SCHOOL PERSONNEL ASBESTOS AWARENESS TRAINING

A Training Course
Required by
AHERA

by

Larron Laboratory
529 Broadway
Cape Girardeau, MO
(314) 334-8910

COURSE NAME:

SCHOOL PERSONNEL ASBESTOS AWARENESS TRAINING

COURSE RATIONALE:

40 CFR Part 763, Appendix C to Subpart E, III. (EPA Approval of Training Courses) requires that the following information be provided to the Regional Asbestos Coordinator in the EPA region where the training course maintains its principal business office.

The School Personnel Asbestos Awareness Training course is being developed to meet the requirements of AHERA stated in section 763.91, Operations and Maintenance, (c) Training, 1i through 1v.

COURSE SPONSOR:

Larron Laboratory
529 Broadway
Cape Girardeau, MO 63701
(314) 334-8910

STATES THAT CURRENTLY APPROVE THIS TRAINING PROGRAM

Because AHERA is new legislation and this course is mandated in section 763.91, this request for course approval is the initial request to the EPA.

COURSE CURRICULUM:

I. Length of training
    A. 1/4-1/2 day (2-4 hours)

II. Course topics
    A. Asbestos: forms and uses
    B. Health effects of asbestos exposure
        1. Asbestosis
        2. Lung cancer
        3. Mesothelioma
        4. Relationship between smoking and asbestos exposure
        5. Latency periods
    C. Determination of condition of ACBM
        1. Recognition of damage
        2. Recognition of deterioration
        3. Recognition of delamination
    D. Locations of identified ACBM in each school building and recommended procedures for limiting exposure
    E. Knowledge of school's asbestos management plan
        1. Location of master plan
        2. Name, address, and phone number of LEA's person designated to carry out the management plan

III. Amount and type of hands-on training
   A. None required or necessary in this type of awareness course

IV. Examinations
   A. None required or necessary in this type of awareness course

V. Course materials
   A. Student course manual and instructor's manual are contained in appendix A of this application
   B. Course materials used are derived from EPA-funded courses or publications
      1. "Practices and Procedures in Asbestos Control," Midwest Asbestos Information Center, University of Illinois-Chicago, School of Public Health and The National Asbestos Training Center, University of Kansas
      2. "Asbestos Abatement: Facility Survey and Building Systems," University of Florida-TREEO Center, Gainesville, FL

VI. Course completion certificate
   A. A facsimile of a "successful completion of training" certificate is contained in appendix B of this application
   B. Wallet-sized completion certificates are also planned

VII. Course Instructors and/or resource personnel
   A. David J. Roth, Sr. Laboratory Manager
      Senior Chemist and Asbestos Project Manager
      B.S., Chemistry, Southeast Missouri State University, Cape Girardeau, MO, 1961
      M.S., Chemistry, 1963, Southern Illinois University, Carbondale, IL

   Continuing Education includes:
   1) "Identification of Asbestos," McCrone Research Institute, Chicago, IL
   2) "Sampling and Evaluating Airborne Asbestos Dust," NIOSH 582, NIOSH Training Center, Cincinnati, January, 1986
   3) "Workshop on Safe Removal of Asbestos from Buildings and Structures," University of Missouri-Columbia, April 1986
   4) "The Professional Approach to Asbestos Hazards Programs," AHP Research, Inc., October, 1986
   5) "Practices and Procedures in Asbestos Control," Midwest Asbestos Information Center, University of Illinois-Chicago, School of Public Health, June, 1986
   6) "Procedures for School Inspection," Illinois Department of Public Health, Springfield, December, 1986
   7) "Building Inspection and Management Planning," University of Texas-Arlington, October, 1987

   Experience includes more than 3 years in asbestos analysis and/or abatement management. Mr. Roth has participated in over 25 abatement projects in Illinois and Missouri.

B. Daniel B. Roth, Chemist and Asbestos Project Manager
B.S. Chemistry/Biology, Concordia College, River Forest, IL, 1986

Continuing Education includes:

1) "Sampling and Evaluating Airborne Asbestos Dust," NIOSH 582, NIOSH Training Center, Cincinnati, July, 1986
2) "The Professional Approach to Asbestos Hazards Programs," AHP Research, Inc. October, 1986
3) "Procedures for School Inspection," Illinois Department of Public Health, December, 1986
4) "Practices and Procedures of Asbestos Control," University of Kansas, June, 1987
5) "Identification of Asbestos," McCrone Research Institute, Chicago, IL, June, 1987
6) "Building Inspection and Management Planning," University of Texas-Arlington, October, 1987

Experience includes more than 1 year in asbestos analysis and/or abatement management. Mr. Roth has participated in more than 15 abatement projects in Illinois and Missouri.

