CHEM SCOPE ASBESTOS CONTRACTOR/SUPERVISOR TRAINING
Updated 4/2/10

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COURSE OVERVIEW AND CURRICULUM

Required training for asbestos Contractor/Supervisors in schools and other buildings per State and Federal Regulations. Initial training has five days of training totaling 40 hours and including 14 hours of hands on instruction. Refresher training is 8 hours and must be taken annually.

Physical Characteristics of Asbestos and asbestos containing materials: Identification, aerodynamic properties, uses, appearance, review of hazard assessment considerations and a summary of abatement control options. Potential health effects related to asbestos exposure; the nature of asbestos related diseases, routes of exposure, dose response relationships and the lack of a safe exposure level; the synergistic effect of smoking and asbestos exposure, latency periods and a discussion of the relationship of asbestos exposure to asbestosis, lung cancer, mesothelioma and cancers of other organs.

Employee personal protective equipment: Classes and characteristics of respirator types; limitations of respirators; proper selection, inspection, donning, use, maintenance and storage procedures for respirators; methods for field testing of the facepiece to face seal (fit checks); qualitative and quantitative fit testing procedures; variability between field and laboratory protection factors that alter respiratory fit such as facial hair; the components of a proper respiratory protection program. Selection and use of personal protective clothing; use, storage, and handling of non-disposable clothing and regulations covering personal protective equipment.

State of the art work practices and best available technology: Proper work practices for asbestos abatement activities, including descriptions of proper construction, maintenance of barriers and decontamination enclosure systems; positioning of warning signs; lock-out of electrical and ventilation systems; proper working techniques for minimizing fiber release; use of wet methods, negative exhaust ventilation equipment; use of HEPA vacuums, proper clean-up and disposal procedures; work practices for removal, encapsulation, enclosure and repair of ACM (asbestos containing material). Emergency procedures for unplanned releases; potential exposure situations; transport and disposal procedures; and recommended and prohibited work practices. New abatement related techniques and methodologies.

Personal Hygiene. Entry and exit procedures for the work area; use of showers; avoidance of eating, drinking, smoking and chewing in the work area and potential exposures such as family exposure.

Additional Safety hazards encountered during abatement and how to deal with them including: electrical hazards, heat stress, air contaminants other than asbestos, fire and explosion hazards, scaffold and ladder hazards, slips, trips and falls and confined spaces.

Medical monitoring requirements: OSHA and EPA Worker Protection Rule; requirements for physical examinations including a pulmonary function test, and a medical history for each employee; chest x-rays. Establishment of respiratory protection programs.

Air monitoring procedures to determine airborne asbestos fibers: including descriptions of aggressive air sampling, sampling equipment and methods, reasons for air monitoring, types of samples and interpretation of results. including how personal air sampling is performed and the reasons for it. Preparation for final air clearance and related topics including area monitoring and laboratory requirements.

COURSE OVERVIEW AND CURRICULUM (CONT)

Relevant Federal, State, and local regulatory requirements, procedures and standards: relevant Requirements of TSCA Title II, NESHAP, OSHA 29 1926.1101 = EPA Worker Protection Rule, OSHA 29 1910.134, other EPA, OSHA, DOT regulations and State regulations.

Insurance and liability contractor issues, workers compensation coverage and exclusions; third party liabilities and defenses, bonding, liability insurance coverage and exclusions.

Recordkeeping for asbestos abatement projects: Records required by Federal, State and local regulations; records recommended for legal and insurance purposes.

Supervisory techniques for asbestos abatement activities. Supervisory practices to enforce and reinforce the required work practices and discourage unsafe work practices.

Contract specifications: Discussions of key elements that are included in contract specifications.

Equipment and supplies and interior and exterior abatement.

Building systems: A discussion of building systems and drawings and plans relevant to asbestos abatement.

Course review: A review of key aspects of the training course is completed before the required examination.

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PRE-COURSE QUIZ

This quiz is for your use to evaluate your knowledge before the course. This will not be graded but questions are typical of the exam to be given at the end of this course.

Circle the letter by the best answer to the question.

1. The OSHA Excursion Limit (EL) involves the following:
   a. 20 minute sampling
   b. 2 fibers/cc EL
   c. 30 minute sampling
   d. sampling for excursions once per month

2. Which regulation requires accredited individuals for school related asbestos activities?
   a. AHERA
   b. OSHA
   c. NESHAP
   d. NIOSH

3. Personal air sampling is conducted for the purpose of:
   a. determining the cleanliness of the work area
   b. proving that individuals are working each day
   c. proving compliance with the PEL and EL
   d. to check the fit test

4. Which asbestos-related condition is associated with large concentrations of asbestos inhaled over a long period of time?
   a. Skin disorders
   b. Mesothelioma
   c. Lung cancer
   d. Asbestosis

5. Prior to an asbestos project in Connecticut, 10 day notification is required to be sent to:
   a. Connecticut OSHA
   b. Department of Public Health
   d. Connecticut DEP
   c. NIOSH

6. Which agency regulates employee safety in the construction industry?
   a. The U.S. EPA
   b. OSHA
   c. NIOSH
   d. MSHA

7. Which of the following areas usually contains the workers shower?
   a. The bag out enclosure
   b. The bathroom
   c. The decontamination unit
   d. The HEPA area

SECTION 1

PHYSICAL PROPERTIES AND USES OF ASBESTOS
BACKGROUND AND HISTORY OF ASBESTOS USE

A. IDENTIFICATION OF ASBESTOS:

1. Suspect ACBM (asbestos containing building materials)

a. Surfacing

b. Thermal System Insulation (TSI)

c. Miscellaneous Materials

2. Assumptions

a. OSHA assumes the above materials are ACM (asbestos containing material) unless proven otherwise.

b. In general, any suspect material may be assumed to contain asbestos.

c. Non-suspect materials such as fiberglass, metal, wood, and glass may be assumed to not contain asbestos. However watch out for materials that may be attached or underneath these non-suspect materials.

3. Laboratory Analysis

a. PLM (polarized light microscopy)

b. NIST Accredited Lab (National Institute of Standards and Technology)

c. < 1 % asbestos

4. Physical Appearance of Asbestos

a. Naturally occurring crystalline silicate minerals.

b. Fibrous forms:

1) Parallel bundles of minute fibers.

2) Smaller bundles called "fibrils."

3) Minute individual fibers.

4) Perfect lengthwise cleavage

5) Length-to-width ratio typically > 10:1

5. Physical Appearance of Asbestos Containing Materials
See Building Systems in Section 9-3

B. FORMS OF ASBESTOS:

Chrysotile (Serpentine)-
- White Asbestos
- Most common form of asbestos
- Wavy fibers
- Wettable
- Considered the least dangerous type of asbestos
- 93 percent of total domestic Asbestos products

Amphiboles -
- Less common forms
- Straight rigid fibers including:

Amosite -
- Brown Asbestos
- Brittle fibers
- High resistance to heat.
- 5% of asbestos used

Crocidolite -
- Blue Asbestos
- 2% of asbestos used
- Acid resistance

Anthophyllite Actinolite and Tremolite- Rarer forms of amphiboles
Actinolite and tremolite also exist in non-fibrous forms.

C. PROPERTIES OF ASBESTOS

Thermal insulating ability	**Inexpensive**
Virtually indestructible	**Mechanical strength**
Chemical resistance	**Flexibility**
Fire resistance	**Friction and wear characteristics**
Wet strength	**Acoustical properties**

D. AERODYNAMIC CHARACTERISTICS OF ASBESTOS FIBERS;

1. Flight Characteristics and Settling Time

a. Number of Particles per unit mass is astronomical

b. Shape of fibers and light weight promotes entrainment into the air with little force.

c. Long, slender and thin fibers. To be demonstrated using the microscope.

2. Fiber release parameters:

a. More stable Chrysotile vs more volatile Amphiboles

1) Hydrophilic chrysotile

2) Hydrophobic amphiboles

3) Kinks and weave of chrysotile vs straight more brittle amphiboles

4) Importance of surfactants and removal encapsulants

5) Why amosite is more costly to abate.

b. Humidity and moisture effects-

1) Summer vs winter conditions

2) Reason for wetting

3) Matrix effects of binders

c. Air Entrainment and Erosion

d. Abrasion

e. Vibration

f. Wet residues that dry and become entrained in air

3. Settling Time:

a. Fibers may remain suspended in air indefinitely with moderate air movement, can spread throughout a building on air currents.

b. In absence of air movement, fibers may take days to settle.

E. USES AND LOCATIONS OF ASBESTOS

1. General Information:

a. 3,600 products since the early 1900's.

b. 90,000 tons of asbestos used in the USA in 1989 compared to 900,000 tons in 1973.

2. Asbestos Cement Products: "Transite"

a. 65 percent of all asbestos used, A hard and tough flexible cement.

b. Flat or corrugated sheets

1) Siding
2) Tiles
3) Insulating board

c. Transite Pipe

1) Rainwater drains
2) Gutters
3) Pressure piping including water mains = largest single use.

3. Major Building Uses:

a. Flooring: A Miscellaneous Material. Usually chrysotile. Found in finished areas
1) Mastic (still used)
2) Floor tiles (rarely used after 1989)
3) Linoleum (top layer or felt backing up to 1989)

b. Thermal Insulation: Retards heat loss or gain

Pipes, ducts and vessels, such as breeching found in boiler rooms: Rarely used after 1980.
Common forms of pipe insulation are air-cell or cement.
1) Boiler rooms
2) Other mechanical rooms
3) Steam tunnels
4) Pipes and HVAC ducts throughout building leading to:
a) Radiators
b) Registers
c) Fixtures

c. Fireproofing and Structural uses in Condensation Control:

1) Spray on Surfacing on steel beams and decking: Rarely used after 1980. Delay or prevent collapse of structures in fires.

2) Applied to steel and concrete to minimize condensation.

d. Acoustical:

Used extensively prior to the 1970's for ceiling tiles and panels.

Surfacing on ceilings and sometimes walls: Rarely used after 1980.

e. Roofing: Rarely used after 1980.
1) Flashing
2) Built- up roof
3) Felts
4) Tar

f. Transite panels:

Rarely used after 1980. Frequently seen behind radiators and in siding

g. Electric cable insulation and lighting fixtures

h. Glues, caulks and putties

i. Preformed boards

4. Special Building Uses:

a. Amosite: High temperature applications

1) Steam boilers and lines

2) Exhaust fire boxes

3) Power plants generating high pressure steam.

b. Crocidolite: Very resistant to acids and to outdoor exposure.

c. Chrysotile and crocidolite are used in Asbestos textiles and filtration products.

d. Anthophyllite, actinolite, and tremolite are used primarily in adhesives and cements. They are too brittle for textile products or for use as fibrous reinforcement.

5. Major Non - Building Uses: ACM

a. Brake linings

b. Clutch facings

c. Gaskets

d. Reinforced plastics.

e. Appliances

F. DATES OF USE OF ASBESTOS

KEY Term **Friable ACM:** EPA- An Asbestos Material that can be crumbled, pulverized or reduced to powder when dry by hand pressure and which releases Asbestos fibers into the environment.

USES	DATES OF USE
Friable-Insulating Spray-applied insulation, or troweled on	**1935 - 1978**
Preformed Thermal Insulating Products Bats, blocks and pipe covering	**1925 - 1949**
Textiles Cloth, blankets, felts, sheet, cord, rope, yarn, tubing, tape/strip, curtains	**1920 - Present**
Cementitious Products, Extrusion, panels, pipe	**1930 - Present**
Paper Products, Corrugated millboard	**1910 - Present**
Roofing Felts smooth or mineral surface, shingles, pipelines	**1910 - Present**
Asbestos Containing Caulking putties, Joint compounds, Roofing asphalts, mastics, asphalt tile roof putty, plaster, stucco, sealants, cement.	**1920 - Present**
Asbestos in Portland Cement (Ebony Products)	**1930 - Present**
Flooring Tile and Vinyl asbestos tile Sheet Goods, asphalt asbestos tile sheet goods	**1950 - 1989**
Wall Covering, Vinyl Wallpaper	**1920 - Present**
Paints and Coatings, Roof coating,	**1900 - Present**
Surfacing Materials including Plaster and Sheetrock	**1900 - 1989**

G. REVIEW OF HAZARD ASSESSMENT CONSIDERATIONS:

For hazard assessment, the inspector must do a visual examination to identify suspect asbestos and touch the material to see if it is crumbling or dusting off. Damaged material must be sampled and tested by PLM. **Air sampling is not routinely used for hazard assessment under the EPA protocol**. (This may be confusing, since OSHA's assessment requirements are largely focused on air sampling.)

1. Significant damage

2. Potential significant damage

3. Potential damage

4. No Damage

5. Nature and extent of existing damage

6. Friability

7. Accessibility

8. Activity

9. Proximity to repair items

10. Visibility

11. Environmental factors including vibration and water damage

12. Use of adjoining space

13. Air plenums If air returns to the air handler via the space above the drop ceiling (rather than return air ducts), this is called **a return air plenum**..

14. Population exposed

15. Interaction between environmental factors such as vibration with building configuration such as accessibility and use of adjoining spaces.

H. OVERVIEW OF RESPONSE ACTIONS:

1. Encapsulation

a. An asbestos abatement option which means treating ACBM with an encapsulant material that surrounds or embeds asbestos fibers in an adhesive matrix to prevent fiber release. The material may be a penetrant, which penetrates and hardens the asbestos material; or a bridging encapsulant, which covers the surface of the material with a protective coating. Both are applied to the surface of the material using airless spray equipment at low pressure in order to reduce fiber release during applications.

b. All procedures necessary to apply an encapsulant to Asbestos-containing building materials to control the possible release of Asbestos fibers into the ambient air. This includes all the steps specified below: The practice of spraying water damaged, loose, or hanging Asbestos Material is not considered a satisfactory control method and is not considered proper Encapsulation.

1) Remove damaged, loose, or hanging areas of existing Asbestos material and place in sealable plastic bags for transport.

2) Repair damaged and missing areas to obtain a suitable base for sealing using Asbestos free replacement material in accordance with manufacturer's instructions.

3) Encapsulation disturbing **equal to or** more than 3 linear or 3 square feet of Asbestos Material is considered an Abatement project and subject to all the procedures for Asbestos Removal.

4) Apply a final spray with Encapsulant.

c. Encapsulant (sealant): a liquid material which can be applied to Asbestos-Containing Material and which controls the possible release of Asbestos fibers from the material either by creating a membrane over the surface (bridging encapsulant or by penetrating into the material and binding its components together (penetrating encapsulant). Any such encapsulants must be in conformance with Building and/or Fire Safety Code requirements.

2. Removal

a. An asbestos abatement option which means stripping ACBM from surfaces and disposal.

b. All procedures necessary to remove Asbestos containing materials from the designated areas and to transport and dispose of these materials at an acceptable site.

3. Enclosure

Enclosure: An asbestos abatement option, a response action where an airtight, impermeable, permanent barrier is constructed around ACBM to prevent the release of asbestos fibers into the air. (Sometimes the word also refers to the asbestos abatement work area containment system which includes various plastic enclosures such as the worker decontamination enclosure, the equipment decontamination enclosure, the work area enclosure.)

4. O&M

Operations and Maintenance Program: (O&M) means an ongoing program of work practices to maintain friable ACBM in good condition, ensure clean up of asbestos fibers previously released, and prevent further release by minimizing and controlling friable ACBM disturbance or damage.

5. Isolation

A response option which generally includes shutting of doors and keeping an area vacant until funds are available to conduct abatement.

6. Repair

A response option for small amounts of ACBM which returns them to intact state, usually as part of an O&M Program.

I. ADVANTAGES & DISADVANTAGES OF ABATEMENT CONTROL OPTIONS

1. Removal

a. Containment barriers, Decontamination Units, Negative Air, and other preparations are needed.

b. Eliminates asbestos source

c. Can be used in most situations.

d. Improper removal may raise fiber levels.

e. Replacement may be necessary.

f. May render equipment useless if proper substitute materials are not available.

g. May require major destruction of associated equipment.

h. Inaccessible ACBM beyond protrusions usually remains and is invisible.

2. Encapsulation

a. Same preparations as for Removal are still needed.

b. Initial costs usually lower than for removal if replacement is avoided.

c. Replacement not needed.

d. Initial fiber release potential during abatement usually lower than for removal.

e. Ideal for strongly bound materials such as transite to prevent surface dusting.

f. Asbestos source remains and must be removed later.

g. For surfacing, weight of encapsulant may cause material to fall.

h. Repair of damaged surfaces is required before spraying or wrapping.

i. Likely to add to cost of later removal.

j. Long-term costs could be higher than for removal.

k. Inaccessible ACBM remains and is invisible.

l. Not suitable when severe damage such as delamination or water damage is evident or if material is fluffy.

3. Enclosure

a. Same preparations as for Removal are still needed.

b. Initial costs usually lower than for removal, especially if enclosure is planned part of renovation like installing walls

c. Reduces exposure in area outside enclosure.

d. Usually replacement not required.

e. Ideal for isolated areas such as crawl spaces which do not need to be accessed.

f. Disturbance in enclosed area is unlikely.

g. High Initial cost if major changes are needed such as relocating fixtures and utilities.

h. Asbestos source remains and must be removed eventually.

i. Difficult or impossible access for periodic reinspection.

j. Fiber release can continue behind enclosure.

k. Long-term costs could be higher than for removal.

l. Inaccessible ACBM remains and is invisible.

m. Not suitable for ceilings when severe damage or water damage is evident.

SECTION 2

POTENTIAL HEALTH EFFECTS related to ASBESTOS EXPOSURE

INTRODUCTION:

The adverse health effects from Asbestos exposure were first described in the early 1900's. Nevertheless, widespread concern about Asbestos developed only recently as a result of the extensive health problems that have emerged among people who were heavily exposed during and immediately after World War II.

Repeatedly breathing large amounts of Asbestos is associated with Asbestosis, increased risk of lung cancer and mesothelioma.

Individuals vary considerably in their ability to withstand disease. Asbestos fibers can produce a fatal disease in one person, and yet leave no marks on a colleague working nearby. Preventive measures must be adequate to protect all including those most likely to develop disease.

Asbestos fibers in the air are not visible to the naked eye and there is no odor, irritation or other tangible signs of exposure. Only sophisticated air sampling and analysis using microscopic methods can detect the presence of these fibers.

The mere presence of Asbestos materials in a building should not produce airborne fibers as long as the material is maintained in a secure wrapping or binder and otherwise maintained in good condition. Release of Asbestos into the air in occupied areas must be carefully avoided. Exposures to Asbestos in buildings may occur upon wear or damage and is often due to improperly handling the material and permitting fibers to become airborne. Once inhaled, Asbestos fibers may enter the lungs and last indefinitely there.

A. NATURE OF ASBESTOS RELATED DISEASES;

Dose Response Relationships, Latency Periods and the Lack of a Safe Exposure Level

Key Terms:

Dose-Response relationship -

A principle in toxicology wherein increases in the dose, or exposure, result in proportional increases in the response, or effects.

Latency Period -

Length of time between exposure to a toxic substance and the onset or appearance of resultant disease. Asbestos-related diseases have relatively long latency periods.

1. Major Diseases:

a. Asbestosis:

1) Scarring of the lung tissue seen on x-ray, a form of pulmonary fibrosis. A form of pneumoconiosis, which is a generic name for lung diseases caused by inhalation of dusts.

2) Associated with breathing large amounts of asbestos.

3) A restrictive lung disease. When fibers lodge in the alveoli, the resultant scarring results in decreased surface area, thereby reducing the lung's ability to oxygenate the blood. Also, as the lung's ability to expand and the breathing capacity are reduced, patients become short of breath.

4) A progressive lung disease, which means that it can progress even after exposure is discontinued. If the disease process is advanced, it can cause disability and death.

5) Prevention and early detection include chest x-rays, pulmonary function tests and exposure history.

6) The latency period for Asbestosis is 5 - 10 years with very heavy exposure. Otherwise it may be 20 - 40 years.

b. Lung Cancer: - abnormal cell growth

1) Asbestos is a known human carcinogen.

2) Generally, a dose-response relationship exists: the risk of disease increases in direct proportion to the increase in Asbestos exposure.

3) However, for lung cancer, there is no known threshold, or "safe" dose, at which it can be said that the risk of this response, lung cancer, is zero.

4) Latency period > 15 years, with a peak at 30-35 yrs.

c. Mesothelioma:

1) A rare form of cancer of the pleural cavity or peritoneal cavity, associated only with Asbestos exposure.

2) An essentially incurable form of cancer.

3) Mesothelioma tumors are the uncontrolled growth of cells in the lining of the chest cavity (called the pleura) in between the chest walls and the lungs, or in the lining of the abdominal cavity (called the peritoneum).

4) Associated with low levels of Asbestos exposure.

5) Latency period for mesothelioma is up to 40 years.

6) Usually fatal within 1-2 years after diagnosis.

2. Minor Occurrence of Diseases:

a. Other Cancers- (Less common).

1) Gastrointestinal tract or digestive tract due to the ingestion of Asbestos fibers.

a) Esophagus
b) Stomach
c) Colon

2) Vaginal (very rare)

3) With early detection, these types of cancers can be curable.

b. Pleural Diseases - Less Serious Disease,

Thickening or scarring of the pleural tissues which normally have no serious health effect but indicate Asbestos exposure

B. ROUTES OF EXPOSURE TO ASBESTOS FIBERS.

1. Lung diseases caused by inhalation (breathing)

a. Lungs continuously exposed to vapors and suspended particulate matter.

b. Defenses: Most particles, including Asbestos fibers, are trapped and eliminated by the defense mechanism.

1) Breathing passages lined with a sticky mucous layer that traps small particles.

2) Cilia line the bronchial tubes. These are hair-like projections that continuously move the mucous layer toward the mouth.

c. Some Asbestos fibers can be carried along in the air, down the bronchial tubes, and lodge in the lung tissue where they may remain and incite a reaction in the surrounding lung tissue.

d. Some fibers break into small fragments and are eliminated from the body.

e. Other fibers migrate to the mesothelial lining. These retained fibers trigger tissue defense reactions and create lung disease.

2. Less common gastrointestinal diseases caused by ingestion.

a. Ingestion means to take into the gastrointestinal system. May include eating or indirectly by swallowing fibers that were inhaled.

b. Asbestos can contaminate food, water or other beverage

c. Residues of asbestos on the skin may result in this extra exposure by hand to mouth activity.

C. SYNERGISTIC EFFECT BETWEEN CIGARETTE SMOKING AND ASBESTOS EXPOSURE;

1. Synergistic effect means the combined, or multiplicative, effect of two factors wherein the whole is greater than the sum of its parts.

2. Incidence of lung cancer is much higher among smokers who were also exposed to Asbestos:

3. Smokers not exposed to Asbestos ten times that of non-exposed, non-smokers.

4. Non - smokers exposed to asbestos have a risk of approximately five (5) times that of non-exposed, non-smokers.

5. Combination (synergistic) effect, among smokers who are also exposed to Asbestos, is 50 - 90 times that of non-exposed, non-smokers.

6. Cigarette smoke has numerous other adverse effects.

7. Cigarette smoke deactivates the cilia.

8. Extrapolation: Conclusions above about the synergistic effect have been extrapolated from data at high exposures to risk assessments for low exposures.

9. Greater lung cancer risk for smokers exposed to asbestos

10. Mesothelioma: No synergistic effect known.

11. Stop smoking and risk of lung cancer can decrease to close to that of a non-smoker.

D. RELATIONSHIP BETWEEN ASBESTOS EXPOSURE AND ASBESTOSIS, LUNG CANCER, MESOTHELIOMA, AND CANCER OF OTHER ORGANS.

1. Signs of Exposure to Asbestos:

No way to tell except by: Personal air monitoring or knowing that Asbestos is being disturbed in the area.

2. Relative Hazards of Asbestos Types

a. All agree that the amphibole types are dangerous.

b. Many believe that chrysotile Asbestos is less dangerous than amphiboles.

c. Other important factors known are the fiber length and diameter which combined with the long latency make it extremely difficult to draw conclusions.

d. The most prudent approach is to treat all forms of Asbestos with due care and minimize exposure.

e. One point is generally agreed on: Crocidolite and amosite are more dangerous than chrysotile

f. Much controversy over Chrysotile. some say it is harmless; some say just as bad as amphibole type asbestos.

3. Fiber size and shape:

a. Fibers longer than 5 microns and thinner than 0.5 microns appear to be more carcinogenic than shorter and thicker fibers.

b. Fibers longer than 8 microns are not generally respirable and much less dangerous.

c. Therefore, thin fiber between 5-8 microns are the worst.

E. MAN-MADE MINERAL FIBERS

1. Fiberglass, Mineral Wool and Refractory Ceramic Fibers may be linked with lung cancer.

2. Mineral wool (rock wool) according to EPA is a probable human carcinogen and fiberglass is a possible human carcinogen.

3. These man-made mineral fibers do not appear to be as toxic as asbestos, which is a known human carcinogen.

4. OSHA regulates airborne exposure to man-made mineral fibers. There are monitoring and respirator requirements. Can be tested by NIOSH 7400.

5. There is a NIOSH guideline for glass fibers of about 2 f/cc.

6. OSHA standards are expressed in mg/m3 (mg of dust/cubic meter of air).
The OSHA permissible exposure limit (PEL) for total particulate matter in air for nuisance dust is 15 mg/m3 if the matter has <1% asbestos.

7. Established ACGIH limits for mineral wool are in the classification of nuisance dust with a Permissible Exposure Limit of 10 mg/m3.

SECTION 3

EMPLOYEE PERSONAL PROTECTIVE EQUIPMENT

A. REGULATIONS Covering Respiratory Protective Equipment Covered in This Section:

The purpose of OSHA is worker protection.

1. Construction Industry Asbestos Standard: 29 CFR 1926.1101.

2. Respirator Standard: CFR 1910.134.

B. CLASSES AND CHARACTERISTICS OF RESPIRATOR TYPES:

1. Air Purifying Respirators:

a. Negative Pressure:

HEPA filter/ NIOSH approved respirators used for asbestos. Half or Full Face. NIOSH = National Institute for Occupational Health and Safety.

b. Powered Air Purifying Respirator (PAPR):

1) Face piece can be a half-mask, full-face mask or helmet.

2) At least 4 CFM to a tight fitting facepiece

3) At least seven CFM to a loose fitting helmet or hood.

4) Batteries need constant attention

2. Supplied Air Respirators: Breathing Air Systems

a. General

1) Deliver breathing air through a supply hose connected to the worker's facepiece.

2) Very high degree of protection

3) Can operate in oxygen deficient and toxic atmospheres.

4) Additional training is needed from the manufacturer to operate and maintain the individual system.

b. "Type C Air-Supplied" respirators- supplied by remote tanks or compressor.

1) Tanks: Continuous supply of grade D breathing air required

2) Compressor- typical 100 SCFM; 50 PSIG for a low pressure system.

a) Heats air- must be cooled before delivery
b) Carbon monoxide sources
c) Needs purification, temperature control and monitoring

3) Distribution

a) Continuous and sufficient supply

b) Measure air pressure in the supply system

c) Hose lines maintained at 60-75 PSIG

d) Up to 300 ft of hose

e) Check pressure with all respirators in use

4) Adequate reserve air and escape time of 5 minutes

5) Temperature control of breathing air

6) Continuous carbon monoxide monitor and alarm

7) Cautions in the use of breathing air systems

a) Locate compressor to take in clean air from outside the work zone, at least 8 ft above ground away from vehicles and the compressor exhaust. Best location is 15-20 ft up a tree.

b) Monitor carbon monoxide every 4 hours of use.

b) Compressor oil must be compatible with system

c) Purifying system required with compressors; must not be overloaded.

d) Never use pure oxygen for asbestos abatement

e) Inspect all components for damage

f) Explosion possible. Inspect safety relief valves carefully.

c. High Pressure Versus Low Pressure Systems:

1) High pressure = greater than 200 PSIG (lbs/sq inch gauge pressure).

a) Air may go directly into a storage tank.

b) A pressure regulator reduces the pressure to 125 PSIG for distribution to a manifold from which 2-6 masks may be supplied through low pressure airlines.

2) Low pressure = less than 200 PSIG (lbs/sq inch gauge pressure).

a) Air comes directly from a compressor with a purifying train.

b) Air is distributed to a manifold as above.

c) Emergency tank air supply is required per 1910.134.

d. Testing for Grade D Air:

1) Carbon Monoxide (CO) 20 PPM max. Use an MSA Passport Monitor or similar device to test at least every 4 hours in addition to any automated tests on the equipment. Critical to test CO.

2) Oxygen 19.5-23.5%. (Tested simultaneously with the CO)

3) Carbon Dioxide (1000 PPM max). Can be tested with Draager or Sensidyne tubes or with an infrared detection meter.

4) Condensed Hydrocarbons 5 milligrams/cubic meter. Collect samples in a gas bag and take to the lab for GC gas chromatographic analysis.

5) Objectionable odors none.

6) Water vapor 66 PPM (parts per million) max. This is to prevent interference with the CO scrubbing devices. Water indicating tubes are used in the purifying train.

e. Determining Proper Backup Air Volumes:

1) Allow a clean reservoir with 30 minutes of air for each mask connection. Figure 15 CFM at each connection. Therefore 450 cubic ft of air (at atmospheric pressure) is needed for each worker. A typical 80 cubic ft size cylinder when fresh has about 2000 PSIG of air. PSIG DIVIDED BY 14 = THE NUMBER OF ATMOSPHERES. So this cylinder has about 140 atmospheres of pressure and therefore 140 times 80 = 11,200 cubic ft of air at atmospheric pressure. 11,200 divided by 450 = 24.88, leaving enough air for about 24 workers to escape.

2) If the hose is cut, the above calculations are meaningless, so make sure each worker has his SCBA.

3. SCBA Self Contained breathing apparatus-

a. Portable tank with fresh air

b. Short term or emergency escape use

NOTE: THE ABOVE IS ONLY A PRIMER. THOSE WHO ARE GOING TO MONITOR SUPPLIED AIR MUST GET DETAILED INFORMATION FROM THE SUPPLIER AND THE MANUFACTURER OF THE PARTICULAR EQUIPMENT.

C. LIMITATIONS OF RESPIRATORS:

1. Oxygen Deficiency:

a. Normal air contains about 20.9% oxygen.

b. Work area air must contain 19.5 to 23.5 % oxygen.

c. Only supplied air or SCBA apparatus is acceptable in oxygen deficient atmospheres.

d. HEPA or other air purifying respirators do NOT protect against oxygen deficiency.

2. Toxic Contaminants:

a. HEPA filters do NOT protect against toxic vapors.

b. Special cartridges are needed for each class of vapors.

c. Always request a material safety data sheet (MSDS) when dealing with strange contaminants. The MSDS must say what type of respirator is needed.

d. Consult respirator or chemical suppliers on specific problems.

D. PROPER RESPIRATOR SELECTION

1. By OSHA requirements Discussed in Section 3.

2. According to limitations Discussed Above on page 22.

3. By Technical Agencies: Select the respirator for any substance which provides the required protection factor based on personal air monitoring vs the exposure limits : (These agencies have no enforcement role.)

ACGIH- American Conference of Governmental Industrial Hygienists
NIOSH- National Institute for Occupational Safety and Health.

4. Protection or Fit Factors:

a. A protection or Fit factor is a value obtained by dividing the concentration outside by the concentration inside the mask.

$$\text{Protection Factor (PF)} = \frac{\text{Conc. outside mask}}{\text{Conc. inside mask}}$$

b. Protection factors are not used to determine the TWA and PEL exposures; these are determined outside the mask.

c. Protection factors presented in Table 1 of 1926.1101.

1) Negative pressure HEPA filtered:

a) Half-mask air purifying "not in excess of 1 f/cc (10 X PEL)

b) Full face mask air purifying "not in excess of 5 f/cc (50 X PEL) (if the mask is quantitatively fit tested; but if qualitatively fit tested, the PF is only 10.

2) PAPR': "not in excess of 10 f/cc (100 X PEL)*

***PROTECTION FACTORS FOR TIGHT FITTING PAPRS:**

AGENCY	PROTECTION FACTOR	MASK	FIT TESTING METHOD
OSHA	100	FULL FACE	QUALITATIVE
OSHA	50	½ FACE	QUALITATIVE
OSHA	1000	FULL FACE	QUANTITATIVE
NIOSH	50	½ OR FULL FACE	ANY

3) Supplied air types: (1000 X PEL or more)

E. RESPIRATOR DONNING, USE, MAINTENANCE, INSPECTION AND STORAGE PROCEDURES;

1. Each Time Donning the Respirator:

a. Medical approval needed

b. Only use the respirator for which fit tests were made.

c. Inspect for defects. Repair or replace any defective parts using only correct parts of the same brand.

d. Install new cartridges as needed.

e. Adjust straps. Over-tightening the straps will sometimes reduce facepiece leakage, but the wearer may be unable to tolerate the respirator during the work period.

f. Respirator straps go under protective hood

g. Seal Check. If fit is unsatisfactory, check for loose cartridges, missing gaskets and other defects (below) and adjust as needed or obtain new fitted respirator or parts.

2. Use and Daily Maintenance:

a. Trouble

1) Negative Pressure Respirators:

a) Increased breathing resistance indicates filters are full. Leave Work Area immediately and change the filters.

b) Decreased breathing resistance indicates leak. Correct at once.

2) PAPR

a) Reduced air flow can be detected by feel and sound and indicates weak battery or plugged filters. Leave Work Area immediately and correct before re-entry.

b) If battery goes, tight fitting PAPR becomes temporary negative pressure respirator.

b. Taking off

1) HEPA vacuum off any gross contamination.

2) Proceed to the shower with respirator still on.

3) Clean the respirator using soap and water and rinse.

4) Remove the cartridges and wash the respirator with detergent (disinfectant if needed) in warm water using a brush and wiping with a clean paper towel.

5) Wash the cartridge gaskets separately. Never use solvents other than water since they are likely to attack the rubber facepiece.

6) Rinse thoroughly in warm tap water to remove all traces of detergent and disinfectant.

7) Dispose of the wet respirator cartridges in a receptacle for Asbestos waste.

8) Proceed to the Clean (change) Room and dress

3. Storage:

Allow to dry on a clean paper towel for the next days use.
When dry, reassemble with the cartridges and package the unit in a 1-2 gallon zip loc bag with the exhalation valve up. Store free of overlaying material and equipment to avoid distorting the rubber.

4. Maintenance of Air Purifying Respirators: Checking for Defects:

a. Rubber facepiece:

1) Dirt- Clean .

2) Permanent distortion, cracks, tears, or holes - Issue new facepiece.

3) Loose fitting valves or other parts- Replace or issue new facepiece.

4) Warped, cracked, torn or missing gaskets- Replace.

b. Headstraps:

1) Breaks, loss of elasticity or tears- Replace headstraps.

2) Broken or malfunctioning buckles or keepers- Replace.

c. Valves:

1) Loose- Tighten or replace.

2) Dirt or residue- Clean or replace.

3) Rupture, missing cover or other defect- Replace.

d. Filter element:

1) Proper filter.

2) Missing or worn gaskets- Replace.

3) Worn, Cracked, dented or contaminated- Replace filter.

