1912 Mail Service Center
Raleigh, NC 27699-1912
Telephone: 919-707-5950

2. National Emission Standards for Hazardous Air Pollutants:

N.C. Department of Health and Human Services
Division of Public Health
Health Hazards Control Unit
1912 Mail Service Center
Raleigh, NC 27699-1912
Telephone: 919-707-5950

3. Transportation of asbestos and asbestos waste:

Program Administrator
N.C. Division of Motor Vehicles
Enforcement Motor Carriers
3128 Mail Service Center
Raleigh, NC 27699-3128
Telephone: 919-861-3186

4. North Carolina Solid Waste Management Rules (regulating the disposal of asbestos waste in landfills):

N.C. Department of Environment and Natural Resources
Division of Waste Management
Solid Waste Section
1646 Mail Service Center
Raleigh, NC 27699-1646

5. Licensing for contractors (including general contract work and asbestos contracting):

N.C. Licensing Board for General Contractors
P.O. Box 17187
Raleigh, NC 27619
Telephone: 919-571-4183

OSH Publications

We provide a variety of OSH publications. These include general industry and construction regulations, industry guides that cover different OSH topics, quick cards, fact sheets and brochures that cover a wide variety of serious safety and health workplace hazards. Workplace labor law posters are available free of charge. To obtain publications, call toll free at 1-800-NC-LABOR (1-800-625-2267) or direct at 919-807-2875. You may view the list of publications and also download many of them at **www.nclabor.com/pubs.htm**.

Occupational Safety and Health (OSH) Sources of Information

You may call 1-800-NC-LABOR (1-800-625-2267) to reach any division of the N.C. Department of Labor; or visit the NCDOL home page on the World Wide Web: <http://www.nclabor.com>.

Occupational Safety and Health Division

Mailing Address:
1101 Mail Service Center
Raleigh, NC 27699-1101
Local Telephone: 919-807-2900 Fax: 919-807-2856

Physical Location:
111 Hillsborough St.
(Old Revenue Building, 3rd Floor)

For information concerning education, training, interpretations of occupational safety and health standards, and OSH recognition programs contact:

Education, Training and Technical Assistance Bureau

Mailing Address:
1101 Mail Service Center
Raleigh, NC 27699-1101
Telephone: 919-807-2875 Fax: 919-807-2876

Physical Location:
111 Hillsborough St.
(Old Revenue Building, 4th Floor)

For information concerning occupational safety and health consultative services contact:

Consultative Services Bureau

Mailing Address:
1101 Mail Service Center
Raleigh, NC 27699-1101
Telephone: 919-807-2899 Fax: 919-807-2902

Physical Location:
111 Hillsborough St.
(Old Revenue Building, 3rd Floor)

For information concerning migrant housing inspections and other related activities contact:

Agricultural Safety and Health Bureau

Mailing Address:
1101 Mail Service Center
Raleigh, NC 27699-1101
Telephone: 919-807-2923 Fax: 919-807-2924

Physical Location:
111 Hillsborough St.
(Old Revenue Building, 2nd Floor)

For information concerning occupational safety and health compliance contact:

Safety and Health Compliance District Offices

Raleigh District Office (3801 Lake Boone Trail, Suite 300, Raleigh, NC 27607)

Telephone: 919-779-8570 Fax: 919-420-7966

Asheville District Office (204 Charlotte Highway, Suite B, Asheville, NC 28803-8681)

Telephone: 828-299-8232 Fax: 828-299-8266

Charlotte District Office (901 Blairhill Road, Suite 200, Charlotte, NC 28217-1578)

Telephone: 704-665-4341 Fax: 704-665-4342

Winston-Salem District Office (4964 University Parkway, Suite 202, Winston-Salem, NC 27106-2800)

Telephone: 336-776-4420 Fax: 336-767-3989

Wilmington District Office (1200 N. 23rd St., Suite 205, Wilmington, NC 28405-1824)

Telephone: 910-251-2678 Fax: 910-251-2654

To make an OSH Complaint, **OSH Complaint Desk:** 919-807-2796

For statistical information concerning program activities contact:

Planning, Statistics and Information Management Bureau

Mailing Address:
1101 Mail Service Center
Raleigh, NC 27699-1101
Telephone: 919-807-2950 Fax: 919-807-2951

Physical Location:
111 Hillsborough St.
(Old Revenue Building, 2nd Floor)

For information about books, periodicals, vertical files, videos, films, audio/slide sets and computer databases contact:

N.C. Department of Labor Library

Mailing Address:
1101 Mail Service Center
Raleigh, NC 27699-1101
Telephone: 919-807-2850 Fax: 919-807-2849

Physical Location:
111 Hillsborough St.
(Old Revenue Building, 5th Floor)

N.C. Department of Labor (Other than OSH)

1101 Mail Service Center
Raleigh, NC 27699-1101
Telephone: 919-733-7166 Fax: 919-733-6197