NYS/AHERA
ASBESTOS INSPECTOR
TRAINING MANUAL

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CHAPTER 1

Asbestos History and Types

Historical Perspective

Asbestos is a naturally occurring mineral silicate, mined from the earth's ore similar to iron and copper. The word "asbestos" is derived from a Greek adjective meaning inextinguishable. This magic mineral as it was called is due its ability to withstand heat and its soft pliant properties. Early uses show the Romans using it for candle wick, the Egyptians using it for mummification. While travelling to China, Marco Polo described observing miraculous garments that were cleaned by being placed in fires. These garments were without a doubt made from asbestos.

Until its re-emergence in the 19th century, asbestos use was limited and received little attention. In the 1860's during the Industrial Revolution asbestos use became more widespread. The first commercial mine was developed in Quebec, Canada with extensive deposits being discovered. Being cheap to mine and found in abundant quantities, add to that the remarkable heat and chemical resisting properties asbestos use exploded in the US during World War II.

Since the turn of the century, annual production increased from 400,000 tons to 3.5 million tons at its height of production in the late seventies. After the end of WWII the asbestos manufacturers diversified its use to over 3000 different commercial products. Such products were thermal system insulation, floor tiles, roofing tars, asbestos cement "transite" products, brake and clutch lining to name a few. Estimates indicate that more than half of the large multi-story buildings constructed in the 1950 – 1970s contained spray applied asbestos containing materials. Asbestos use in the United States started to decline in the mid 1970s when EPA bans on spray applied asbestos fireproofing were established.

Health Effects

Asbestos fibers have some unique health effects on people. Of all the compounds capable of producing an adverse effect on the human body, asbestos may have a longer latency period between exposure and the subsequent appearance of disease than any other substance. For example, certain types of cancers that develop from asbestos exposure may not appear until forty years after the exposure occurred. The adverse health effects from asbestos exposure were first described in the early 1900's. Nevertheless, widespread concern about asbestos developed only recently because of the health problems that have emerged among people who were heavily exposed during and immediately after World War II. In addition to several types of cancer, asbestos can cause damage to the lungs in a way different from exposure to other materials. Individuals vary considerably in their ability to withstand the diseases associated with asbestos exposure.

Prior to 1900

In the first century AD, Pliny the elder, the Roman Naturalist and Strabo, the Greek geographer wrote of sickness and untimely death among slaves involved in the weaving of asbestos cloth.

Early 1900s

A London doctor H. Montague Murray conducted a post mortem exam on a young asbestos factory worker who died in 1899. Dr Murray gave testimony on this death noting confirmation of the presence of asbestos in the lung tissue, expressing an expert opinion his belief that the inhalation of asbestos dust had at least contributed to, if not actually caused the death of the worker.

1920s - 1930s

In 1924 Dr W.E.Cooke, a British pathologist documented the case of a 33 year old asbestos textile worker who died of fibrosis of the lungs, indicating that scar tissue in her lungs contained a large quantity of asbestos fibers.

In 1927 Dr Cooke named the physical scarring of lung tissue “Asbestosis”. In 1930, the major asbestos company Johns Manville produced a report for internal company use only reporting on asbestos worker fatalities in their facilities. In 1933 Metropolitan Life Insurance Co doctors found that 29% of workers in a John Manville plant had asbestosis. 1934 saw Johns Manville and Raybestos-Manhattan another large asbestos manufacturer edit and downplay the dangers of asbestos exposure.

Late 1930s – Early 1940s

Asbestos exposure was linked to lung cancer in American and British journals. It was then classified as a carcinogen. In 1944, a Met Life Company report found 42 cases of asbestosis among 195 asbestos miners.

1960s

In the 1960s, thirty – three cases of Mesothelioma were reported in South Africa. Mesothelioma is a rare and virtually incurable cancer of the lung or stomach lining. All but one of the patients had occupational exposure to asbestos or lived in an asbestos mining area.
In 1964 a mortality study by Dr. Irving J. Selikoff of Mount Sinai Medical School reveals high rates of lung cancer, mesothelioma and asbestosis among US insulation workers. Afterwards, the first warnings about asbestos fibers appear on cartons of insulation products. "Inhalation of asbestos in excessive quantities over long periods of time may be harmful," the alert says.
In 1968 Johns-Manville puts warnings on bags of asbestos in 1968