C. Steven K. Fritzler, Chemist and Asbestos Project Manager
B.S. Chemistry/Biology, Concordia College, Seward, NE, 1971
M.Ed. Science Education, University of Missouri-Columbia, 1976

Continuing Education includes:

1) "Practices and Procedures of Asbestos Control," Midwest Asbestos Information Center, University of Illinois-Chicago, School of Public Health, May, 1987
2) "Sampling and Evaluating Airborne Asbestos Dust," NIOSH 582, Midwest Center for Occupational Health and Safety, St. Paul, MN, June, 1987
3) "Asbestos Abatement: Facility Survey and Building Systems," University of Florida-TREEO Center, Gainesville, FL, September, 1987
4) "Management Planning," University of Texas-Arlington, October, 1987

Experience includes more than 4 months of asbestos analysis and/or abatement management. Mr. Fritzler has participated in more than 12 asbestos abatement projects.

D. Carol A. Roth, Asbestos Project Manager
B.S. Vocational Home Economics, Southeast Missouri State University, Cape Girardeau, MO, 1961

Continuing Education includes:

1) "Practices and Procedures of Asbestos Control," University of Kansas, March, 1987
2) "Sampling and Evaluating Airborne Asbestos Dust," NIOSH 582, Birmingham, AL, July, 1987
3) "Building Inspection and Management Planning," University of Texas-Arlington, October, 1987

Experience includes more than 6 months of asbestos analysis and/or abatement management. Ms. Roth has participated in more than 10 asbestos abatement projects.

E. Emma Craig, Technician

Continuing Education includes:

1) "Procedures for School Inspection," Illinois Department of Public Health, December, 1986

2) "The Professional Approach to Asbestos Hazards Programs," AHP Research, Inc., October, 1986

Experience includes 1 month of asbestos sampling and analysis. Ms. Craig has participated in 2 abatement projects.

F. Robert Bennett, Technician
B.S., Concordia College, Seward, NE, 1973

Continuing Education includes:

1) "Sampling and Evaluating Airborne Asbestos Dust," NIOSH 582, New York, NY, June, 1987

Experience includes 3 months of asbestos air sampling and analysis. Mr. Bennett has participated in 5 abatement projects.

SCHOOL PERSONNEL ASBESTOS AWARENESS TRAINING

APPENDIX A

SCHOOL PERSONNEL ASBESTOS AWARENESS TRAINING

COURSE MANUAL

by

Larron Laboratory
529 Broadway
Cape Girardeau, MO
(314) 334-8910

ASBESTOS: FORMS AND USES

What is Asbestos?

Asbestos is a term for a group of naturally occurring minerals that separates into fibers. The mineral rock is mined and then milled for commercial use. Asbestos fibers are incombustible and have good thermal and electrical insulating properties. There are six asbestos minerals that are used commercially:

Chrysotile
Amosite (Cummingtonite-grunerite asbestos)
Crocidolite
Anthophyllite asbestos
Tremolite asbestos
Actinolite asbestos

Chrysotile and amosite are the most frequently found asbestos minerals in the asbestos-containing materials used in school buildings.

Why is Asbestos a Unique Environmental Contaminant?

The durability of asbestos fibers and their small size and fibrous shape make asbestos an unusual environmental contaminant.

Asbestos fibers cannot be easily destroyed or degraded. The size and shape of these fibers permit them to remain airborne for long periods of time. Asbestos fibers that are released from asbestos-containing materials enter the air and contaminate the building environment.

When the fibers have entered the air, individuals in the building can be exposed and inhale the fibers.

Although most fibers will not remain in the lungs, those that are retained will stay indefinitely.

What are Some Uses of Asbestos in School Buildings?

Most asbestos products are used in building construction and many products containing asbestos are found in buildings. Asbestos has been used in cement products, plaster, fireproof textiles, vinyl floor tiles, thermal and acoustical insulation, and sprayed materials.