F. QUALITATIVE FIT TESTING PROTOCOL USING IRRITANT SMOKE (STANNIC CHLORIDE):

1. Prior to initial use of a respirator, whenever a change in conditions such as a different respirator facepiece type is used, and at least annually thereafter.

2. Test subject clean shaven at facepiece sealing surface.

3. Fit-testing of tight-fitting PAPR's in the negative pressure mode. This is accomplished by shutting off the power.

4. Selection of respirators available and mirror available to evaluate the fit.

5. Test subject informed about the selection process and trained in putting on respirators.

6. Assessment of comfort shall include the following points:
a. Position of the mask on the nose
b. Room for eye protection
c. Room to talk
d. Position of mask on face and cheeks

7. The following criteria shall be used to help determine the adequacy of the respirator fit:
a. Chin properly placed;
b. Adequate strap tension, not overly tightened;
c. Fit across nose bridge;
d. Respirator of proper size to span distance from nose to chin;
e. Tendency of respirator to slip;
f. Self-observation in mirror to evaluate fit and respirator position.

8. Test subject conducts a seal check.

9. If a test subject exhibits difficulty in breathing during the tests, she or he shall be referred back to the doctor who approved this individual for respirator use.

10. If the employee finds the fit of the respirator unacceptable, the test subject shall be given the opportunity to select a different respirator and to be retested.

11. To be discussed with test subject prior to the commencement of the fit test:
a. Description of the fit test and test exercises that the subject will be performing.
b. Test subject's responsibilities during the test procedure.

12. The respirator shall be worn for at least 5 minutes before the start of the fit test.

13. The fit test shall be performed while the test subject is wearing any safety equipment that may be worn during actual respirator use which could interfere with respirator fit.

14. Test Substance delivery: The test substance is an irritant smoke (stannic chloride). Sealed glass and plastic tubes with substances to generate this smoke are available from IPCO safety supply company. When the tube ends are broken and air passed through them with an aspirator (squeeze bulb), a dense irritating smoke is emitted. The squeeze bulbs used are Sensodyne kits calibrated to deliver 20 cc of air per squeeze using the thumb and index finger to compress the bulb until the opposite walls are touching. By squeezing gradually over 6 seconds, 20 cc is delivered and using 10 squeezes/per minute, a rate of 200 cc/min of smoke is delivered.

15. No form of test enclosure or hood over the test subject shall be used.

16. The smoke can be irritating to the eyes, lungs, and nasal passages. The test conductor shall take precautions to minimize the test subject's exposure to irritant smoke. Sensitivity varies, and certain individuals may respond to a greater degree to irritant smoke. Care shall be taken when performing the sensitivity screening checks that determine whether the test subject can detect irritant smoke to use only the minimum amount of smoke necessary to elicit a response from the test subject.

17. The fit test shall be performed in an area with adequate ventilation.

18. Sensitivity Screening Check:

a. Break both ends of a smoke tube

b. Attach one end of the smoke tube to a 1/2 ounce aspirator squeeze bulb calibrated to deliver 20-cc per squeeze.

c. Cover the other end of the smoke tube with a short piece of open rubber tubing to prevent potential injury from the jagged end of the smoke tube.

d. Advise the test subject that the smoke can be irritating to the eyes, lungs, and nasal passages and instruct the subject to keep his/her eyes closed while the test is performed.

e. Carefully direct one squeeze of the irritant smoke in the test subject's direction to determine that he/she can detect it.

19. Irritant Smoke Fit Test Procedure

a. Test subject dons the respirator without assistance, and performs seal checks.

b. The test subject instructed to keep eyes closed.

c. Respirator not adjusted once the fit test exercises begin. Adjustment voids the test.

d. The test operator directs the stream of irritant smoke from the smoke tube toward the face seal area of the subject, using the low flow pump or the squeeze bulb. The test operator shall begin at least 12 inches from the facepiece and move the smoke stream around the whole perimeter of the mask. The operator shall gradually make two more passes around the perimeter of the mask, moving to within six inches of the respirator.

e. If the person being tested has not had an involuntary response and/or detected the irritant smoke, proceed with the test exercises.

20. Test Exercises

During the following exercises, challenge the respirator seal continually with the smoke, directed around the perimeter of the respirator at a distance of six inches at a rate of 10 gradual squeezes per minute (200 cc/min). Withdraw the tube and stop pumping at once if the test subject should exhibit a characteristic cough reaction to the smoke. In this case the test has failed and the procedure needs to be repeated with another facepiece.

a. 1 Minute Normal breathing. In a normal standing position, without talking, the subject shall breathe normally.

b. 1 Minute Deep breathing. In a normal standing position, the subject shall breathe slowly and deeply, taking caution so as not to hyperventilate.

c. 1 Minute Turning head side to side. Standing in place, the subject shall slowly turn his/her head from side to side between the extreme positions on each side. The head shall be held at each extreme momentarily so the subject can inhale at each side.

d. 1 Minute Moving head up and down. Standing in place, the subject shall slowly move his/her head up and down. The subject shall be instructed to inhale in the up position (i.e., when looking toward the ceiling).

e. 1 Minute Talking. The subject shall talk out loud slowly and loud enough so as to be heard clearly by the test conductor. The subject can read from the Rainbow Passage or count backward from 100.

Rainbow Passage

When the sunlight strikes raindrops in the air, they act like a prism and form a rainbow. The rainbow is a division of white light into many beautiful colors. These take the shape of a long round arch, with its path high above, and its two ends apparently beyond the horizon. There is, according to legend, a boiling pot of gold at one end. People look, but no one ever finds it. When a man looks for something beyond reach, his friends say he is looking for the pot of gold at the end of the rainbow.

f. 1 Minute Bending over. The test subject shall bend at the waist as if he/she were to touch his/her toes.

g. Normal breathing. Same as exercise (1).

21. Follow-up

a. Question the test subject regarding the comfort of the respirator upon completion of the protocol. If it has become unacceptable, another model of respirator shall be tried.

b. If the subject reports detecting the irritant smoke at any time, the test is failed; repeat the entire sensitivity check and fit test procedure.

c. Each test subject passing the irritant smoke test without evidence of a response (involuntary cough, irritation) shall be given a second sensitivity screening check, with the smoke from the same smoke tube used during the fit test, once the respirator has been removed, to determine whether he/she still reacts to the smoke. Failure to evoke a response shall void the fit test.

d. If a response is produced during this second sensitivity check, then the fit test is passed.

G. OTHER FIT TESTING METHODS

1. Banana Oil and Saccharin Qualitative Tests:

a. The same general procedure is used.

b. Depend on the wearer's response, and thus are not entirely reliable. (Irritant Smoke eliminates this variable.)

Details can be found in 1910.134 as amended F.R. 1/8/98.

2. Quantitative Fit Tests:

a. Quantitative fit testing uses a non-hazardous test aerosol (such as corn oil, polyethylene glycol 400 [PEG 400], di-2-ethyl hexyl sebacate [DEHS], or sodium chloride) generated in a test chamber, and employing instrumentation to quantify the fit of the respirator; Quantitative fit testing using ambient aerosol as the test agent and appropriate instrumentation (condensation nuclei counter) to quantify the respirator fit. A device called a Portacount TM quantitatively fit tests respirators with the use of a probe. The probed respirator is only used for quantitative fit tests. A probed respirator has special sampling fittings installed on the respirator that allows the probe to sample the air from inside the mask. A probed respirator is required for each make, style and model.

b. Quantitative fit testing also uses controlled negative pressure (CNP) and appropriate instrumentation to measure the volumetric leak rate of a facepiece to quantify the respirator fit. The CNP instrument manufacturer Dynatech Nevada also provides attachments (sampling manifolds) that replace the filter cartridges to permit fit testing in an employee's own respirator.

H. SEAL CHECK

Before conducting the negative and positive pressure checks, the subject shall be told to seat the mask on the face by moving the head from side-to-side and up and down slowly while taking in a few slow deep breaths. Another facepiece shall be selected and retested if the test subject fails the user seal check tests.

1. Negative Pressure Test

a. Cover air inlets with the palms to restrict air flow and inhale gently so the facepiece collapses slightly.

b. Hold breath for about 10 seconds. If the facepiece remains slightly collapsed and no inward leakage is detected, the respirator probably fits tightly enough.

c. This Seal Check has potential drawbacks, such as the hand pressure modifying the facepiece seal and causing false results.

2. Positive Pressure Test:

a. Close the exhalation valve and exhale gently into the facepiece. (For some respirators, this test requires that the wearer remove the exhalation valve cover before the respirator is put on and then replace the valve before use.) The test is easy for respirators whose valve cover has a single small port that can be closed by the palm or a finger.

b. Should have slight positive pressure inside the facepiece without any evidence of outward leakage around the facepiece.

c. When exerting enough exhalation pressure, the facepiece should lift off the face rather than have air blow by the face only.

I. FACTORS THAT ALTER RESPIRATOR FIT **and cause variability between field and laboratory protection factors:**

1. Active field conditions

2. Length of time since lab test

3. Wear on equipment

4. Dust build up in HEPA filters

5. Reproducibility of mask adjustment

6. Growth of facial hair

7. Change in weight

J. WRITTEN RESPIRATORY PROTECTION PROGRAM

1. Procedures for selecting respirators for use in the workplace;

2. Medical evaluations of employees required to use respirators;

3. Fit testing procedures for tight-fitting respirators;

4. Procedures for proper use of respirators in routine and reasonably foreseeable emergency situations;

5. Procedures and schedules for cleaning, disinfecting, storing, inspecting, repairing, discarding, and otherwise maintaining respirators;

6. Procedures to ensure adequate air quality, quantity, and flow of breathing air for atmosphere-supplying respirators;

7. Training of employees in the respiratory hazards to which they are potentially exposed during routine and emergency situations;

8. Training of employees in the proper use of respirators, including putting on and removing them, any limitations on their use, and their maintenance; and

9. Procedures for regularly evaluating the effectiveness of the program.

K. PERSONAL PROTECTIVE CLOTHING:

1. Selection, Use and Storage

a. Protective clothing must be worn in the asbestos work area.

b. The suit is needed to keep gross asbestos contamination off the body, thus making decontamination easier and minimizing the chance of tracking to other areas of the building or bringing asbestos contamination home.

c. Disposable coveralls usually with attached "feet" and hooded head covering.

d. Disposable vs re-useable

e. Tight fitting vs heat stress

f. Loose vs catching in equipment and fall hazards

g. Disposable suits are used which are made of Tyvek, or spun breathable fabrics.

h. Selection of sizes: Most popular Suit sizes: triple (xxx) and double (xx).

i. Storage in clean room in clean, sealed cases or lockers for donning.

i. Other equipment:

Each abatement worker should have a full range of protective equipment available for use as may be needed at the work site including:

Hard hats
Safety goggles
Boots
Protective gloves
Safety shoes
Ear protection
Knee pads
For high places wear rubber soled shoes

Keep these items HEPA vacuumed and stored in plastic bags between jobs.

2. Donning the suit:

a. In clean area outside the work area or in clean change area of the Decontamination unit

b. Zip the suit down to the crotch

c. Place street clothes in locker stripping naked or at least to undergarments or swim suit.

d. Step into the suit and zip up

e. Use duct tape if necessary to blouse or adjust fit

f. Use duct tape to make a belt for personal air sampling pump.

g. Don and seal check respirator

h. Pull hood over head

i. Don any other needed safety equipment

j. Use this opportunity to bring clean supplies and tools into the work area

k. Ready to enter work area

l. Enter via the shower Decon or the "bag out"

3. Taking off the Suit, Decontamination Procedure:

a. In the work area near the equipment room of the Decon Unit, HEPA vacuum off gross contamination paying attention to the respirator itself.

b. Proceed to the Equipment Room

c. If wearing a sampler, place personal air sample cassette in clean zip loc pouch and HEPA vacuum or wet wipe the pump. A plastic baggie secured with an elastic may be used to protect the pump while in the work area.

d. Remove all clothing except respirator and dispose of suit in asbestos waste receptacle.

e. Proceed to the shower with respirator still on. Still wearing the respirator, clean the respirator and self using soap and water and rinse self in the shower. Dispose of the wet respirator cartridges in a receptacle for Asbestos waste.

f. Following showering and drying off, proceed directly to the Clean (change) Room and dress in street clothes or one may don disposable clothing of a different color or otherwise distinctively different, for use outside the Work Area, than suits used inside the Work Area.

4. Regulations covering personal protective equipment (PPE)

The following regulations dealing with protective equipment have some bearing on asbestos abatement. We will discuss some of the more commonly applicable ones.

OSHA 29CFR 1910.132-3 Protective Clothing (see above)
OSHA 29CFR 1910.136 Foot protection
OSHA 29CFR 1910.137 Electrical protective devices
OSHA 29CFR 1910.94 ventilation
OSHA 29CFR 1910.119 process safety
OSHA 29CFR 1910.134 respirators
OSHA 29CFR 1910.120 hazardous waste
OSHA 29CFR 1910.preface 179.220-227 PPE program
OSHA 29CFR 1910.146 permit required spaces
OSHA 29CFR 1910.156 fire brigades
OSHA 29CFR 1910.160 fire extinguishers
OSHA 29CFR 1910.335 energized plugs and receptacles
OSHA 29CFR 1910.1000 air contaminants
OSHA 29CFR 1910.1001 asbestos
OSHA 29CFR 1910.1027 cadmium
OSHA 29CFR 1926.28 PPE
OSHA 29CFR 1926.951 tools and protective equipment
OSHA 29CFR 1926.952 mechanical equipment
OSHA 29CFR 1926.1101 Asbestos
OSHA 29CFR 1926.59 hazard communication
OSHA 29CFR 1926.52 hearing
OSHA 29CFR 1926.62 lead
OSHA 29CFR 1926.103 respiratory protection
OSHA 29CFR 1926.300 power transmission apparatus
OSHA 29CFR 1926.353 ventilation

5. Storage and handling of non-disposable clothing used in Asbestos Abatement; (1910.1001, 85; 1926.1101,97)

a. HEPA vacuum before leaving the work area to decontaminate.

b. Take off in the equipment room of the change area and leave there in containers with the same OSHA labels specified for wastes.

c. Must launder so as to prevent the release of airborne asbestos in excess of the PEL or EL.

d. Commercial laundries or cleaning establishments: If given to another person for laundering: must inform such persons of the requirements to launder the clothing so as to prevent exceeding of the PEL and EL.

e. Contaminated clothing shall be transported in sealed impermeable bags, or other closed impermeable containers and be labeled:

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

f. Must be periodically examined for rips or tears and repaired or replaced as needed.

6. Regulations Covering Respiratory Protective Equipment

Construction Industry Asbestos Standard: CFR 29 1926.1101

Respirator Standard: CFR 29 1910.134

These are discussed in detail above and further in the section on regulations.

SECTION 4

STATE OF THE ART WORK PRACTICES

Proper Work Practices for Asbestos Abatement Activities as they Apply to Removal, Encapsulation, Enclosure and Repair

Required Practices, Recommended Practices and Prohibited Practices including Personal Hygiene

Section 4-1

Asbestos Abatement Equipment and Supplies

A. HEPA FILTRATION

1. HEPA Filter: high efficiency particulate air filter; designed to trap 99.97% of particles >0.3 microns.

2. Negative Air Units:

a. Machines that must produce at least **four air changes/ hour** in each Work Area. This is required by OSHA and DPH.

b. **0.02 inches of water** negative pressure in Work Area This is in the OSHA regulation but not in the DPH regulations.

c. Air monitoring of the HEPA unit exhaust is very important to ensure that filters are properly working.

d. Accessories include exhaust and intake ducts and flanges and adapters to connect the duct work, and spare filters.

e. True flow with some units may be 75% of stated flow.

f. Flow drops as filters plug and with longer duct runs.

g. Can't assume theoretical flow is correct. Flow should be monitored and pressure must be monitored.

h. Calculated flow needed for an area is: room volume in cubic ft divided by 15 to obtain a theory of 4 air changes/hour.

3. HEPA Vacuums

a. A vacuum cleaner with a HEPA filter.

b. Air sucked into the cleaner first goes to a vacuum bag, then to a secondary filter and finally to the HEPA filter.

c. Never use an ordinary vacuum cleaner since it will blow out fine ACM dust.

d. Most HEPA vacuums move about 200 CFM (cubic ft/min) of air through the filter.

e. Used for cleaning surfaces before, during and after abatement

f. Used for cleaning self before leaving Work Area

g. Operating instructions provided by the manufacturer of the machine are to be followed.

h. See that attachments are available which are appropriate for use on each type of surfaces including brushes of various sizes, crevice tools, and angular tools.

1) Brush tool for walls, fixtures and woodwork.
2) Wheeled floor nozzle for bare floors
3) Carpet beater for carpets
4) Rubber cone where the floor meets the wall and other cracks.
5) Slender and long plastic fitting for between radiator sections.

i. Filter change:

1) When machine flow begins to get restricted.

2) In a contained area.

3) Full set of protective clothing including appropriate respirator.

4) Usually change bag and prefilter first and see if the flow is OK.

5) Hose must be checked for blockage and cleaned by suction from a second HEPA unit. Do not blow out the hose since this will contaminate the area.

6) Check gaskets, filters and vacuum bag for tears.

7) A second HEPA unit can be used to advantage to clean out the unit being serviced.

8) Use extreme caution to avoid release of asbestos dust into the environment.

9) Used HEPA filters and vacuumed debris are to be included with the asbestos waste.

10) After the servicing, the machine should be turned on to check the operation.

11) Room surfaces near the filter change must be cleaned up.

j. Check daily for damage, especially power cords and switches.

k. At the end of the job before the cleaner is to be taken out of the Work Area, it is to be sealed in leak proof wrapping after doing the following:

1) Clean each attachment by sucking through the vacuum while tapping and wet wipe each attachment. Place the cleaned parts in a sealable plastic bag.

2) Suck out and seal the end of the hose with duct tape to prevent dust from leaking.

3) Unplug and damp wipe the unit clean.

B. THE DECONTAMINATION UNIT **(SEE DRAWINGS IN Handout on W.W.W.Chem-scope.com, SEE PAGE 41)**

1. Equipment Room: contaminated area next to Work Area

2. Shower Room: contiguous to and between equipment room and clean room.

3. Clean Room:

a. Storage of street clothes

b. Change area

c. Each room separated by an airlock

C. AIRLESS SPRAYERS

1. Used to spray encapsulant and surfactant.

2. Airless sprayers really use air but the air is not mixed with the spray.

3. Fine spray is important

4. Critical to clean nozzle after use

D. CHEMICALS (ALWAYS NEED MSDS'S)

1. Amended Water

2. Encapsulant (sealant)

3. Spray Glue

4. Mastic remover

E. WASTE DISPOSAL CONTAINERS

1. Water and air tight.

2. Must be labeled in large legible letter:

DANGER

CONTAINS ASBESTOS FIBERS

AVOID CREATING DUST

CANCER AND LUNG DISEASE HAZARD

3. Double 6-mil polyethylene bags or special drums

4. Bulk storage and transportation vessels must be air and dust tight

5. May be specially lined dumpsters or trucks.

6. Vacuum transfer devices and receptacles may be used provided the transfer and storage is contained to permit no dust evolved to the building or outside air.

F. WET CLEANING EQUIPMENT:

Cloths, mops, rags, towels and sponges or other cleaning tools which have been dampened with amended water.

G. PERSONAL PROTECTIVE EQUIPMENT (PPE):

See Section 3.

H. AIR MONITORING EQUIPMENT

See Section 5.

Section 4-2

Interior Abatement

State of the Art Work Practices

A. ASBESTOS PROJECT

1. An activity in a facility which involves 3 sq ft or 3 lin ft of ACM or more.

2. Containment barriers, Decontamination Units, Negative Air, Decontamination Unit, other preparations and final clearance are needed.

3. The 3 types of abatement: Removal, Encapsulation and Enclosure were already discussed on pages 11-14.

B. PREWORK CONSIDERATIONS: (For Removal, Encapsulation or Enclosure)

1. Prework Inspections: Refer to the pre-abatement check list in Handout on W.W.W.Chem-scope.com.

2. Pre-cleaning of the Work Area,

a. General

1) Poor pre-cleaning leads to failed finals and to embarrassment after floor poly is removed.

2) Personal samples taken.

3) Decon and negative air in use.

4) Full protective gear used.

b. Movable Objects:

1) Remove what can be moved - furniture, stored material & movable Equipment.

2) Wet clean or HEPA Vacuum objects as appropriate before taking out of Work Area.

3) Remove objects from Work Area to a temporary location or wrap as waste what is not to be cleaned and dispose of as contaminated waste.

c. Fixed objects and other surfaces:

1) HEPA vacuum and/or Wet Clean objects to remain in Work Area.

2) Enclose cleaned objects with a minimum of 6-mil plastic sheeting and tape.

3) Clean the remaining Work Area surfaces using HEPA vacuums and/or Wet Cleaning methods as appropriate.

3. Construction of Critical Barriers:

a. Work area separated from non Work Areas by air tight barriers.

b. Seal off all openings, with polyethylene sheeting 6-mil thick including:

1) Windows

2) Corridors

3) Doorways

4) Skylights

5) Duct vents and diffusers

6) Any other penetrations into the Work Area

c. Do not seal off sprinkler heads, smoke/heat detectors or other safety equipment.

d. Ceiling Management:

1) Any ceiling protrusions, panels, porous surfaces, or irregularities which may become contaminated, interfere with the work or permit contamination beyond the confines of the Work Area must be managed to prevent contamination or release of fibers. This is usually done by critical barriers, but there are special cases when not feasible, such as active sprinklers and alarm detectors.

2) If work is required above drop ceilings, a decision is needed to demolish or preserve the drop ceilings.

3) If all work is below drop ceilings:

a) The ceiling is protected with plastic or

b) The work is done in small plastic enveloped containments called "mini-containments" or

c) Ceiling mounted objects that interfere with Asbestos Abatement, such as lights and other items not sealed off, are cleaned and removed.

4. Construction of Floor and Wall Plasticization:

a. Cover flooring and wall surfaces with polyethylene sheeting sealed with tape.

b. Use a minimum of two layers of 4-mil polyethylene on walls and 6-mil polyethylene on floors.

c. Floor plastic must interleave under the wall plastic so that polyethylene extends at least twelve inches up on walls. This keeps the water from leaking out.

5. Worker Decontamination System:

a. Configuration:

1) At least 3 compartments separated by airlocks

2) Equipment room contiguous to the Work Area

3) Shower Room

4) Clean Room

5) Contiguous to the Work Area when feasible. (Must notify DPH and the facility owner when a remote decontamination unit is used.)

b. Equipment Room:

A contaminated area or room which is part of the Worker Decontamination Enclosure with provisions for storage of contaminated clothing and equipment.

c. Shower Room:

1) Pass through shower that does not restrict passage: hot and cold or warm running water, one shower per 10 employees or fraction thereof for each sex, soap (See OSHA 1910.141)

2) Polyethylene on Shower Room and adjoining Equipment and Clean Rooms must be non-transparent.

3) Waste from the shower must be filtered with best available technology (less than 5 microns filter porosity).

d. Clean Room:

1) Storage of street clothes

2) Change area

3) Next to non- Regulated area.

e. Equipment Decontamination Unit

1) When feasible, provide a second decontamination unit for equipment and waste containers. This unit is sometimes called the "bag-out".

2) Can be attached to the Worker Decontamination Unit or be at a separate opening to the Work Area. Provisions for cleaning Equipment and waste containers and transferring out of the Work Area.

3) Can be a separate two chambered unit at a separate opening to the Work Area.

4) Workers cannot leave by this route, they must go through the shower, etc. To move bags from the clean end of the bag-out, workers in clean suits must get them.

6. Proper Demarcation of Work Areas, Positioning of warning signs

a. Post OSHA signs at all potential entries to Work Areas including decontamination unit entries.

b. Barriers. Interior = critical barriers or negative pressure enclosures. Roofing could be saw horses or warning tape.

c. OSHA signs must be on waste container at least during loading and unloading of wastes.

7. Shutdown/Modification of Facility Systems;

a. Electrical and ventilation system lock-out;

1) Lockout and tagging applies to all HVAC and to any portion of the electrical system which is de-energized for safety or other reasons.

2) HVAC (heating ventilation and air conditioning) systems which interact with the Work Area must be turned off.

3) Electrical breakers or fuses which control power to the above equipment must have tags attached at all points where such equipment or circuits can be energized and access to these points must be locked. Breaker and fuse boxes may usually be secured with a padlock. Tags must be clearly marked to identify the equipment which has been deactivated.

4) The chain of command and circumstances for re-energizing must be clearly delineated to avoid premature activation.

5) Where lighting is affected, lock and tag out and provide temporary Lighting consisting of low voltage lights.

b. HVAC Shutdown

1) HVAC shutdown in the area

2) Lockout-tag out as above- be very sure that this is done.

C. TECHNIQUES FOR MINIMIZING FIBER RELEASE:

1. Maintenance of Containment Barriers and Decontamination Enclosure Systems;

a. Check for leaks daily

b. Smoke tests and visual examination

c. Manometric tests daily

d. Repair leaks promptly

2. Work Practices:

a. Methods Used:

1) Wet methods

2) Decontamination procedures

3) Material drop restrictions : **Above 10 ft material must be bagged before dropping to the floor.**

4) HEPA vacuuming

5) Disposal practices

6) The aerodynamics of fiber dispersal must be clearly understood by the Contractor/Supervisor.

b. Coordination of Methods:

1) The appropriate method must be employed at the right time in the work sequence for each material being abated.

2) The Contractor/Supervisor should consider the material and the conditions of the Work Area such as high elevation which will affect the exact work operations.

3) The following are some general guidelines:

Wet

Wait

Cut

Disassemble

Package

Wet package contents further as needed

Wet clean substrate surfaces

HEPA vacuum when dry

Lock-down (see page 48)

Take down of containment other than critical barriers, negative air and decontamination units

HEPA vacuum again

3. Personal Hygiene

a. Entry and Exit Procedures for the Work Area;

1) Restricted Access to Work Area:

a) Signs to restrict access.

b) Barriers

c) Guard(s) at entries

2) Entry Procedure:

a) All persons entering the Work Area must be properly authorized and equipped with proper respiratory protection and protective clothing.

b) Enter the decontamination area through the clean room.

c) Remove and deposit street clothing in locker.

d) Put on protective clothing and respiratory protection in the clean room.

e) Before entering the regulated area, employees pass through the equipment room.

3) Exit Procedure and Use of Showers: (Refer to page 33)

a) HEPA vacuum self **in the work area**.

b) Equipment Room, remove all clothing.

c) Do not remove respirators in the equipment room.

d) Shower.

e) Clean room.

b. Other personal hygiene requirements:

Eating, smoking, chewing gum or tobacco and drinking prohibited in the Work Area.

4. Use of Wet Methods and Continuous Cleaning; Abatement Area Clean-up Procedures

a. Wetting ACM: The first step in asbestos stripping is to wet the material by spraying of ACM with amended water and then continue wetting during abatement.

NESHAP (and other regulations) require adequate wetting during stripping and maintaining the asbestos material in a wet condition in preparation for transport and disposal.

b. Wet cleaning surfaces:

Use cloths, mops, rags and towels and sponges or other cleaning tools which have been dampened with amended water, and by afterwards disposing of these cleaning items as Asbestos contaminated waste.

c. When Water Use is Not Feasible:

1) DPH/EPA: When it is not feasible to use water for reason of unavoidable equipment damage or for safety reasons, obtain prior written approval from EPA and/or the State DPH. (NOTE for NESHAP sized jobs): ALL ACM MUST BE KEPT WET until sealed in a leak tight container. Subject to such approval, water may be omitted during stripping but must still be added to the wastes as packaged.

2) OSHA: OSHA will allow employers to claim infeasibility if they cannot use wet methods due to conditions such as electrical hazards, hot surfaces, and the presence of technical equipment which cannot tolerate moisture.

d. Gross Removal:

1) Wet Asbestos Material freshly.

2) Remove intact or in manageably sized sections.

3) Carefully lower to the floor.

4) Drop restrictions.

a) For heights greater than 15 ft, use an inclined chute or scaffolding or containerize the material at the elevated level.

b) For materials removed at a height greater than 50 ft from the floor, a dust- tight, enclosed chute must be used to transport material to containers on the floor unless a raised scaffold is used to bag the wastes.

3) Do not let Asbestos materials dry out once disturbed during the work.

4) Repeat all cleaning operations constantly during the work to avoid any accumulations of debris.

e. Bagging:

1) Bag the wet Asbestos waste freshly. Perform bagging at frequent intervals to prevent drying and to prevent possible tracking of Asbestos wastes.

2) Seal filled containers with the wet Asbestos waste in the Work Area. Wet clean the outside of the sealed bag and move to the Holding Area (bagout) for double bagging by workers who have entered from uncontaminated areas dressed in clean disposable suits. Only the double sealed bags and other cleaned materials should exit via the bagout. Persons should leave only via the Decon- shower route.

3) The Asbestos materials must be packaged in impermeable dust tight containers (i.e., heavy duty six (6) mil polyethylene bags or sealed fiber pack drums):

4) All containers including the Asbestos waste storage unit must be labeled in large legible letter:

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

f. Cleaning Surfaces:

1) Remove visible accumulations of Asbestos Material and debris.

2) HEPA or Wet clean all surfaces within the Work Area.

3) Constantly change to fresh wipers, mops, brushes etc. Used wipers will only smear. Use clean water each time.

g. Lock-down (see page 48)

D. WASTE TRANSPORT AND DISPOSAL PROCEDURES INCLUDING PROPER CLEAN-UP

1. Cleanup

a. Equipment and Container Clean-up:

Note: Gross contamination may still exist inside the HEPA vacuums and negative air machines. These are changed in the Work Area if the filter becomes full.

1) Empty HEPA vacuum in the Work Area.

2) Negative air unit:

a) Outer filters on negative air units must be disposed of in the asbestos wastes, and the outside of the units thoroughly wet cleaned before removal from the Work Area.

b) Inner filters on negative air units must be changed at the beginning of the next abatement job inside the contained Work Area. Remove all pre-filters and damp clean

c) Change HEPA filters in the Work Area during early stages of abatement including gross removal if the filter becomes full. Otherwise change the inner filters at the start of next project after containment is established. Outer filters on negative air units must be moistened and disposed of in the asbestos wastes at any time when loaded or before taking from the site.

3) Sealed waste containers and all equipment used in the Work Area must be included in the clean-up and must be removed from Work Areas.

4) When decontamination is not possible or feasible, the object must be wrapped in two air tight layers of 6 mil polyethylene and the outside thoroughly cleaned before removal or placed in an airtight metal drum with a locking lid. Includes:

a) HEPA vacuums and accessories

b) Asbestos insulated or coated materials removed intact without stripping

c) Construction materials

d) Tools

e) Electrical equipment

f) Decon and shower components

g) Negative air units, and

h) Anything else.

b. Lock-down: Must be done after the visual but before final air samples and allowed to dry before the samples. A leaf blower may be used to speed up the drying.

1) Spray encapsulate (lock-down) all stripped surfaces using a fine spray mist. Follow manufacturer's instructions for the airless sprayer and encapsulant.

2) After all visible residue has been removed, spray apply a thin coat of Encapsulant to cleaned surfaces and to plastic barriers after cleaning.

3) Lock-down spray is usually a skin irritant and tends to plug respirator cartridges and air samples, so avoid contact with the liquid and mist.

4) Since the lock-down is invisible on most surfaces, monitor the process to ensure complete work.

5) Air sampling for final clearance must be done after lock-down is dry.

2. Transportation and Disposal:

a. Asbestos wastes must be wet.

b. No visible emissions.

c. Must be sealed in water and air tight containers.

d. Double 6-mil polyethylene bags.

e. Commercial fiber drums designed for asbestos wastes.

f. Bulk storage and transportation vessels must be lined, air and dust tight.

g. Outer containers must be clean and tightly sealed.

h. May be specially lined dumpsters or trucks. Contained "Suck trucks" may be used provided the transfer is HEPA filtered and emissions monitored.

i. Waste must not be liquid.

j. Must be labeled per OSHA regulations in large legible letters:

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

k. The waste must go to an EPA approved landfill for asbestos wastes.

l. Disposal in Connecticut - DEP permit is needed.

m. For NESHAP covered jobs: Also label each container with the name of the generator and the name of the work site.

n. Waste manifest completed. One copy goes with the shipment and one copy is kept by the contractor.
o. Disposal in EPA approved landfill or approved waste processing site.

E. EMERGENCY PROCEDURES, UNPLANNED RELEASES AND POTENTIAL EXPOSURE SITUATIONS:

1. Emergency Exits:

a. Exits clear of equipment and materials at all times to permit emergency exit without interference.

b. Brightly colored markings on the floor tracing the escape route and clearly mark the safe ways out of the containment. Each worker must be specifically instructed as to the emergency evacuation procedure. Make sure emergency lighting will operate.

c. When fire or other such emergency threatens safety, it is acceptable to cut or break barriers to get out.

2. Power Failure:

a. Prior training on procedures including escape.

b. Suspend work.

c. Prior setup to provide emergency lighting.

d. Back-up generators.

e. Decontaminate as best can do. Don't shake out suits; roll them up. Keep respirator on.

f. Limit area of tracking until power is back on and then finish decontamination and clean up of any tracked dust.

3. Emergency Response to Asbestos Fiber Releases

a. Isolate area with barriers and signs and keep material wet.

b. Limit access to the area to trained personnel with respirator and a disposable suit.

c. HVAC shutdown in the area if possible.

d. Seal air vents especially return vents.

e. Use a mini-enclosure or a glovebag as appropriate to address damaged ACM.

f. HEPA vacuum any visible reside and cover the floor under the damaged ACM with 6- mil polyethylene.

g. Use properly labeled leak-proof disposal containers.

h. Patch the damaged area with appropriate asbestos free materials.

i. Dispose of wastes in EPA approved landfill.

4. Occupant's Emergency Needs:

a. Safe passage areas

b. Availability of specialized trades needed for access to mechanical areas undergoing abatement.

5. Escape For Supplied Air Respirators

SCBA Self Contained breathing apparatus-

Portable tank with fresh air, Short term or emergency escape use

6. Medical Prevention and Response:

a. Emergency plans must be ready in the event medical treatment is needed.

b. Heat Related Disorders.

c. Other Preparations:

1) Emergency phone available

2) First Aid Supplies and training

3) CPR training

4) Evacuation to designated medical facility

5) For large projects involving physical and chemical hazards: arrangements made with local medical response units, can be coordinated with local hospital.

7. Fire Prevention and Response at Abatement Sites:

a. Polyethylene burns similarly to candle wax. Fire resistant poly should be used but this is not much better than ordinary poly.

b. Special precautions for containing hot surfaces

c. Written emergency action plan and fire prevention plan

d. OSHA Fire Protection and Prevention includes requirements for:

1) Temporary or permanent water supply for fire protection

2) A trained fire fighting brigade as the project warrants

3) Portable fire extinguishers of a 2A rating for every 3000 sq ft of the Work Area. Point of travel to the nearest fire extinguisher must not exceed 100 ft.