Regulations

Timeline

- In 1970 The Occupational Safety and Health Act creates an exposure limit of 5 fibers per cubic centimeter of air.
- In 1973, a federal jury awards some $79,000 to Clarence Borel, an insulation worker who dies from mesothelioma the same year. Meanwhile the EPA bans the spraying of asbestos for fireproofing and insulation.
- In 1980 Johns –Manville has been named as a defendant in nearly 5,000 claims brought by 9,300 plaintiffs. The company would file for bankruptcy under Chapter 11 as the firm is hit with approx 11,000 lawsuits over a 2 year span
- In 1983 Maryland becomes the first state with a law governing asbestos removal companies.
- In 1984 the EPA Asbestos School Hazard Abatement Act is enacted which sets up programs providing loans and grants to schools to finance abatement projects.
- 1985 Local law 76 of New York City becomes law setting some of the most stringent asbestos abatement requirements in the nation
- 1987 The Asbestos Hazard Emergency response Act is promulgated requiring every school in the country (K – 12) to inspect their buildings for asbestos, document the results, and institute a plan for managing in place asbestos. NYS Code Rule 56 becomes law.
- 1989 the EPA Ban and Phase Out Rule is promulgated
- 1991 NYC Local Law 76 becomes Title 15 Chapter 1. Also most of the EPA Ban and Phase Out Rule was vacated after EPA lose a lawsuit with asbestos manufacturers. From the original ban, only 6 categories of asbestos materials remain banned.

- 1999 extensive cleanup operations began in Libby, Montana due to asbestos contaminated vermiculite including the former W. R. Grace Processing facilities, several Libby schools, and a few residences.
- 2000 hundreds of people in Libby, including former mine workers, their families and other residents, have exhibited signs and symptoms of asbestos related disease. The federal Agency for Toxic Substances and Disease Registry (ATSDR) conducted medical testing for residents and observed pleural abnormalities in 18% of the people who participated. ATSDR also found that mortality in Libby from asbestosis was 40 – 80 times higher than expected, and mortality from lung cancer was 20 – 30 % higher than expected. The Libby site was added to EPA's National Priorities List (NPL) in 2002.

Picture of asbestos fibers

Identification of Asbestos

Categories

According to EPA, Asbestos Containing Material (ACM) is defined as any material that contains greater than 1% asbestos by Polarized Light Microscopy (PLM). ACM is classified into three different categories:

I. Thermal System Insulation
II. Surfacing Material
III. Miscellaneous Material

Thermal System Insulation

Insulation used to prevent heat loss or gain or prevent condensation on pipes, boilers, tanks, ducts, and various other components of hot and cold water systems and heating, ventilation, and air conditioning (HVAC). Examples include pipe lagging, block, batt, and blanket insulation;

Surfacing material

Spray applied or troweled on applications on walls, ceilings and structural members. Other examples include for acoustical, decorative, or fireproofing purposes.

Miscellaneous Materials

Any ACM that does not meet the TSI or SM definition. Examples include floor tiles, gaskets, asbestos cement (transite) products, adhesives, roofing felt outdoor siding and fabrics

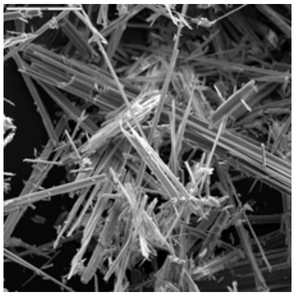
Asbestos Types

The asbestos mineral is categorized in six types and two distinct groups.

Serpentine Asbestos (snake-like structure)

I. Chrysotile

Amphibole Asbestos (needle like structure)



II. Amosite
III. Crocidolite
IV. Tremolite
V. Actinolite
VI. Anthophyllite

Chrysotile is the most common type of asbestos found, with approximately 95% of all asbestos found in buildings in the US. Chrysotile is commonly known as “white asbestos”, so named for its natural color. The majority of asbestos products are chrysotile.

Amosite (brown asbestos) heads up the amphibole class was discovered in South Africa, and is named as an acronym from Asbestos Mines of South Africa. It is found most frequently as a fire retardant in thermal insulation products .

Crocidolite, “blue asbestos” another member of the amphibole class was used in high temperature insulation applications.

The remaining three types in the amphibole class are found in trace amounts and have little commercial value.

Chrysotile and crocidolite are found in asbestos textiles and filtration products. Large amounts of chrysotile are found in asphalt flooring, vinyl floor tiles, pavings and road surfaces. In addition, chrysotile was uses in brake linings, clutch facings, gaskets, and reinforced plastics.

Amosite was used primarily for high temperature applications. Amosite also has good heat and acid resistance, which make it more acceptable in products requiring less flexibility and workable characteristics than chrysotile.