Asbestos also is used in automotive brake linings. In schools that have shops for automotive training, asbestos contamination can occur as a result of automotive brake servicing.

What Asbestos-Containing materials in School Buildings can Create An Exposure Problem?

Only certain kinds of asbestos-containing materials in school buildings are considered hazardous. The potential for release, contamination, and exposure depends on the condition fo the asbestos-containing material (such as deterioration from age) and the probability that the material will be damaged.

Hard asbestos-containing materials such as vinyl floor tile do not generally create exposure problems. Asbestos fibers are firmly bound or encased in the material. Sanding, grinding, or cutting will cause asbestos fibers to be released. Therefore, these hard materials should not be considered hazardous unless they are machined.

Is a Medical Examination necessary for Persons Exposed to Asbestos in School Buildings?

Medical examination are not recommended in school exposure situations. It is difficult to detect asbestos-released diseases in children due to the long induction period before the disease appears. Individuals who have been exposed to asbestos should avoid smoking; and of course, medical advice should be obtained for any specific concerns or symptoms. Soft or loosely bound (i.e., friable) asbestos-containing materials can release asbestos fibers following only minor disturbance to the material. It is these soft asbestos-containing materials that can caused contamination and exposure problems.

What is Friable Material?

Friable material is material that can be crumbled, pulverized, or reduced to powder in the hand. Friable material may be an asbestos-containing material or it may be a material that contains other fibers such as cellulose and glass fibers.

What are Friable Asbestos-Containing Materials?

Friable asbestos-containing materials that were used for fireproofing, thermal and acoustical insulation, or decoration in building construction and renovation. The asbestos content of these materials is usually found in the range of 5% to 50%. These materials were usually applied by spraying but have also been applied by troweling. They are friable in varying degrees depending on the components of the material, the amount of cement added, and the method of application. Sprayed material is usually soft. Cementitious material varies from soft to relatively hard.

What is Sprayed Asbestos Material?

Sprayed asbestos material is a mixture of asbestos fibers, other fibers (cellulose, non-asbestos mineral fibers) and a binder which has been applied to ceilings, beams, and other surfaces by spraying. It has been widely used for fireproofing, thermal and acoustical insulation, and decoration. Most friable material in schools is sprayed material.

In 1973, EPA Prohibited that spraying of asbestos material for fireproofing and insulation. EPA prohibited the application of sprayed asbestos material for nearly all purposes in 1978.

Where are Friable Asbestos Materials Located?

Friable asbestos materials are usually found on overhead surfaces, steel beams, ceilings, and occasionally on walls and pipes.

Does all Friable Material Contain Asbestos?

Many materials that look like friable asbestos material do no necessarily contain asbestos. Some friable material contains glass fibers, cellulose, or other non-asbestos fibers.

How are Asbestos Fibers Released form Friable Asbestos Material?

Fibers are released from friable material as a result of a breakdown in the integrity of the material due to deterioration or direct contact and damage.

As friable asbestos material ages, it can lose its cohesive strength and release fibers. Fallout of fibers from deteriorated material is usually low-level but continuous.

Fiber release by contact and damage depend on the accessibility of the material and the degree of disturbance. Contamination can be very high for brief periods of time during a disturbance and then gradually decrease as the fibers settle. Fiber release can occur after only minor contact with friable material.

Direct contact or damage to asbestos materials can occur in a number of ways:

1.) School Activities - A ball hitting friable material on a gymnasium ceiling or wall. Hanging pictures ar attaching displays to friable material will cause fiber release.

2.) Maintenance Activities - Any maintenance activity involving intentional or accidental contact with friable material.

3.) Vandalism - Material may be scraped, gouged, or hit.

4.) Water Damage - Water from roof or plumbing leaks will cause material deterioration and in some cases delamination (i.e., breaking away of layers of material from the underlying surface).

5.) Vibration - Building vibration from sources within or outside the building. For example, vibration from activities on the on the floor above or vibration from machinery can cause movement of the friable material and release fibers.

Fibers that have been released can remain suspended in the air for many hours. After the fibers settle, they can be resuspended in the air by disturbances created by student activities or custodial work such as dusting or sweeping. Resuspension of asbestos fibers in the air is call reentrainment. Reentrainment may cause repeated exposures after the fibers are released from the friable asbestos material.

Is Asbestos Contamination Permanent Once it Occurs?