4) Where more 5 gal of flammable or combustible liquid exists, a 10B fire extinguisher must be located within 50 ft of the material. (This is likely to include gasoline used for generators.)

e. Ensure that the area allows a quick and easy escape route and all workers are briefed on escape.

f. No smoking, no welding, no other ignition sources near flammable materials.

g. Make sure outside contractors or other building occupants who may work near the area are aware of the safety requirements.

h. Notify local fire marshall in advance.

i. Emergency equipment on hand including fire extinguishers and first aid kits.

j. Do not block exits

8. Training:

Workers must be instructed on fire, electrical, and other hazards peculiar to each job site. Instructions must include spill response, power failure and emergency evacuation procedures.

9. Sudden Releases Which May Result in Occupant and Worker Exposure:

a. Prevention

1) Planning ahead

2) Proper work practices

3) Housekeeping

4) Training

b. Detection

1) Visual monitoring of containment, adjacent areas and storage areas

2) Air monitoring showing changes from the baseline.

3) Drop in monitored containment pressure and flaps stop moving or move less.

4) Can see equipment failure

5) Unusual noises.

6) Odors of chemicals used in containment noticed outside containment.

c. Correction

1) Asbestos- provisions for emergency wetting, HEPA vacuums and isolation.

2) Chemicals - see MSDS for spill response.

F. DETERMINING THE EFFECTIVENESS OF AIR FILTRATION EQUIPMENT;

Air velocity = Distance air travels in a unit of time. (e.g. ft/minute, or fpm).

Volume flow = air velocity times the cross sectional area of a duct, e.g. (fpm) (f2) = CFM (cubic ft / minute.

1. Air Filtration Devices and Vacuum Systems: Design and Construction of HEPA Filtration Units

a. Theory of air filtration and HEPA filter design,

1) Air filtration is a process by which particles are trapped by a medium and air and very fine particulates are allowed to pass through.

2) Force is needed to push or pull the air through the filter medium, consisting of pressure or vacuum. Pressure is defined as force per unit area.

3) If we make a fine porosity filter, this creates resistance to flow so a lot of pressure or vacuum is needed to move the air through the filter medium. This creates a back pressure at the filter inlet. The difference between the pressure at the inlet and outlet of a filter is called a pressure drop. Pressure drop increases as filters become loaded with particulates.

4) HEPA filters are specially designed with a lot of surface area to compensate for the resistance of the filter. They are tested with aerosols such as dioctyl phthalate atomized into the air to determine the retentivity in microns. (99.97% of particles >0.3 microns.)

5) Larger particles are more easily trapped and can be captured simply by a change in direction or by more porous openings. Pre-filters in front of the HEPA filter are used to take load off and to delay plugging the fine HEPA filters. The HEPA element is pleated into a honeycomb pattern many times to increase the surface area and arranged in a housing to allow the flow to access all pleats.

6) Humidity, temperature and vibration all have effects upon filtration efficiency. Particle shape, mass and size are also important.

7) As filters are used, particles trapped block the pores or holes of the filter and create more resistance to flow (more back-pressure).

b. Negative Pressure Differential Monitoring: Measurement of Differential Pressure and Flow Rate of air

1) The differential pressure is the difference in pressure between one location and another- as inside vs outside the containment.

2) The pressure has two components: static pressure and velocity pressure. When air is forced to move by a fan, the moving air acquires a force or pressure component in the direction it is moving due to it's weight and inertia. This force is called velocity pressure. In operating a duct system, a second pressure is also always present; it is independent of air velocity or movement and is called static pressure. In a system, static pressure will be positive on the discharge side of the fan and negative on the inlet side. Total pressure is the combination of static and velocity pressure and is expressed in the same units. Manometers can be used to separately measure the static pressure and total pressure and calculate the velocity pressure by difference. If there is no flow, then all the pressure is static. In practice, on asbestos projects we will use "total pickup sensors" which combines the results of static and velocity pressures.

3) Manometers. The U tube manometer is a basic primary standard air gauge. Mercury, water or other liquid is placed in a hollow graduated glass U tube. When pressure is applied to one end of the tube, the column of liquid moves. The liquid displacement is measured in inches. One can't accurately see 0.02 inches directly with any precision, so although this instrument very accurate, it is not sensitive enough to measure 0.02 inches of water. It is useful for checking higher pressures.

4) MagnahelicR Gauges. Air pressure exerted upon a diaphragm causes motion which is transferred to an indicating pointer. With the pointer at zero, the pressure is the same on both sides of the diaphragm. The diaphragm is linked to the end of a leaf spring. The free end of the spring is attached to a magnet. The magnet is kept at a measured distance from a helix. (The helix has a high magnetic permeability and aligns itself according to a fixed magnetic field, maintaining a set distance from the helix). When air pressure is exerted on the diaphragm and as the spring moves, the helix moves to maintain the set distance. Motion of the spring also moves the pointer. This apparatus is calibrated against primary standards and the spring position can be adjusted to set the correct pressure. A variation of this device can be used in the range of 0 -0.5 inches of water and could be used to measure 0.02 ".

5) PhotohelicR gauges are variations of the magnahelic type where infrared radiation detected by a phototransistor is used to sense the closing of a shutter activated by the diaphragm's movement.

6) Inclined vertical manometers are a variation of the U tube manometers. A red dyed gauge oil is used in a clear plastic housing calibrated in inches of pressure. By placing the calibrated tube at an angle, the sensitivity is not good enough to measure 0.02 inches of water.

7) Ball rotometers are used to measure very low air flow, typically in liters/minute, applied by an air sampling pump. The force of the air moves the ball upward against gravity in the tapered bore of a graduated plastic housing. The ball stops moving when it reaches a wide enough point in the taper for the air to pass by the ball. The distance the ball is raised is directly proportional to the flow rate. These rotometers are calibrated against a primary standard such as a soap bubble buret. One special ball rotometer model is ideal for differential room pressure applications or by changing scales, for direct measurement of negative air flow. This is a Dwyer Model 460 air gauge. Dwyer (215 957-0355). We will demonstrate its use and do some Hands-on applications with this gauge. This gauge reads in inches of water and in air velocity at the same time.

8) Vaneometer. This is the most sensitive air flow measuring device known. A thin steel sheet is suspended on a knife edge in a calibrated housing. The faintest draft causes motion of the steel sheet and the reading in ft/min can be directly taken from the scale. We will demonstrate and use a Model 480 vaneometer.

9) Thermal Anemometers are very practical for measuring negative air flow. The temperature change due to the velocity of air passing through a sensor is picked up by a thermocouple and transmitted to a needle or digital output. These are not usually sensitive enough for the room differential of 0.02 inches, however.

c. Temperature and pressure correction:

1) Temperature and barometric pressure affect the density of air. The temperature and barometric pressure must be measured and corrected for if SCFM (Standard CFM are to be reported.)

2) Atmospheric conditions, especially temperature, affect air density and contribute to errors unless accounted for.

3) When air is colder, it is more dense and at a given observed velocity, more air is actually moved than indicated.

4) As the atmospheric pressure increases, air becomes denser and more air is actually moved than indicated. Pressure does not change the volume flow as much as temperature but still needs to be considered.

d. Practical Application of HEPA Filtration Units.

1) No regulated standards for system design (other than the filter rating 99.97%, etc.

2) Some manufacturer's take short cuts and use lower horse power motors and filters with higher back pressure under use. The result is that some brands plug more quickly than others. Surplus negative air, constant monitoring and filter change are critical.

3) A 2000 CFM unit operates at a static pressure anywhere from 1.75 to 2.3 inches of water, depending on the brand and the loading. The static pressure is a function of the power of the blower. As the filter gets loaded with particles, the flow goes down drastically.

4) The flow rate in CFM also decreases as the length of duct increases, bends, is restricted or as a function of the friction of the duct system.

5) A 20 Amp circuit may be needed for one 2000 CFM unit. Check the manufacturers label for electrical requirements.

6) Provide adequate makeup air from upstream of the Decon.

7) Check the gasket between the HEPA filter and housing each time the filter is changed or after the unit has been transported.

8) Filter Replacement

a) Outer 1/2 inch prefilter may last only 2 hours in heavy removal and inner 2 inch prefilter may last 24 hours.

b) HEPA filter may last about 700 hours.

c) Changing the 1/2 inch prefilter more often prolongs the life of the HEPA filter.

d) All filters must be accessible from the Work Area.

e) When pressure drop exceeds manufacturer's specs, change the prefilters first and if the condition persists, change HEPA filter. The maximum pressure drop should be 1 inch of water for a clean filter.

f) Excess moisture will cause the HEPA filter to fail.

g) Each HEPA filter should have a UL586 label.

2. Use of Negative Pressure Exhaust Ventilation Equipment; Qualitative and Quantitative Performance of HEPA Filtration Units,

a. Negative air: HEPA filtered blower sucks air from the Work Area and discharges it outside.

b. One air change required every 15 minutes.

c. Quantitative measurements of negative pressure of at least 0.02 inches of water and of CFM of each machine.

d. Qualitative observations of flow and pressure:

1) Decon tent flaps sucked in

2) Cloth streamer at discharge

3) Visible bending- in of containment walls.

3. Calculation and Measurement of Negative Air Flow: Sizing the Ventilation Requirements,

a. The total air flow must be at least 4 air changes per hour.

b. Determine the room volume in cubic ft (length X width X height)

c. Divide the cubic ft by 15 to obtain the CFM needed.

d. Provide enough negative air machines to meet or exceed this need.

e. True flow is usually 75% or less of rated flow.

f. Consult the negative air machine manufacturer for specifications on machines under real life conditions.

g. For successful abatement, use more negative air than needed, as a rule of thumb, double the theoretical amount.

Example:

A room is 150 ft long, 40 ft wide and 10 ft high = 60,000 cu ft 60,000 divided by 15= 4000 CFM needed.

4. Location of HEPA Filtration Units:

a. Required Flushing Technique: Place Negative air machines to provide a flow across the Work Area and position to draw air away from workers. To accomplish this, place the main negative air machine intake at the furthest feasible point from the Decon as illustrated in the lecture. Portable air intakes are needed to move contaminated air flow away from the workers.

b. Exhausts must go outside if possible and must never discharge near building air intakes, open windows or any area where exposure is possible.

c. Be extremely watchful of adjacent non- Work Areas where there is strong negative air pressures which may suck contaminated air into clean areas. A fan room, outside wind pressure, strong interior drafts and adjacent asbestos abatement areas are examples of possible strong negative pressure areas. Be sure to smoke test all these possible areas.

d. Accessories include exhaust and intake ducts and flanges and adapters to connect the duct work, and spare filters.

5. Monitoring of Negative Air:

a. Flow and pressure must be monitored and recorded daily

b. At least four air changes/ hour in each Work Area.

c. At least 0.02 inches of water negative pressure in Work Area

d. Many Negative air units have Pressure indicators or alarms:

e. Too low a back pressure may also indicate a leaking filter.

f. Too high a back pressure (pressure drop) indicates the filter needs to be changed.

g. Flow and pressure drops with longer duct runs

h. PCM (phase contrast microscopy) Air monitoring of the HEPA unit exhaust is very important to ensure that filters are properly working.

i. Watch for new filters going on line especially. Note: sometimes fibers come off the filter itself for the first hour of use. These can be recognized as very large ribbon-like fibers. If they are seen, repeat the sampling and they should go away.

6. Qualitative and Quantitative Tests of Containment Barrier Integrity and Best Available Technology:

a. Smoke tests with negative air temporarily shut off before abatement.

b. Frequent monitoring of differential pressure.

G. USE OF HEPA VACUUMS:

1. Operating Instructions:

a. Follow instructions provided by the manufacturer of the machines used.

b. Workers must be trained in the specific operation and filter changing procedures.

2. Special Attachments Needed:

Brushes of various sizes, crevice tools, and angular tools.

3. HEPA Vacuuming Procedures:

a. HEPA vacuums are used only on dry material.

b. They are to be used in all stages of the work including the pre-cleaning, final cleanup and are used to supplement the wet cleaning operation.

c. At the conclusion of the active abatement process, all surfaces in the abatement area must be thoroughly and completely HEPA-vacuumed. These surfaces include abated and non-abated surfaces exposed to asbestos dust generated by the abatement process.

d. Final performance criteria for successful cleaning including HEPA vacuuming must be specified and include no visible residue and the successful final aggressive air test.

4. Maintenance of the HEPA Vacuum:

a. HEPA vacuums must be properly maintained in accordance with manufacturer's instructions.

b. Change filters in the work area at appropriate times during the abatement process, such as during gross removal. Operators must use extreme caution when opening the HEPA vacuum for filter replacement or debris removal, due to the potential leakage if the vacuum's seal has been broken and the vacuum's bag is disturbed. Operators shall wear a full set of protective clothing and equipment, including appropriate respirators, when performing this maintenance function.

c. Include filters and bags in the asbestos wastes, making sure to wet the material before disposal.

d. Once the final cleaning process is underway, filter changes must not be done in the work area and suction intakes must be sealed with plastic before removal from the work area.

H. PROPER CLEAN-UP

1. Cleaning

a. Surfaces:

1) Remove visible accumulations of Asbestos Material and debris. HEPA or Wet clean all surfaces within the Work Area. The secret to wet cleaning is to constantly change to fresh wipers, mops, brushes etc. Used wipers will only smear. Use clean water each time.

2) Use HEPA vacuum and amended water until there is no visible residue.

3) Decontaminate or wrap equipment before removal from area

b. Equipment and Container Clean-up: See page 47

c. Lock-down: See page 48

2. Transportation and Disposal See page 48:

I. PREPARATION OF THE WORK AREA FOR FINAL CLEARANCE AND THE FINAL CLEARANCE PROCESS:

1. Initial visual inspection for completeness of work- no visible residue.

2. Equipment not in use cleaned or sealed and removed.

3. Bags removed

4. First layer of plastic removed and the area HEPA vacuumed.

5. Second visual inspection including flashlighting and touching all surfaces.

6. Lock-down spray applied to cleaned surfaces and to plastic barriers.
(Air sampling for final clearance must be done after lock-down is dry.)

7. ALL remaining plastic other than critical barriers removed.

Floor plastic should be removed before final testing unless the floor plastic is a Critical Barrier such as over a grate or other open surface. In this case, the person making the final inspection should so note in his report and another visual made after the floor criticals are removed.

8. Dry at least overnight.

9. Touch-up cleaning and optional leaf blowing

The Contractor may use optional leaf blowing to aid as a touch-up cleaning provided the blower does not impinge on Critical Barriers where any dust may enter contiguous areas. This technique must be supported by ample negative air in order to be effective and is not a replacement for the conventional cleaning procedures.

10. Critical Barriers must remain sealed

11. Negative Air Units and Decons remain in operation

12. Shower must remain operational.

13. Final Clearance Air testing is done.

a. DPH Licensed Project Monitor

b. No occupancy until test is satisfactorily completed

c. No visible residue

d. Aggressive air sampling, recommend 1200 liters.

e. Air testing by PCM (NIOSH Method 7400) - May be used for areas with ACM less than 500 lin ft or 1500 sq ft, or < 260 lin ft or 160 sq ft for schools. (**Remember, PCM is used for air and PLM for bulks**.)

1) At least 5 samples must be taken in each Work Area.

2) Each of 5 aggressive air samples in the Work Area must have a concentration of 0.010 fibers/cc or less.

3) Lab analysis at AIHA Accredited lab or **for scope on site AIHA Registered analyst must be used.**

f. TEM (according to 40 CFR Part 763):

1) Must be used for areas with ACM > than 500 lin ft or 1500 sq ft, or > 260 lin ft or 160 sq ft for schools and may be used for smaller areas.

2) EPA Recommends use of TEM for all finals and use of a NIST Accredited lab.

3) DPH requires a NIST Accredited lab for all finals as of 12/31/04

4) Air Monitoring volumes must be at least 1200 liters

5) Concentrations in the work area must average <70 structures/sq mm or be statistically lower than the average of the same number of samples collected outside the Work Area.

g. Need for site specific instructions by Project Designer for final inspection and air clearance.

1) Influence on project cost vs possible shortcuts to be avoided.

2) Exercise of Project designer's greater expertise.

h. Relationship between Visual Inspection and Air Test Results.

1) 90 % of failures is due to failed visual inspection.
2) Must always be an explanation for failed air test results, inside vs outside contamination, final too soon after abatement, improper lock-down or hidden residue.
3) Discussion of subjective nature of visual inspections and how a specification can impose objective criteria that will help ensure successful air tests.

J. SPOT REPAIRS INCLUDING GLOVEBAG USE

1. General

< 3 sq ft or 3 lin ft of ACM

a. Unless an emergency repair, may require off-hours work.

b. Isolate area with barriers and signs

c. HVAC shutdown in the area if possible

d. Seal vents

e. Use a mini-enclosure or a glovebag if possible

f. HEPA vacuum any visible reside and cover the floor under the work with 6 mil polyethylene .

g. Limit access to the area to trained personnel with respirator and a disposable suit.

h. Wet material

i. Use leak proof disposal containers

j. OSHA labels

k. Patch the damaged area with asbestos free materials which are appropriate for the application.

l. Same disposal practices as for asbestos projects above

2. Use of glovebags and a demonstration of glovebag use.

a. Overview of the Glovebag Procedure:

The glovebag consists of a 6-12 mil bag fitted with long-sleeved gloves, a tool pouch and a 2-inch opening used for water application. The bag is fitted around the pipe or other small piece and the work is manipulated using the gloves.

b. When can a glovebag be used?

State DPH regulations are stricter than OSHA regulations on glovebag use and permit the use as follows:

At any time within a general negative pressure enclosure.

Repair or maintenance involving less than 3 sq or 3 linear ft of ACM

As the second layer of plastic within a negative pressure enclosure.

Otherwise as permitted by an Alternate Work Practices from DPH.

c. Materials:

Glovebag
Pump-up garden sprayer (2-3 gallon size)
Amended water
Duct tape (three-inch width)
Polyethylene disposal bags (six mil)
Smoke tubes with aspirator bulb
HEPA-filtered vacuum cleaner
Bone saw
Utility knife with retractable blade
Wire cutters
Tin snips (if aluminum jacket is present)
Polyethylene plastic (roll of 4 or 6 mil)
Respirator
Disposable full-body suits with hood and feet covering
Small scrub brush
Stapler
Several rags
Wettable cloth Wettable cloth is a plaster impregnated fiberglass webbing available at many hardware and/or plumbing supply stores, one trade name is Diplag.
Asbestos caution signs and labels
Reinsulation materials as necessary

d. Glovebag Operation:

1) Two trained persons are required

2) Not for hot pipes over 150 degrees F

3) Isolate area as above

4) Mix the surfactant with water in the garden sprayer.

5) Place one layer of duct tape around the pipe at each location where the glovebag will be attached.

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

7) Pre-cut the wettable cloth into donut shaped strips to repair insulation ends. Cut the inner diameter one-half inch smaller than the diameter of the pipe beneath the insulation. The outer diameter of the donut should be three inches longer than the diameter of the pipe insulation being removed. Finally, cut a slit in each of the two donuts so they can be slipped around the pipe.

8) Place materials into the pouch located inside the glovebag.

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

10) Place the glovebag around the section of pipe to be worked on, and staple the top together through the reinforcing duct tape. Staple at intervals of approximately one inch.

11) Fold the stapled top flap back, and tape it down with a strip of duct tape.

12) Tape the ends of the glovebag to the taped portion of pipe.

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

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

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

16) If the section of pipe is covered with an aluminum jacket, this is removed first, using the wire cutters to cut any bands and the tin snips to remove the aluminum. It is important to fold the sharp edges in to prevent cutting the bag when it is placed in the bottom. Use caution to prevent cuts - these edges are sharp.

17) With the insulation exposed, use the bone saw to cut the insulation at each end of the section to be removed inside the glovebag.

NOTE: A bone saw is a serrated, heavy-gauge wire with ring-type handles at each end. Throughout this process, water is sprayed on the cutting area to keep dust to a minimum.

18) Once the ends are cut, the section of insulation should be slit from end to end using the utility knife and water continuously supplied. Some insulation may have wire to be clipped as well.

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

20) Lift the insulation off the pipe and gently place in the bottom of the bag.

21) Using the scrub brush, rags and water, scrub and wipe down the exposed pipe inside the glovebag.

22) Wet the donut-shaped pieces of wettable cloth over the exposed ends of the insulation remaining on the pipe.

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

24) Remove the vacuum nozzle, and twist the water sleeve closed, and seal with duct tape.

25) From outside the bag, pull the tool pouch away from the bag and twist it to separate it from the bag. Place duct tape over the twisted portion and then cut the tool bag from the glovebag, cutting through the twisted-taped section. In this manner, the contaminated tools may be placed directly into the next glovebag without cleaning. Alternatively, the tool pouch with the tools can be placed in a bucket of water, opened underwater, and the tools can be cleaned and dried without releasing asbestos into the air.

26) Rags and the scrub brush should be discarded with the asbestos waste.

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

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

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

30) Twist the top of the bag closed, fold this over, and seal with duct tape. Label the bag with a warning label.

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

32) Asbestos-containing material must be disposed of at an approved landfill in accordance with DEP /EPA regulations.

SECTION 5

AIR MONITORING

A. SAMPLING EQUIPMENT

1. Low Volume Sampling Pumps and Equipment

(Used for personal sampling)

a. Battery powered personal sampling pump

1) The pump should be able to operate for eight hours starting on a fully charged battery at a flow rate of at least 1.7 L/M (liters/minute) against a resistance of six inches of water measured at the pump inlet.

2) Commercial battery operated-rechargeable sampling pumps are available from MSA, Bendix, Sensidyne and elsewhere.

3) The pump should have an external means of adjusting the flow rate and a rotometer to indicate the flow rate.

4) Allowed flow rate of 0.5 - 5 liters per minute

5) Pumps should be recharged routinely overnight at the end of each days work.

b. Field calibration device

1) Usually a ball rotometer with a range of 0-4 liters/min.

2) Higher range rotometers are available.

c. Tubing

Laboratory tubing such as rubber or plastic with 6- mm bore and about 100 cm length. Tygon or medium wall rubber tubing are commonly used.

d. Clothing spring clip

Since the pump will usually be installed on a worker, it must have a belt clip. The clip should be designed to prevent slippage from the belt even if its position becomes inverted.

e. Tubing-to-field monitor metal adaptor

A short plastic or metal adaptor with ridges on one end to grip the inside of the tubing. The other end is designed for a pressure fit into the field monitor. Modern cassettes are equipped with this built-in adaptor.

f. Field monitor or "cassette" (filter and holder)

g. Sealable plastic bag such as a Zip-Loc bag to contain sample cassettes and parts

2. High Volume Sampling Equipment

(Used for collection of area samples and finals.)

a. High volume pump.

1) This is basically a vacuum pump which can exert a vacuum of > 20 inches of mercury.

2) High Volume Sampling Pumps are available from Gast, Dawson, Allegro and other sources.

3) The pump should have an external means of adjusting the flow rate such as a valve.

4) Flow regulating devices Constant flow orifices critical and limiting orifices are also available which control the pump flow to a constant rate.

The design depends on a surplus of pressure exerted by the pump motor and under these conditions, a constant flow rate is obtained which is not very sensitive to pressure changes. Even so, there are many things that can go wrong with this type of device, such as leakage, and it is still necessary to calibrate the pump externally.

b. The same tubing, adaptors and sealable plastic bags as for personal sampling above.

c. For PCM analysis, the same cassette is used as for personal samples.

d. Special cassettes are described below for TEM samples.

e. Rotometer 0-20 liters/minute

f. Tripod to mount cassettes about 30 inches above the floor.

3. Use of Fibrous Aerosol Monitors (FAM) on Abatement Projects;

a. FAM uses laser light and electrical field technologies to instantaneously analyze the fiber content of the air.

b. The instrument provides a continuous measurement, with direct readout of the number or concentration of asbestos fibers.

c. FAM can be used with a strip chart recorder to provide a record of air quality conditions.

d. FAM is typically used as a barometer rather than a precision testing device, it serves to alert personnel of any change in the fiber count.

e. If FAM is used it should be used in conjunction with an approved method such as PCM or TEM.

4. Sampling media, types of filters, types of cassettes,

a. Field Monitor (Cassette = Filter and Holder). Millipore or equivalent. The unit consists of:

1) Conductive plastic case for Aerosol monitoring, consisting of a filter holder, and a 50-mm conductive cowling with an end cap.

2) 25- mm diameter, plain white mixed cellulose ester (MCE) membrane filter, (pore size of 0.8-1.2 micrometers for PCM and 0.4 micrometer for TEM.)

3) Support pad. The pad is a stiff, thick, lint-free and porous disc that rests on a rim or on studs in the cassette bottom.

4) Two plastic sealing caps.

5) The outside mating surfaces of the field monitors may be covered with a "shrink-fit" band to provide proper sealing and a writing surface for filter identification.

6) The OD of the filter is 25 mm, but since part of the housing covers the filter, the true effective diameter is roughly 22 mm.

7) Manufacturer's specification requires an effective filter area of 385 sq mm.

b. Filter Orientation:

1) MCE filters are cellulose strands bound together in a web called "tortuous pore" and display a very irregular surface when observed under magnification.

2) Filters are always placed facing at a 45 degree angle down toward the ground during sample collection and sampling is done "open faced" with the plug and the end cap off the inlet.

c. Storage and Shipment of Filters;

1) The field monitors in which the samples are collected should be shipped in a clean and rigid container with sufficient dust- free packing material to prevent jarring and crushing.

2) Never transport loose samples.

3) Never use dusty packing materials.

4) Always inspect cassettes for gross contamination after sampling and before shipment. Repeat the sampling as needed or take any corrective action needed.

5) Make sure cassettes are sealed with conductive cowlings in place.

6) Do not use plastic packing such as polystyrene foam which generates static electricity.

7) Sealable containers with sample silos and cover to avoid contamination or shock which may dislodge fibers from the surface.

8) Security seal to learn if package has been opened in transit.

9) Each sample labeled

B. CALIBRATION TECHNIQUES AND CALCULATIONS:

1. General:

a. OSHA Regulations require calibration of the sampling pump with a representative filter between the pump and the calibration device at the start and end of each sample.

b. Frequency of Calibration: We recommend the following:

1) Lab calibrate all rotometers with a soap bubble meter when new.

2) In addition, lab check the rotometers vs soap bubble meter if:

a) Any rotometers disagree with each other

b) If there is any unexplained change in flow rate of any pump, or

c) If they have just been repaired, misused, or received from the manufacturer.

d) If the equipment receives hard usage at least every six months.

3) In the field, do external rotometer checks upstream of the filter at the beginning and end of each sample. Record these data on the sample worksheet.

2. Primary Calibration Standards:

a. A primary standard is a device to measure the actual volume drawn by a pump in a specified time. The volume must be measurable by some direct and independent means, independent of the gas or air involved.

b. The standard is volumetric by nature. A soap-bubble buret is the primary standard commonly used for sampling pump calibration.

c. A soap-bubble buret is a primary standard including timed passage of bubbles through an inverted buret.

d. True calibration is done with primary standards in the laboratory.

e. Other standard calibrating instruments, such as a spirometer, Marriott's bottle, or dry gas meter can be used. The calibration should be of sufficient precision such that the 95% confidence limits on the flow rate are + or - 10% (95% of the flow rates will fall within + or - 10% of the calibrated value).

3. Intermediate Standard:

a. An intermediate standard is one that cannot be primary by definition, but is just as accurate if maintained and must be calibrated (and periodically recalibrated) by a primary standard.

b. A wet-test meter is a common example of an intermediate standard. This is basically a drum half filled with water. A rotor inside the drum is attached to an indicating pointer on the outside of the meter.

c. When a pump is connected to the outlet and turned on, air comes through the inlet and rises, causing the rotor to turn. The amount of turning is related to the quantity of air passing through. The indicating needle reads volume.

d. There are several disadvantages to the wet-test meter, including possible corrosion, and friction and inertia problems respectively at high and low flow rates.

4. Secondary Calibration Standards - Rotometers:

a. General:

1) A secondary standard is any air flow measuring instrument that does not fit the definitions of a primary or intermediate standard and has been calibrated by a primary standard.

2) The rotometer is the principal secondary standard.

3) A rotometer is a transparent tapered tube containing a float which is typically a round ball.

4) The theory of operation is that air passing up through the tube must push around the ball to get out. As the ball rises, its sides get further from the wall of the tube and eventually there is not enough pressure drop to cause a further rise. The ball will then remain suspended at a pressure proportional to the flow rate indicated.

5) Take the ball reading at the center of the ball and look straight across the face plate. Always make sure the rotometer is vertical, since canting it will cause errors.

b. Pump Rotometer:

1) The low flow sampling pump usually has a ball rotometer which typically indicates a flow rate from 0-4 l/min.

2) The pump rotometer is usually wrong; assume it to be so. Usually the actual flow is lower than the flow indicated by the rotometer.

3) The pump rotometer is useful in quickly detecting large increases in the reading signaling a leak or a ruptured cassette or large decreases in the reading indicating overloading of filters, crimped tubing or a dying battery. Internal leaks are checked by turning the pump on to full flow and plugging the inlet. If no leaks are present, the pump should nearly stop and the pump rotometer should read zero.

4) Use of the secondary standard rotometer in the field upstream of the filter is strongly recommended to detect leaks and other problems.

5) The actual flow rate is said to be the reading of the reference calibration device in liters/min (l/min). The true value of the flow rate should be ñ5% of the observed value.

6) It is possible to calibrate the pump rotometer against a primary standard (usually the soap bubble meter) and prepare a calibration chart for the apparent vs actual readings. However this approach is subject to large errors due to possible leakage and pressure changes in the field unless rigorous control of conditions is maintained.

c. External Rotometer:

1) In the field, the external rotometer is much more reliable than the pump rotometer. The pump flow should be determined from an external rotometer attached upstream of the cassette (where air enters the cassette).

2) The external rotometer is calibrated at the lab vs a soap bubble meter.

3) Each external rotometer should be given a serial number and the calibration data recorded in a log book and in a field worksheet.

5. Temperature and Pressure Effects

Temperature and barometric pressure affect the density of air. The temperature and barometric pressure must be measured and corrected for in the calibration process.

6. Calibration with the Soap Bubble Flow Meter:

a. Apparatus

1000-cc dispensing buret inverted
sampling pump
rubber tubing
beaker with 1:5 liquid soap: water mixture
U tube manometer, 0-8 inches of water
bubble trap (a fritted plastic sampling impinger may be used)
representative cassette
thermometer
barometer
assorted clamps
stop watch
rotometers to be calibrated

b. Procedure

Note: Pump rotometers and external rotometers may be calibrated simultaneously. Make sure the serial number of each unit is recorded vs the calibration data.

1) Before the soap-bubble buret is used, wet the buret inside with soap. Avoid excessive foam and suds. Unclamp the buret, remove the tubing, and pour soap down the wall while simultaneously rotating the buret. Collect the drainage in the soap reservoir. Continue to rotate the buret tilting it so the soap slowly runs down the wall until the wall is uniformly wet. Invert and re -clamp the buret in a level position and attach the tubing.

2) Make a fresh liquid soap water mixture without any foam. A 1:5 mixture of detergent to water is mixed by stirring.

3) Make sure the battery is charged to manufacturer's specifications.

4) Connect the filter cassette inlet to the top of the buret with a length of hose.

5) Connect the rotometer to the cassette outlet. Mount the rotometer level.

6) Check all connections and start the pump.

7) Adjust the pump so that rotometer indicates the first setting to be calibrated between 0.5 and 5 l/min.

8) Zero the stop watch.

9) Raise the beaker with soap solution to touch the inverted buret to the liquid surface. Evenly break the surface of the liquid to start a bubble up the buret. A number of bubbles may be drawn up successively to condition the surface of the buret. Perform this task until the bubbles are able to travel the entire length of the buret without breaking.

10) Wait for an even bubble (free of bubble clusters) and time the efflux time between two marks on the buret, usually between 0 ml to the 1000 ml mark for a volume of 1 liter.

11) Record the pump pressure for reference in inches of water. The pressure drop across the filter must be less than 13 inches of water (about 1 inch of mercury). Record the atmospheric pressure (mm of mercury), and the room temperature (degrees Celsius converted to degrees Rankin). Record the pump and rotometer serial number, date, and name of person performing the calibration.

12) Repeat the process in triplicate for each of three pump settings and average the data for each pump setting.

13) Calculate the calibrated flow rate in liters/ min. by dividing the volume traveled by the soap bubble by the elapsed time.

NOTE: Field corrections to the flow rate for pumps with rotometers may be necessary if the pressure (elevation) or temperature where the samples are collected (actual flow rate) differs significantly from that where the calibration was performed (indicated flow rate). Actual flow rates at time of sampling may be calculated for a linear scale rotometer by using the following correction formula:

$$Q_{actual} = Q_{indicated} \left[\frac{P_{cal}}{P_{actual}} \cdot \frac{T_{actual}}{T_{cal}} \right]^{1/2}$$

where both pressure (P) and temperature (T) are in absolute units:

P = mm of mercury
T = deg Kelvin = deg Celsius + 273

C. AIR MONITORING RECORDKEEPING AND FIELD WORK DOCUMENTATION AND CALCULATIONS:

REMEMBER ALWAYS INSPECT THE CASSETTES WITH A FLASHLIGHT AFTER SAMPLING AND IF THE CASSETTES ARE VISUALLY CONTAMINATED OR THE FILTER IS RUPTURED, THEN REJECT THE SAMPLES AND REPEAT THE TESTS.

1. See Section 9-2 starting on page 159 for Records needed

2. Completing Air Sampling Records and Calculations

a. PCM: (See sample of form FL 22 in Handout on W.W.W.Chem-scope.com.

1) Complete the heading and sign the entry "sampled by"____.

2) Record the sample number and description.

3) Enter the starting and end time of sampling that you measured with the rotometer. Average the two readings.

4) Determine the difference in minutes between the starting and end time in minutes.

5) Multiply the average flow rate in liters per minute times the minutes and enter the result in liters on the next column.

6) The analyst who may also be the Project Monitor, will complete the next four columns: Data below is for the Chem Scope WB optics and 25-mm cassettes. Other optics may vary slightly.

(.00785 = Walton Beckett field area, mm^2)
(385 = Effective filter area, mm)

a) f/flds = direct from the count

$$\text{b) f/mm2} = \frac{\text{f/flds}}{0.00785}$$

$$\text{c) f/cc} = \frac{\text{f/mm2 X 385}}{(\text{liters})(1000)}$$

$$\text{d) LOD} = \frac{2.69}{\text{liters}}$$

Example: For a sample of 1200 liters, 17 fibers were counted for 100 fields, then:

a) f/flds = 17/100 = 0.17

$$\text{b) f/mm2} = \frac{0.17}{0.00785} = 21.7$$

$$\text{c) f/cc} = \frac{21.7 \text{ X } 385}{(1200)(1000)} = 0.0069$$

$$\text{d) LOD (f/cc)} = \frac{2.69}{\text{liters}}$$

7) For finals, the job fails if any of the five samples are 0.01 f/cc or greater by NIOSH 7400.

8) OSHA ID-160: In general, for personal samples which are above 1 f/cc or for background samples (excluding finals) which are over 0.01 f/cc: immediately notify your supervisor to obtain further instructions.