Key Uses of Asbestos in Buildings

Surfacing Materials

Asbestos was mixed into wall and ceiling plaster, floor leveling compound, stucco, and other surfacing materials applied to floors, walls and ceilings. The asbestos was used with these materials as a binding agent and to increase the strength and durability of the material.

Fireproofing

Structural materials used in building construction are affected by high temperatures. Sufficient amounts of heat can result in a deterioration of ductility, tensile and compressive strength. At 1000 degrees Fahrenheit, ASTM A36 steel loses approximately 40% of its yield stress. Asbestos has been widely used to insulate structural steel in building construction.

Thermal System

Asbestos is used as thermal insulation in several applications. Thermal insulation retards the flow of heat energy by restriction, conduction, convection, and radiant transfer within the skin surfaces of the materials to which it is applied. The ability of a material to retard the flow of heat is dependent on the amount of thermal conductivity. To be effective, thermal insulation materials must have a low level of thermal resistance. Because of these properties, asbestos pipe lagging was used extensively.

Acoustics

The application of asbestos in controlling acoustics in building structures was used extensively prior to the 1970's. Asbestos materials lacked a reverberate surface from which sound could bounce. This made asbestos an excellent sound absorber. The sound absorption efficiency increased as the thickness of the application increased. For this reason, it was used in theaters, gymnasiums, and school hallways until banned.

Friable and Non-Friable ACM

The first concern regarding ACM is its location in a building. Second and more importantly is the condition of that ACM. The "dangerous condition" of ACM is defined as friable.

EPA's definition is friable materials "can be crumbled, pulverized, or crushed to powder with hand pressure when dry."

The New York State Department of Labor (NYSDOL) definition is "any material that when dry, can be crumbled, pulverized, or reduced to powder by hand pressure, or is capable of being released into the air by hand pressure."

The New York City Department of Environmental Protection (NYCDEP) definition is "friable asbestos material shall mean any asbestos or any ACM that can be crumbled, pulverized, or reduced to powder when dry, by hand or other mechanical pressure"

EXAMPLES OF FRIABLE ACM

- Spray applied fireproofing
- Boiler insulation
- Pipe insulation
- Troweled on wall/ceiling plaster

EXAMPLES OF NON FRIABLE ACM

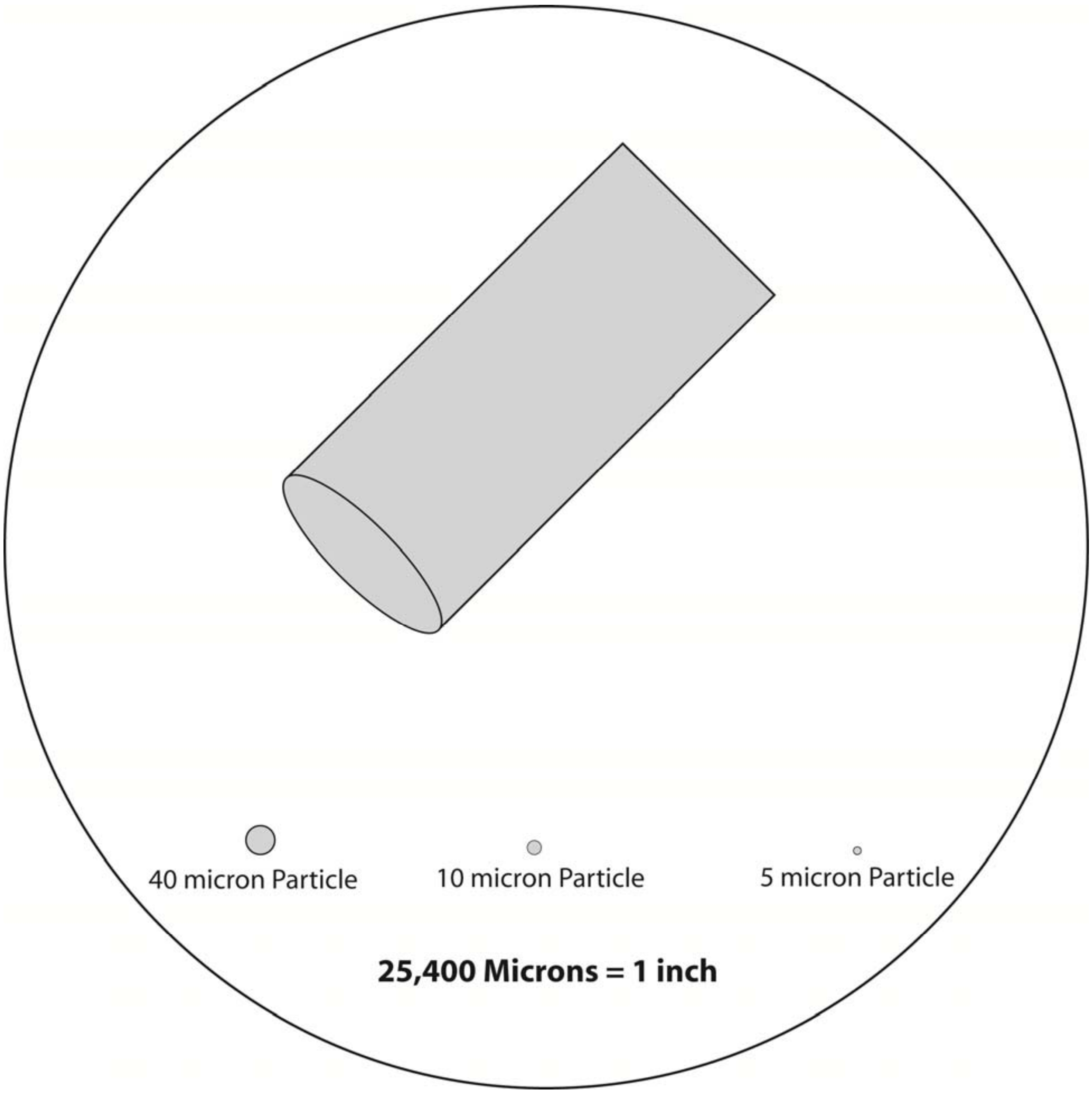
- Floor Tiles (VAT)
- Transite (Asbestos Cement)
- Roofing Materials
- Mastic
- Caulking