Asbestos fibers tend to remain in the building that they contaminate but can be removed by cleaning. Wet mopping is recommended since water inhibits fiber movement, thus preventing reentrainment during the cleaning process. Dry dusting and sweeping will cause reentrainment and should be avoided. If wet cleaning is no feasible, a High Efficiency Particulate Air (HEPA) filtered vacuum should be used. Conventional vacuum cleaning equipment normally used in the school is not equipped with a filter size small enough to collect asbestos fibers and should not be used to clean in areas of asbestos contamination. If conventional vacuum cleaning equipment is used, fibers can be reentrained.

When Should School Officials Be Concerned About Asbestos Material?

If friable asbestos material is present in the school building, an exposure problem may exist.

Is Pipe Covering and Boiler Lagging of Concern?

Friable asbestos material was used for many years in pipe covering and boiler lagging until EPA prohibited its application in 1975. Pipe covering and boiler lagging do no create an exposure hazard unless the friable insulation material is exposed, retaping or covering the damaged area will prevent asbestos fiber release.

HEALTH EFFECTS OF ASBESTOS EXPOSURE

INTRODUCTION

Asbestos has been in general use throughout the world since the turn of the century. Annual production increased progressively from approximately 400,000 tons in the 1900's to 3,500,000 tons in the late 1970's. Since that time production has declined. Because of its unique physical properties - the very reason why asbestos has achieved such widespread use - once it is installed, applied, or used in any way-- it becomes permanent. It doesn't "go away".

In addition to its special physical properties, asbestos fibers have unique medical effects. Of all of the compounds capable of producing an adverse effect on the human body, asbestos may have a longer latency period between exposure and the subsequent appearance of disease than any other substance. For example, certain types of cancer that develop from asbestos exposure may not appear until 40 years after the asbestos exposure occurred!

Although the adverse effect upon health from asbestos was first described in the mid-1950's, widespread concern about asbestos has developed only recently because of the extensive health problems now appearing among people who were heavily exposed during and immediately after World War II. In addition to several types of cancer, asbestos can cause damage to the lungs of a kind not seen from exposure to other materials.

Individuals vary considerably in their ability to withstand disease. Some of us get colds frequently, others are virtually immune to such infections. Asbestos fibers can produce a fatal disease in one person, and yet leave no marks on a colleague working nearby. Disease due to asbestos occurs among susceptible housewives of asbestos workers, due presumably to contact with asbestos in the contaminated clothing brought home by the worker. Preventive measures must be adequate to protect the most sensitive-- those of us most likely to develop disease.

IMMEDIATE HEALTH EFFECTS

Unlike other organs, the lung is continuously exposed to the environment with all of the vapors and suspended particulate matter that it contains. All of us are endowed with a complex defense system to protect the lung from damage from these materials.

Our breathing passages are lined by a sticky mucous layer that traps small particles. The membrane that lines the bronchial tubes contains hair-like projections that continuously move that mucous layer toward the mouth. Most particles, including asbestos fibers, are trapped and eliminated by this mechanism.

But, some asbestos fibers are carried along in the air, down the branchial tubes, and lodge in lung tissue where they remain. Some fibers break into small fragments and are eliminated from the body, but others remain, either whole or in segments, and incite a reaction in the surrounding lung tissue. These retained fibers-- plus the associated tissue reaction-- creates lung disease.

The initial deposition of asbestos fibers and resulting tissue reaction proceeds unknown to the person in whom it has occurred. There are no symptoms or signs associated with the process. Thus, an exposed person is usually quite unaware of any consequences of his exposure at the time it is occurring. Symptoms that workers may notice are the result of the contaminated environments in which they work. Construction sites are frequently dusty, and it is the various dusts and fumes, not the asbestos fibers, that create the cough, breathing difficulty, and uncomfortable workplace conditions.

LATE HEALTH EFFECTS

Asbestos reaches the body by inhalation, skin penetration or via the mouth, and the lung is the most important site of the majority of the adverse health effects.