If you are instructed to submit for OSHA-ID-160: Submit the samples (filters and slides) to the PLM laboratory for analysis by OSHA Method ID-160. Complete worksheet Form FL-22-160 up to the column titled % asb PLM, and enclose this worksheet with the samples. Other specs besides 1 f/cc and 0.01 f/cc may be established for particular jobs. REMEMBER, OSHA ID-160 CANNOT BE USED FOR FINALS.

9) Record the data in f/flds for the two required field blanks at the bottom of the page. Blanks are subtracted from the sample values, except blanks > 3f/100 fields are rejected and the set must be repeated.

10) Complete the information at the bottom of the page.

b. TEM samples:

1) Use Air Sample Record for TEM samples (See sample of form FL 22 T to follow in Handout on W.W.W.Chem-scope.com.

2) Make sure you take a minimum of 1200 liters after temperature and barometric pressure correction.

3) Calculations are done by the TEM laboratory. Average of all inside samples must be below 70 s/mm2 for the area to pass or the TEM lab must run the outside samples and statistically compare with the inside samples.

3. Measuring Negative air Flow

a. Determine the f/min of air passing through the duct by placing the manometer probe at intervals of every 2 inches across the duct and averaging these readings.

b. For the pre-abatement inspection, record this average value on form FL 12a.

c. Measure the diameter of the duct with a ruler and record the diameter (d in inches). The radius in inches = 1/2 the diameter.

d. Convert the radius to ft by dividing by 12.

e. Then: calculate the duct area = 3.14 (radius)(radius). (Pi r^2).

f. Another, method is to use a tape measure and find the circumference of the duct then find the diameter from the equation C = 3.14 X d, d = C/3.14).

CFM (f^3/min) = observed Ft/min_____ X duct Area (f^2)_____

Example: the diameter is 14 inches and therefore = radius = 7 inches or 0.58 ft. Area = (.58)(.58)(3.14) = 1.06 f^2. Then, if the observed flow averaged 2300 f/min:

CFM = observed Ft/min 2300 X duct Area (f^2) 1.06 = 2443 CFM. Rounded off to 2 significant figures = 2400 CFM.

(Note: SCFM could be calculated using pressure and temperature corrections, but this is not normally done for this particular measurement.)

D. AIR SAMPLE ANALYSIS, TECHNIQUES AVAILABLE AND LIMITATIONS OF AHERA ON THEIR USE,

1. Transmission Electron Microscopy (TEM)

a. Background

TEM is a technique which focuses an electron beam onto a thin sample mounted in the microscope column under vacuum. As the beam transmits through the sample, an image resulting from varying density of the sample is projected onto a fluorescent screen.

b. Sample Preparation and Analysis EPA's Recommended Technique for Analysis of Final Air Clearance Samples)

1) Air samples for TEM analysis are now collected on MCE filters but an older technique employs polycarbonate filters.

2) A direct transfer method is used for the transfer of a carbon-coated replica of the filter material (with embedded fibers and particulates, etc) right onto a copper grid suitable for TEM analysis.

3) Indirect transfer techniques require an intermediate step that may break-up fiber bundles, resulting in an increased fiber count.

4) Mandatory and non-mandatory methods are in the appendices to 40 CFR part 763 of the AHERA Regulations. These methods are to be used for AHERA TEM protocol in schools for final clearance.

5) The entire analysis must be done in a positive pressure clean room.

c. What TEM Measures

1) TEM has the advantage of being able to detect very small asbestos particles, but is by itself, not specific. TEM can see fibers as thin as 0.0002 micron diameter and counts fibers as short as 0.05 microns in length. (By comparison, PCM can only see fibers about 0.1 micron diameter and counts fibers longer than 5 microns in length.

2) TEM can detect the likely presence of asbestos in a population of fibers by its fiber shape and configuration.

3) XRD, x-ray diffraction instruments are used in conjunction with TEM to identify the crystal structure and confirm the identification.

4) The combined use of TEM with XRD gives a powerful tool for analysis of small asbestos fibers in the air. Even so, the TEM/XRD analyst must be very careful to avoid false positives since there are many look-alike minerals. In addition, a few problems have been observed where TEM XRD identification has mistaken fibrous talc for anthophyllite asbestos.

d. Air Sample Conditions Which Prohibit Analysis

1) Overloading with particulates

2) Blinding with lock-down

3) Ruptured filters

4) Sample volume of less than 1200 liters

e. EPA Recommendation for Clearance (TEM)

1) EPA Requires that for schools, TEM must be used when asbestos quantities exceed 160 sq ft and 260 lin ft.

2) EPA Recommends that TEM be used for all finals.

2. Phase Contrast Microscopy (PCM)

a. Background

1) The filter membrane method was used in 1964 in conjunction with the U.S. Public Health Service Division of Occupational Health as part of an epidemiological study of the asbestos products industry.

2) The method was evolved as NIOSH Analytical Method # P&CAM 239, Asbestos Fibers in Air. The P&CAM 239 method used 37-mm cassettes, liquid phthalate-oxalate reagent, B counting rules and a Porton reticle compared to the current 25-mm cassettes, acetone triacetin, a Walton Beckett Graticule, and "A" counting rules.

3) NIOSH 7400 and OSHA ORM retained the P&CAM 239 variations as options until 1990 when the use of those options became obsolete.

4) The OSHA asbestos standard of June 1986 lowered the 8-hour TWA permissible exposure limit (PEL) from the previous value of 2 fibers/cc to 0.2 fiber/cc.

5) OSHA promulgated regulations in 1989 establishing an Excursion Limit EL of 1 f/cc for a 30 min sampling period at the expected time of highest exposure which is still in effect. The standard requires employers to conduct asbestos exposure monitoring of employees. The purpose of monitoring is to determine the amount of respiratory protection needed. This is done by measuring accurately the airborne concentrations of asbestos fibers in a workplace to which employees would be exposed if they were not wearing respirators.

6) In 1994, OSHA 1926.1101 replaced 1926.58. With this revision, the OSHA reference method of Appendix B OSHA, Method ID-160 or NIOSH 7400 Method may be used for personal air samples. Note: Only NIOSH 7400 may be used for finals if PCM is used. A PEL of 0.1 f/cc became effective in 1994.

b. Sample Preparation

1) Overview:

The sample is collected by drawing air through a cellulose ester membrane filter by means of a suction pump. (The initial filter on which sample is collected is opaque. The PCM analysis depends on having an optically transparent slide.) The filter is transformed from an opaque solid membrane to a transparent optically homogeneous gel using acetone vapor and triacetin. A "hot block" is used to vaporize acetone. The fibers are sized and counted using a phase-contrast microscope at 400X magnification.

2) Procedure:

a) Clean slides are pre-labeled with the sample ID.

b) A wedge of about 1/4 of the filter area is cut from the filter with a scalpel and laid on the slide.

c) The slide with the wedge is placed in the hot block.

d) About 300 microliters of acetone is dispensed into the hot block with a syringe and the heat vaporizes the acetone and "clears" the slide.

e) The slide is removed from the hot block and the outline of the wedge is marked with an indelible pen on the back of the slide.

f) A drop of triacetin is placed on the cleared wedge.

g) A glass cover slip is placed over the triacetin.

h) The edges of the cover slip are sealed with clear nail polish.

i) The slides are then heated for several minutes to aid in the final clearing.

j) The slides are now ready for examination on the microscope.

c. What PCM Measures

1) PCM has the advantage of being inexpensive and rapid compared to TEM and by itself is not specific. PLM may be used in conjunction with PCM for asbestos identification in air samples. PLM is the classical method for building materials.

2) PCM can only see fibers about 0.1 micron diameter and counts fibers longer than 5 microns in length.

d. Types of Air Samples

1) **Personal** (**Breathing Zone)** Samples:

a) Battery operated pump 2-5 liters/min.

b) NIOSH 7400, OSHA Reference Method, or OSHA Method ID-160 may be used.

(1) All 3 methods count fibers greater than 5 microns in length.

(2) NIOSH 7400 counts all fibers whether they look like asbestos or not.

(3) OSHA reference method (ORM) 1926.1101 Appendix B does not count fibers which are obviously non-asbestos or fibers which can be ruled out as being possible asbestos fibers. PLM is usually used in conjunction with PCM to make the identification of fibers.

(4) OSHA Method ID-160 is identical to ORM.

2) Fixed-Station Area Samples (High Volume Pumps)

a) Final Samples- Only TEM or NIOSH 7400 may be used

b) Other Area samples besides finals- NIOSH 7400, OSHA Reference Method, OSHA Method ID-160 or TEM may be used.

e. AHERA's Limits on the Use of Phase Contrast Microscopy for Post Abatement Testing

1) PCM may only be used for smaller size Work Areas.

2) Schools: TEM analysis is required for projects disturbing 260 lin ft or 160 sq ft.

3) For NON-SCHOOL sites in Connecticut, TEM analysis is required for projects disturbing 500 lin ft or 1500 sq ft

F. SAMPLING STRATEGIES

1. Collection of Samples

a. Field Calibration:

1) Remove the two end plugs and Calibrate the sampling pump with a representative cassette in line.

2) Check the pump flow rate vs a rotometer connected to the intake of the cassette. A tapered hose barb is used to adapt the rotometer to the cassette opening.

3) Store the end plugs in the plastic bag. Keep the bag sealed unless adding or removing cassettes or parts.

4) A representative filter is always used in the sampling and calibration process. Filters of different resistances or a given filter changing resistance while sampling affects the pressure and therefore the actual flow rate.

b. Blanks:

Two Field Blanks or 10% of sample set, whichever is greater: Momentarily open the end caps on the field blanks and re-seal

c. Labeling and Sample Records:

1) Label the sample cassette and blanks with unique ID #s.

2) Store the field blanks in the plastic bag.

3) Record the following information on a sample worksheet vs the sample ID #:

a) Date and site identification
b) Type of sample: personal, pre-abatement, during work, final, or general background sample.
c) Pump start and ending times
d) Starting and ending flow rates
e) Temperature and Barometric pressure
f) Name and signature of person collecting the sample
g) Additional Requirements for area samples:

(1) Description of the sample; e.g. in negative air exhaust, outside decon, etc.

(2) Location of the sample including a drawing.

h) Additional Requirements for personal samples:

(1) Description of the sample; e.g. Excursion or TWA.

(2) Location of the Work Area.

(3) Employee name, job title and social security number

(4) Type of job activity during sampling

(5) Type of respirator (NIOSH- approved for asbestos)

d. Calculation:

sample volume (liters) = flow rate (liters/min) X time (min.)

The entire purpose of calibrating the sampling train is to find out what volume, expressed as cc or liters of air were collected.

(One liter = 1000 cc.) The volume is one of the components needed to calculate the concentration of fibers in air.

("Concentration" is the amount of something relative to the medium that something exists in. Percent (%) is a common expression of concentration that we are familiar with. The concentration of a substance in air is usually expressed as weight, number of particulates, or parts per unit volume of the air sampled.)

In the case of asbestos, the concentration units are fibers per cubic centimeter of air or f/cc.

In order to know how many cc have been collected we must know the flow rate which is usually expressed in liters/min (l/min). This is part of the information needed to later determine the concentration which is calculated after the PCM analysis of the air sample filter.

The sample volume is obtained by multiplying the sample time by the corrected flow rate as read from the standard used.

2. Personal Sample Techniques:

a. Mounting the Personal Sample:

1) Mount the Sampling Pump on the Worker and remove the end cap in order to collect an "open faced" sample.

2) Fasten the sampling pump to the worker's belt and fasten the cassette near the worker's mouth,

3) Then invert the monitor making certain the exposed filter is facing downward.

4) Turn the pump on to the calibrated flow rate (0.5 to 5 lpm).

5) Pumps must be mounted in a position which is comfortable for the worker and which provides a secure installation out of the way. In most cases the pump may be mounted at the worker's rear and the tubing strung over the shoulder so the cassette points downward at about 45 degrees.

6) Always tape the cassette to the tubing to prevent the cassette from falling off.

7) Adjust the position of the sample so that the tubing does not pinch.

b. Follow up Checking of Sampler:

1) Check the sampler position and pump flow rate periodically during the sampling period and record each reading in the worksheet.

2) Always check the flow at the end of the sample and record the final reading and time the sample ends in the log book.

c. 8-hour TWA Samples:

Samples taken to determine the 8-hour, time-weighted concentration may have to be changed several times to prevent overloading.

d. "Excursion Limit" (EL) Samples:

1) Separate daily sampling must be conducted for the "Excursion Limit" (EL) of 1.0 f/cc over a 30 minute sampling period.

2) The EL sample may be taken as one increment of the 8 hour time weighted average PEL. (see discussion on page 82 below on the EL.

e. Recharging of Pumps:

1) Follow manufacturer's instructions. Check the voltage of the pump battery with a voltmeter both with the pump off and while it is operating to assure adequate voltage for operation.

2) If necessary, charge the battery to manufacturer's specifications.

3) Pump batteries that are repeatedly used for short times and then prematurely recharged will develop a "memory" and eventually the battery will run down at the time it remembers.

4) One approach is to fully discharge the battery by running until the battery is depleted and then recharge at the end of each days work.

5) Another approach is to keep a log of operating and charging times and follow the manufacturer's recommendation for hours of operation before recharging.

f. Pump records:

Keep an operating log of each pump including the serial number, date put into service, and dates of use and calibration data.

3. Review of Strategy for Daily Personal Samples to Determine EL and PEL Compliance:

a. Objective:

Personal testing is needed for the required assessment.

b. Method: NIOSH METHOD 7400 (PCM) OR ORM OR ID-160

c. Samples Must Include Daily:

30 min excursion limit samples and

8 hour time-weighted average concentration samples.

d. Personal air sampling results must be at the work site within 24 hours

e. Monitoring must be performed on at least 25% of the work force involved in the project. The sampling must cover each type of work operation.

f. Excursion limit monitoring be conducted for each shift, each job classification, and each Work Area in which operations are most likely to produce exposures above the EL.

g. Sampling and calibration for the excursion limit is conducted by the same procedure as that used for monitoring the PEL. One or more samples collected from the breathing zone over the 30 minute period are analyzed, and the results used to determine the 30-minute exposure.

h. The table on the next page shows the optimum flow rates and sampling times required to reach a limit of detection which reliably falls under the 1.0 f/cc EL.

QUANTITATION LIMITS FOR
EXCURSION LIMIT ASBESTOS SAMPLING

FLOW RATE	SAMPLING TIME F/CC	LIMIT OF LOWER QUANTITATION, LOQ
5.0 lpm	30 min.	0.0323
2.5 lpm	30 min.	0.065
2.0 lpm	30 min.	0.081
1.6 lpm	30 min.	0.102
1.0 lpm	30 min.	0.163
0.5 lpm	30 min.	0.336

Using 25 mm cassette filters, Based on 10 fibers/100 fields

G. COLLECTION OF AREA SAMPLES (FIXED STATION SAMPLERS)

1. General:

An area sample differs from the personal sample in several ways:

a. High volume pumps are used for area samples capable of much higher flow rates.

b. The area sample is collected at a fixed location

c. The area sample may not be used for monitoring employee exposure but only for other purposes:

1) "Background" Samples: Various methods may be used.

a) Pre-Abatement
b) During Abatement
c) General information

2) Final Reoccupancy Clearance NIOSH method 7400 (PCM) or Transmission Electron Microscopy (TEM) must be used.

3) Ambient sampling ("background samples") not required by regulatory protocol but is recommended or specified for many purposes

2. Sampling Procedure:

a. Electrical:

If the pump is not equipped with an on-off switch, use an external switching device. A five plug receptacle equipped with a circuit breaker and switch is convenient for taking multiple samples. Make sure all power cords are grounded and equipped with a ground fault circuit interrupter (GFCI).

b. Tripod:

Set up the tripod so that the cassette may be secured about 30 inches from the floor.

c. Starting the Sample:

1) Place the sample cassette on the tripod

2) Remove the end caps

3) Collect an "open faced" sample with the cassette pointing downward at about 45 degrees

4) Place the end caps in the plastic bag.

5) Turn on the pump, making sure to record the time. Timers are useful for unattended samplers to ensure full running time.

d. Check the pump operation and flow rate periodically

3. Pre-Abatement Air Sampling:

a. Objective:

1) Determine prevalent airborne fiber concentration at key locations.

2) Why is this important?

a) Head off problems with getting clean make-up air and failing later finals.

b) Liability and disputes which may arise if the building is later found to be contaminated.

c) Determine the baseline for future comparison during work and thereby detect an increase in fiber concentrations in key areas.

b. Sampling locations:

Pre-Abatement air samples should be collected at strategic locations inside and outside the planned asbestos Work Area to establish prevalent ambient air concentrations under normal building activity before the asbestos abatement work begins. Strategic locations are those where later problems are commonly encountered or where concentrations are critical:

1) Outside the Decon clean room/ Waste Bag-out area

2) Negative air exhausts

3) Closest approach corridors

4. Final Reoccupancy Testing after asbestos abatement

a. Objective:

In addition to the visual inspection, determine if area is acceptable for reoccupancy by deliberately blowing up any possible asbestos dust into the air and collecting this airborne dust for analysis.

b. Selection of Sample Locations:

1) For symmetrical Work Areas take middle and near four corners.

2) For irregular Work Areas, include at least one sample in each extension.

c. NIOSH Method 7400: (PCM)

1) We recommend to collect 1200 liters. (The minimum volume specified in the NIOSH 7400 method is 400 liters, however few, if any, professionals take the minimum amount for the sake of reliability.)

2) Maximum flow rate is 16 liters/min.

(Calculation of theoretical volumes Air Monitoring volumes must be sufficient to provide a lower detection limit (LOD) of 0.010 fibers/cc. The minimum sample volume needed is theoretically 270 liters based on the LOD of 5.5 f/cc or 7 f/mm2 for NIOSH 7400. To attain the lower limit of quantitation (LOQ) of 10 fibers/100 fields, a volume of 500 liters is needed. To obtain samples in the preferred filter loading range of 100-500 f/mm2, an infinitely large sample would be needed which would most likely be blinded by ambient dust before the desired loading is reached.

3) Each of 5 aggressive air samples in the Work Area must have a concentration of 0.010 fibers/cc or less according to EPA regulations for schools or according to Connecticut Regulations.

d. TEM Final Sampling:

1) Collect 5 or more samples of 1350 liters (Note: Volume must be at least 1200 liters, but added volume is for a safety factor.) aggressively in the Work Area, and the same number of samples non-aggressively at the same time outside the Work Area. For multi-level areas, take 5 samples on each level. For areas over 5000 sq ft take one added sample for each additional 5000 sq ft.

2) Use a 0.4 micrometer porosity MCE or polycarbonate filter.

3) Calibrate pump flow rate using a rotometer at beginning and end of sampling and a representative filter.

4) Between 1 and 10 liters/min must be used.

5) A typical strategy for rapid sampling is 10 l/min for 120 + minutes to produce a volume of 1200 + liters.

6) Prepare two field blanks and also reserve one sealed blank.

7) Make very sure to have at least 1200 liters since a smaller sample will be rejected.

8) Be especially careful not to contaminate the sample cassettes. Use a separate filter of the same lot to calibrate. Keep all the parts in the plastic bag and in a clean location.

e. Aggressive Sampling:

1) Thorough visual inspection of the Work Area

2) Critical barriers remain in place

3) Air filtration units remain on

4) Use a minimum 1 horsepower leaf blower directed at floors, walls, and ceilings five minutes before sample collection.

5) Note: ASTM E-1368 specifies use of sweeping or brushing, leaf blower or 20 inch stationary fans directed at the ceiling, 1 per 10,000 ft3 to keep the air agitated. (EPA 560/5-85-024).

5. During Abatement Monitoring

a. Objective:

1) Determine if there has been an increase above baseline values so that corrective action may be taken.

b. Sampling locations:

1) Collect samples at the same locations as for pre-abatement sampling.

2) Usually, area sampling is not done inside the asbestos Work Area. (Personal sampling is required inside the Work Area.)

3) If samples exceed the baseline or if they exceed 0.01 f/cc, then corrective action is needed.

H. SPECIAL SAMPLING PROBLEMS

1. Crawl Spaces and Tunnels

a. Distributing the sampling pumps requires several multi-plug GFCI receptacles from which various length power cords may be run to cover the entire space.

b. Have the pumps placed and ready to turn on before using the leaf blower.

2. Occupied Areas for Barrier Monitoring:

a. In occupied areas, close supervision of the sampling is essential since onlookers will often disturb the pumps.

b. Try to locate pumps out of traffic patterns

c. Make sure to duct tape extension cords to avoid trip hazards.

d. When possible, use a barrier tape or other set-back to keep traffic out of the sampling area.

3. Dusty Areas and Acceptable Samples for Laboratory Analysis

a. The Monitor is required to flashlight and look at the filter face for gross amounts of dust. Samples with excess dust must be rejected.

b. Construction areas and some types of manufacturing operations are dusty by nature. For heavy particulate levels, it may be necessary to limit the sample volume for each sample and take successive samples until the lab has a chance to characterize the site conditions.

c. The next consideration is to obtain a high enough fiber count on the filter to get a reasonable level of precision. At the least, an adequate fiber density is desired to obtain a minimum count of 10 fibers in 100 fields, which is the least total fiber count that yields an acceptable count precision. This filter loading is known as the lower quantitation limit (LOQ).

d. When an agglomerate (mass of material) covers more than 25% of the field of view, reject the field and select another. Do not include it in the number of fields counted.

e. If one has very little idea of airborne fiber and particulate levels, the best procedure is to take several long samples (as one 8 hour or two consecutive 4 hour samples) in conjunction with several short samples (as four consecutive 2 hour or eight consecutive 1 hour samples. If the longer samples prove very difficult to count, the microscopist will have the shorter samples to fall back on.

f. The nature of the sampling environment and visible observation of dust are good indicators of when to shorten the samples.

g. After the first day at a steady state site, the sampling strategy can be optimized.

h. During an asbestos abatement project, the fine mist created by spraying encapsulant (Lock-Down Spray) frequently blinds air samples. This will be seen by the microscopist as white spheres on the filter. It is best to have the sample cassette changed before and after this operation and wait at least one hour before starting final samples.

i. Final Air Samples:

1) In clean atmospheres with little dust, very large samples may be taken. Hopefully, the final area is dust free.

2) One problem is entry of dust from outside the Work Area which contaminates the Work Area and of course the samples. In this case the area is likely to fail and the contractor should be encouraged to bring fresh make up air in from a clean area or from the outside by means of extra ducting.

I. INTERPRETATION OF RESULTS AND CALCULATIONS:

1. Personal Samples TWA:

a. Compare the time weighted average with the PEL and the 30 min excursion result with the EL:

b. Calculate the time weighted average (TWA) exposure for each employee as in the following example:

c. Divide the sampling periods into decimal fractions of the working day and multiply that fraction times the concentration for that portion of the day: Then add the products of the multiplication to get the TWA.

Example:

The first sample is 1/2 hr with a concentration of 2.0 f/cc.

The second sample is 3 1/2 hrs including lunch and breaks with a concentration of 0.6 f/cc.

The last sample is 4 hrs including breaks with a concentration of 0.2 f/cc.

hrs	dec fract of day	X	f/cc	=	
.5	0.063		2.0	=	0.126
3.5	0.437		0.6	=	0.262
4	0.5		0.2	=	0.100
					0.488= TWA f/cc

The TWA is above the PEL.

d. Another method is to use the equation:

TWA =

$$\frac{C1T1 + C2T2 + C3T3....}{T1 + T2 + T3 + ...}$$

where C is the fiber concentration expressed as f/cc
T is the duration of the sample (in hours)

Using the above Example:

$$\frac{(2)(0.5) + (0.6)(3.5) + (0.2)(4)}{.5 + 3.5 + 4}$$

= 1.0 + 2.1 + .8 / 8 = .488 f/cc (TWA)

2. Excursion Limit (EL)

1.0 f/cc over a 30 minute sampling period.

The EL sample may be taken as one increment of the 8 hour time weighted average PEL.

Example:

a Work Area has 6 workers; 4 removing pipe insulation and 2 bagging.

Worker 1 is removing in an area with much prior damage and likely to have the highest exposure of the group and especially when he begins.

The following should be done:

a. Take a 30 min excursion sample for the first half hour for worker 1.

b. Take a TWA sample for the balance of the work day for worker 1.

If the Work Area is dusty, split the remaining 7 1/2 hours between two samples to avoid blinding filters.

c. Take an 8 hour TWA sample or two 4 hour samples for one of the workers bagging.

3. During Abatement Monitoring:

If readings increase above the baseline:

1) Re-run the during work and baseline samples by OSHA Method ID-160 to see if the increase is due to asbestos fibers.

2) Reason: determine whether the work is causing asbestos contamination outside the containment including the negative air exhausts and detect and correct problems early in the process; or prove the asbestos fibers did not escape to avoid liability and disputes which may arise.

4. Final Clearance Testing

Compare values to regulated standards cited above and if the observed values exceed the standards one of the following common reasons should be checked out:

1) Visual missed something? Reclean

2) One negative air unit not running and fibers getting sucked into containment by other machines?

3) Dirty air entering? Check outside samples.

4) Final run too soon after abatement? Wait overnight and re-test.

5) Other sources of asbestos in the Work Area not in scope of work? May need abatement.

J. QUALITY ASSURANCE

1. Objective:

Establish and maintain high standards of performance, quality control, and produce accurate and precise analytical results.

2. Sample Collection:

a. Calibrate all sampling equipment as described above.

b. All labels on filters should be coded to prevent bias by lab personnel.

c. 2 Field blanks as described above.

d. Recheck visual while pumps are running.

e. Check filters visually for dust

f. Double check labels on samples vs site work sheets before leaving site.

3. PCM Analysis

a. Training:

NIOSH 582 or equivalent course for sampling and evaluating airborne fibers.

b. Reference slides:

Permanently mounted field control slides to be used on a daily basis.

c. Blind Recounts:

At a rate of 10%, the analyst will recount previously run samples at random from the completed sample storage containers. Analysts re-run these slides blind.

d. AIHA-AAR Proficiency Testing:

At a frequency of at least every 4 months, each analyst is required to run a set of 4 AAR samples and must maintain AAR (Asbestos Analysts Registry, American Industrial Hygiene Association) proficiency. This program requires submittals to AIHA, analyst training, participation in the AAR proficiency testing program, an adequate quality assurance program, training of analysts. There is no site visit by AIHA.

e. Comparison with Another Operator Outside the laboratory:

At a frequency of at least every 6 months, four previously run samples are exchanged (our samples submitted to outside laboratories for analysis and a similar number received from the same laboratories).

f. Calibration Procedures:

Alignment of the microscope is checked at each sitting for each analyst: after focusing on a PAT (Proficiency Analytical Testing) program slide, the condenser centration is checked using a centering telescope and adjusted as needed as detailed in the analytical method.

At least daily: The microscope is checked with a phase test slide (Align the phase annulus and phase plate).

The Walton Beckett Graticule is checked when new with a stage micrometer.

SECTION 6

REGULATIONS

Key points are presented from selected regulations. The professional Supervisor or Project Monitor should read the entire regulation referenced and be familiar with other existing regulations. Regulations vary in scope but overlap considerably. Some regulations are more detailed or are stricter than other regulations on certain requirements. Where regulations differ, the strictest provision must apply.

In this section, we examine some of the pure aspects of each regulation; in other sections the combined requirements are woven together. This creates some duplication in the text, but it is important for the student to know the source of each requirement. In addition, some terms are presented which are explained more fully in sections to follow.

Section 6-1

U.S. EPA Asbestos Regulations

A. TSCA, TITLE II AHERA ASBESTOS HAZARD EMERGENCY RESPONSE ACT

40 CFR 763 subpart E, Oct 1986, Asbestos in Schools Rule.

1. Synopsis:

a. Covers Schools public or private grades k-12

b. Inspections required for friable and non-friable ACBM every 3 years.

c. Management plans required for all schools

d. Response actions must be implemented which will "protect human health and the environment".

e. EPA Accreditation required for individuals: Abatement Workers; Supervisors and Monitors; Inspectors; Management Planners, and Project Designers.

f. LEA must have a "designated person"

g. 2 hr awareness training for custodial and maintenance workers within 60 days of hire.

h. Signs in routine maintenance areas.

i. Can assume materials are ACBM or collect bulk samples of materials and submit to NIST Accredited Lab for PLM analysis. Damaged assumed ACBM must be tested

j. Periodic Surveillance every six months and Annual notification to PTO.

k. Rigorous recordkeeping requirements.

l. DPH regulation 19a-333-1-13 include all of the AHERA requirements plus a few more; a copy of this DPH regulation is in the handout on W.W.W.Chem-scope.com.

2. Requirements for School Inspections:

a. Visual inspection

b. Materials Not Included in AHERA Inspections:

1) Stored material

2) Concrete

3) Cinder block

4) Blackboards

5) Pressed wood

6) Carpets

7) Curtains

8) Table and desk tops

9) Chemical lab gloves and other fire resistant equipment

10) Exterior roofing and most other exterior materials

c. Identify all homogeneous areas of friable and non-friable suspected ACBM.

d. Assume ACBM or sample.

e. Assess friable ACBM.

f. Prepare Inspection Report and Management Plan.

3. Asbestos Abatement Projects Records:

See Section 9-2 starting on page 159.

Records of abatement projects at schools have a high chance of being inspected by DPH within 2 years of the project.

B. NESHAP

National Emission Standards for Hazardous Air Pollutants.

40 CFR Part 61 Subparts A (general) and M (Asbestos). Clean Air Act,

Covers practically all facilities, activities and buildings except some residentials.

1. Main Subparts:

a. Subpart A includes parts 61.01 -.19 which are of general nature and apply to asbestos and 32 other Hazardous Air Pollutants.

b. Subpart M deals with Asbestos and consists of parts 140-157. The original part M was effective March 31, 1971. There were major amendments effective on November 20, 1990.

61.140 Applicability
61.141 Definitions
61.142 Asbestos mills
61.143 roadways
61.144 manufacturing
61.145 Demolition and Renovation
61.146 spraying
61.147 fabricating
61.148 insulating materials
61.149 waste disposal from asbestos mills
61.150 waste disposal from manufacturing, fabricating, demolition, renovation and spraying
61.151 inactive disposal sites for asbestos mills, manufacturing, and fabricating.
61.152 air cleaning
61.153 reporting
61.154 active waste disposal sites
61.155 waste conversion
61.157 delegation of authority

2. Requirements of Subpart M:

a. Homes with 4 or less units exempted from regulation, unless a number of homes are done as part of the project or a home had former non-residential usage.

b. MUST inspect for asbestos prior to any demolition or renovation project

c. PLM is official test method.

d. Many new definitions including:

Demolition means any work involving taking out load supporting building members or intentional burning.

Renovation means altering a facility component in any way including stripping of asbestos.

Category 1 non-friable asbestos means resilient flooring, asphalt roofing, gaskets, and packings > 1% asbestos by PLM.

Category 2 non-friable asbestos means any other non-friable material with > 1% asbestos by PLM.

Regulated asbestos containing material (RACM) means any of the following:

1) Friable asbestos

2) Category 1 asbestos which has become friable

3) Category 1 asbestos which is subject to sanding, grinding, saw-cutting or abrading.

4) Category 2 asbestos which has a high probability of becoming pulverized, crumbled or reduced to powder during the demolition or renovation work.

In other words RACM means asbestos which is friable or likely to become friable.

3. Notification Requirements Effective 10/1/97: in Maine, NH, Mass and CT.

Normal state DPH asbestos notifications (in CT of 10 calendar days or emergency notifications) satisfy NESHAP requirements and EPA does not also need to be notified. However, failure to notify DPH will also subject the party to EPA violation.

(In other states, one still must notify EPA directly.)

Note: Effective about June 2004, DPH requires notification of all demolitions.

4. Normal EPA Notification Requirements (exclusive of item 3 above)

Note: These no longer apply in Connecticut.

a. For projects involving any demolition or renovation which may disturb more than 260 linear ft or 160 Sq ft of RACM:

1) Prepare and submit 10- (weekday) notification forms required by the USEPA.

2) Submit forms to:

USEPA, Region 1
Air and Management Division
J F Kennedy Federal Building
Boston MA 02203
(617) 565-3273

b. Remember, for demolition, notification is required even if no asbestos is involved.

c. If amount of RACM changes by 20% or more, a revised notice is needed.

d. If start date of project changes, a revised notice is needed.

e. Blanket notification for the year:

If a series of jobs is expected to be done at a site in the course of the year and the total RACM work is >260 lin ft or 160 sq ft, a blanket notification may be sent for a calendar year by about 12/15 of the year preceding. Must notify by the next day of each individual job.

1) Non-scheduled renovation: A series of jobs is expected because of routine equipment failure.

2) Planned renovation: A renovation operation or a series of renovations at a site where RACM will be occasionally stripped within a year.

f. Emergency renovation: Must result from a sudden unexpected event that, if not taken care of, poses a hazard or may cause damage or an unreasonable financial burden. Must notify by the next day.

5. Emission controls.

a. No visible emissions

b. Wet removal

c. Material drop restrictions

6. Waste disposal manifests

Required by NESHAP

a. Label each waste bag with site and generator name in addition to the usual OSHA labeling.

b. EPA Approved Landfill

c. Waste vehicle labeled during loading and unloading

d. EPA must be notified if the dump receipt is not received within 45 days of the manifest date.

7. NESHAP (Supervisor) Training certification posted on site

8. Asbestos must be removed:

a. Before demolition or renovation if friability is possible. Removal required before disturbance or dislodging will result or

b. If the work precludes future removal.

Note: In some cases, non-regulated asbestos may be left in the affected area before demolition or renovation but the follow up work for waste disposal may be enormous since contaminated parts of the structure must be disposed of or the asbestos sorted out after demolition. These sites should be evaluated on a case by case basis. For interior asbestos, because of CT and OSHA regulations, it is usually necessary to properly remove the asbestos before disturbance.

9. Unexpected Asbestos:

There must be a plan to handle unexpected RACM which is exposed during a project. If the unexpected RACM becomes part of the rubble, then all contaminated rubble must be properly disposed of.

10. Interaction with State and OSHA regulations:

a. The NESHAP regulation potentially relaxes standards for Category 1 asbestos which would be significant if state regulations are relaxed.

b. Other fine points of the regulations are in line with existing state or OSHA regulations and not mentioned here.

C. ASHAA

1. The Asbestos School Hazard Abatement Act of 1984.

2. Congress adopted it as a mechanism to fund schools and for initial funding of EPA Asbestos Information Centers

D. EPA WORKER PROTECTION RULE

1. 40 CFR part 763 subpart G, 1987.

2. For public sector employees not otherwise covered by OSHA, including school employees.

3. Same requirements as OSHA 1926.1101.

E. THE 1982 ASBESTOS IN SCHOOLS RULE:

1. Required inspections for friable ACBM only

2. Required notification of employees and PTAs and posting of notices.

3. No requirement for management plans or response actions

F. EPA ASBESTOS BANS

1. 1970:

Spraying of commercial Asbestos products and the use of ACM pre-molded or wet-applied thermal insulating products.