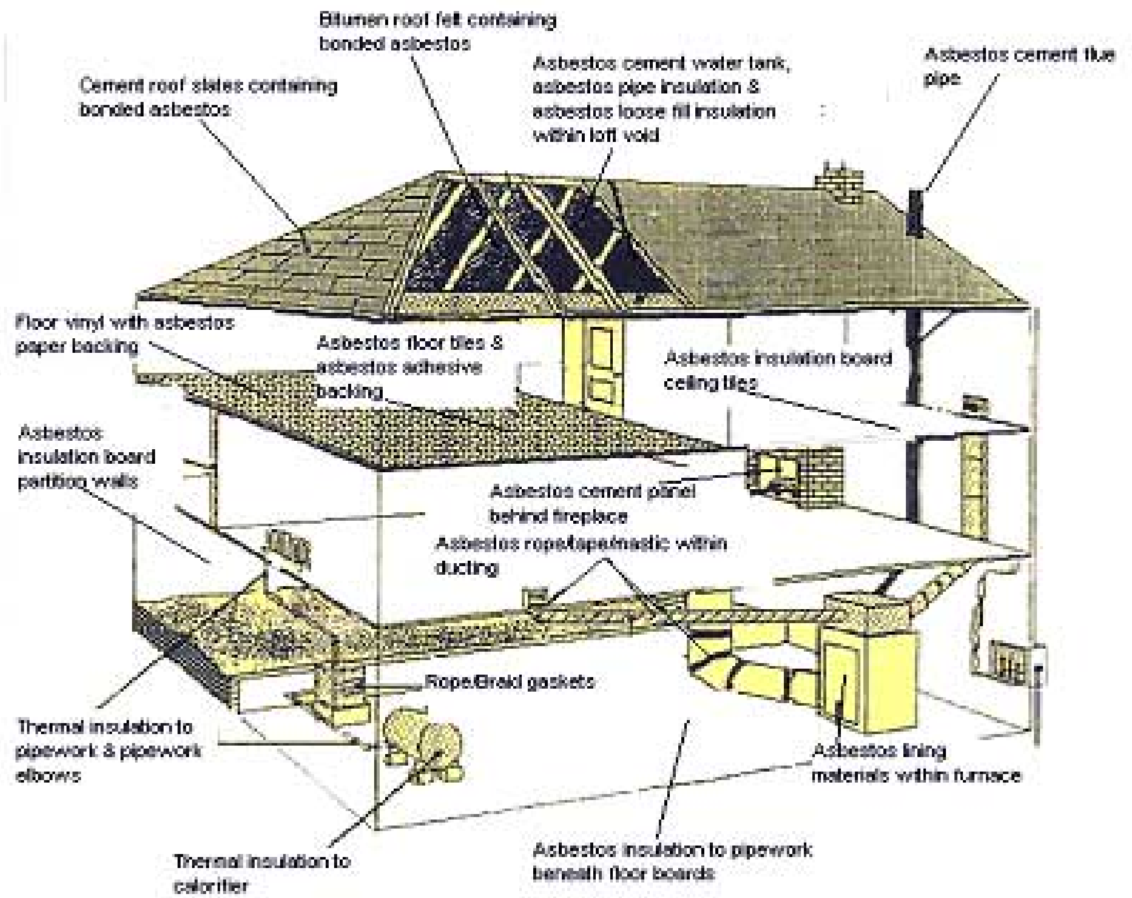
Properties and Uses of Asbestos

PROPERTIES	USES
Heat Resistant	pipe insulation, boiler insulation
Chemical Resistant	lab countertops
Friction Resistant	brakes on cars, trains, clutch systems
Fire Resistant	Fire proofing, gloves, clothing for fire fighters
Electrical Resistant	cable wrap
Acoustical Properties	ceiling tiles, wall plaster
High Tensile Strength	VAT, roofing, concrete

Enlargement of Small Particles and Comparison to Human Hair

Enlarged View




Bitumen roof felt containing bonded asbestos
Cement roof slates containing bonded asbestos
Asbestos cement water tank, asbestos pipe insulation & asbestos loose fill insulation within loft void
Asbestos cement flue pipe
Floor vinyl with asbestos paper backing
Asbestos floor tiles & asbestos adhesive backing
Asbestos insulation board ceiling tiles
Asbestos insulation board partition walls
Asbestos cement panel behind fireplace
Asbestos rope/tape/mastic within ducting
Rope/Braid gaskets
Thermal insulation to pipework & pipework elbows
Asbestos lining materials within furnace
Thermal insulation to calorifier
Asbestos insulation to pipework beneath floor boards

CHAPTER 2

Regulatory Review

Federal Regulations

Introduction

The Environmental Protection Agency (EPA) and the Occupational safety and Health Administration (OSHA) are the main federal agencies involved with regulating asbestos in buildings. The EPA regulates protection of the public on environmental matters while OSHA regulates the protection of workers in the work place.

EPA Regulations

The EPA has two major acts that contain asbestos standards:

The Clean Air Act (CAA) and the Toxic Substance Control Act (TSCA).
They are summarized below including the CFR reference.

Clean Air Act

National Emissions Standards for hazardous Air Pollutants (NESHAP)
NESHAP for asbestos: 40CFR Part 61 Subpart M

TOXIC SUBSTANCE CONTROL ACT (TSCA)