Cancer

The inside of the rib cage and the outer surface of the lungs are both covered by a glistening membrane know as the pleura. An unusual form of cancer, known as mesothelioma, originates in this pleural tissue. This is the type of cancer that can take as long as forty years from the onset of exposure to its appearance. Only a small number of people who have been exposed to asbestos develop mesothelioma. On the other hand, it seldom, if ever, occurs in adults in the absence of asbestos exposure. There are other, much more frequent types of lung cancer that occur irrespective of asbestos exposure. They are very closely related to cigarette smoking. Exposure to asbestos and to cigarette smoke increases the likelihood of developing these common forms of lung cancer. For example, the frequency of these lung cancers in asbestos workers who do not smoke is only 2 to 3 times greater than the non-exposed, non-smoking population; but among asbestos workers who smoke 1 pack per day, the cancer rate rises to 40 times, and if they smoke more than a package a day, it is as great as 90 times the rate in non-exposed non-smokers! There is a multiplication effect from cigarette smoke and asbestos with regard to lung cancer. Smoking is not a factor in the production of the pleural cancer, mesothelioma.

Asbestosis

This is a special form of scarring of lung tissue, also known a pulmonary fiberosis, that may develop after many years of asbestos exposure. The breathing capacity is reduced, patients become short of breath, specific abnormalities appear on the chest x-ray film, and if the disease process becomes advanced it can cause complete disability and death.

Pleural Disease

The migration of asbestos fibers into the pleural membranes produces a thickening of pleural tissue that can be seen on the chest x-ray film. Although there are numerous other causes for thickening of the pleural surfaces, when it is due to asbestos it results in changes on the chest x-ray films with unique features. These pleural changes frequently occur in the absence of any other effects from asbestos exposure. Unlike asbestosis, the lung tissue-scarring mentioned above, there can be extensive involvement of the pleural membranes without the patient becoming aware that any changes have occurred. Frequently, there are no symptoms and lung function is intact. However, in some patients, symptoms do develop. These alterations of the pleura can be considered a "marker" of asbestos exposure. At times they may be associated with lung disease, but this is infrequent.

SMOKING AND ASBESTOS EXPOSURE

In addition to the multiplicative effect that cigarette smoking has on the occurrence of ordinary lung cancer among those exposed to asbestos, cigarette smoke has numerous other adverse effects upon the lungs. Cigarette smoke impairs the normal defense mechanisms that exist within the lung so that the clearance process described earlier is impaired. There is strong experimental evidence that retention of asbestos fibers in the lung is increased among smokers because of smoking-induced reductions in lung clearance. The frequency of all types of lung disease is greatly magnified among smokers, but the combination of cigarette smoke and asbestos fibers is particularly hazardous for the lungs.

ACBM LOCATIONS AND PRESENT CONDITIONS

Certified inspection has determined that asbestos containing building materials (ACBM) are present in the building(s) of this Local Educational Agency (LEA).

Each location of ACBM has been assessed and placed into one of the following categories:

(1) Damaged or significantly damaged thermal system insulation ACM;
(2) Damaged friable surfacing ACM;
(3) Significantly damaged friable surfacing ACM;
(4) Damaged or significantly damaged friable miscellaneous ACM;
(5) ACBM with potential for damage;
(6) ACBM with potential for significant damage;
(7) Any remaining friable ACBM or friable suspected ACBM;

Shown below is a complete listing of the ACBM in this LEA. The specific location and the present assessed condition is indicated, using the numbered categories above:

LOCATION **CONDITION**

(locations cont.)

LOCATION	CONDITION

Below is the name, phone number, and address of the person or agency responsible for carrying out the asbestos management plan of this LEA. **IF** ANY **ACBM UNDERGOES** ANY **CHANGE OF CONDITION, CONTACT THIS PERSON OR AGENCY IMMEDIATELY!**

SCHOOL PERSONNEL ASBESTOS AWARENESS TRAINING

INSTRUCTOR'S MANUAL

by

Larron Laboratory
529 Broadway
Cape Girardeau, MO
(314) 334-8910

TYPES AND CHARACTERTISTICS OF ASBESTOS

Asbestos is a naturally occurring fibrous mineral silicate of several distinct types. Its unusual properties have made it useful in a wide variety of products.

Properties:

1. Noncombustible
2. High tensile strength
3. Good noise absorption
4. Thermal insulator
5. Control condensation
6. Resistant to the effects of corrosive chemicals
7. Resistant to the effects of friction

Types and Characteristics

There are six types of asbestos:

Chrysotile	Tremolite
Amosite	Actinolite
Crocidolite	Anthophyllite

Three of these types have been used extensively in building materials and products for at least the last century.