2. 1989

Was put on hold due to court stay

3. 1993:

a. Ban of 1989 is still on hold due to legal ramifications.

b. Prohibition of new uses or resumption of uses stopped.

c. Labeling requirement.

4. Despite Bans,:

a. Still possible to encounter asbestos in new building materials. Especially glues, tars, mastics and putties.

b. Make sure the building owner knows to specify asbestos free materials in new installations and to check the MSDS'

G. ASHARA: Asbestos School Hazard Abatement Reauthorization Act

1. Synopsis:

a. This regulation requires extension of EPA Accreditation requirements to public and commercial buildings for individuals doing asbestos inspection, project design and abatement. Individuals doing more than one task must be EPA Accredited in each discipline. A Model Accreditation Plan (MAP) is included with this regulation which, as adopted by DPH, defines the syllabus of approved asbestos courses.

b. There are also increased training requirements compared to the original AHERA regulation.

c. The proposed EPA regulations were published in May of 1992. The effective date was to be 11/28/92, but the final rule was published on 2/3/94 and really effective 4/3/94.

d. Licensing and training requirements in many states such as CT reinforce this regulation and generally follow the MAP. Some states are stricter.

2. Applicability:

Public and commercial buildings which means All buildings other than schools and residentials with < 10 units.

3. Principal Changes in Training Requirements Compared to AHERA:

a. Separate worker and contractor courses for initial and refresher. (Can no longer upgrade workers by taking an additional day.) (5 day contractor/supervisor and 4 day worker.)

b. Increased Hands-on training to:
Worker 14 hrs (from 6)
Supervisor 14 hrs (from 6)
Inspector no change still 4 hrs

c. Changes in Curricula:

1) Worker training:

Minor additions and deletions. Add a discussion of the relationship of exposure to asbestosis, lung cancer, mesothelioma and diseases of other organs.

Some wording changes in the employee personal protective equipment and work practices training.

2) Con/Sup training:

Air monitoring: add EPA's recommendation that TEM be used for final air samples and a NIST Accredited lab be used.

Minor wording changes.

3) Inspector:

Under Bulk Sampling:
Add EPA's Recommendation that a NIST Accredited PLM lab be used.
Under Recordkeeping: Add EPA's Recommendation that standardized forms be used for recording inspection results for schools and for public and commercial buildings.

4) Management Planner:

Not a required but a recommended EPA Accreditation for public and commercial buildings.

Add a recommendation that standardized forms be used for recording inspection results for schools and for public and commercial buildings. And add the forms to the curriculum.

5) Project Monitor:

Not required by EPA. States are allowed to adopt the MAP for this discipline.

Section 6-2

OSHA Regulations

A. SCOPE OF OSHA ASBESTOS STANDARDS:

1. OSHA Construction STANDARD: (29 CFR 1926.1101; formerly 1926.58):

a. Coverage under a standard is determined by the work operation and not on the primary activity of the employer.

b. All construction-related work which may disturb asbestos including general industry applications of any of the following:

1) Demolition

2) Removal

3) Encapsulation

4) Construction

5) Alteration

6) Repair

7) Maintenance and custodial work

8) Renovation

9) Installation

10) Emergency clean-up

11) Transportation, disposal or storage

12) Excludes asphalt roof coatings, roofing cements and roofing mastics. (includes roof felts).

2. OSHA General Industry Asbestos Standard, (29 CFR 1910.1001):

Covers brake and clutch repair and manufacturing of asbestos products and any operations where the PEL may be exceeded.

Note: Maintenance or other construction activities are covered by 1926.1101.

3. 1915.1001 Shipyard Industry Asbestos Standard

Not discussed in this course. Similar to the construction standard below, but one must exactly review this regulation if one works in shipyards or shipboard.

Note: DPH asbestos standard discussed below also applies to ships in dry-dock.

B. OSHA CONSTRUCTION STANDARD: (29 CFR 1926.1101) Final Rule Effective 10/11/94; As Amended 7/30/98 and As Amended by 1910.134 Eff 4/98.

1. Definitions Include:

Disturbance means activity that crumbles or pulverizes ACM or generates visible debris.

Employee exposure is defined as the exposure outside any respirator use. Designation of controls according to classification:

Class I work = TSI and surfacing removal of ACM or PACM (presumed asbestos containing material) (TSI and Surfacing have the same meaning as in EPA AHERA except drywall is not classed as surfacing but plaster is.

Class II work = Removal of ACM or PACM other than TSI and surfacing, i.e. miscellaneous material such as transite siding or sheetrock.

Class III work = repair and maintenance where ACM may be disturbed, less than a standard glove bag or less than 3 sq ft.

Class IV work = maintenance and custodial including work in general industry or construction industry associated with Class I, II and III work, i.e., custodial and maintenance work is Class IV work only if associated with a construction asbestos project.

Regulated area = an area established by the employer to demarcate areas where Class 1, II, and Ill 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.

2. Regulated Areas (Asbestos Work Areas) 1926.1101 (e)

a. All Class I, II and Ill Asbestos Work

Any area where Asbestos is disturbed (Does not depend on exceeding PEL)

b. Demarcation including Signs

1) Signs posted at all entries to Work Areas.

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

2) Supplementary bilingual, pictograph, and/or graphics signs must be available.

3) Demarcation usually includes critical barriers or negative pressure enclosures in addition to signs.

c. Limited Access (to authorized persons)

d. Respirators and protective clothing

e. Prohibited activities: No one can eat, drink, smoke, chew tobacco or gum, or apply cosmetics in the regulated area.

f. Competent Person

g. Personal monitoring

h. Trained personnel

3. Exposure Limits:

a. Permissible Exposure Limit (PEL): 0.1 f/cc, 8 hour TWA

b. Excursion Limit (EL) 1.0 f/cc, 30 minute monitoring during each day's peak work disturbing asbestos in each Work Area

c. Method: We can use the method that only counts asbestos fibers, OSHA Method ID-160 (Same as the method in Appendix B of 1926.1101) for personal samples.

4. Personal Air Sampling:

a. Required for Class I, II and for Class III jobs.
(Remember OSHA requires personals, HEPA Vacuums and water on all these jobs)
b. Required daily for each Work Area.

c. Very tough to rely on first day or past work history to avoid doing this sampling.

1) OSHA says that first day monitoring can no longer be relied on to predict the exposures of a job since the first day may have lighter exposure.

2) Assessments are needed to rely on historical data.

d. Employees must be able to observe this monitoring and the results must be posted daily at the work site.

5. Respirator Use:

a. Operation specific requirements. Respirators are required for:

1) Class I work

2) Class II work where ACM is not removed intact

3) All Class II and III work where the employer cannot produce a negative initial exposure assessment

4) Class IV work in regulated areas (e.g. cleanup in a Class I job is Class IV work).

b. Class I jobs require PAPR if the expected or actual exposure is from 0.1 - 1.0 f/cc for the 8 hr PEL. Supplied air must be used above 1.0 f/cc.

c. Assessment: If competent person determines exposures will be below the PEL, must use at least 1/2 face negative pressure, non disposable respirator with HEPA filters in the regulated area.

d. In addition to the operation specific requirements for regulated areas, respirators are required at any time when exposure is above the PEL.

e. A PAPR must be used when the employee wants it.

6. Protective Clothing

a. Disposable Coveralls

b. Laundering (for non-disposable clothing)

c. Contaminated clothing.

Either as wastes or for laundering, handled as Asbestos Wastes.

a) Must be transported in sealed impermeable bags, or other closed, impermeable containers, and

b) Have required labels.

d. Inspection of protective clothing.

1) The competent person shall examine work suits worn by employees at least once per work shift for rips or tears.

2) When rips or tears are detected, immediately mend or replace.

7. Hygiene Facilities and Practices: "Decons"

Note: DPH is stricter in some respects, but these would actually apply for any EXTERIOR WORK since work practices in the DPH asbestos standard as we will discuss below apply to interior work. In addition DPH allows a remote shower when not feasible to connect one to the Work Area.

a. Class I asbestos jobs > 25 linear or 10 square feet:

1) Decons or Decontamination areas: adjacent and connected to (contiguous) the regulated area with an equipment room, shower area, and clean room connected to each other in series. See schematic drawings in the handout on W.W.W.Chem-scope.com.

a) Equipment room. Supplied with impermeable, labeled bags and containers for the containment and disposal of contaminated protective equipment.

b) Shower Area unless the employer can demonstrate that it is not feasible. Provided per 29 CFR 1910.141(d)(3) (One shower per 10 employees or fraction thereof of each sex and soap with warm water.)

c) Remote Shower: Where the employer can demonstrate that it is not feasible to locate the shower between the equipment room and the clean room, or where the work is performed outdoors, the employers shall ensure that employees:

(1) Remove asbestos contamination from their work suits in the equipment room using a HEPA vacuum before proceeding to a shower that is not adjacent to the Work Area; or

(2) Remove their contaminated work suits in the equipment room, then don clean work suits, and proceed to a shower that is not adjacent to the Work Area.

d) Clean Change Room. The clean room shall be equipped with a locker or appropriate storage container for each employee's use. When the employer can demonstrate that it is not feasible to provide a clean change area adjacent to the Work Area or where the work is performed outdoors, the employer may permit employees engaged in Class I asbestos jobs to clean their protective clothing with a portable HEPA-equipped vacuum before such employees leave the regulated area. Following showering, such employees however must then change into street clothing in clean change areas provided by the employer which otherwise meet the requirements of this section.

2) Decontamination Area Entry Procedures. The employer shall ensure that employees:

a) Enter the decontamination area through the clean room;

b) Remove and deposit street clothing within a locker provided for their use; and

c) Put on protective clothing and respiratory protection before leaving the clean room.

d) Before entering the regulated area, the employer shall ensure that employees pass through the equipment room.

3) Decontamination area exit procedures. The employer shall ensure that:

a) Before leaving the regulated area, employees shall remove all gross contamination and debris from their protective clothing.

b) Employees shall remove their protective clothing in the equipment room and deposit the clothing in labeled impermeable bags or containers.

c) Employees shall not remove their respirators in the equipment room.

d) Employees shall shower prior to entering the clean room.

e) After showering, employees shall enter the clean room before changing into street clothes.

4) Lunch Areas. Whenever food or beverages are consumed at the worksite where employees are performing Class I asbestos work, the employer shall provide lunch areas in which the airborne concentrations of asbestos are below the permissible exposure limit and/or excursion limit.

b. Small Class I work (< 25 linear or 10 square feet) and for Class II and Class III Jobs Where no Negative Initial Exposure assessment was produced). DPH is stricter as mentioned above, so these would actually apply for any EXTERIOR WORK:

1) Contiguous equipment room with impermeable drop cloth on the floor.

2) The area must be of sufficient size as to accommodate cleaning of equipment and removing personal protective equipment without spreading, contamination beyond the area (as determined by visible accumulations).

3) Work clothing must be cleaned with a HEPA vacuum before it is removed.

4) All equipment and surfaces of containers filled with ACM must be cleaned prior to removing them from the equipment room or area.

5) The employer shall ensure that employees enter and exit the regulated area through the equipment room or area.

c. Requirements for Class IV work.

Employees performing Class IV work within a Class I, II or III area must comply with the respective hygiene practice required within that area.

d. In Review: Considering OSHA and DPH Regulations, There are Four exceptions to Contiguous Shower Requirement:

1) Outdoors

2) Where is shown not to be feasible.

3) Class III jobs.

4) Any job involving less than 3 sq ft or 3 lin ft of ACM.

8. Medical Surveillance:

a. Required for those employees who:

1) Are issued a negative pressure respirator.

2) For a combined total of 30 days or more per year either engage in Class I, II or III work and/or who are exposed above the PEL or EL.

b. More than one hour of work counts as a day.

Note: This is one area where the General Industry Standard is stricter: All exposed above the PEL or EL, irrespective of the 30 days, must have medical surveillance.

c. At least once per year and at time of hire unless done within the year hired.

d. Requires

1) Examination under supervision of a licensed physician.

2) No cost to the employee.

3) At a reasonable time and place.

4) **Always requires Questionnaire** with medical and work history with special emphasis directed to the pulmonary, cardiovascular, and gastrointestinal systems.

5) Medical Exam including pulmonary function testing of forced vital capacity (FVC) and forced expiratory volume at one second (FEV 1).

6) Optional chest X-ray if ordered by the physician.

7) Information provided to the physician.

a) A copy of 1926.1101 with Appendices D, E, G and I;

b) Description of the affected employee's duties as they relate to the employee's exposure;

c) The employee's representative exposure level or anticipated exposure level;

d) A description of any personal protective and respiratory equipment used or to be used; and

e) Information from previous medical examinations of the affected employee that is not otherwise available to the examining physician.

8) Physician's written opinion

a) Whether the employee has any detected medical conditions that would place the employee at an increased risk of material health impairment from exposure to asbestos;

b) Any recommended limitations on the employee or on the use of personal protective equipment such as respirators; and

c) A statement that the employee has been informed by the physician of the results of the medical examination and of any medical conditions that may result from asbestos exposure.

d) 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.

e) The employer shall instruct the physician not to reveal in the written opinion given to the employer specific findings or diagnoses unrelated to occupational exposure to asbestos.

f) The employer shall provide a copy of the physician's written opinion to the affected employee within 30 days from its receipt.

9. OSHA Asbestos Record Retention

a. Exposure monitoring results (30 years)

b. Medical surveillance records (duration of work +30 years)

c. Training records (one year)

10. Presumption of asbestos: Assume material is asbestos or test to prove otherwise.

a. All TSI and surfacing materials installed before 1980 are PACM.

b. All floor tile and roofing installed before 1980 is assumed to contain asbestos.

c. Assumed asbestos materials as adopted by EPA are also asbestos unless shown to be otherwise.

d. If the owner wishes to not assume materials are asbestos, OSHA requires the following:

1) Inspection and sampling using an EPA Accredited Inspector.

2) Sampling requirements for bulk samples are now the same as the EPA requirements. For each homogeneous area:

a) Surfacing:

3 samples up to 1000 sq ft,

5 samples for 1-5000 sf

7 samples above 5000 sf

b) Miscellaneous Materials: in a manner sufficient to be correct. (Industry practice is to generally take 3 samples unless it is a patch or very small area.)

c) TSI 3 samples

3) PLM analysis: Lab used must be NIST or AIHA proficient in bulk sample analysis. AIHA Proficiency is rated twice a year by AIHA based on ability to run unknown samples for asbestos content.

4) To prove material in a homogeneous area is not asbestos, all samples in the area must test negative (<1% asbestos).

e. Building owner or employer is responsible for treating the above materials as asbestos.

f. If there is good cause to know that a material is asbestos containing the employer and/or building owner is deemed to know that fact. This includes material besides those mentioned above.

g. Debris in an enclosed area where TSI or surfacing is present, and not intact, is presumed to be asbestos containing.

11. Hazard Communication Requirements for Employers Besides Owners:

a. Employers who discover the presence of ACM or PACM on the worksite must notify the project or building owner.

b. On worksites having multi employers:

1) The person who discovers the material is also to notify the other employers.

2) An employer planning Class I or Class II asbestos work is to inform all the other employers on the site of the location and quantity of these materials and the measures to be taken to protect them from exposure.

c. Employers who are not owners planning Class I, II or III work must notify the owner of the location and quantity of ACM and PACM known or later discovered.

1) Within 10 days of completion of Class I or II asbestos work, the employer of the employees who performed the work shall inform the owner and employers who will be working in the area of the quantity and PACM or ACM remaining in the former regulated area and the final monitoring results.

2) For inadvertently discovered ACM/PACM there is a 24 hour notification requirement to the owner and all employers at the site.

12. Owners - Notification and Labeling

a. Building "Owners:

1) OSHA considers building owners as statutory employers, who must "take necessary and appropriate action to protect employees other than their own..."

2) OSHA is requiring the owner to receive, maintain and communicate knowledge of the location and amount of ACM or PACM to employers of employees who may be exposed.

3) The building owner must keep records of all information received through this notification scheme, or through other means, which relates to the presence, location and quantity of ACM and PACM in the owner's building, project or vessel and transfer all such information to successive owners.

4) OSHA has defined 'building owner' to include those lessees who control the management and record keeping functions of a building/facility.

5) When the lease expires the records go to the owner or the next lessee.

b. Owners must notify of the location of ACM/PACM:

1) Employers who bid for work

2) Tenants

3) Employees

c. Asbestos materials must be visibly labeled when feasible as close to the installed material as feasible:

1) In construction areas where there is any possibility for disturbance.

2) In areas of buildings where they may be disturbed by any type of construction related activity including custodial, maintenance or outside contractors.

d. Exemption: products which the manufacturer demonstrates cannot release fibers in excess of the PELs. OSHA has found that this exemption will never apply to PACM (surfacing or TSI); rarely will it apply to other asbestos containing materials.

e. Housekeeping workers must be informed that all resilient floor material that they clean buff or otherwise maintain may contain asbestos.

13. Note on Assessments which are discussed below.

a. There are 2 kinds of assessments done by a competent person: one is called "Initial Exposure assessment" which is required for Class I, II, and III jobs; and the other is called "Negative initial exposure assessment", which is an optional process.

b. A new Initial Exposure Assessment must be produced immediately before or at the initiation of a new job. Employers may evaluate repetitive operations with highly similar characteristics, as one job, such as cable pulling in the same building so long as historic data used reflect operations of the same duration and frequency."

c. The best approach for the monitor is to see that personal air sampling is done daily, evaluate those results and also to complete the pre-abatement inspection form in the hand-outs.

14. Initial Exposure Assessment:

a. Class I, II, III jobs: Immediately before each job or at the beginning of each job unless a Negative Initial Exposure assessment has already been made for this job.

b. Purpose is to ascertain actual or expected employee exposures during the job, to make sure that all control systems are appropriate for the operation and will work properly.

c. Basis of assessment:

1) Assessment shall be based on personal air monitoring for this job, if feasible, and

2) Consideration of all observations, information or calculations which indicate employee exposure to asbestos, including any previous monitoring. The initial assessment may conclude that exposures are likely to be below the PEL only as the result of a negative initial exposure assessment.

15. Negative Initial Exposure Assessment:

It is possible, but difficult, to make a Negative Initial Exposure Assessment for any one specific asbestos job by any one of three methods:

a. Objective Data: Use objective data to demonstrate that the product involved in the work or the process used cannot exceed PEL's.

1) This is virtually impossible for Class I work,

2) Very difficult to prove for Class II work and

3) May apply to Class III or IV work.

Note: The stricter state regulations would limit the changes in work practices to practically every situation.

b. Historical Data: Monitoring data from prior jobs closely resembling the present job (PEL and EL):

1) Within 12 months of the present job

2) Monitoring and analysis done in accordance with the OSHA standard in effect at the time.

3) Data obtained during work operations closely resembling the present job considering:

a) Process used

b) Type of material

c) Control methods including placing and repositioning the ventilation equipment,

d) Work Practices including techniques used for wetting the ACM or PACM in the various circumstances encountered

e) Environmental conditions including impacts due to weather conditions

f) Employee training

g) Employee experience

h) Workplace conditions

i) Degree and quality of supervision

j) Duration of the job and corresponding monitoring

c. Personal Monitoring of the Present Job: (PEL and EL for Class I and II work)

1) For Class I jobs, we must assume PEL is exceeded until we actually have test results unless the steps in b. above are completed.

2) Furthermore, the results of the first day's monitoring cannot be used to predict the results for the additional days unless the operation is identical.

Attach Personal Monitoring Data for the Present Job: (PEL and EL) when available to the Summary Sheet on the following page.

NEGATIVE EXPOSURE ASSESSMENT SUMMARY:

The purpose is to prove exposure is below the PEL of 0.1 f/cc.

1. Are the present crew and supervision at least as experienced and competent as prior crews/supervisors? _____

2. Do the process, conditions, materials, work practices of the historical jobs cited, closely resemble the present job being evaluated? _____

3. Does any days monitoring results indicate a mean TWA (8 hr) greater than 0.05 f/ cc for any employee? _____

4. Does any days monitoring results indicate a single EL value (30 min) greater than 0.5 f/ cc for any employee? _____

5. What training does the Competent Person performing this evaluation have: AHERA training as contractor/supervisor: ____ project designer _____ or inspector management planner course _____. Does the Competent Person meet the requirements in 1926.32: "one who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them." _____

6. What is expected employee exposures during the job: PEL statistically less than 0.1 f/cc? _____ EL statistically less than 1 f/cc? _____.

7. Are all control systems appropriate for the operation and will they work properly? _____

To confirm this, inspect the actual work setup and document with the Pre-Abatement Check List in the hand-outs.

Conclusion: After consideration of all observations, information and calculations which indicate employee exposure to asbestos, including any previous monitoring: There is _____ is not_____a high degree of certainty that employee exposures are likely to be below the PEL using the processes and practices outlined above for this job.

Workers will use a minimum of _____ NIOSH approved respirators for this job and also perform initial and periodic personal monitoring of exposures (PEL and EL) for each shift of this job. (Class I jobs require PAPR or Supplied Air Respirators if the expected or actual exposure is from 0.1 - 1.0 f/cc for the 8 hr PEL. Supplied air must be used above 1.0 f/cc.)

Negative Initial Exposure Assessment? Yes ___ No: _____

_____ _____/_____
Competent Person Print Name Competent Person Signature/date

16. Methods of Compliance (work practices):

Note: For interior work, State regulations are still stricter except as specified below. For details See 1926.1101 (g) 4 if interested in details of the OSHA regulation. Most of the following are in addition to the DPH requirements:

a. Must smoke test all negative pressure enclosures.

b. Must have manometer readings of negative pressure of 0.02 inches of water or greater recorded daily.

c. Required in all jobs (Class 1, II, III and IV) regardless of the results of the Assessment:

1) HEPA vacuums

2) Wet methods "OSHA will allow employers to claim infeasibility if they cannot use wet methods due to conditions such as electrical hazards, hot surfaces, and the presence of technical equipment which cannot tolerate moisture. (NOTE for NESHAP jobs): ALL ACM MUST BE KEPT WET until sealed in a leak tight container .

3) Prompt cleanup and disposal in leak-tight containers.

d. Prohibitions:

1) High speed abrasive disc saws

2) Dry sweeping and dry cleanup including shoveling

3) Employee rotation

4) Compressed air unless in a negative pressure enclosure

e. Added Requirements for Class I Jobs:

1) Class I jobs require PAPR or Supplied Air Respirators if the expected or actual exposure is from 0.1 - 1.0 f/cc for the 8 hr PEL. Supplied air must be used above 1.0 f/cc.)

2) To use lesser respirators, must have a Negative Initial Exposure assessment.

3) Supervised by competent person

4) Negative pressure enclosures:

a) At least four air changes/ hour

b) Negative pressure of at least 0.02 inches of water monitored daily.

c) Continued use through the job

d) Air flushing technique - ventilation placed to draw dust away from the worker.

e) Smoke tests before work begins and at start of each shift and any leaks sealed.

f) Deactivate electricity or use GFCI.

17. Notification to OSHA

a. Required when controls other than specified are to be used in Class I jobs. Alternatives for Class I require a rigorous demonstration and advance notice to OSHA.

b. When the employer intends to utilize controls other than a negative pressure enclosure for Class I jobs.

c. In some circumstances, where modifications of glovebag or glove box systems and other control systems are to be made.

18. Exemptions:

a. For use of a technology which is not referenced in the standard, must notify OSHA before the job including the basis for the project designer or CIH's decision. Daily perimeter monitoring must be implemented and a final clearance done. (Note: DPH regulations require the final anyway.)

b. Glovebag Use: Applications extended without quantity limitations to TSI and surfacing. NOTE: State regulations limits use to areas with <3 sf or 3 lf of ACM, so the OSHA change would only affect exterior work. Must be a 2 man glovebag. Negative pressure glovebags and boxes are also allowed for Class I work.

c. Mini-enclosures are allowed for Class I work. (Note: must comply with DPH enclosure requirements.)

19. Flooring Work:

a. Must assume floor tile and mastic contains asbestos unless proven otherwise as above.

b. A CIH or a project designer must certify the PLM results.

c. Must mist the snip point used for cutting sheet flooring.

d. OSHA says can omit negative pressure enclosure if a Negative Initial Exposure assessment is developed. Note: DPH regulations require negative pressure enclosures anyway.

e. OSHA allows containment to be omitted in some cases when the tiles are removed intact (non-aggressive method which does not break or dust tiles); CT would require an AWP (alternate work practice) approval by DPH.

20. Exterior work:

OSHA requires for disposal **wet, sealed and labeled** regardless of interior or exterior.

a. "OSHA believes that outdoor Class I work may be safely done without (negative pressure) enclosures. Therefore 1926.1101 paragraph (g) allows all outdoor Class I work to be conducted using other control methods, such as a glovebag system...." Decontamination units are still required and including showers when feasible.

b. Transite Panel and Siding Removal on Exteriors Other Than Roofs:

1) OSHA is requiring a job by job evaluation by a competent person of Class II work including transite panel removal.

2) OSHA says that: For rare cases when the evaluation of material, condition, crew and past exposure data do not support a Negative Initial Exposure assessment, additional precautions including critical barriers and a respirator must be used.

3) No cutting, breaking or abrading unless other methods cannot be used.

4) Each piece sprayed with amended water before removal.

5) Unwrapped pieces lowered immediately to the ground using dust tight chute, crane or hoist. Wrapped pieces lowered by the end of the shift.

6) Nails shall be cut with a flat, sharp instrument.

c. Roofing Work: OSHA regulates roofing; DPH does not regulate exterior non-friable materials.

1) Keep intact to the extent feasible during removal

2) When not intact, wet methods are required when feasible. Not required when there is a safety hazard.

3) Cutting machine blades must be continuously misted during use unless a competent person determines that misting substantially decreases worker safety.

4) For power roof cutter with an aggregate roof, collect dust with a HEPA vacuum or HEPA dust collector. For smooth roofs, a HEPA vacuum or HEPA dust collector or wet sweeping/wiping can be used to clean up debris. Immediately bag the dust.

5) Do not throw or drop ACM to the ground. It can be carried, passed by hand or lowered using a covered dust tight chute, crane or hoist.

6) If ACM is not intact, lower unbagged material as soon as practicable but always by the end of the shift. While the material is on the roof it shall either be wet, placed in an impermeable waste bag, or wrapped in plastic sheeting.

7) When intact, lower to the ground as soon as practicable by end of the shift.

8) Upon being lowered, transfer unwrapped material to a closed receptacle.

9) Roof level HVAC must be isolated or HVAC must be shut down.

10) For repair or removal of less than 25 sq ft during a day involving intact sections, wet methods and HEPA vacuum can be omitted unless visible dust is generated.

11) For intact roofing, flashing or similar work, only the following need be done:

a) Competent person inspection determines that roofing will remain intact.

b) All employees trained

c) No sanding grinding or abrading.

d) Methods which keep the material intact must be used.

e) No dropping or throwing to the ground.

f) Remove from the roof by the end of the shift.

12) Areas of the roof will be a regulated area where dust or debris may accumulate.

13) Only necessary work should be done on the roof while asbestos materials are being removed and the locations of the work should be selected to minimize exposure, such as upwind of the asbestos work. OSHA said the 20 ft barrier approach has merit, but the exact determinations should be made on site and could vary according to working conditions.

21. Removing Gaskets

Note: For interior work, also check stricter DPH regulations.

a. If deteriorated and unlikely to be removed intact, use glovebag.

b. Thoroughly wetted with amended water before removal and immediately placed in the disposal container.

c. Any scraping to remove loose residue must be performed wet.

22. Additional Notes for Class III Work

a. DPH standards for projects apply when repairs involve more than 3 ft.

b. The incidental cutting away of ACM/PACM to access mechanical or structural components for repair or maintenance is considered Class III work.

c. Remember: Respirators, protective clothing, personal monitoring, Isolation with signs, protection of HVAC, HEPA vacuums, training, wet methods and proper disposal are required.

d. Local exhaust ventilation is required if feasible.

e. For TSI and surfacing work which involves drilling, cutting, abrasion, sanding, chipping, breaking or sawing, isolation such as mini-enclosures must be used and respirators must be worn, and where a Negative Initial Exposure assessment has not been made, tenting must be used.

23. Training requirements:

Training must be at no cost to the employee.

a. All inspector work: 3 days AHERA Training

b. Class I and II work = AHERA Training

1) 40 hours for supervisors
2) 32 hours for workers

c. Class III work = 16 hours equivalent to the EPA O&M worker training plus more training if the competent person so determines

d. Class IV work = 2 hours. **Can’t disturb any asbestos.**

e. Competent Person Requirements:

AHERA training as contractor/supervisor, project designer or inspector management planner course. In addition to the following requirements in 1926.32: "one who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them."

24. Floor Maintenance- Housekeeping requirements:

Practices for ACM/PACM floor: sanding prohibited, stripping done with low abrasive pads below 300 RPM plus wet methods, burnishing and dry buffing done only over enough wax to prevent contact with the floor.

25. Appendices:

a. Appendices A,C,D,E and F of the General Industry Std are binding.

b. Appendices A,C,D and E of the construction Industry Std are binding. B,F,H,I and K are not binding.

c. Appendix A changed the same for all standards:

1) In para 1 "such as the NIOSH 7400 method" is replaced: with: "the most current version of the OSHA ID-160 Method or the NIOSH 7400 method". Recommended flow rate for personal samples increased; now 0.5- 5 liters/ minute.

2) In para 2 add "Do not reuse or reload cassettes for asbestos sample collection"

3) Para 11 : "Each set of samples taken will include 10% field blanks or a minimum of 2 field blanks....from the same set of cassettes as used for the samples..".Any blanks representing counts higher than the detection limit shall be rejected.

4) In the quality control section, inter-lab participation is required.

d. Appendix J was added: OSHA Method ID 191 for bulk identification of asbestos.

C. OSHA HAZARD COMMUNICATION PROGRAM FOR THE CONSTRUCTION INDUSTRY (CFR 29 1926.59)

1. General:

a. Deals with chemical hazards in the work place such as:

1) Coatings

2) Spray Glues

3) Solvents/ Mastic Removers- Hazards are fire, irritation and possible health effects.

4) Reinsulation Materials

5) Encapsulants

6) Spray poly

7) Surfactants

b. Employees have a right to know if working with a dangerous material and must be trained in how to work with it safely.

2. Key Elements:

a. Comprehensive written hazard communication program.

b. Material safety data sheets (MSDS)

c. Labels

d. Employee Training

3. MSDS's and how to read them:

a. MSDS's are the key to the hazard communication standard.

b. Manufacturers must provide and employer must obtain MSDS's for all hazardous materials which are accessible to all exposed employees.

c. Employees must be trained on how to use a MSDS

d. Employers must have MSDS on the job site for each chemical:

e. Employers on the job site must share MSDS's and other hazard communication with other employers and their employees; the GC (general contractor) is responsible for coordinating this effort for the entire project.

f. MSDS's must include:

Section I

Product identity and ingredients

Must be the same as on the container label

Must have the manufacturer's name, address and emergency phone number.

Section II Hazardous Ingredients

Must list hazardous ingredients greater than 1% including: chemical name, synonyms and the CAS # (Chemical Abstracts Service). If carcinogens are present at more than 0.1% they must be identified as carcinogens.

In case of trade secrets, the manufacturer can withhold the name of the chemical but must give a more complete description of the hazards and the properties.

Legal exposure limits

PEL (OSHA)

TLV (ACGIH, AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS)

NIOSH LIMITS OR MANUFACTURER ESTABLISHED LIMITS

Section III Physical and chemical characteristics

Boiling point
Vapor Pressure
Vapor density
Appearance and odor
Specific gravity
Evaporation rate
Miscibility with water

Section IV Fire, Explosion and reactivity hazards

Flash point

< 100 deg F is flammable like gasoline, acetone, gases like methane and acetylene 100-200 deg F is combustible like lighter fluid, mineral spirits, fuel oil.

Extinguishing Media:

Class A for paper and wood
Class B for liquids or greases
Class C for electrical fires
Class D for metals such as magnesium or metal alloys

Fire fighting procedures and unusual explosion hazards

Here you will see instructions like "do not use water" and any special manufacturer's instructions for handling fires with this chemical.

Section V Reactivity Data

Incompatibility with other chemicals. For example if you mix chlorine bleach and ammonia, poisonous phosgene gas is released.

Section VI Health Hazard Data

Health hazards, risk of cancer

Acute (short term) effects
Chronic (long term) effects
Routes of entry (ingestion, inhalation, skin)
Target organs such as heart, liver, etc
Signs or symptoms of exposure
Medical conditions generally aggravated by exposure

What to do if someone is exposed

Section VII Precautions for safe handling and use

Spill and leak procedures, Waste disposal method and other special precautions for handling and storing

Section VIII Control measures

How to eliminate or minimize the hazard including:

Ventilation and other engineering controls

Personal protective equipment requirements

Emergency and first aid measures

Spill and Leak procedures

Each MSDS may use different formats but all must contain the above information.

D. RESPIRATORY PROTECTION STANDARD OSHA 29 CFR 1910.134

1. Written Program See F. Below

2. Respirator Assignment and Maintenance

a. Respirators should be assigned to individual workers for their exclusive use.

b. Fit testing must be checked after repair or replacement of component parts.

c. Inspection for defects

d. Maintenance and storage procedures.

3. Employee Training Program

4. Respirator Program Evaluation and Recordkeeping

E. OTHER IMPORTANT OSHA REGULATIONS AFFECTING ASBESTOS ABATEMENT

1. Fire safety OSHA 29 1910.38 and 1926.24 and 1926.150-155)

2. Ladder and Scaffold safety, OSHA 29 CFR 1926.450 et seq

3. Electrical safety OSHA CFR 29 1926.402 and .416-.417

4. Recording and Reporting of Injuries OSHA 29 CFR 1926.22

5. First Aid and Medical Attention OSHA 29 CFR 1926.23

6. Shower and Sanitation requirements OSHA 1910.141

F. REQUIRED WRITTEN SAFETY AND HEALTH PLANS/PROGRAMS:

The plans can be incorporated into a single Safety and Health Plan which always must be kept on the job sites. Usually the employer makes a number of copies of this plan which each supervisor brings to the job site.

1. Lead compliance plan (Required by OSHA, 1926.62)

a. Activities in which lead is emitted:

1) Equipment used.

2) Materials used:

3) Controls in place

4) Crew size

5) Employee job responsibilities

6) Operating Procedures

7) Maintenance Practices

b. A description of the specific means that will be employed to achieve compliance and where engineering controls are required, engineering plans and studies used to determine methods selected for controlling exposure to lead:

c. A report of technology considered in meeting the PEL

d. Air monitoring data which documents the source of lead emissions

e. A detailed schedule for implementation of the program including documentation such as copies of purchase orders for equipment, construction contracts, etc.

f. A work practice program which includes items required under protective clothing housekeeping and hygiene facilities and a good work practice program such as described in Appendix B of 1926.62:

1) Adherence to the PEL

2) Exposure assessment

3) Respirator, protective clothing and equipment use

4) House keeping procedures.

5) Hygiene facilities and practices.

6) Medical surveillance and medical removal practices

7) Employee information and training

8) Signs

9) Record keeping procedures

10) Observation of monitoring.

g. An administrative control schedule, i.e. job rotation

h. Arrangements made among contractors on multi-employer sites with respect to informing affected employees of potential exposure to lead and with respect to responsibility for compliance with 1926.62 (e) and 1926.16.

i. Other Considerations.