a. The Asbestos Hazard Emergency Response Act (AHERA)
AHERA: 40CFR, Part 763, Subpart E

b. Worker Protection Rule 40CFR, Part 763, Subpart G

c. Ban and Phase-Out Rule 40CFR, Part 763, Subpart I (Section 762.162 – 763.179)

Another law is the Asbestos school Hazard Abatement Reauthorization Act (ASHARA). This was primarily a revision to AHERA Appendix C, which outlines training and certification requirements for different asbestos disciplines.

NESHAP

The National Emission Standards for Hazards Air Pollution (NESHAP) regulation is part of the federal Clean Air Act, and was amended in November 1990. NESHAP applies to all building and structures in the United States regardless of their use. The important elements of NESHAP are summarized as follows:

1. ACM is defined as any material containing greater than 1% asbestos.

2. The EPA must be notified 10 working days prior to the removal of asbestos, provided the following amounts are met or exceeded:

   → Equal to or greater than 260 linear feet
   → Equal to or greater than 160 square feet
   → Equal to or greater than 35 cubic feet

   The law requires that the building owner remove the asbestos prior to renovation or demolition. This ensures that there will be no activity, which may render the material friable or cause visible emissions of asbestos to be discharged into the air.

3. ACM is divided into friable and non-friable.

4. Non-friable materials are divided into two categories and are exempted from NESHAP requirements, provided the activities performed will not render them friable. These categories are:

   <u>Category I materials</u> (ACM packing, gaskets, resilient floor coverings and asphalt roofing)
   <u>Category II materials</u> (any ACM that, when dry, cannot be rendered friable, excluding Category I non-friable ACM)

   All ACM must be kept adequately wet during any disturbance activities.