Types	Characteristics
Chrysotile	White asbestos; fine silky fibers; flexible and high tensile strength; accounts for over 90% of the uses of asbestos.
Amosite	Brown asbestos; brittle fibers; bonds well with plastic and is used in heat insulation materials.
Crocidolite	Blue asbestos; strongest of the asbestos fibers; brittle fibers; usually found in combination with chrysolite in pipes and sheeting; also occasionally found with amosite or chrysolite in pipe and boiler wrap; also as decorative material.

APPLICATIONS AND LOCATIONS IN BUILDINGS

Asbestos is a component of many types of materials and products used in building construction. Asbestos-containing materials are found in two major forms, friable and non-friable.

Friable material can be crumbled, pulverized or powdered by hand pressure when dry.

Non-friable material is matrix-bonded and not likely to release fibers upon casual contact.

Methods of Application

1. Sprayed or troweled onto ceilings, beams, and walls.
2. Pipe and boiler insulation
3. Materials such as ductwork, ceiling & floor tiles, wall boards, and roofing felts.

Trade Name of ACM

Sprayed-On

Asbestos-Spray	Limpet	Spraycraft
Monokote-MKIII	Sabinite	Kilnoise Plaster
Cafco-Soundshield	Spraydon	Audi-Cote
Cafco-Blaze Shield	Cafco-Type D	
Cafco-Heat Shield	Cafco-Type I	

Pipe & Boiler Wrap

Johns Manville (JM) and Newelle 85% Magnesia Block
Pipe Covering, and Cements
JM Suprex Blocks
JM Marinite
JM and Atlas spongefelt Pipe Covering
JM Thermo-Wrap and Thermo-Tape
JM Asbestos Sponge
JM 302 and 352 Insulating Cements
JM Thermobestos Blocks
JM Asbestocell
JM Newtherm
JM Fiberfill
Atlas 650, 660, 250, 280, 18 Cold Water Paste
Atlas Aircell and Finecell
Atlasite, Caposite
"Newalls" Newtempheit
JM and Atlas Rope Lagging

Subdivision	Generic name	Asbestos (%)	Dates of use	Binder/sizing
Asbestos-containing compounds	caulking putties	30	1930-present	linseed oil
	adhesive (cold applied)	5-25	1945-present	asphalt
	joint compound		1945-1975	asphalt
	roofing asphalt	5	unknown-present	asphalt
	mastics	5-25	1920-present	asphalt
	asphalt tile cement	13-25	1959-present	asphalt
	roof putty	10-25	unknown-present	asphalt
	plaster/stucco	2-10	unknown-present	portland cement
	spackles	3-5	1930-1975	starch, casein, synthetic resins
	sealants fire/water	50-55	1935-present	caster oil or polyisobutylene
	cement, insulation	20-100	1900-1973	clay
	cement, finishing	55	1920-1973	clay
	cement, magnesia	15	1926-1950	magnesium carbonate
Asbestos ebony products		50	1930-present	portland cement
Flooring tile and Sheet Goods	vinyl/asbestos tile	21	1950-present	poly(vinyl)chloride
	asphalt/asbestos tile	26-33	1920-present	asphalt
	sheet goods/resilient	30	1950-present	dry oils
Wallcovering	vinyl wallpaper	6-8	unknown-present	—
Paints and coatings	roof coating	4-7	1900-present	asphalt
	air tight	15	1940-present	asphalt

but are very difficult to pull apart. Accordingly, as the chest cavity expands, the lungs expand and air rushes in. If these linings (mesothelia) were to become damaged, inhalation could not occur properly.

The body has several mechanisms by which it "filters" the air it breathes. First, very large particles are removed in the nose and mouth. Many smaller particles are trapped in the mucous-coated walls of the airways and are caught. These airways have a hair-like lining (ciliated cells) which constantly beats upward. Accordingly, particles caught in the mucous are swept up into the back of the mouth. From here they are swallowed or expelled by coughing. Cigarette smoking temporarily paralyzes these ciliated cells, inhibiting one of the body's natural defenses against unwanted dust. As the smoker sleeps, the hair-like cells start working again and carry large amounts of mucous into the back of the mouth. This causes the so-called "smoker's hack" in the morning. After the first cigarette or two, the cleansing mechanism is paralyzed again and the coughing stops. It should now be evident why cigarette smokers who are exposed to asbestos appear to be at greater risk. Other reason will also be discussed later in this section.