1) Frequent and regular inspections of the job sites, materials and equipment are made by a competent person.

2) Employee access to company program and S.O.P.s (standard operating procedure)

3) Updating of the program at least every 6 months.

2. Written Respiratory Protection Program

a. Procedures for selecting respirators for use in the workplace;

b. Medical evaluations of employees required to use respirators;

c. Fit testing procedures for tight-fitting respirators;

d. Procedures for proper use of respirators in routine and reasonably foreseeable emergency situations;

e. Procedures and schedules for cleaning, disinfecting, storing, inspecting, repairing, discarding, and otherwise maintaining respirators;

f. Procedures to ensure adequate air quality, quantity, and flow of breathing air for atmosphere-supplying respirators;

g. Training of employees in the respiratory hazards to which they are potentially exposed during routine and emergency situations;

h. Training of employees in the proper use of respirators, including putting on and removing them, any limitations on their use, and their maintenance; and

i. Procedures for regularly evaluating the effectiveness of the program.

3. Emergency response plan 29 CFR 1910.120 and other OSHA Regulations

a. An organizational structure showing personnel roles, lines of authority communications and training.

b. Pre-emergency planning

c. Safe distances and places of refuge

d. Site security and control measures

e. Evacuation routes and procedures

f. Decontamination procedures

g. Medical emergencies - treatment and first aid

h. Emergency alerting and response

i. Inspection for effectiveness of the plan

j. Personal protective equipment

k. Procedures for handling emergency response

4. Hazard Communication/Right to Know Program (29 CFR 1926.59)

a. Responsible individuals

b. List of hazardous substances

c. Labels

d. MSDS's

e. Non-routine tasks

f. Multi-employer worksites

g. Employee information and training

h. Outside contractor policy

5. Medical Surveillance Program

a. For all employees who do abatement 30 or more days per year.

b. Medical examinations to determine fitness for work at no cost to the employee.

(1) Prior to assignment of the negative-pressure respirator.
(2) At least annually thereafter.
(3) Questionnaire .
(4) Physical examination directed to the pulmonary and gastrointestinal systems.
(5) Any other examinations or tests deemed necessary by the examining physician.
(6) Information provided to the physician.
(7) Physician's written opinion including any recommended limitations on the employee or on the use of personal protective equipment such as respirators.

c. Medical surveillance records for each employee.

(1) The name and social security number of the employee;
(2) Copy of the employee's medical examination results.
(3) Physician's written opinions;
(4) Any employee medical complaints related to exposure to asbestos; and
(5) Copy of information provided to the physician.
(6) Record is maintained for the duration of employment plus thirty (30) years.

Section 6-3

DPH Regulations

A. DPH ASBESTOS STANDARD: 19A 332-1-16 (AMENDED 4/04)

Includes single family homes.

1. Applicability:

a. All Interior Work
b. Includes all structures even single family homes and ships in dry dock.
c. Applies to schools. (Plus reoccupancy criteria in DPH School regulations are stricter.)
d. Notification needed for friable exterior work

2. Asbestos Project: ≥ 3 sq ft or 3 linear ft of asbestos material

3. Notification: (new)

a. From:
1) Asbestos abatement contractor
2) Facility owner
3) OR ANY PERSON WHO WILL BE CONDUCTING DEMOLITION ACTIVITIES

b. For:

1) Asbestos abatement involving more than ten linear feet or twenty five square feet of ACM

2) **OR BEFORE ENGAGING IN THE DEMOLITION OF ANY FACILITY**.

c. To:

1) DPH
Connecticut Dept of Public Health
410 CAPITOL AVE MS # 51 AIR
PO BOX 340308
HTFD CT 06134
(860) 509 7367

2) Facility owner, if notification made by asbestos contractor.

d. DPH Submittal:

1) On DPH forms

2) Postmark or hand deliver **10 calendar days before starting abatement or demolition**

3) For emergency,

- within one (1) working day after the start of asbestos abatement **OR DEMOLITION**.
- Must include **A COPY OF** ANY **WRITTEN ORDER REQUIRING DEMOLITION**

e. EPA Submittal:
An EPA submittal is no longer needed.

f. **Asbestos abatement notification** minimum information:

1) Name, address and phone number of Asbestos Abatement Contractor.
2) Name, address and phone number of Facility Owner.
4) Exact facility location **(site address, building name or number if applicable and exact room within the building).**
5) Nature of the asbestos abatement
6) Facility description including size, age and use.
7) Amount of ACM to be removed, enclosed or encapsulated or contained in the facility or part thereof to be demolished.
8) Scheduled start and completion dates. **(Fax any changes to the CT DPH. Notify the CT DPH especially if the project ends at an earlier date).**
9) Description of work practices to be followed to comply with 19a-332a-5-12
10) Name and address of Asbestos waste disposal site.

g. Prepare a separate demolition notification (using CT DPH Demolition/Notification Form, copy on Handout on W.W.W.Chem-scope.com) for each facility for which there is a proposed demolition with the following minimum information:

1) Type of notification (new, emergency, revised)
2) The name, address, telephone number, and a contact person for the facility owner/operator.
3) The name, address, telephone number, and a contact person for the demolition contractor.
4) The name, address, telephone number, and DPH License number of the Asbestos Inspector who conducted the Pre-Demolition Asbestos Survey.
5) Start Date and Completion Date.
6) Name and address of the facility
7) Use of the Facility (School, Public Building, Manufacturing, Office, College, Commercial, Church/Synagogue, Residential, Other) and number of dwellings.
8) Building Data (Square Feet, Number of Floors, Age).
9) Name and address of the Demolition Disposal Facility.
10) Name and address of the Waste Hauler.
11) Name and address of the person completing the form.

Note: An air clearance should be conducted even for buildings being demolished. Typically, for insurance reasons, the demolition contractor is going to have an employee check every space inside a building to be demolished to be certain that there are no vagrants or squatters hiding inside.

4. DPH Required Records:

a. The notification
b. List of names and social security numbers of all staff related to the asbestos project.
c. Log of control of access to the Work Area
d. All records required by EPA, OSHA, AND DEP
e. During work air sampling
f. Post abatement reoccupancy

5. General abatement requirements:

a. Signs
b. Critical Barriers: page 40.
c. Objects in the Work Area:

1) Movable objects decontaminated using HEPA vacuums and/or wet cleaning methods as appropriate and removed from Work Areas to a temporary location. Otherwise dispose of as contaminated waste.

2) Fixed objects within the Work Area: cover with a minimum of 4-mil plastic sheeting and tape. The distinction between movable and fixed objects is made in the definitions. The rest is a matter of common sense.

d. Floor and Wall Plasticization:
Cover flooring and wall surfaces with polyethylene sheeting sealed with tape. Use a minimum of two layers of 4-mil polyethylene on walls and 6-mil polyethylene on floors. Floor plastic must interleave under the wall plastic so that polyethylene extends at least twelve inches up on walls, then wall polyethylene sheeting is applied to the floor thus overlapping the first layer by at least 12 in. This keeps the water from leaking out.

e. Restricted Access to Work Area:

All persons entering the Work Area must be properly authorized and equipped with proper respiratory protection and protective clothing.

f. Cleaning using HEPA vacuum and amended water until there is no visible residue.
g. Ventilation (Negative air): one air change every 15 minutes.
h. Waste water filtered by best available technology. 5 microns or smaller porosity.
i. Asbestos wastes wet and sealed in leak tight containers.
j. Waste labeled per OSHA regulations:
k. Disposal at authorized facility.

6. Worker Decontamination System:

a. Same as OSHA 1926-1101 reference to Hygiene Facilities and it applies for any asbestos project >3 sf or Lin ft.
b. Clean room
c. Shower room:
d. Equipment room
e. Each room separated by airlocks. An airlock is a special plastic barrier.
f. Decontamination procedures are outlined on page 33.
g. Contiguous decontamination system when feasible. (Must notify DPH and the facility owner when not feasible)

7. Asbestos Removal Practices:

a. Wet Asbestos Material
b. Remove intact or in large sections (as large as feasible) and carefully lower to the floor.
c. Spray encapsulate all stripped surfaces
d. Decontaminate or wrap equipment before removal from area
e. Empty HEPA vacuum in the Work Area

f. Negative air units:
1) Remove all pre-filters and damp clean
2) Change HEPA filters at start of next project after containment is established

8. Encapsulation:

a. An abatement option involving full setup, repair and use of a spray called an Encapsulant.
b. Spraying an encapsulant called "lock- down" is also required after asbestos abatement.

9. Enclosure

a. First encapsulate as above
b. Construct barriers to isolate

10. Spot Repairs

a. Isolate with barriers (glovebag permitted)
b. Wet material
c. HEPA and wet clean surfaces
d. Use leak proof disposal containers
e. OSHA labels and NESHAP labels if appropriate
f. Filter waste water
g. Same disposal practices as for asbestos projects above

11. Alternate Work Practices AWP

a. May apply if there is existing gross contamination, only floor tile or other situations.
b. Licensed Project Designer must apply and get approval FROM DPH.
c. Use forms provided by DPH
d. $ 200 fee. Request cannot be faxed.

12. Post abatement reoccupancy testing (finals):

No occupancy until test is satisfactorily completed
(See pages 59-60 and 85-87.)

B. CHANGES IN DPH ASBESTOS REGULATIONS THIS DECADE:

1. Effective in January 1991:

a. Friable Asbestos Material is redefined:
b. Traditionally, friable means An Asbestos material that can be crumbled, pulverized or reduced to powder when dry by hand pressure and which releases Asbestos fibers into the environment.
c. As additionally defined in the Connecticut regulations:
d. Also includes any non friable ACM that potentially can be broken, crumbled, pulverized or reduced to powder as the result of asbestos abatement.
e. Exterior asbestos excluded
f. TEM limits changed to 500 lin ft and 1500 sq ft
g. Lab requirements for final air samples: AIHA accredited lab or AIHA registered analyst must be used.

2. Effective October 1991:

a. Portions of the state board of education regulations were repealed (sec 10-292-a and 10-292-b).
b. Temporarily it was lawful to do abatement during school session. However, DPH regulations for asbestos in schools restored the requirement to get DPH permission first.
c. Annual school updates no longer required to be submitted to state.
d. DPH is now doing many on site school inspections focusing on schools involved in abatement- past and in progress.
e. EPA funded the DPH to add inspectors.

3. October 2009

a. DPH charges fees for notifications of $100 plus 1% of the project excluding reinsulation up to a max fee of $5000. Jobs under 160 sq ft - flat $100 fee only.
b. Fee for alternate work practice is now $200.
c. Notification forms
d. Reinspections (compliance inspections) $100.

4. Dec 1, 1992 19a-333-1-13, June 2006

DPH came out with regulations to replace the repealed school regulations. The DPH regulations are nearly the same as AHERA and additionally restrict asbestos abatement while school is in session. In June 2006, DPH expanded the definition of “while school is in session” to include all times when students are in the building. If students will be in any part of the building, the LEA must submit a request for approval to DPH. The details are provided in the course handout on W.W.W.Chem-scope.com.

5. Effective Fall of 1994, State licensure requirements 19a 332-17-23 rev

6. 1998-1999 - State licensure requirements; copy in Handout on W.W.W.Chem-scope.com.

D. LICENSING REQUIREMENTS EFFECTIVE 6/4/99 SEC. 20-440- AND 20-441.

1. Licensure of asbestos contractors.

a. Stricter than 1994 regulations in some respects: fee is $625 per year.

b. The licensed contractor will have to hire certified asbestos and supervisors.

c. Additional submittals with license application:

1) Medical monitoring
2) Employee training
3) Equipment specifications
4) Air monitoring data
5) Permits, violations, and any legal actions.

2. Certification and licensure of asbestos consultants

a. Existing licensing for consultants will continue for each discipline and will be considered "certification and licensing".

b. Licenses will be offered in the following disciplines of asbestos consultation:

1) Inspector
2) Inspector/management planner
3) Project designer
4) Project Monitor.

c. Applicants simultaneously apply for certification and licensure as asbestos consultants in the same application-

d. Training requirements are the same with the exception of the new Project Monitor course and inspectors need only 4 hour refresher.

e. Inspector

1) Scope of Licensure and Authorization:

a) Review facilities records; perform visual inspection or surveillance of facilities

b) Identify, document or inventory materials suspected of containing asbestos

c) Collect bulk samples for asbestos analysis according to procedures established by applicable state or federal laws and, regulations and

d) Provide direct supervision to non-certified individuals collecting bulk samples of materials suspected of containing asbestos.

e) Inspectors shall apply current concepts and knowledge of best available technology to evaluate the conditions and accessibility ACM.

2) Qualifications.

a) Either a bachelor's or an associate's degree in engineering, architecture, industrial hygiene or a scientific field determined by the commissioner to be closely related and

b) Six months employment experience in an occupation determined by the commissioner to be closely related; or two (2) months field experience under the direct supervision of a licensed inspector or management planner.

c) 3 day inspector approved training and required refreshers

3) Exempted activities:

a) Periodic surveillance. However, no touching or taking of samples is permitted without a license as an inspector.

b) Compliance inspections by federal or state agency.

c) Visual inspections to determine whether a response action is complete (must be a licensed Project Monitor).

f. Management planner (Inspector/Management Planner)

1) Scope of Licensure and Authorization:

a) Utilize information developed from facility inspections to assess potential hazards of ACM

b) Develop abatement response actions, operations and maintenance plans, and select and recommend abatement actions.

c) All the authorizations of an inspector.

2) Qualifications.

a) Either a bachelor's or an associate's degree in engineering, architecture, industrial hygiene or a scientific field determined by the commissioner to be closely related and

b) Applicants shall have minimum of six (6) months experience in asbestos abatement, including experience in asbestos management or three (3) months field experience under the supervision of a licensed management planner.

c) 3 day inspector plus 2 day management planner approved training and required refreshers.

g. Project Designer

1) Scope of Licensure.

a) Apply knowledge of facility construction, design and development of abatement projects; abatement specifications; bidding documents; architectural drawings; and schematic representations of material locations.

b) May also determine how asbestos abatement should be conducted.

2) Qualifications.

a) Bachelor's degree engineering, architecture, industrial hygiene or a scientific field determined by the commissioner to be closely related.

b) One year experience in asbestos abatement, including experience in asbestos abatement design or six (6) months field experience under the supervision of a licensed project designer.

c) 3 day approved project designer training and required refreshers.

h. Project Monitor

1) Scope of Licensure.

a) Function as on-site representative of the facility owner or other persons.

b) Interpret project specifications or abatement management plans.

c) Monitor and evaluate contractor or employee compliance with applicable regulations or specifications and

d) Ensure that abatement projects are properly conducted and completed.

e) The Project Monitor shall not function as the asbestos contractor, or as an employee of the asbestos contractor on the same asbestos abatement project.

2) Qualifications.

a) Either bachelor's degree in engineering, architecture, industrial hygiene or a related scientific field or an associate's degree in biology, chemistry or a closely related field.

b) Applicants shall have a minimum of one (1) year experience in asbestos abatement, including experience in asbestos abatement project monitoring or six (6). months field experience under the supervision of a licensed Project Monitor.

c) Training:

(1) Existing licensed project monitors must take the Project Monitor refresher course

(2) New project monitors must take the five day Project Monitor initial course and the required annual Project Monitor refreshers.

3. License and certification application for asbestos consultants.

a. Written application using prescribed forms.

1) Copies of training certificates.

2) Documentation demonstrating necessary educational and employment experience

b. Payment of a $250 licensure fee by certified or bank check.

c. Annual Renewal of License during the month of birth with application and $250 fee.

d. Certification expires simultaneously with training certificate. Any individual either seeking licensure or possessing licensure as an asbestos consultant shall maintain current certification in the appropriate discipline. (For those who become inactive, the longest lapse between courses is 24 months; otherwise initial training must be taken over.)

e. Denial of eligibility of applicant for licensure.

1) Failed to comply with the general statutes and regulations governing his profession;

2) Convicted of a felony

3) Pending or prior disciplinary action or unresolved complaint before any duly authorized professional disciplinary agency including a foreign jurisdiction;

4) Subject to DPH hearing:

a) Has committed an act that, if the-applicant were licensed, would not conform to the accepted standards of practice of the profession, including but not limited to, incompetence, negligence, fraud or deceit; illegal conduct; procuring or attempting to procure a license, certificate or registration by fraud or deceit; or engaging in, aiding or abetting unlicensed practice of a regulated profession

b) Has a condition that would interfere with the practice of his profession, including, physical illness or loss of skill or deterioration due to the aging process, emotional disorder or mental illness, abuse or excessive use of drugs or alcohol.

f. Exemption. An individual who between July 1, 1985 and November 1, 1994, has been employed for a minimum of two (2) years as an asbestos consultant may be licensed as an asbestos consultant without the bachelor's degree, provided the applicant has met all other requirements.

g. Decertification. Suspension and revocation of certification. Civil penalties.

1) Performing work requiring certification at a job site without being in physical possession of initial and current documents of accreditation and current certificate;

2) Permitting the duplication or use of one's own document of accreditation or certificate by another;

3) Performing work for which certification has not been received;

4) Obtaining accreditation from a training provider that does not have approval by the Department to offer training for the particular discipline;

5) Violation of other Connecticut regulations or general statutes concerning asbestos;

6) Obtaining certification and/or licensure through fraudulent representation of accreditation documents;

7) Obtaining accreditation documentation through fraudulent means;

8) Gaining admission to and completing refresher training through fraudulent representation of initial or previous refresher training accreditation documentation; or

9) Obtaining licensure through fraudulent representation of licensure requirements such as education, training, professional registration, or experience.

h. Change of office or residence address. Notify DPH within thirty days.

4. Requirements for certification and employment as an asbestos abatement site supervisor or asbestos abatement worker.

a. Individual Certification required for work with 3 sq ft or lin ft of ACM **or more**.

b. Must have initial and current certificates at the job location.

c. Certification is good for one year and expires on the same date as that of accreditation.

d. Each individual sends written application to DPH including:

1) Copies of training certificates.

2) List of all asbestos contractors and asbestos consultant employers over the last three years.

3) Fees: Supervisor $100 / Worker $50.

This page updated 5/12/04

E. ASBESTOS IN SCHOOLS: CONNECTICUT GENERAL STATUTES SECTIONS 19A-333-11B

Has all the requirements of AHERA But Stricter or more detailed in several respects:

1. Need permission to do abatement while school is in session.

2. Final clearance clarification on not dividing areas in order to do only PCM finals.

3. Procedures for fiber release episodes.

4. Added Requirements for response action recordkeeping. See the check list with the handout on W.W.W.Chem-scope.com.

F. OTHER STATES: Updated 5/12/04

1. Before considering working out of state, obtain the latest regulations from the state and determine if licensing is required.

2. CONES: Consortium of North East States:

a. The following states are members, require licensing and have training reciprocity:

State	Asbestos Contact/	Phone
CT	DPH/	(860) 509 7559 (860) 509 7367
MAINE	DEP ASB CERT COORDINATOR	(207) 287 2651
NJ	DEPT OF HEALTH ENV HEALTH SVCES	(609) 984 2193
NY	DEPT OF HEALTH ASB SAFETY TRAINING PROG.	(518) 402 7940
MASS	DLI DIV ASB/LEAD LIC AND ENFORCEMENT	(617) 727 9612
NEW HAMP.	BUR OF HEALTH RISK ASSESSMENT, ASB MGMT CONTROL PROGRAM	(603) 271-5870 (603) 271 4609
RHODE IS.	OFFICE OF OCC. AND RADIOLOGICAL HEALTH DEPT OF HEALTH	(401) 222 7795
VERMONT	DEPT OF HEALTH ASB AND LEAD REGULATORY PROGRAM	(802) 863 7231

b. Remember One must pay a fee to any of these states and obtain a license before working there in the asbestos field.

Section 6-4

DOT Regulations

US Department of Transportation Regulations (DOT)
CFR 49 Parts 171-173

1. Research and Special Programs Administration is an arm of DOT which regulates hazardous material transportation including asbestos.

2. Regulations were published in the Federal Register on 12/21/90 which became effective on October 1, 1991:

3. Asbestos was divided in two categories which are now obsolete. See revisions below.

4. On Oct 1, 1992 Editorial and Technical Revisions were published which simplified the rule:

5. One shipping description of NA 2212.

6. Up to 440 lbs of asbestos allowed on cargo aircraft.

7. A placard is needed for shipments over 440 lbs.

8. Drivers must have function specific training. OSHA hazard communication training EPA training is sufficient if it covers DOT topics.

9. Small shipments such as samples are generally exempted unless they contain a pound or more of friable asbestos. Even so, the following exemptions apply:

10. Less than 66 lb package with inner packages securely wrapped and not exceeding 11 lbs each are exempt from marking and labeling for ground transportation.

11. If the entire package is less than 64 lbs and the inner packages are less than one ounce (30 grams) each and inner containers are at least 8 mil plastic, glass, metal or earthenware.

12. Non-friable ACM is exempt.

13. Manufactured products are exempt.

14. Air samples are in practice exempt.

15. For most abatement wastes, the shipping papers need to have the following information:

RQ- 1 LB (REPORTABLE QUANTITY)
NAME: ASBESTOS NA 2212
HAZARD CLASS: 9
MIXTURE
PACKING GROUP III
TOTAL QUANTITY _____

16. DOT Labels:

Usual OSHA label may be used on the package unless it is over 66 lbs in which case the following added label is needed:

RQ- 1 LB (REPORTABLE QUANTITY)

NAME: ASBESTOS WASTE MIXTURE NA 2212

NAME OF THE CONSIGNEE OR CONSIGNOR

(EPA NESHAP also requires the container/truck be labeled during loading and unloading)

Section 6-5

DEP Disposal Regulations

Connecticut General Statutes Sec 22a-209-8 (i) (DEP Applies to Waste Disposal in Connecticut)

Connecticut DEP: Any disposal of Asbestos in the State of Connecticut must be authorized by the office of Solid Waste Management. To request a disposal permit, contact the Solid Waste Management Unit at 566-5847.

Twenty five day notification must be sent to:
State of Connecticut
Dept. of Environmental Protection
Solid Waste Management Unit
79 Elm St.
Hartford CT 06106

SECTION 7

SAFETY HAZARDS OTHER THAN ASBESTOS

A. ELECTRICAL SAFETY

(See OSHA CFR 29 1926.402 and .416-.417)

1. Construction electrical installations must comply with 1984 National Electric Code and meet additional requirements.

2. Check existing power for proper grounding, exposed wires and panels and safe access.

3. Determine whether electrical equipment in the Work Area which may get wet or be contacted by workers can be safely shut down.

4. Do not interfere with existing alarms and sensors.

5. Use lock out/tag out procedures.

6. Use only grounded outlets and 3-wire heavy duty cords with GFCI protection (Ground Fault Circuit Interrupter).

7. Power cords must not be hung by staples or nails.

8. Check all electrical equipment daily for damage, especially power cords and including HEPA vacuums, HEPA negative air units, temporary lighting, and power tools. Grounding continuity tests of equipment must be made at least every 3 months.

9. Use non-metallic tools as applicable. Do not use metal ladders.

10. Lamps for general illumination must be protected from breakage and metal shells grounded.

11. Temporary lighting must not exceed 12 volts and must be GFCI protected. Temporary lights must not be suspended from their cords unless they are designed to be hung this way.

12. For high work including exterior abatement, plan carefully for overhead wires and other electrical equipment.

13. Do not lay electrical cords over wet surfaces.

B. LADDER SAFETY (SEE OSHA 29 CFR 1926.450)

1. Safety check program for defects- cracks, splits, missing or weak rungs.

2. Use correct ladder for the job.

3. No jury-rigged ladders

4. Keep rungs free of residue during work

5. 4:1 lean ratio for ladders

6. Do not paint rungs or rails

7. No ladders in passages or doorways unless protected by barriers.

8. Ladders tied off at top to prevent dislodging.

C. SCAFFOLD SAFETY (SEE OSHA CFR 29 1926.450-454 AMENDED 8/30/96)

1. General Requirements:

a. If more than 10 ft high must have railings and toe boards.

b. Scaffold must support at least 4 times the intended load.

c. Designed by a qualified person.

d. Platform fully planked at all levels and no space more than 1 inch between the platform and uprights.

e. Platform or walkway must be at least 18 inches wide (with some exceptions).

f. Front edge of all platforms not more than 14 inches from the face of the work (when work face is to the side) unless guard rails or personal fall arrest measures are used. Except: Outrigger scaffolds: front edge not more than 3 inches from the face of the work.

g. Secure platform or use required overhang of at least 6 inches. Overhang can't be more than 12" for a <10 ft platform; no more than 18" for a >10 ft platform with some exceptions.

h. Each end of abutted plank must rest on it's own support.

i. No opaque finishes used for wood platforms.

j. No mixing of different component brands with some exceptions.

k. No mixing of different metals unless competent person determines there will be no galvanic action.

l. No more than 4:1 height : base ratio for supported scaffolds.

2. See Special Requirements for Specific Scaffolds in the regulations cited:

3. Highlights of other requirements:

a. Regular inspection

b. Dimensions conform to standards

c. Maintenance of wheels or casters in good condition

d. Properly secured components

e. Practices to keep clean during work

f. Guard Railings 42 inches high and toe boards required for work over 10 ft off ground

g. Stringing of electrical wires for electrical and trip safety

h. Proper lighting where scaffolds are used

i. Fall protection screen required under scaffold where workers may walk under

j. Condition of flooring for movable units

k. Maximum spans for 2x10 ft planking full dressed lumber:

25 pounds/sq ft maximum 10 ft span

50 pounds/sq ft maximum 6 ft span

l. Safe access requirements including secured ladder or stair tower.

m. Reinforcement includes diagonal and cross bracing

n. Safety considerations for riding mobile units

o. Competent Person must oversee construction and take-down.

D. FIRE (AND EXPLOSION) SAFETY **(OSHA 29 1910.38 AND 1926.24 AND 1926.150-155)**

Key Points for Fire Prevention and Response at Abatement Sites:

1. Polyethylene burns similarly to candle wax. Fire resistant poly should be used but not much better in some cases than ordinary poly.

a. Special precautions for containing hot surfaces

b. Written emergency action plan and fire prevention plan

c. OSHA Fire Protection and Prevention includes requirements for:

1) Temporary or permanent water supply for fire protection.

2) A trained fire fighting brigade as the project warrants.

3) Portable fire extinguishers of a 2A rating for every 3000 sq ft of the Work Area. Point of travel to the nearest fire extinguisher must not exceed 100 ft.

4) Where more 5 gal of flammable or combustible liquid exists, a 10B fire extinguisher must be located within 50 ft of the material. (This is likely to include gasoline used for generators.)

d. Ensure that the area allows a quick and easy escape route and all workers are briefed on escape.

e. No smoking, no welding, no other ignition sources near flammable materials.

f. Make sure outside contractors or other building occupants who may work near the area are aware of the safety requirements.

g. Notify local fire marshall

h. Emergency equipment on hand including fire extinguishers and first aid kits.

i. Do not block exits

E. HEAT RELATED DISORDERS

1. Be watchful in summer and in work in hot areas.

2. High Work Area temperatures, extended work in hot environments with protective suits, insufficient salt and fluids will cause these disorders.

3. Progressive in nature becoming more severe as exposure continues and can lead to a fatal condition resulting from heat stroke- Most advanced stage

4. Prevention:

a. Drinking water, fruit juice, Gator Aid,

b. Frequent breaks, cooling, ventilation, breathable suits.

c. Salt on an individual basis

d. PAPR's and other forced air respirators are preferred

5. Emergency plans must be ready in the event medical treatment is needed.

6. Heat Fatigue:

a. Profuse perspiration and tiredness always precedes the more serious disorders below. May also have heat cramps which are severe intermittent abdominal and arm and leg muscle pains.

b. Give about 1/4 teaspoon of salt in a glass of water.

7. Heat exhaustion:

a. A state of very definite weakness.

b. Pale cool clammy skin, weak and rapid pulse, tense muscles.

c. Remove from hot area and lay down with feet elevated higher than head; keep quiet.

d. Get medical help. If conscious give salt tablets and fluids such as fruit juice. Keep warm to avoid shock.

e. Lack of prompt detection and care can result in heat stroke.

8. Heat stroke:

a. High body temperature (over 105 degrees), dry skin (no perspiration), headache, numbness or tingling and confusion prior to sudden delirium or coma.

b. Needs immediate emergency medical treatment with initial injection of normal saline (salt water).

c. While awaiting help, place in cold water or ice bath if available. Wrap naked in wet sheets while awaiting help or during transport. Do not let body temperature get below 103. Victim usually cannot take fluids or salt orally at this point of the progressive illness. Lack of prompt care can result in uncontrolled increase of body temperature and death. Will be fatal if salt water is not administered in time.

F. CHEMICAL AND BIOLOGICAL HAZARDS / DUST AND AIR CONTAMINANTS OTHER THAN ASBESTOS:

1. Building Material Sources:

a. Building owner must provide list of hazardous materials already at the site and information about these materials. Always refer to MSDS's. (Material Safety Data Sheets).

b. Lead and Cadmium dust from paint and plumbing and demolition.

c. Watch out for PCB'S in transformer areas and fluorescent ballasts.

d. Mercury: toxic, has appreciable vapor pressure- inhalation hazard
Mercury in instrument areas and laboratories may be present in flooring. Mercury may be present in latex paint; usually present in florescent fixtures.

e. Mold and bacterial contamination around HVAC systems- slime and Legionnaires disease

f. Hospitals: viral and bacterial contamination and carcinogenic chemicals such as ethylene oxide and formaldehyde.

g. The employer is responsible to provide appropriate employee protection for all hazards at the work site.

2. Substances used in or Introduced into Facilities

a. Always refer to MSDS's. (Material Safety Data Sheets).

b. Conform to "Right to Know" Program

c. Building owner must provide list of hazardous materials already at the site and information about these materials.

d. Spray glue: fire and inhalation hazard.

e. Surfactants: see MSDS

f. Cleaners: see MSDS

g. Gasoline: flammable, inhalation, skin absorption, toxic

h. Encapsulants: usually irritants

i. Other Flammable materials

j. Bird droppings

k. Other sanitation problems such as old toilets

G. SLIPS TRIPS AND FALLS

1. Stairs: Covering non-slip and free of objects and debris

2. Extension cords: out of path or secured under walkable surface.

3. Lock-down Spray problems

4. Proper ladder and scaffold use

5. Roofing safety

6. Housecleaning and Storage Practices

7. Airlines used with supplied air units

H. POWER TOOLS (see 29 CFR 1926.302 for electric and pneumatic power tools)

I. CONTROL OF HAZARDOUS ENERGY LOCKOUT/TAGOUT (see CFR 29 **1910.147)**

Pertains to unexpected energization of a piece of equipment which may cause injury. Employer must have a standard operating procedure and training.

J. SUPPLIED AIR RESPIRATORS- carbon monoxide

K. GENERAL CONSTRUCTION HAZARDS FROM FALLING OBJECTS-

Hard hats and other prescribed equipment including safety goggles and steel tipped shoes.

L. CONFINED SPACES:

See OSHA CFR 29 1910.146 if a confined space is to be entered;

1. A space:

a. Large enough for entry and work but restricted entry and exit and

b. Not intended for continuous occupancy.

2. May contain hazardous atmosphere: Must test for:

Oxygen, combustibles, carbon monoxide, hydrogen sulfide and any other suspected air contaminant.

3. Must have separate training and specialized equipment for confined space entry.

M. OTHER HAZARDS.

1. Exterior work in inclement weather frost bite and exposure protection

2. Cuts- infections

3. Drinking and drugs- effect on coordination and thinking

4. Sanitation- personal hygiene practices for disease protection in the field

N. LEAD DUST ON ASBESTOS JOBS:

1. Most dangerous when in the form of dust or fumes

2. Lead dust settles on flat surfaces. Hand to Mouth contact results in exposure

3. Can breathe lead dust resulting in exposure

4. Lead Sources on the Asbestos Job

a. Paint and dust and soil, largely from paint
b. Lead solder in pipes and fixtures
c. Demolition

1) Plumbing
2) Painted surfaces, walls and ceilings
3) Lead containing mortar
4) Ceramic glazed materials
5) Floor tile
6) Baseboards
7) Welding and cutting steel work with lead primer

d. Lead abatement
e. Preparation for painting (sanding, etc)
f. Metal stripping and refinishing
g. Lead containing sites

1) Lead mining, smelting and refining
2) Lead crystal makers
3) Ceramic glaze manufacturers
4) Plastic manufacturers
5) Wire and cable manufacturers
6) Electronics manufacturers
7) Firing ranges
8) Artists
9) Metal fabricators

10) Car mechanics
11) Printers
12) Scrap / recycling yards

h. Industrial Uses

1) Tank linings and Radiation shielding
2) Piping for corrosive gases and liquids
3) Bearings
4) Storage batteries
5) Ceramics or Plastics
6) Electronic devices
7) Specialty alloys for corrosion resistance including solder
8) Corrosion resistant coating on steel cable
9) Pigment in rubber
10) Laboratory
11) Ammunition

5. Health Effects

a. Central and Peripheral Nervous System
b. Reproductive Effects
c. Gastrointestinal Effects
d. Renal (Kidney) Toxicity
e. A cumulative poison:
f. Dose-Response Relationship
g. Symptoms usually don't develop until some damage is done
h. Slow rate of discharge from the body

6. Blood Lead OSHA Standard

a. 40 micrograms/ deciliter (ug/dl) or higher, testing every two months

b. 50 ug/dl or higher, medical removal

7. Typical Adult Blood Lead Reactions

15- 25 ug/dl: Increase in blood pressure; harmful effects on fetus, joint and muscle aches Reproductive problems

40 ug/dl: Kidney damage; damage to blood formation.

60 ug/dl: Anemia; nerve damage; constipation; stomach pains; irritability and fatigue; memory and concentration problems; clumsiness; drowsiness and sleep problems.

80 ug/dl and higher: Blue line on gums; uncontrollable shaking of hands; wrist and foot drop; hallucinations; brain damage; coma; death.