5. No visible emissions are allowed during renovation, demolition, packaging, transporting or deposition.

6. Containers of ACM debris are to be labeled with the waste generator's name, the address from which the waste was taken, and the proper OSHA-specified label: In addition, the U.S. Department of Transportation classifies ACM waste as Class 9 waste-miscellaneous (also known as regulated waste)

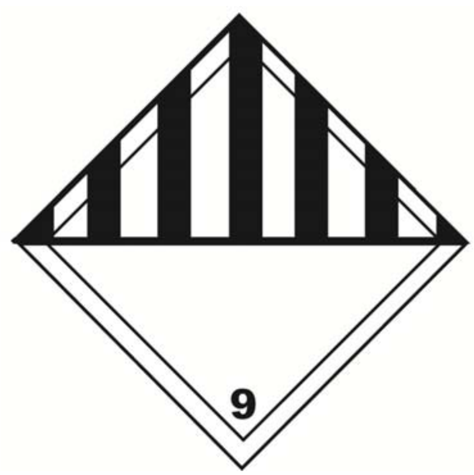
7. All asbestos waste must be disposed of in an EPA-approved landfill

8. Landfills must cover the previous day's ACM waste with at least six inches of compacted non-ACM material

9. If a number of small asbestos abatements are expected to be performed within a single year, then the owner must notify the EPA 10 days prior to the start of that year if the levels of 260 linear, 160 square or 35 cubic feet may be exceeded.

10. No ACM may be stripped, removed or otherwise handled or disturbed at a facility unless at least one on-site representative trained in the provisions of NESHAP is present.

EXAMPLE OF DOT PLACARD



EXAMPLE OF GENERATOR LABEL

EXAMPLE OF OSHA LABEL

AHERA

The Asbestos Hazard Emergency Response Act (AHERA) regulation went into effect on 12 December 1987. AHERA requires every public and nonprofit private school, kindergarten through 12th grade (K-12), to be inspected every three years for all friable and nonfriable ACBM (Asbestos-Containing Building Material). A document with its location must be prepared and a plan for the continuous in-place management of the ACBM must be prepared. This responsibility rests with the LEA, or, Local Education Agency (school district), and their "designated person."

The designated person is an individual appointed by the LEA to ensure that the provisions of AHERA are met. These provisions include:

1. Inspect, sample, and document all ACBM
2. Re-inspect every 3 years
3. Notify all occupants and parents of inspections
4. Develop a Management Plan. The elements of the management plan include:
    - Response actions to all ACBM
    - Written Operations and Maintenance procedures
    - Six-month periodic surveillance program
    - Schedule of any abatement activity
    - Training of affected workers
    - Labeling of all ACBM in routine maintenance areas
5. Recordkeeping for the above activities

According to AHERA, any individual who inspects a school building or develops a written management plan must be accredited by the EPA to do so. A person who conducts response actions, which will affect more than three square feet or three linear feet of asbestos, must also be accredited by the EPA. The New York State Department of Labor has converted this accreditation to certification since New York State is now an EPA-approved state. Therefore, the

EPA automatically accredits any certification you receive from the State of New York.

ASHARA

On April 4, 1994 an amendment to AHERA known as ASHARA went into effect. This amendment requires that any individual who inspects, designs or conducts response actions in any public and commercial building must be certified by the EPA.

EPA Worker Protection Rule

The worker protection rule was promulgated by the EPA to extend coverage to those workers who are not protected under federal OSHA regulations or state OSHA programs. This was because OSHA was not given the power to enforce their regulations in public buildings.

In New York, the agency that enforces OSHA regulations, as well as their own, for public employees is the Public Employee Safety and Health Bureau (PESH), which is within the New York State Department of Labor.

EPA Ban and Phase-Out Rule

In 1989, EPA banned most of the asbestos product categories, but in 1991 most of the ban was repealed, leaving only a few categories still banned.

Product categories still banned

Corrugated paper, roll board, commercial paper, specialty paper, flooring felt and any new use of asbestos (after 1989).

Product categories no longer banned

Vinyl asbestos floor tile, pipeline wrap, roofing felt, roof coatings, automatic transmission components, clutch facings, brake pads, drum brake linings, brake blocks, gaskets, millboard, asbestos cement: pipe, shingle, flat sheet, corrugated sheet

OSHA Regulations

The Occupational Safety and Health Administration (OSHA) is the federal agency that sets standards designed to protect workers in the workplace from real or potential hazards. In term of asbestos regulations, OSHA has three standards:

Construction Standard for Asbestos:	**29CFR 1926.1101**
General Industry Standard for Asbestos	**29CFR 1910.1001**
Shipyard Industry Standard for Asbestos	**29CFR 1915.1001**

The OSHA regulation entitled 29 CFR 1926.1101 applies to any construction related activities likely to involve asbestos exposure:

- Demolition or salvage of structures where asbestos is present;
- Removal or encapsulation of materials containing asbestos;
- Construction, alteration, repair, maintenance, renovation of structures, substrates, or portions thereof, that contain asbestos;
- Installation of products containing asbestos;
- Asbestos spills or emergency clean-up;
- Transportation, disposal, storage, or containment of ACM.