Even with the above-mentioned natural defenses of the body, some dust particles inevitably reach the tiny air sacs. When this occurs, large cells (called macrophages) attempt to engulf the particle and "digest" it. For this reason they are sometimes called the lung's garbage collectors. However, because asbestos is a mineral fiber, macrophages are often not successful. If the cells cannot digest the fibers, they call in a secondary defense mechanism. They deposit a coating on the fibers causing scar tissue to be formed, and a condition develops known as asbestosis.

Diseases Associated with Asbestosis

1. Asbestosis - a non-malignant, progressive, irreversible lung disease caused by the inhalation of asbestos dust and characterized by diffuse fibrosis (widespread scarring of lung tissue).

   a. Asbestosis is generally associated with high dose exposures over a long period of time. There does appear to be a dose-response relationship.

   b. Asbestosis is generally not a problem for those who occupy buildings containing asbestos materials because airborne levels are usually much lower than industry levels.

   c. Asbestosis is the major health hazard associated with asbestos.

2. Lung Cancer - an uncontrolled growth of abnormal cells in the lung(s). There are many causes of lung cancer, of which asbestos is only one.

   a. As with asbestosis, there appears to be a dose-response relationship.

   b. There appears to be a synergistic effect between asbestos-induced lung cancer and cigarette smoking. When compared to non-smokers and non-asbestos workers--

      - Employees exposed to industrial concentrations of asbestos (without protection) have a 5X greater risk of getting lung cancer;
      - Cigarette smokers (not exposed to asbestos) have a 10X greater risk of getting lung cancer;
      - Asbestos workers who smoke have more than a 50X greater risk.

   c. Lung cancer is the second major health hazard associated with asbestos exposure.

3. Mesothelioma - a relatively rare form of cancer which develops in the lining (mesothelium) of the chest cavity.

   a. The asbestos-associated disease of greatest concern in buildings and asbestos abatement work is probably mesothelioma. This type of cancer spreads rapidly and is always fatal. Approximately 75% of cases can be linked to asbestos exposure. Other suspected causes of mesothelioma include fibrous zeolites (erionite) and ethylene oxide gas (sterilant).

   b. There does not appear to be a synergistic effect between mesothelioma and cigarette smoking.

   c. There does not appear to be a dose-response relationship between asbestos exposure and mesothelioma. People who have lived near asbestos mines or other sources have become victims of this disease, indicating that relatively low exposures may initiate the disease in some people. This disease received a lot of notoriety when Steve McQueen was afflicted.

   d. There are 44 documented confirmed cases of mesothelioma in people under 18 years of age.

      - 0-5 years (9 cases)
      - 6-10 years (6 cases)
      - 11-15 years (16 cases)
      - 16-18 years (13 cases)

Sex ratio (male:female)=3:2 for mesothelioma.
Tumor site ratio (pleural:peritoneal)=6:1 for mesothelioma.

4. Latency of Disease - All diseases associated with asbestos exposure take several years from the time of exposure(s) to show up as symptoms. Government policy is based on latency of disease and potential for early exposure in schools.

- Asbestos/5	15-30 years
- Lung Cancer	20-30 years
- Mesothelioma	30-40 years

5. Other diseases associated with asbestos exposure include cancer of the colon, esophagus, stomach, and gut cavity.

Fiber Size - Which Ones Are Important?

1. Fibers that remain in the lung are very small. The large particles are filtered out by natural defense mechanisms and don't reach the lung. Particles which remain in the lung range from 0.5 to 5 microns.

2. Fiber counting for compliance with OSHA regulations done with phase contrast microscopy only includes fibers that are 5 microns or longer and about 0.25 microns wide. In those situations where we want to know all sizes of asbestos fibers that are present, electron microscopy is used. It is estimated that the optical microscope only sees 10% of the fibers present due to the limit of resolution.

3. Though there is no conclusive evidence, many researchers believe that the longer, very thin asbestos fibers are those which are most likely to induce disease.

Dose-Response

1. The greater the asbestos exposure, the more likely asbestosis and lung cancer are to develop. The dose of asbestos is cumulative with newly inhaled fibers added to the burden already present.

SCHOOL PERSONNEL ASBESTOS AWARENESS TRAINING

APPENDIX B