8. Prevention

a. Have suspect materials tested
b. Wear protective gear (same as for asbestos)
c. Use good personal hygiene (same as for asbestos)

SECTION 8

ASBESTOS ROOFING ABATEMENT

A. PLANNING

1. Does not need a containment

2. If friable, must be done by licensed contractor.

3. Careful sampling of all layers by a licensed inspector

4. Delineation of asbestos and non-asbestos roofing

5. Are there other asbestos materials besides roofing such as:

a. Siding

b. Flues

c. Transite panels

d. Sheds and cupolas

B. SAFETY AND WORK ENVIRONMENT:

1. HVAC intakes to be protected

2. Possible leakage of water into the building

3. Fate of skylights and other protrusions

4. Surrounding area use- close by homes, school

5. Seasonal problems including:

a. Antifreeze protection for the water to be used on the roof
b. Excessive heat or cold stress for workers

6. Altitude and pitch of the roof

7. Precipice or walled edge

8. Accessibility from inside the building

9. Possible location of clean change area

10. Structural soundness of roof for work

11. Pitch and hardness of grounds around the building for staging

12. Structural possibilities for enclosure

13. Fate of the building- demolition, reinstallation of new roof, etc.

14. Special electrical safety including overhead power lines

15. Fire prevention and escape

16. Waste storage location and movement of the material to the storage area

17. Availability of a remote shower

18. Electrical power availability

19. Is the roof covered with stone?

C. NOTIFICATIONS:

1. DPH, EPA, and DEP Notification. See page 96-97, 129-130, 142..

2. Local Notification and building permit often required.

D. REGULATIONS ON ROOFING ABATEMENT

1. OSHA:

a. Same personal protection as for indoor projects including:

1) Training

2) Signs

3) Shower and clean change facilities. Shower may be remotely located

4) Respirator and protective suit

5) Personal monitoring

6) Containment no longer required

7) Regulated Area

b. Work Practices:

1) Continual misting of cutting blade

2) Keeping intact during removal

3) Wet methods

4) Immediate Packaging

5) Covered receptacle via dust tight chute, or wrapping material in plastic sheeting and lowering it to ground by end of shift.

6) Loose dust from sawing HEPA vacuumed immediately.

7) HVAC isolated, HEPA filtered, or extended, or

8) HVAC must be shut down and vents sealed with 6 mil plastic.

9) Power cutting with misting is allowed if cuts are made to obtain largest feasible pieces.

10) Exemption for Wet methods on roofs:

Competent person determines hazard

Power tools with HEPA vacuum system, or hand methods.

2. NESHAP/Clean Air Act (40 CFR 61, Subpart M)

a. Regardless of friability, material must be disposed of in accordance with CFR 40 PART 61.152. EPA approved landfill.

b. Does not include homes less than 5 dwelling units.

c. If demolition is involved or if more than 160 sq ft becomes friable, the NESHAP regulations apply.

d. If the roof is to be saw cut and the amount of asbestos roofing is 5580 sq ft or greater, it is covered by NESHAP.

e. Other cases where roofing is treated as friable:

1) If it is friable or in poor condition and likely to emit dust.

2) If the material is subject to sawing or abrasion.

3) If the building is burned.

f. No visible emissions

g. Wet methods

h. Material drop restrictions

1) Material must be transported to the ground via dust-tight chutes, or

2) Containers if removed from a height greater than 50 feet.

3. DPH Asbestos Standard is not applicable to exterior asbestos abatement, except notification to DPH is required when the material is friable and then Licensing applies.

4. DEP Waste regulations still apply.

5. Local Regulations: Most municipalities require a building permit.

Section 9-1

Insurance and Liability Issues

Contractor Considerations

A. LIABILITY TYPES

1. Statutory:

a. Government regulation and criminal violations

b. Violation of the law includes Acts or omissions

c. Penalties and enforcement exacted by the governing body

d. Owner often shares this liability

e. Defenses:

1) Follow regulations and

2) Be able to prove that regulations were followed

Documentation (See record Keeping in Section 9-2)

Physical evidence - the completed or in progress work

Witnesses and media such as photos and videos.

Independent testing and inspection

2. Contractual

a. Two party obligations: Contractor and Client

b. Written agreement

1) Formal- Contract Specifications normally used

2) Contractor Proposal, and Customer Purchase Order or letter to proceed are a less formal contract are less often used but are considered a contract.

c. Breach of Contract may result in non-payment and/ or lawsuit to recover money.

d. Indemnification (an owner's defense):

1) Agreement to assume responsibility for consequences of act or failure to act.

2) Does not relieve Tort -third party liability except to the extent of the contractor's ability to pay.

3) Does not relieve Statutory Liability.

e. Defenses:

1) Read the contract and follow or use written change orders.

2) Make sure terms of contract are consistent with codes and regulations and make written exceptions with the bid.

3) Keep written records of all work and changes to the work.

4) Contractual insurance coverage

3. Tort (Third Party Liability):

a. The third party can be a neighbor, bystander, passer-by, a visitor or an occupant. May include someone else's employee.

b. A form of civil liability. Requires two conditions:

1) Someone is AGGRIEVED (harmed personally or financially)

2) Someone is responsible.

c. Defenses:

1) The likelihood and degree of adverse affect on the defendant depends on:

Level of negligence

Following regulations

Following specifications

Risk contribution

Proof- documentation and witnesses and medical evidence

Degree of harm

2) Follow state of the art practice and/or industry custom.

3) Follow regulations and Be able to prove that regulations were followed:

4) Documentation (See record Keeping in Section 9-2)

5) Physical evidence - the completed or in progress work

6) Witnesses and media such as photos and videos.

7) Independent testing and inspection

4. Specific Examples of Defenses:

a. Regulations require HEPA filtered negative air machines. Suppose someone near the exhaust path sees some dust and claims they were exposed. How can the contractor prove there was a HEPA filter in the machine and that the filter was properly function?

Answer: Logs of project shows filter was changed and the entry should be dated and initialed by the supervisor. More importantly, records of an independent air monitoring test of the filter exhaust is needed.

b. Regulations require 4 air changes per hour and negative pressure in the work area. After the job has been in progress for a week or so, the building occupants get nervous about the asbestos work and complain to the owner. An independent lab test finds the air outside the work area is contaminated. How can the contractor prove that the contamination did not come from his containment?

Answer: Pre-abatement air samples before the work might show up building contamination. Independent continuous during work monitoring outside the containment, especially the decontamination unit, if clean, will help disprove the owner's claim. Observation of other building activity such as construction outside the work area should be recorded in the supervisor's log which may explain the source of such contamination. Other proof needed is logs showing negative pressure in the containment

B. LIABILITY INSURANCE

Key Terms:

Claims made: Covers claims which occur and are made during the term of the policy.

Occurrence: Covers incidents which occur during the policy term, regardless of when the claim is made.

Aggregate Limit: The maximum amount of coverage for all losses during the policy period.

Single Limit: the maximum amount of coverage for a single incident.

Combined Single Limit: Used with automobile liability policies; means the coverage per claim but there is no aggregate limit.

Exclusion: Something not covered by the policy.

Master Policy: Provides a specific total dollar amount of coverage to a group of insured parties. The amount of coverage may be inadequate.

Excess or Umbrella Liability: Additional blanket coverage

1. Worker's Compensation Insurance (mandatory)

a. Required by state law for all employees.

b. Covers any work related injury, illness,
1) Medical payments
2) Disability - wages paid to maximum set by State law
3) Disfigurement - compensation paid for scarring, etc

4) Employers Liability

5) Connecticut Statutory Limits:
$100,000 each accident
$500,000 disease policy limit
$100,000 each employee disease

c. Exclusions:

1) Strictly covers the employees of the insured

2) Only job related injury, illness or disability

3) Owners and officers may be voluntarily exempted.

d. Defenses:

1) Institute a written policy for employees including: To give prompt report of illness or injury attributed to their work.

2) Establish procedures for immediate examination and treatment

3) Make sure that OSHA 200 form report of injuries and illness is kept up to date.

4) Make sure the workers compensation carrier is notified immediately in writing of any report of employee illness or injury alleged to be work related.

e. Cost:

Based on a percentage of payroll, the percentage depends on prior claims. Typically 2-10% of payroll. Rates just went down in Connecticut due to new legislation which reduced the wage compensation rate and tightened up on claims such as scarring.

2. General Liability Insurance:

a. Contractor's Property: Premises - fire, theft and injury.

b. Automobile liability usually a combined single limit.

c. Commercial Liability Portion: Harm during on-site operations.

d. Completed Operations: Covers claims made after leaving the site; May be occurrence or claims made

e. Exclusions:

1) Pollution: excludes coverage for any personal injury or property damage caused by a broad list of substances, which can include asbestos.

2) Asbestos: policy may specifically exclude asbestos related injury.

f. Anticipatory damage (damages that are claimed to be anticipated to have been caused by asbestos exposure.

g. Coverage for employees, tenants and/or subcontractors.

h. Defenses:

1) Make sure subcontractors are insured.

2) If employees use their own autos for work or if autos are leased, get non-owned and leased auto coverage.

3) Use A or better rated company (Best's ratings)

i. Costs: About $30,000/year. Add about $10,000 per year for each additional million.

j. Length of policy: generally one year.

k. Typical limits are $1 million single limit and $2 million aggregate.

l. Availability: Widely available: See technical journals for advertising. Contact local insurance brokers who can provide a selection of companies offering coverage.

C. BONDING

A supplement to insurance which reserves a guaranteed amount of cash set aside to be paid in case of default. Bonding is more difficult to obtain than insurance and requires very complex applications and collateral which may include individual principal's homes.

1. Payment bond: a surety company agrees to pay for labor and materials supplied to a project in the event the contractor fails to do so.

2. Performance bond: a surety company agrees to complete performance of a project if the contractor fails to do so. Usually a cash amount equal to the contract sum.

3. Bid bond: Usually 5% of the bid sum.

Section 9-2

Recordkeeping

A. PAPERWORK THE PROJECT MONITOR SHOULD BRING WITH HIM TO THE PROJECT:

1. Project Monitor's license

2. Latest refresher AHERA certificate

3. Fit testing record within one year

4. Medical approval within one year

5. Blank Forms: See samples in the hand-outs.

a. Asbestos Pre-Abatement Inspection Form FL-12A 11/97

b. Daily Perimeter Containment Monitoring Check List FL 12C 11/97

c. Daily Sign-In Sheet Form SIS 11/97

d. Final Clearance Inspection Check List FL-22V 4/20/91 (Use reverse side for Drawing)

e. Air Sampling/ NIOSH 7400 Sample Record FL-22 2/95

f. Air Sampling / Analysis by TEM AHERA FL-22T 1/95

g. Air Sampling/ OSHA ID-160 Sample Record FL-22-160 10/97

h. Respirator Instruction and Qualitative Fit-Testing Certificates If fit testing is conducted, Fit Test Record (See sample in the hand-outs.)

i. Microscope Calibration Logs For Q-21 12/9/91

j. Chain of Custody Form FL-4 1/92

k. Quality Control Report

B. WHAT PAPERWORK MUST BE DEVELOPED AT THE PROJECT:

1. General

a. Items marked with * These must be on site at all times and included in the final report preparation.

b. Document each step of the project include: who, what, where and when.

c. ** indicates additional requirements for AHERA covered schools.

2. Specific EPA, DPH and OSHA Paperwork Requirements for Day 1:

a. Before Abatement Starts, Copies of Contractor's:

1) DPH Notifications

2) Contractor asbestos license

3) Daily Sign-In Sheet Form SIS 11/97:

All abatement staff to complete for each employee.

** Sign it next to printed names.

4) Workers/supervisors AHERA training certificates complete including initial and refresher training to date. If there are any deficiencies, that individual is not to work on the project.

a) Initial training: Effective 4/18/90, all training must be completed within a two week period. Supervisor must have a 40 hour approved course period. Except after September 1988 and before 4/18/90 one could upgrade a 32 hour worker course with an Asbestos Supervisor Upgrade Course if the upgrade course was taken within 6 months of the last day of the initial course.

b) Refresher training:

Current refresher must not have expired.

Refreshers must be taken every 12 months to work continuously.

Longest lapse between courses is 24 months; otherwise initial training must be taken over.

Effective 4/3/94, workers and supervisors must take the specified refresher, i.e. a worker can't take a supervisor refresher and vice-versa.

c) Date training was completed must be on cert **

d) Location of training must be on cert **

e) Number of hours completed must be on cert **

5) Fit testing records current within one year.

6) Medical respirator approval within the last year.

7) MSDS's for all chemicals brought to the site and including replacement materials (Make sure they are asbestos free). Required OSHA Hazard Communication information and training for any hazardous chemicals at this site according to CFR 29.1926.59. A list of all the hazardous chemicals to be brought to the site including amounts to be brought in, the intended use, and Material Safety Data Sheets (MSDS's) for each chemical.

8) Certification that vacuums, Negative Air equipment, and other local exhaust/ventilation equipment conform to ANSI Z9.2-1979.

9) Certification that fire safety requirements have been met or will be met. Contractor is responsible for applicable notifications, coordination regarding fire safety, alarm and sprinkler management. Emergency response plans must be determined in advance. The contractor must have provided worker fire extinguisher training according to OSHA 1926.50 (a)(5). Escape route breakthroughs and avenues of exit in the event of a fire must be visibly marked inside the containment. Fire extinguishers must be provided inside and outside the containment. Emergency lighting must be installed and properly operating.

b. Copies of any alternate work practice (AWP) requests and DPH response to the request(s).

c. Perform a Pre-abatement Inspection

Use Form FL-12A and complete all items.

3. Specific EPA, DPH and OSHA Paperwork Requirements for Each Project Day:

a. Check any new employees entering the site as in 2. a. 3) above.

b. Daily Sign-In Sheet Form SIS 11/97 plus contractors dive sheets (time cards or daily logs of access to the Work Area, showing times of entry, exit and proof of control of the Work Area by a supervisor and daily contractor narratives).

1) Signatures** vs printed names and job title or function (worker or supervisor).

2) Social security number

3) State and certification number and agency of initial asbestos training and current refresher.**

4) Times of entry and leaving the Work Area

5) Work description for each shift

6) If the Project Monitor finds any of the above are missing or incomplete, he will deny access to those who are not in compliance and/ or not permit work to commence.

c. Daily Personal Sample records

d. Air Monitoring and Visual Inspection Reports Including Pre-Abatement, During Work and Finals:

1) Name and signature** of any person collecting any air sample on the air sample worksheet

2) The locations where those samples were collected, description plus a good drawing showing sample location and identifying absolutely the location of the Work Area.

3) Date and location of collection.

4) Name and address of analyzing laboratory (on the lab report).

5) Date of analysis (on the lab report)

6) Results of analysis (on the lab report)

7) Method of analysis (on the lab report)

8) Name and signature** of person performing analysis (on the lab report)

9) Laboratory accreditation statement** (on the lab report)

10) A statement for each final clearance report as to the visible residue criterion passing or failing the inspection.

11) A statement as to what suspect ACM remains in each Work Area after each final clearance.

12) Air Sample Records

a) Must show diagram showing placement of each pump.

b) Documentation of final Visual inspection. Final Clearance Check list (See sample of form FL 22v to follow in The hand-outs)

c) PCM: (See sample of form FL 22 to follow in The hand-outs).

d) If TEM samples are collected:

(1) Air Sample Record for TEM samples (See sample of form FL 22 T in The hand-outs)

(2) Chain of custody form.

(3) Copy of Shipping records of samples.

e. Project Logs and Daily Logs

Developing Project Logs and Daily Logs; What Should Be Included and Who Sees Them:

Contractor's (or Project Monitor's if the job is monitored daily) daily logs must include the following information for each shift:

1) The date and times and description of each activity including entry to and leaving the site, contacts made, work done, etc.

2) List of all asbestos personnel and function of each (can refer to the sign in sheet for that day), Must include the project monitor's name. **You must sign in, even if you are just doing a final.**

3) The names of Work Areas being worked on and the activity in each area.

4) Synopsis of air sample results as to whether in or out of compliance**.

4. Final Report Assembly

a. Assemble the above daily data in chronological order.

b. Double Check to see that the Specification scope of work matches the actual work done and that complete paperwork is present for each day's operation. Make sure the same name for each area is used on the spec and the project work.

c. Make sure each page is labeled with the full date and a unique project identifier. This includes each side of two- sided pages.

d. Make sure project monitor signs the logs and visual report.

e. Prepare a synopsis of the project like this:

Site name:

The reason for the abatement was to .....**

Contractor name and address:

Start and end date:

Summary of the scope of work completed including the quantity and exact location of ACBM removed **

Summary of what suspect ACM is left in the area

Air samples were/ were not in compliance. If not, explain why and what corrective action was taken.

Monitor name and signature if the project was monitored daily.

f. If there is no written project design, include detailed written description including Methods used for the Asbestos Abatement Project** supplement check lists with narrative as needed.

g. Attach all the data to the summary sheet and prepare a table of contents. Verify all data is present.

h. Compare site copies with retain sheets kept at the shop.

i. Add the waste disposal manifests as soon as they are available for all waste leaving the site.

j. Copy of the specification (which for schools** also includes a copy of the Project Designer's licence and AHERA certificates.)

k. For each Work Area, pre-abatement inspection report according to the Pre-abatement Check List in The hand-outs.

l. For each Work Area, during work check list (See check list in The hand-outs).

m. Copies of Lab credentials **:

1) AIHA Accreditation Certificate for each PCM lab used.

2) NIST Accreditation Certificate for each TEM lab used.

n. DPH alternate work practice applications and approvals or rejections.

o. Air sampling data for personals and final clearance.

p. Certification of asbestos free replacement materials used when applicable.

5. Records must be kept for at least 30 years.

C. AHERA REQUIRED O&M WORK RECORDS FOR SCHOOLS:

1. Name of person(s) performing the activity

2. Start and completion dates

3. Location

4. Description of activity

5. If removal, the name and location of storage and disposal sites

D. SUPPLEMENTARY RECORDS RECOMMENDED FOR LEGAL AND INSURANCE:

1. All correspondence related to the project

2. Contracts, proposals, purchase orders and specifications showing the scope of work.

3. Equipment servicing and maintenance records.

4. Additional record keeping specified by project designer.

5. Supplementary testing such as bulk sampling of suspect materials encountered.

6. Photos of the Work Area setup

7. Videos of crucial work operations such as changing HEPA filters and containment and decontamination unit set up and use.

Section 9-3

Building Systems

A. DRAWINGS AND PLANS:

1. Drawings:

a. Architectural Drawings: show the building structure or design.

b. Building Drawings: contain structural details or blueprints.

c. Floor Plans: Schematic layout of the building showing building spaces.

d. Master Riser Plan: Three dimensional building layout.

e. As Built Drawings: Electrical or mechanical features as actually built.

f. Mechanical Drawings:

1) Plumbing
2) Electrical
3) HVAC

g. Framing Plan: Shows vertical columns and supports of the building.

h. Site Plan: Shows arrangement of buildings on the property and other details which may include roads, and utilities.

B. BUILDING FEATURES:

1. Building exterior

a. Evidence of building additions type, texture and colors of:

Brick
Block
Poured concrete
Other exterior building materials

b. Other features:

Partial building floors
Mechanical protrusions
Exterior entry to storerooms
Outbuildings
Exterior porticos.
Roof drains.
Gross measurement of building dimensions.

c. Mechanical areas of the building. How does building heat distribute to the room spaces? Is there a HVAC? Does, for example, the system have steam or hot water heat?

C. BUILDING COMPONENTS:

1. Mechanical Systems and Areas Where ACBM May be Concentrated

a. Boiler Rooms:

1) Boiler:

a) May be original or added with new wing construction.

b) Usually more than one boiler. Are they all the same? If not, you can expect different homogeneous areas of boiler and pipe insulation throughout the building.

c) External: Is the boiler insulated with an exterior cement jacket, cast iron clad, aluminum or sheet metal clad over insulation?

d) Internal: Always assume there is internal ACBM unless there is certification that the boiler is asbestos free.

e) Oil Fired units:

Most institutional boilers are oil fired with steam or hot water feed to room heat exchangers. Heavy grades of oil require heat tracing from outdoor tanks and usually asbestos insulated plumbing.

f) Gas Fired Units: Gas inlet lines are usually not insulated.
Ducts and vibration dampers may be asbestos insulated or containing.

g) Boiler Exhaust System:

Fire box

Manifold

Breeching

Chimney.

More than one boiler may feed to the same breeching via individual exhaust headers which will be perhaps a third the size of the breeching diameter.

2) Pipes: Most pipes originate in the boiler room.

a) Pipes may have different insulation composition:

Fuel feed

Circulating water feed and return

Water or steam take away and return lines

Domestic hot and cold water lines

Different diameters

Fittings vs runs

Pipe joints including T's, L's, flanges, I's and other transitions including sites where pipe hangers are attached are often of different composition than the pipe run insulation.

b) Types of Insulation on pipes:

Air-cell - honeycomb paper, usually ACBM

Cementitious - ACBM or other

Wrapped paper - ACBM or other

Black tar coated - ACBM or other

Foam - ACBM or other

Wool types. - ACBM or other

Fibrous glass with asbestos - ACBM or other

Rock wool or mineral wool. - ACBM or other

Modern fiberglass insulation, usually pink or yellow- not ACBM. Sometimes fiberglass insulation is used for runs and asbestos or non-asbestos cement for fittings.

c) Pipe Paths through Building:

Protrusions of pipe from the boiler room determine the likely path of flow through the building.

Overhead including above drop ceilings

Pipe tunnel system?

Risers exposed or run inside walls or pipe chases.

3) Hot water tank- condensate tank

4) Cooling Units: Central air conditioning compressors may be located in the boiler room. Here you will see another selection of insulated pipes and ducts. The ducts may be insulated outside and occasionally inside. Be watchful for interior duct insulation. Ducts usually have expansion and vibration joints which may be asbestos containing.

b. HVAC: (Heating, Ventilation, and Air Conditioning System)

1) Basic components:

Fans
Ducts
Heat exchangers
Heat source such as a boiler
Compressor or other form of chiller.

2) Operation:

Heat or cooling source
Heat exchangers
Air inlets
Air returns
Fresh make up air added- about 10%
Humidity may be added.

3) Flow Path:

Overhead
Other
Inlets: Ducted
Returns:
Ducted or
Natural building space used for Return air

4) Spreading Contamination by Air Transport:

Air transport is a major factor in spreading asbestos contamination HVAC insulating materials and flex joints frequently contain asbestos.

5) ACBM in the HVAC System:

a) May be covered with canvas, foil or paper.

b) Exterior of air ducts may be a soft friable cement board which is glued and wired onto the duct

c) Troweled on cement may be used at joints.

d) A gray white asbestos paper is sometimes glued directly on the ducts.

e) Exhaust ducts around kitchens may have a loose, fluffy spray on or troweled on amosite insulation.

f) Asbestos insulation sometimes used inside of ducts.

g) Fiberglass insulation with foil wrap is commonly used in air system ducts. Always watch out for asbestos cement tipping at hangers and joints.

h) Duct joints may be connected by flexible duct connectors. These may contain asbestos or not. A gray white fabric is almost always ACM. Black rubber may be asbestos or not. Vibration dampers connecting fan units to ducts may be of the same composition as the duct connectors.

c. Room Heat Exchangers and Duct Inlets and Returns

1) From the mechanical rooms:

a) Piping path to the room heat units:

Pipe tunnel

Pipe travel over drop ceilings, inside walls or exposed

Pipe risers to upper floors inside walls or accessible

b) Duct path to the rooms:

Is space over the drop ceiling a return air plenum?

General path?

Type of insulation?

c) Nature of the room heat exchangers:

Baseboard, radiator, blower units, etc?

Asbestos in the room heat exchangers?

Asbestos paper insulation on walls?

Asbestos pipe insulation?

Transite panel inside below or behind?

d. Electrical System:

1) Safety:

Intrusion into electrical systems is generally not done for safety reasons.

2) Electrical Applications:

a) Asbestos cloth insulation is used in older wiring service. This type of insulation is easily recognized by its woven or braided appearance, fibrous texture and gray color.

b) Asbestos transite type insulation may be used in panels transformers, motors or boxes and in any portion of the electrical system. These materials are hard gray nonfriable insulators.

c) Asbestos cement or paper may be used in older fluorescent fixtures and inside built in spotlight fixtures and ceiling or wall protrusions.

2. Ceiling Construction

a. Surfacing Materials

1) Hard plaster construction:

Support of steel mesh or wood slat - metal or wood lathing.

Base plaster coat - lime, sand and animal hair called "brown coat". The dried coating is hard cement and coarse textured.

Finish plaster "lime coat" is applied over the brown coat. This is a mixture of plaster of Paris and lime. This coating when dry is very hard and smooth.

Asbestos may be added to either the brown or finish coat plaster usually by choice of the installer.

2) Softer white troweled on cement - frequently asbestos containing and may be applied directly on lathing or over concrete or plastered ceiling.

3) The ceiling is the more likely place to encounter asbestos surfacing as compared to walls. Hallways, stairwells, under stairs and above heat sources such as boilers are more likely to have asbestos surfacing for fireproofing than rooms.

4) Plaster board is a more modern preformed plaster section which is nailed onto studs and finished with a finish coat plaster. The latest version is called sheet rock. Any of these boards or the finish plaster or taping compound may contain asbestos.

b. Ceiling tiles and panels:

1) Acoustical tiles, usually 12x12 inches may be glued onto ceilings or upper walls directly or glued onto furring strips.

2) Fixed Ceilings; In renovation, drop ceilings may be fixed ceilings of sheetrock, Acoustical tile on lathing or separate plaster ceilings. Typically in renovation such ceilings are usually more prevalent in rooms than in halls. Hall ceilings are more likely to be lay in drop ceiling panels because of the need to access mechanical components frequently found in halls.

3) The lay in drop ceiling, usually 2x4 or 2x2 ft panels laid on a metal grid. The grid is typically suspended on wires.

4) Composition: Ceiling tiles and panels have various compositions both asbestos and non asbestos containing. Cellulose and mineral wool are commonly used with or without asbestos.

c. Miscellaneous:

1) Asbestos containing paint is more likely to be present in ceilings than elsewhere. Ceiling tiles or finished surfaces may be painted with asbestos containing paint for strength or noise control.

2) Concrete ceilings are sometimes the finished ceilings in lower floors and mechanical areas. Four by eight ft panels of various compositions may be attached to the ceilings.

3) Asbestos putty may secure metal studs to surfaces.

4) Asbestos tar may exist on exterior walls.

3. Wall Construction:

a. Plaster or sheetrock of the same type as used in ceilings may be used in the wall construction.

b. Exterior and interior walls may be of different construction. Homosote and fiberboards are commonly used. Homosote is a gray fibrous, usually non asbestos board. Fiberboards are usually cellulose and rarely contain asbestos.

c. Transite asbestos panels may be used in wall construction, especially on outside walls and behind radiators or as door or window panels. Halls and some rooms may not have finish wall construction and may be cement or cinder block or poured concrete. Frequently sheet rock is added in renovation to modify rooms.

4. Floor Construction:

a. Substrate: usually concrete or board "hardwood" flooring.

b. Vinyl tile.

1) Older 9x9 inch type

2) Newer 12x12 inch tile.

3) Linoleum

4) Mastic adhesive

5) Multiple layers of floor tile or linoleum.

6) Plywood often used to cover old vinyl flooring.

5. Roof Deck Underside:

a. Spray on surfacing on steel decking and beams.

1) Easy to recognize from the gray cotton candy like appearance.

2) Detected quickly in areas with no drop ceilings or above lay in drop ceilings.

b. Roof drains may be asbestos insulated steel or made of hard asbestos cement. These may be located from outside as mentioned above.

c. Troweled on asbestos insulation may also be used in high rooms such as gyms and auditoriums. From a distance, these may appear to be concrete or plaster. It is essential to access these for close up observation.

6. Exterior Considerations

a. Underside of porticos and covered walk ways:

1) Troweled on asbestos cement

2) Asbestos transite panels.

b. On the roof

1) Evaporative cooling units

2) Fan rooms,

3) Friable materials near air intakes.

7. Windows

a. Caulk between window frame and wall

b. Glazing holding glass panes in place

Section 9-4

Supervisory Techniques

For Asbestos Abatement Activities

A. QUALIFICATIONS OF THE SUPERVISOR:

1. AHERA 5 day course

2. Knowledge of construction industry

3. Experience as an abatement worker and supervisor

4. Must thoroughly understand the regulations and the work

5. Communications skills with people

6. Basic arithmetic reading and writing skills

7. Conscientious

8. Not necessary to be the best worker

9. Good stature.

B. RELATIONS WITH OTHERS:

1. Chain of Communication and Command:

2. Subordinates

3. Superiors:

4. Public Relations:

C. EFFECTIVE COMMUNICATIONS:

1. Speak clearly

2. Face the person you are speaking to and do not look away.

3. Some friendly greeting is always in order

4. Make your subordinates feel important

a. Pay attention to their work

b. Point out some good thing before criticizing

c. Stress how important their job is

5. Make sure your subordinates understand their assignment and are properly trained and equipped for their tasks.

6. Be positive and right to the point

7. Praise good work and within the limits of authority try to reward individual performance

D. APPEARANCE

E. TRAINING OF SUBORDINATES:

1. Explain the purpose and importance of the task

2. Tell the key points

3. Demonstrate by doing the task as you explain each step

4. Watch the subordinate do the task while you guide the work

5. Review the needed steps again

6. Reinforce by the subordinates continuation of the work

7. Check the work and comment on the progress

8. The next work day, make sure the subordinate remembers the work. Repeat steps above as needed.

9. Make a record of what was taught

F. ENFORCING THE RULES:

1. Apply uniformly to subordinates with no favorites

2. Should be part of a written procedure

3. Each subordinate must be taught what the rules are

G. DISPUTES AND UNPLEASANT SITUATIONS:

1. Among subordinates

a. Call them aside separately

b. Make an equitable decision

c. Call them together as appropriate

2. Subordinate refuses a lawful order

a. First find out why he refused

b. Unless his reasons are very compelling, advise him he must do this work and that further incidents could result in disciplinary action.

c. If provided by company policy, a written warning is advised

H. IMPROPER CONDUCT INCLUDING UNSAFE CONDUCT:

1. The supervisor is responsible for bringing an immediate end to any improper conduct on the job site. It may be necessary to suspend the subordinate for the day. Any such incident should be noted in writing and given to superiors.

2. Depending on company policy, the supervisor may have the authority to dismiss a worker on site. Before dismissing an employee, at least one warning should be given in writing.

I. ROUTINE DUTIES OF THE SUPERVISOR:

Enforcing and Reinforcing the Work Practices:

1. Method:

a. Delegate duties to the work force.

b. Check personally

c. If done wrong - tell and show the right way again

d. If done right - praise

2. Report progress and results to superiors.

3. Workplace safety and security

4. Maintain all records (SEE RECORD-KEEPING in Section 9-2)

5. Make sure supplies and equipment are on hand

6. Ensure workers properly trained including fire, electrical, and other hazards peculiar to the job site. Instructions should include spill response, power failure, and emergency evacuation procedures. The workers must receive the required OSHA Hazard Communication information and training for any hazardous chemicals.

7. Inspecting the work frequently including equipment and containment integrity.

8. Seeing that proper respiratory protection and other safety equipment is used

9. Enforcing engineering controls, work practices, and personal protective equipment usage.

10. Posting signs.

11. Guarding the Work Area against unauthorized intrusion

12. Ensuring proper decontamination procedures

13. May conduct the personal and area air sampling.

14. Enforcing all other regulatory and safety practices and company policy.

15. Discouraging unsafe work practices.

Section 9-5

Contract Specifications

A. KEY TERMS

Addendum: A change in the work usually before the bid but always before the contract signing.

Change order: A change in the work after the contract signing. The is the owner's acknowledgement of extra or less work to be done which differs from the original contract. "Add-on" or "extra".

Liquidated damages: A daily penalty the contractor pays when the completion of the job is not on schedule.

Performance Spec Specifies the end result

Means and Methods Spec specifies how to do the work or what equipment to use.

To waive formalities: The building owner may waive contract requirements at his discretion. For example, the contract calls for 2 million dollars insurance and the owner allows 1 million.

Waiver of lien: Building owner may require the contractor to get the subcontractors to fill out a document acknowledging that the contractor has paid the subcontractor and there will be no building owner liability as the result of subcontractor's claims in the future.

A.I.A. American Institute of Architects: A.I.A. sells blank contract forms for construction contracts.

Unit price: The charge per given unit of work such as dollars per man hour, per square foot, etc.

B. PRINCIPAL ELEMENTS OF CONTRACT SPECIFICATIONS:

1. Bidding Instructions

Invitation to bid

Information for bidders

Submittals

Completed Bid Reply Documents

Bid bond and performance bond

Qualifications of Contractor AIA Form 305 or equivalent form.

Insurance Coverage

Proposal

List of all subcontractors to be used

2. Contract/Agreement

Definitions

Description of Work

Payment

Performance, Maintenance and Payment Bond

Time of Completion

Insurance

Guarantee

Compliance With Laws

Indemnity

Changes - Extra Work

Claims for Damages and Liens

Abandonment of the Work or Other Default

Provisions Required by Law Deemed Inserted

Permits

Not to Sublet or Assign

Employ Competent Men and Sufficient Labor and Equipment

Access to Work

Changes not to Affect Bonds

Prices for Work

Moneys May be Retained

Final Payment

Right to Alter Form, Quantity, etc. of Work

Contract Sum, Execution of Agreement

Special Conditions

3. Technical Specifications

a. Scope of work

b. Detail of Execution of Work

General Plan of Work

Time Table

Principal Regulations

Air Monitoring Program

Notifications

Submittals Prior to Commencement of Work

Site Condition

Personnel Protection

Materials, Tools and Equipment

Preparation and Maintenance of Work Areas

Right to Stop Work

Asbestos Removal and Cleanup

Final Clearance and Restoration of the Work Area

Disposal

Replacement Materials

Terminology

c. Drawings

Floor Plans

Elevations

Specifications supersede drawings when different

4. Important Things to look for in the Specifications:

Scope of work.

Unusual requirements in the execution of work which will cost more money to do.

What work is provided by others? For example: moving furniture, stored material and equipment out of the Work Area

Who provides and installs replacement materials?

Is the Walkthrough- Prebid meeting Mandatory?

Is water and electricity provided at the site?

Who pays for Air Monitoring Services? Who pays for personal air samples?

TEM vs PCM, daily monitoring requirements, etc.

Who obtains building permits and gives notifications?

Any problems shutting down electric power including receptacles and lighting fixtures?

Any problems shutting down heating, cooling and ventilating air systems?

Disposition of movable objects within the Work Area. Disposition of items like ceiling tile and carpeting.

Provisions for building or fixture damage

C. CONTRACT ADMINISTRATIVE OPERATIONS:

1. Preparation of Contract Documents by Licensed Project Designer
Required for school jobs to have a project designer associated with the project and to have a detailed written description of the abatement.

2. Bid Advertisement

a. Newspaper

b. Sent to qualified list

c. Special requirements such as bonds, mandatory walkthrough dates, special submittals and special insurance.

d. Basis for accepting or rejecting bids, for example:

Lowest responsible bid

Reject or accept any bid or part of any bid

Lowest base bid from bidder meeting requirements specified in the bid invitation

3. Document Distribution

a. Free documents

b. Pay for documents or

c. Pay with refund later when documents are returned

4. Walkthrough and Pre-bid Meeting

a. Mandatory or Optional

b. Walkthrough

1) Roster - sign in sheet

2) Distribution of documents. Get in advance if possible.

3) Should be shown all areas of the work

4) Ask questions.

5) Determine if an addendum is expected.

5. Addenda

a. May be faxed if contract says so.

b. Usually require signed response for receipt of addendum from each contractor.