Work Classification:

Class I: Activities involving the removal of TSI and surfacing ACM or PACM (Presumed Asbestos Containing Materials).

Class II: Activities involving the removal of ACM, which are not TSI or surfacing materials. This includes, but is not limited to, ACM wallboard, floor tile and sheeting, roofing and siding shingles and construction mastics. These materials are also referred to as miscellaneous materials.

Class III: Repair and maintenance operations where ACM including TSI and surfacing materials are likely to be disturbed.

Class IV: Maintenance and custodial activities during which employees contact ACM and PACM, and the cleanup of waste or debris containing ACM and PACM.

One of OSHA's main responsibilities is to set employee exposure levels to asbestos.
This in no way implies that there is a known "safe" level of exposure, but is used as a trigger for various OSHA requirements.

Exposure levels are expressed as a concentration of airborne fibers per cubic centimeter of air *(f/cc),* and are based on an eight-hour time-weighted average. This means the exposure concentration averaged over an eight-hour period, as opposed to a peak or point-in-time exposure.

The two exposure levels are:

Permissible Exposure Limit (PEL):

The maximum allowable exposure limit of 0.1 *f/cc* for an eight-hour time-weighted average (TWA).

Excursion Limit (EL)

For short duration, high potential exposures, the employer shall insure that no employee is exposed to asbestos fibers in excess of 1.0 *f/cc* over a thirty- minute sampling period.

An essential aspect of the OSHA regulation is the monitoring of worker exposure levels. The sample must be taken in the worker's breathing zone (mid-chest to top of head) and the standard specifies the procedures and analytical methods to be used.

The most important rule to consider when conducting OSHA personnel sampling is to get a good representation of worker exposure for work performed. OSHA does not require that you sample every worker every day. The standard requires that a "representative" number of workers be sampled (NYC law recommends 20% of workers) who are performing different job functions within a regulated area. Choose a worker from each of the job function categories so the overall sampling represents the project.

Exposure Monitoring

Each employer with a work place or work condition, where exposure monitoring is required by the standard, shall perform monitoring to accurately determine the concentration of airborne asbestos fibers to which the employees may be exposed. Representative sampling is required to determine the 8 hr. PEL and Excursion Levels. PEL monitoring must cover full shift exposure. The Excursion Limit monitoring should be performed during the 30-minute period in which the worker will be exposed to the highest airborne fiber concentration.

Initial Exposure Assessment

1. The employer shall ensure that a "competent person" conduct an exposure assessment at the start of the operation to ascertain expected exposures during that operation.
2. Basis of the Initial Exposure Assessment: Unless a negative exposure assessment has been made (see below), personal air monitoring shall be conducted. Until then, the employer shall presume that employees will be exposed in excess of the PEL and EL.

Negative Exposure Assessment

1. For anyone specific asbestos job, the employer may demonstrate that employee exposures will be below the PEL and EL by data which conform to the following criteria:
    a. Objective data demonstrating that the product or material containing asbestos minerals or the activity involving such material cannot release airborne fibers in concentrations exceeding the PEL and EL; or
    b. Where the employer has monitored prior asbestos jobs for the PEL and EL within 12 months of the current job; and the data were obtained during work operations conducted under workplace conditions "closely resembling" the processes, the job was performed by employees whose training and experience was not more extensive than that of employees performing the current job, and this data shows that there is a high degree of certainty that the employee exposures will not exceed the PEL and EL; or
    c. The results of initial exposure monitoring conducted for employees performing work that are most likely to result in exposures over the PEL and EL.

Periodic Monitoring

1. For workers performing Class I and II work, the employer shall conduct daily personal air monitoring that is representative of each worker, unless the employer has conducted a negative exposure assessment for each specific abatement operation.
2. For workers performing abatement operations other than Class I and II, the employer shall conduct periodic monitoring of all work where exposures are expected to exceed a PEL, at intervals sufficient to document the validity of exposure prediction.
    a. Exception: If workers use a supplied air respiratory system, then daily monitoring may be dispensed. However, if certain engineering controls specified by OSHA are not used during abatement, daily air monitoring is required even if the workers use supplied-air respirators.

Termination of Monitoring

1. If the periodic monitoring reveals that employee exposures, as indicated by statistically reliable measurements, are below the PEL and EL, daily monitoring may be discontinued.
    a. Additional monitoring: The employer shall institute personal air monitoring whenever there has been a change in process, control equipment, personnel or work practices that may result in new or additional exposures above the PEL and/or EL, or if the employer has reason to believe that the PEL and/or EL may be exceeded. Such additional monitoring is required regardless of whether a negative exposure assessment was previously produced for a specific job.