6. Bid Opening

a. Public

b. Private

7. Bid Review and Qualifications Review:

8. Award

a. Agree on any add options

b. Agree on work schedule

c. Adjust contract to handle above or other items agreed upon

9. Contract signing

10. Pre-construction Meeting

a. Final Schedule

b. Deployment details

c. Other clarifications

d. Required submittals

11. Construction Phase

a. Enforcement of specifications

b. Interpretation of specifications vs any disputes or questions

12. Change Orders if Applicable at any time after the bid opening.

13. Project closeout

a. Partial payment

b. Retainage

c. Final payment

d. Conditions spelled out in the contract for final submittals

SECTION 10

TERMINOLOGY

and Selective Index

Numbered Definitions are from the DPH regulations 20-440.
Underlined definitions are from the DPH asbestos standard 19a-332a-1-16; bold caps reflect new additions and line out reflect deleted text as of 4/04

(A definition which is numbered and underlined is the same in both standards.)

AAR: (Asbestos Analysts Registry, American Industrial Hygiene Association) page 91.

AIHA: American Industrial Hygiene Association. Lab requirements for: pages: PLM 110; PCM 60.

(1) "Accredited" or "Accreditation" when referring to an individual means that an individual has successfully completed the training requirements as set forth in subsection 20-440-6(c) of these regulations or the refresher training requirements as set forth in subsection 20-441-2 of these regulations and has been issued a document of accreditation by the training provider. Accreditation is necessary in order to obtain certification by the Department.

Accredited or Accreditation (EPA): A person or laboratory is also accredited in accordance with section 206 of Title II of the AHERA Act. Specifically this lab accreditation refers to NIST Accredited. Persons who are accredited by the DPH per the above definition are also accredited by EPA under AHERA. Other DPH regulations also specify AIHA Accredited lab. To avoid confusion in this text, we specifically say "NIST Accredited", "AIHA Accredited", etc.

"Adequately wetted" means sufficiently mixed or coated with water, amended water or an aqueous solution; or the use of a removal encapsulant to prevent dust emissions;

Addendum: Change in work before the bid.

Add-Option: Optional work itemized in the bid form which may or not be done.

Aggressive Sampling: Conducting Air sampling where the air is agitated before and during air sampling according to CFR 40 Part 763, Subpart E. A one-horsepower leaf blower is used to blow off the Work Area surfaces until 5 minutes before sampling pumps are started and 20 inch fans or equivalent blowers are used during sampling. page 87.

A.I.A.: American Institute of Architects.

Airless Sprayer: page 37.

Airlock: A system for permitting ingress and egress while assuring air movement to a contaminated area from an uncontaminated area consists of 2 curtained doorways separated by a distance of at least 3 ft.

Air Monitoring: The process of measuring the fiber content of a specific volume of air in a stated period of time. See Section 5. See personal air samples, area air samples.

Alternate Work Practice (AWP): A project designer function and not detailed in this course. A variance granted by DPH allowed by Asbestos Standard.

"Amended Water" means water to which a chemical wetting agent or removal encapsulant has been added to improve penetration;

Air-Cell: Pipe insulation with a fibrous, air filled honeycomb center.

Anemometer: Air flow measuring device. page 54.

(2) "Approved training provider" means any individual or entity which satisfactorily demonstrates through application and submission of course agenda, faculty resumes, training manuals, examination materials, and equipment inventory that it meets the minimum requirements established by Sections 20-440-1 through 20-440-8 of the Regulations of Connecticut State Agencies;

Area samples: (pre-abatement, during work and finals): equipment page 66; collection pages 78, 80, 79, 84-87.

(3) "Asbestos" means the asbestiform varieties of actinolite, amosite, anthophyllite, chrysotile, crocidolite and tremolite;

(4) "Asbestos abatement" means the removal, encapsulation, enclosure, renovation, repair, demolition or other disturbance of asbestos-containing materials, but does not include activities which are related to (A) the removal or repair of asbestos cement pipe and are performed by employees of a water company as defined in Section 25-32a of the Connecticut General Statutes or (B) the removal of nonfriable asbestos-containing material found exterior to a building or structure other than material defined as regulated asbestos- containing material in 40 CFR 61, the national emission standards for hazardous air pollutants, as amended from time to time;

"Asbestos Abatement Project" means any asbestos abatement performed within a facility involving more than three (3) linear feet or three (3) square feet of asbestos-containing material;

"Asbestos abatement site supervisor" " means any ~~individual~~ **EMPLOYEE** ~~who is employed or engaged by an~~ **OF A LICENSED** asbestos contractor ~~to supervise an asbestos abatement project~~ **WHO HAS SPECIFICALLY BEEN TRAINED AS A SUPERVISOR IN A TRAINING PROGRAM APPROVED BY THE DEPARTMENT AND WHO HAS BEEN ISSUED A CERTIFICATE BY THE DEPARTMENT.** ;

"Asbestos abatement worker" means any employee of ~~an~~ **A LICENSED** asbestos contractor who engages in asbestos abatement; **HAS COMPLETED A TRAINING PROGRAM APPROVED BY THE DEPARTMENT AND HAS BEEN ISSUED A CERTIFICATE BY THE DEPARTMENT.**

(7) "Asbestos-containing material" (ACM) means material composed of asbestos of any type and in an amount greater than one percent by weight, either alone or mixed with other fibrous or nonfibrous material;

Asbestos Containing Building Material: (ACBM) Surfacing ACM, thermal system insulation ACM, or miscellaneous ACM that is found in or on interior structural members or other parts of a school building. The distinction between ACBM and ACM is that ACBM is regulated under AHERA. For example roofing with more than 1% asbestos is an ACM but not an ACBM since AHERA does not regulate roofing. The Term ACM is often loosely used to describe ACM since ACBM is of course also an ACM.

Asbestos Material/Asbestos Containing Material (ACM): A material which contains more than 1% Asbestos by EPA test Method # 600/R-93/116 (PLM). All applicable Federal regulations refer to PLM analysis as the method by which asbestos is quantified.

(8) "Asbestos consultant" means a certified and licensed individual who engages in any activity involving asbestos abatement consultation services: inspector; management planner; project designer or Project Monitor;

"Asbestos contractor" means any person or entity engaged in asbestos abatement whose employees actually perform the asbestos abatement work;

(10) "Asbestos consultation services" means the inspection or evaluation of a facility for asbestos hazards, including, but not limited to, the development of asbestos abatement plans, site inspections, air monitoring and the provision of industrial hygiene services related to asbestos abatement;

Asbestosis: pages 16-18.

ASTM: American Society for Testing and Materials: ASTM E 1368. Guidance on visual inspection at the completion of asbestos abatement not included with this manual, but with the Project Monitor Manual.

Authorized Person: Properly trained and equipped persons who are:
1) Employed by the asbestos contractor or consultant or
2) Other persons representing or working for the owner, consultant and / or asbestos contractor who may be tradesman doing class IV work or for other valid reasons.
3) Federal, State or local inspectors.

AWP: See alternate work practice.

Base Bid: The price bid for work that is in the Scope of Work but not including any add options.

Bid Opening: The deadline for bids to arrive at a specified location, and the time the bids are to be opened after.

Cassette: air monitoring filter assembly. page 67.

Category 1 (NESHAP) non-friable asbestos means resilient flooring, asphalt roofing, gaskets, and packings > 1% asbestos by PLM. page 96

Category 2 (NESHAP) non-friable asbestos means any other non-friable material with > 1% asbestos by PLM. page 96

(13) "Certificate" means a document issued by the department indicating that the individual has satisfied training requirements and any other applicable requirements of the department;

(14) "Certified" or "Certification" when referring to an individual means that a certificate has been issued by the department under the provisions of Sections 20-4401 through 20-440-8 of the Regulations cf Connecticut State Agencies to an individual upon successful completion of an approved training or refresher training course, the receipt of a document of accreditation issued by the training provider and the fulfillment of any other requirements of the department. Certification is required for employment as either an asbestos abatement worker or asbestos abatement site supervisor and is a condition for licensure as an asbestos consultant. Asbestos consultant disciplines for which certification may be issued include: inspector, management planner, project designer and Project Monitor;

Celsius: °C = degrees Celsius. Temperature scale formerly known as Centigrade. To convert from Celsius to Fahrenheit: °F = (1.8) (°C) + 32; To convert from Fahrenheit to Celsius:
°C = (°F-32) (0.56);
deg Kelvin = deg Celsius + 273

CFM: Cubic feet per minute. Volume moving past a reference point per unit time. HEPA vacuum page 36; calculation page 52; PAPR page 20; supplied air page 22; see also SCFM.
and negative air

Change order: A change in the work after the contract signing. The is the owner's acknowledgement of extra or less work to be done which differs from the original contract. "Add-on" or "extra".

Cilia: Hair-like projections that line the bronchial tubes.

Class I Work, Class II Work, Class III Work, Class IV Work:
OSHA page 103.

Clean Room: = Clean change room. An uncontaminated area or room which is a part of the Worker Decontamination Enclosure with provisions for storage of worker's street clothes and protective equipment. See Decon.

(15) "Commissioner" means the commissioner of the Connecticut Department of Public Health;

Crawl space: A confined space, usually at basement or attic level, where one can't normally stand erect.

Competent Person: Page 120.

CONES: Consortium of North East States: CT, MA, VT, ME, RI, NH, NY, and NJ. page 140.

Critical Barrier: The last layer of plastic sheeting separating Work Areas from non Work Areas. page 40.

Curtained Doorway: A device to allow passage from one room to another while permitting minimal air movement between the rooms, typically constructed by placing two overlapping sheets of plastic over an existing or temporarily framed doorway, securing each along the top of the doorway, securing the vertical edge of one sheet along one vertical side of the doorway, and securing the vertical edge of the other sheet along the opposite vertical side of the doorway. Two curtained doorways spaced a minimum of six (6) feet apart form an Airlock.

Decon or Decontamination Enclosure System: A series of connected rooms, with Curtained Doorways between any two (2) adjacent rooms, for the decontamination of workers and of materials and equipment. A Decontamination Enclosure System always contains at least one Airlock. Construction pages 37, 41, The hand-outs; entry and exit-OSHA pages 44, DPH pages 106, 131.

Demarcation including Signs: OSHA page 103.

Demolition (NESHAP) means any work involving taking out load supporting building members or intentional burning.

Demolition (DPH) means the wrecking or taking out of any load-supporting structural member of a facility ~~and any related razing, removing or stripping of asbestos~~ **TOGETHER WITH ANY RELATED HANDLING OPERATIONS OR THE INTENTIONAL BURNING OF ANY FACILITY**

DEP: CT Dept of Environmental Protection

DPH: or (16) "Department" means the Connecticut Department of Public Health.

DOT: US Department of Transportation

(17) EPA means the United States Environmental Protection Agency.

Electrical Safety: page 143, 84; lockout 42; OSHA variance for water infeasibility 45.

"Emergency Asbestos Abatement Project" means an asbestos abatement project which was not planned but results from a sudden unexpected event. This includes operations required by non-routine failures of equipment;

Emergency response: pages 49-51.

Encapsulant, Encapsulation: pages 11-12

Enclosure, to enclose: A method. An asbestos abatement option involving surrounding ACM with an airtight barrier. pages 12,14.

Enclosure (s): Synonym for Containment. Also refers to the abatement Work Area containment system which includes plastic enclosures such as the worker decontamination enclosure, the equipment decontamination enclosure, the Work Area enclosure.) See also negative pressure enclosure, mini-enclosure. Throughout Section 4.

Equipment Decontamination Enclosure: That portion of a Decontamination Enclosure System (Decon) designed for controlled transfer of materials and equipment, typically consisting of a Washroom and a Holding area. See Decon.

Equipment Room: A contaminated area or room which is part of the Worker Decontamination Enclosure with provisions for storage of contaminated clothing and equipment. See Decon.

Excursion Limit: (EL) OSHA 30 minute exposure standard of 1.0 fibers/cc.

(18) "Facility" means the interior and exterior of any private or public building or structure including but not limited to those used for institutional, residential (including single family homes), commercial or industrial purposes and vessels while ashore or in dry dock;

(19) "Facility owner" means the person having title to the facility. For purposes of publicly owned property only, the facility owner shall be defined to be the chief executive officer of the federal, state or municipal agency which owns or controls the use of the facility;

Fibrous Aerosol Monitors (FAM): page 66

Final Clearance: (final reoccupancy testing): Preparation for pages 59-60.
pages 169-171; failed pages 61, 90; PCM criteria page 60; TEM criteria page 60; sampling methods 85-88.

Fixed Object: A unit of equipment or furniture in the Work Areas which cannot be removed from the Work Area. page 39.

Friable ACM: EPA- An Asbestos Material that can be crumbled, pulverized or reduced to powder when dry by hand pressure and which releases Asbestos fibers into the environment.

(20) "Friable asbestos-containing material" means any asbestos-containing material that hand pressure can crumble, pulverize, or reduce to powder when dry and non-friable asbestos-containing material that potentially can be broken, crumbled, pulverized or reduced to powder as a result of asbestos abatement.

Flooring ACM: pages 8, 118, 171.

Glovebag: Pre-fabricated plastic formed around pipes for asbestos repair. pages 61-64, 117, 132.

"Glovebag" means a manufactured polyethylene bag type of enclosure with built-in gloves, such as is placed with an air-tight seal around asbestos- containing material and which permits the asbestos-containing material contained by the bag to be removed without releasing asbestos fibers to the atmosphere;

Health and Safety Plans: pages 125-128.

Heat related disorders: 146-147.

HEPA Filter: A high efficiency particulate air (HEPA) filter in compliance with ANSI Z9.2-1979. pages 35, 52.

HEPA Vacuum Equipment: Vacuum equipment with a HEPA filter system for filtering the air effluent from the unit. pages 35-7 and 58.

(21) "High-efficiency particulate air (HEPA)" means a filtering system capable of trapping and retaining at least 99.97 percent of all monodispersed particles 0.3 micrometer in diameter or larger;

Holding Area: A chamber in the Equipment Decontamination Enclosure located between the Washroom and an uncontaminated area. The Holding area comprises an Airlock. See Decon.

(22) HVAC means heat, ventilation and air conditioning; pages 8, 42, 59.

(23) "Individual" means any human being;

(24) "Inspector" means any licensed individual who identifies, assesses the condition of, or collects bulk samples of suspected asbestos-containing material;

Kelvin: °K = Absolute temperature scale. 0°K is absolute zero and is the theoretical temperature in outer space. deg Kelvin = deg Celsius + 273.

Ladder safety: page 143.

Latency Period: pages 15-16.

LEA: Local Education Agency:

Lead: Dust on asbestos jobs: page 149; lead compliance plan page 125.

(25) "License" means a document issued by the department authorizing an asbestos contractor to engage in asbestos abatement work or an asbestos consultant to engage in any activity directly involved with asbestos consultation services. Licensure shall be restricted pursuant to the limitations of each discipline.

Liquidated damages: A penalty, usually daily, the contractor pays when the completion of the job is not in compliance, usually because it is not on schedule. page 177

Lock-down: Final spray after abatement using an encapsulant. page 48; interference in air samples pages 59, 61, 76, 88.

Lung Cancer: pages 15-19.

(26) "Management planner" means any licensed individual who uses data gathered by asbestos inspectors to assess asbestos hazards, determine-responses and develop implementation plans;

Manometer: pressure/flow measuring device. page 53, measuring negative air flow page 74; OSHA requirement page 117.

Magnahelic[R] Gauge pressure/flow measuring device. page 53

Man-Made Mineral Fibers: page 19.

MCE: Mixed cellulose ester. Polymer used for air sampling filters.

Medical Surveillance: OSHA requirements pages 108, 109, 128.

Mercury: Toxic liquid element used in fluorescent lights, thermometers, barometers (atmospheric pressure gauges) and elsewhere. page 147; see mm of mercury for atmospheric pressure measurement.

mm: Millimeter. 0.001 meter.

mm of mercury atmospheric pressure page 71. (mm of mercury) (0.565) = inches of water.

Mesothelioma: Rare form of cancer. pages 15-18.

Mini-Enclosure or Mini-Containment: A small full containment. pages 40, 120

Miscellaneous Material: ACM or ACBM other than surfacing or TSI, such as transite, floor and ceiling tiles, roofing, mastics, tars, putties, glues, caulks, preformed sheets, paint, transite and electrical wiring pages 8-9, 171, sampling page 110.

Movable Object: A unit of equipment or furniture in the Work Area which can be removed from the Work Area.

MSDS: Material Safety Data Sheet. page 122-124.

Negative Air Units or Negative Pressure Exhaust Ventilation: A portable local exhaust system equipped with HEPA filtration used to create negative pressure in a contaminated area (negative with respect to adjacent uncontaminated areas) and capable of maintaining a constant discharge of filtered air outside and creating suction so that air flow direction moves from uncontaminated areas into the Work Areas. pages 54-56, 131. certification 161; measuring flow pages 55, 74; locations page 57; monitoring 57; cleanup page 47; troubleshooting finals page 90.

Negative initial exposure assessment: pages 113-115.

Negative Pressure Enclosure = or negative pressure containment): pages 116-117 and scattered throughout.

Negative Pressure Respirators: pages 24, 108 scattered in section 3.

(27) "NESHAP" asbestos regulations (40 CFR 61, Subpart M) means National Emission Standard for Hazardous Air Pollutants;

NIST (NIST/NVLAP): National Institute of Standards and Technology/National Voluntary Laboratory Accreditation Program. Accredits labs for PLM and TEM.

NIOSH: National Institute for Occupational Safety and Health.

NIOSH 582: Required 5 day training course for PCM analysts.

NIOSH 7400 method: pages 86, 60, 73, 76, 78, 82, 84.

(28) "Non-friable asbestos-containing material" means any asbestos-containing material that hand pressure cannot crumble, pulverize or reduce to powder when dry; See also Category 1, 2.

Notification: DPH/EPA pages 96-97, 129-130; OSHA requirements pages 117.

O&M: Operations and Maintenance pages 12, 120; records page 164.

(29) **OSHA** means the Occupational Safety and Health Administration of the United States Department of Labor;

OSHA Method ID-160: Microscopic method that only counts asbestos fibers, (Same as the method in Appendix B of 1926.1101) may be used for samples other than final samples. pages 73, 76, 78, 82, 90, 104, 121, 159.

PACM: Presumed ACM (OSHA) page 103, 110 and throughout the text.

PAPR: Powered air purifying respirator. pages 20-24, 105.

PAT: Proficiency Analytical Testing program. See AIHA.

PCB'S: Polychlorinated biphenyls. Highly toxic oils used in transformers and fluorescent light ballasts. Ballasts or transformers which do not say "PCB free" should be treated as PCB containing. Must be disposed of as Hazardous Waste; contact DEP for a list of Licensed Hazardous Waste contractors to be contacted for disposal instructions.

PCM: Phase contrast microscopy. See NIOSH 7400.

Permissible Exposure Limit (PEL): for asbestos OSHA Standard. The employer must ensure that no employee is exposed to an airborne concentration of Asbestos, tremolite, anthophyllite, actinolite, or a combination of these materials in excess of the PEL of 0.1 fibers per cubic centimeter of air as an eight (8) hour time weighted average (TWA), or in excess of 1 fiber/cubic centimeter as a 30- min excursion limit as determined by the method prescribed in Appendix A to OSHA Regulations 29 CFR 1926.1101, or by an equivalent method. (See TWA). PEL's exist for other substances and are listed in CFR 29 1910.1000, subpart Z.

(30) "Person" means any individual, corporation, partnership, firm, association, sole proprietorship, the State of Connecticut or any of its political subdivisions, or any other entity;

Personal Samples: Air samples collected in breathing zone. pages 78-83, equipment page 65; collection 78-83; charging 81; records 81, 161; calculation of TWA 89; sampling required 104; two required field blanks page 73.

Photohelic^{R} gauge: page 53

Plasticize: To cover floors and walls with plastic sheeting as specified in the DPH regulations, Section 4.

PLM: Polarized light microscopy. The method used for determining if materials are asbestos containing. More than 1% asbestos found by this method proves a material is ACM under all the asbestos regulations.

Poly: Short for polyethylene (plastic) sheet.

PPE: personal protective equipment

Protection factor (respirator): calculation page 23.

(31) "Project designer" means any licensed individual who determines how asbestos abatement work should be conducted and who prepares for purposes of an abatement project, plans, designs, procedures, workscope or other substantive direction or criteria;

(32) "Project monitor" means any licensed individual who functions as an on-site representative of the facility owner or other persons by over-seeing the activities of the asbestos abatement contractor.

PSIG: Pounds per square inch gauge pressure. Gauge pressure automatically zeros out the normal atmospheric pressure of about 14.7 PSI or about 760 mm of mercury. Compressor and supplied air pages 21-22.

RACM: NESHAP regulated ACM. page 96.

Records: DPH required page 130; OSHA record retention page 109; air sampling & calculations pages 72, 80; combined DPH/EPA/OSHA pages 159-164; AHERA/O&M page 164; recordkeeping forms- The hand-outs.

Regulated Area: OSHA Page 103-104.

Removal: An asbestos abatement option which means stripping 3 sq ft or 3 lin ft or more of ACM from surfaces, waste transportation and waste disposal at an acceptable site. pages 12-13; procedures 39-61.

"Removal" means the taking out or stripping of any asbestos-containing materials from surfaces or structural components of a facility;

Renovation (NESHAP) means altering a facility component in any way including stripping of asbestos.

"Renovation" means altering, in any way other than demolition, one or more structural components. Operations in which load-supporting structural members are taken out are excluded;

Repair: Returning < 3 sq ft of damaged ACBM to an undamaged condition or to an intact state so as to prevent fiber release. pages 61, 103, 120. See also glovebag and O&M.

"Repair" means the restoration of damaged asbestos-containing material; including but not limited to the sealing, patching, enclosing or encapsulating of damaged asbestos-containing material to prevent fiber release;

Respirator: A device used to protect against inhalation hazards. See Section 3.

(33) "Response action" means a method, including removal, encapsulation, enclosure, repair and operation and maintenance that protects human health and the environment from ACM;

Roofing: pages 118-119; 151-153; installation dates page 10; critical barriers 42; a Category 1 material page 96;

Rotometer: flow measuring device. pages 54, 65-66; calibration 68-72.

Scaffold safety: pages 144-145.

SCFM: Standard cubic feet per minute. CFM corrected to standard conditions of pressure and temperature, i.e., 760 mm of mercury and 70 degrees F. page 54; see also CFM.

School: Any elementary or secondary school as defined in section 198 of the Elementary and Secondary Education Act of 1965 (20 U.S.C. 2854). AHERA pages 93-94; DPH pages 133, 140; Finals pages 60,75,76,78; abatement records pages 159-164; see also O&M. (see school building).

School Building:

1. Any structure suitable for use as a classroom, including a school facility such as a laboratory, library, school eating facility, or facility used for the preparation of food.

2. Any gymnasium or other facility which is specially designed for athletic or recreational activities for an academic course in physical education.

3. Any other facility used for the instruction or housing of students or for the administration of educational or research programs.

4. Any maintenance, storage, or utility facility, including any hallway, essential to the operation of any facility described in this definition of School Building under paragraphs (1), (2), or (3).

5. Any portico or covered exterior hallway or walkway.

6. Any exterior portion of a mechanical system used to condition interior space.

Shower Room: A room between the Clean Room and the Equipment Room in the Worker Decontamination Enclosure with hot and cold or warm running water and suitably arranged for complete showering during decontamination. The Shower Room comprises an Airlock between contaminated and clean areas. Procedure pages 24-5, 33; OSHA 41, 106, during finals 60; remote 106; exceptions 108. See also Decon.

Soap Bubble Flow Meter: Primary calibration standard. pages 70-71.

Synergistic effect: Combination of more than one hazard multiplies the risk of disease.

(34) "Spot repair" means any asbestos-abatement activity involving not more than three (3) linear feet or three (3) square feet of asbestos-containing material;

Static pressure: pages 53, 54.

Stripping: Taking of Asbestos materials from any surface.

"Structural Component" means any pipe, duct, boiler, tank, reactor, turbine, furnace or other component at or in a facility or any structural member of a facility;

"Structural Member" means any load-supporting member of a facility such as beams and load-supporting walls or any non-load supporting member, such as ceilings and non-load supporting walls;

Supplied air respirator: pages 20-23,50. Class I work pages 105,116; carbon monoxide 148.

Surfacing Material: Material in a building that is sprayed-on, troweled-on, or otherwise applied to surfaces, such an acoustical plaster on ceilings and fireproofing materials on structural members, or other materials on surfaces for acoustical, fireproofing, or other purposes. Includes sheetrock. 5, 8, 10, 13, 103, 110, 117, 170, 172. See OSHA Class I.

Surfactant: A soap. A chemical wetting agent added to water to improve penetration. See amended water. pages 37, 62.

Transite: Hard gray ACM sheet or tubing. pages 8, 9, 13; exterior removal pages 118, 169, 170, 171.

TEM: Transmission Electron Microscopy: see also final clearance. pages 75-76, 60,74,78; cassettes 67; finals 86, 100; NIST 164.

TSI = Thermal System Insulation: Material in a building applied to pipes, fittings, boilers, breeching, tanks, ducts or other interior structural components to prevent heat loss or gain, or water condensation, or for other purposes.

(35) **"TSCA"** means Title II of Toxic Substance Control Act, 15 U.S.C. 2641 et seq. page 21

TWA: Time weighted average: calculation page 189.

Type C respirator: (see Supplied air respirator)

Unit price: The charge per given unit of work such as dollars per man hour, per square foot, etc.

Vaneometer: Sensitive air flow measuring device page 54.

Variances: See wet cleaning, alternate work practices, exemptions.

Velocity pressure: page 53.

"Visible Residue" means any debris or dust on surfaces in areas within the enclosed work area where asbestos abatement has taken place and which is visible to the unaided eye. All visible residue is assumed to contain asbestos;

Washroom: A room between the Work Area and the Holding Area in the Equipment Decontamination Enclosure with provisions for storage of contaminated clothing and equipment. Synonym of shower.

Waste Disposal: pages 38,95,98,142.

Wet Cleaning, Wet Methods: The process of eliminating Asbestos contamination from building surfaces and objects by using cloths, mops, or other cleaning tools which have been dampened with amended water, and by afterwards disposing of these cleaning items as Asbestos contaminated waste.

"Work Area" means the specific area or location where the actual asbestos abatement work is being performed or such other areas of a facility which the Commissioner determines may be hazardous to public health as a result of such asbestos abatement.

Work Area: An area where Asbestos Abatement operations are performed which is isolated by physical boundaries to prevent the spread of Asbestos dust, fibers, or debris; Designated rooms, spaces, or areas of the project in which Asbestos Abatement actions are to be undertaken or which may become contaminated as a result of such Abatement actions. A contained Work Area is an area which has been sealed, plasticized, and equipped with a Decontamination Enclosure System. See regulated area.

Worker Decontamination Enclosure System: That portion of a Decontamination Enclosure System designated for controlled passage or workers, and other personnel and authorized persons; typically consisting of a Clean Room, a Shower Room, and an Equipment Room. See Decon.

CHEM SCOPE ASBESTOS CONTRACTOR/SUPERVISOR TRAINING
Updated 4/2/10

ASBESTOS 8 HOUR REFRESHER TRAINING COURSE OUTLINE

Times	Topics
8:00AM - 9:00 AM	Registration and Introduction including student sharing
9:00AM - 9:05 AM	Break
9:05AM - 10:15 AM	Review and discussion of changes in and interpretation of applicable state and federal laws, regulations, policies and guidelines
10:15AM-10:20 AM	Break
10:20AM-11:00 AM	Review and discussions of changes, developments or changes in state-of the art procedures and equipment
11:00AM-11:05 AM	Break
11:05AM-12:00 PM	(MAIN) Review of key areas of initial training specific to each disipline (this is done with unique hands on excersizes including assignments, crossword puzzles, interactive games such as “Are you smarter than your class mates”, picture field trips with discussions, videos from recent job sites, purchased videos, youtube videos, “field-trips” to job sites when appropriate and safe for the students, review of recent training center emails on important topics, discussion of interesting, challenging situations participants have encountered. Discussion of unique regulatory interpretations from CT DPH, EPA and OSHA that participants have encountered.
12:00PM-1:00PM	Lunch
1:00PM-2:00PM	(MAIN) Review of key areas of initial training specific to each disipline (this is done with unique hands on excersizes including assignments, crossword puzzles, interactive games such as “Are you smarter than your class mates”, picture field trips with discussions, videos from recent job sites, purchased videos, youtube videos, “field-trips” to job sites when appropriate and safe for the students, review of recent training center emails on important topics, discussion of interesting, challenging situations participants have encountered. Discussion of unique regulatory interpretations from CT DPH, EPA and OSHA that participants have encountered.
2:00PM-2:05PM	Break
2:05PM-2:35PM	(MAIN) Review of key areas of initial training specific to each disipline (this is done with unique hands on excersizes including assignments, crossword puzzles, interactive games such as “Are you smarter than your class mates”, picture field trips with discussions, videos from recent job sites, purchased videos, youtube videos, “field-trips” to job sites when appropriate and safe for the students, review of recent training center emails on important topics, discussion of interesting, challenging situations participants have encountered. Discussion of unique regulatory interpretations from CT DPH, EPA and OSHA that participants have encountered.
2:35PM - 3:05PM	Course review typically done with a game called Jeopordy and is specific to the course discipline
3:05PM - 3:10PM	Break
3:10PM - 4:00PM	Examination, exam correction and course evaluation

CHEM SCOPE
40 HOUR INITIAL TRAINING: ASBESTOS CONTRACTOR/SUPERVISOR

COURSE PROGRAM
UPDATED 9/13/00

DAY #1

TIME		**TOPIC**
7:45- 8:00 AM		REGISTRATION
8:00-8:30		PRE-COURSE QUIZ COURSE INTRODUCTION AND OVERVIEW
8:30- 10:00		INTRODUCTION TO ASBESTOS ABATEMENT PROCEDURES AND REGULATIONS
10:00-10:15	BREAK	
10:15-11:30		PHYSICAL PROPERTIES AND POTENTIAL HEALTH EFFECTS PERSONAL HYGIENE AND MEDICAL SURVEILLANCE
11:30-12:00	LUNCH	
12:00-2:00		RESPIRATORY PROTECTION
2:00-2:15	BREAK	
2:15-4:00		RESPIRATORY PROTECTION (cont) HANDS ON PERSONAL PROTECTION SESSION RESPIRATOR FIT TESTING AND CARE. PROTECTIVE EQUIPMENT.

CHEM SCOPE ASBESTOS CONTRACTOR/SUPERVISOR TRAINING
Updated 4/2/10

CHEM SCOPE
40 HOUR INITIAL TRAINING: ASBESTOS CONTRACTOR/SUPERVISOR

COURSE PROGRAM
UPDATED 9/13/00

DAY #2

TIME		**TOPIC**
8:00-9:45		EPA, AHERA, NESHAP, WORKER PROTECTION RULE
9:45-10:00	BREAK	
10:00-11:00		OSHA REGULATIONS
11:00-12:00		STATE OF CONNECTICUT REGULATIONS OTHER STATE REGULATIONS DOT REGULATIONS
1200-12:30	LUNCH	
12:30-2:00		BEST AVAILABLE TECHNOLOGY (BAT) WORK PRACTICES ASBESTOS EQUIPMENT. INTERIOR ABATEMENT. SETTING UP THE DECONTAMINATION UNIT AND THE WORK AREA.
2:00-2:15	BREAK	
HANDS ON SESSIONS:		
2:15-4:00		BEST AVAILABLE TECHNOLOGY WORK PRACTICES; HANDS ON: DON PROTECTIVE GEAR AND SET UP AND CALIBRATE PERSONAL AIR SAMPLES SET UP OF ROOM WORK AREA BEGINS, PRECLEANING AND NEGATIVE AIR PLACEMENT

CHEM SCOPE ASBESTOS CONTRACTOR/SUPERVISOR TRAINING
Updated 4/2/10

CHEM SCOPE
40 HOUR INITIAL TRAINING: ASBESTOS CONTRACTOR/SUPERVISOR

COURSE PROGRAM
UPDATED 9/13/00

DAY #3

TIME	**TOPIC**
HANDS ON SESSIONS ALL DAY WITH ACCOMPANYING TEACHING WITH INTERMITTENT BREAKS FULL CONTAINMENT AND GLOVEBAG USE. SIMULATED ASBESTOS PIPE INSULATION ON BASEMENT OR GARAGE PIPES.	
8AM-10 AM	COMPLETION OF SET UP HANDS ON SET UP DECON UNIT
10:00-10:15 BREAK	CRITICAL BARRIERS, FLOOR AND WALL POLYETHYLENE
10:15-12:00	COMPLETION OF WORK AREA SET STRIPPING OF SIMULATED ACM WORKER AND EQUIPMENT DECONTAMINATION. PERSONAL AIR SAMPLING. OTHER HAZARDS BESIDES ASBESTOS.
12:00-12:30 LUNCH	
12:30-4 PM	WORK PRACTICES FOR ASBESTOS ABATEMENT.
2:00-2:15 BREAK	CLEAN UP AND DISPOSAL
2:15-4:00	INSPECTION OF THE WORK AREA FINAL AIR CLEARANCE BREAK DOWN OF EQUIPMENT

CHEM SCOPE ASBESTOS CONTRACTOR/SUPERVISOR TRAINING
Updated 4/2/10

CHEM SCOPE
40 HOUR INITIAL TRAINING: ASBESTOS CONTRACTOR/SUPERVISOR

COURSE PROGRAM
UPDATED 9/13/00

DAY #4

TIME		**TOPIC**
8:00-10:00		ROOFING AND FLOOR TILE ASBESTOS ABATEMENT: PROCEDURES AND PRACTICES
10:00-10:15	BREAK	
10:15-11:30		ADDITIONAL HAZARDS BESIDES ASBESTOS.
11:30 - 12:00	LUNCH	
12:00-2:15		EPA TRAINING/ SLIDE PRESENTATION AND GROUP DISCUSSION
2:15-2:30	BREAK	
2:30-4:00		VCR PRESENTATION AND SLIDES DECONTAMINATION UNITS

CHEM SCOPE ASBESTOS CONTRACTOR/SUPERVISOR TRAINING
Updated 4/2/10

CHEM SCOPE
40 HOUR INITIAL TRAINING: ASBESTOS CONTRACTOR/ SUPERVISOR
COURSE PROGRAM
UPDATED 9/13/00

DAY #5

TIME		**TOPIC**
8:00-8:45		INSURANCE AND LIABILITY ISSUES
8:45- 9:30		RECORD KEEPING
9:30-10:00		ADVANCED TRAINING ON ABATEMENT CALCULATIONS AND PROCEDURES
10:00 - 10:15		BREAK
10:15-10:45		EFFECTIVE SUPERVISION AND SUPERVISORY TECHNIQUES
10:45-11:30		CONTRACT SPECIFICATIONS
1130-12:00	LUNCH	
12:00-1:45		HANDS ON PLANNING WORKSHOP. THE EXERCISE INCLUDES: STARTING FROM A SPECIFICATION, PLAN THE WORK AREA SET UP AND WORK FORCE DEPLOYMENT. COMPLETE NOTIFICATION FORMS, SITE LOGS, WASTE MANIFEST AND OTHER RECORDS. COLLECT PERSONAL AND AREA SAMPLES AND COMPLETE THE SAMPLE PAPERWORK.
1:45-2:00	BREAK	
2:00-2:45		COURSE REVIEW
2:45-4:00		EXAMINATION