Regulated Areas

As mentioned previously, OSHA requires that a regulated area be established wherever airborne asbestos fibers may exceed the PEL. In all regulated areas, proper respiratory protection must be worn and eating, drinking, smoking, chewing gum, chewing tobacco and applying cosmetics are prohibited. Warning signs must delineate the regulated area and access to the area must be restricted to individuals properly trained and equipped to enter such an environment.

OSHA requires that a competent person be designated for insuring worker safety and health in all four classes of work. The competent person is responsible for frequent and regular inspections of the work site, materials and equipment. For Class I and II work, the competent person is also responsible for on-site supervision of the work site including, but not limited to:

- Setting-up the contained area
- Establishing procedures for entry and exit to and from the work area
- Ensuring use of proper work practices
- Ensuring use of personal protective equipment
- Conducting exposure monitoring of the employee

The competent person for Class I and II work must be certified as a Supervisor in an EPA approved training course. For Class III and IV work, the competent person must have completed the 16-hour Operations and Maintenance Course or its equivalent.

Respiratory protection is a major element in the standard and is discussed in the Respiratory Protection chapter of this manual. OSHA stipulates that any individual required to wear a negative-pressure respirator must be included in a medical surveillance program instituted by the employer.

Another aspect of OSHA law is recordkeeping. Due to the latency period of asbestos related diseases, employers are required to maintain all exposure monitoring and medical surveillance records for a period of 30 years from the employee's last day of employment. This includes records for all employees, regardless of the amount of time spent in the regulated area.

New York State Regulations

In addition to the federal regulations that are enforced throughout the US, various states have their own regulations. New York State has various agencies that enforce asbestos regulations, from the training, to the abatement to the waste transportation.

Below is a summary of the various agencies and their regulation:

- **New York State Department of Labor (NYSDOL)** enforces all asbestos abatement regulations for conducting work in New York. The NYSDOL also issues company licenses, worker certification, and will issue any violations of the code. The latest revision to Industrial Code Rule 56 is March 21, 2007.

NYSDOL Title 12 of the New York Codes, Rules and Regulations-Part 56(12NYCRR PART 56) is also known as **INDUSTRIAL CODE RULE 56.**

- **New York State Department of Health (NYSDOH)** regulates all asbestos training and laboratory requirements for working in New York.

- **The New York State Department of Environmental Conservation (NYSDEC)** Division of Solid and Hazardous Materials has rules that focus on what happens to the asbestos after an abatement project.

The New York State regulations came into effect in October of 1987 and require that any company involved in any phase of an abatement project be licensed as an abatement contractor. This includes any organization, which employs workers whose function may be the disturbance of any amount of asbestos (e.g., schools, maintenance companies, etc.). All abatement contractor licenses expire annually.

On January 11, 2006, ICR 56 was amended (revised). These revisions are included in this section.

New York State also requires that any individual who performs tasks for the abovementioned firms are certified as per his/her task. Code Rule 56 has instituted nine different certifications.

<u>**NOTE:**</u> No one may perform a task related to the abatement of asbestos without the proper certifications.

Unfortunately, there is no "blanket" certification. A person who performs many different tasks related to the abatement of asbestos would need a certificate for each task performed. Annual refresher training is required for each certification.

Although some of the tasks listed are not required in Code Rule 56 (e.g., the design of an abatement project), anyone who does them must be certified. In other words, a building owner may want an abatement project designed by a consulting company with experience in abatement design. This is not a requirement of Code Rule 56. However, should the building owner choose to have the project designed, the individual who designs the project must be certified as a Project Designer.

All state certifications are valid for one year and require a refresher course prior to the issuance of a new certificate. Your New York State Department of Labor Asbestos Handling certificate will expire on the last day of the month of your birthday.

Any certification received from the State of New York (not city of New York) is automatically EPA accredited. Those individuals who have received asbestos certificates from the city of New York must also be state certified.

Asbestos Handler (Worker) Certificate: Any person who removes, encapsulates, encloses, repairs or disturbs friable or non-friable asbestos, or who handles asbestos material in any manner which may result in the release of asbestos fiber, shall possess a valid asbestos handler (worker) certificate and shall have such certificate or a copy thereof in his or her possession at all times while working on the project. A person who possesses an asbestos handler (worker) certificate shall be responsible for the proper execution of his or her trade as it relates to an asbestos project.

Allied Trades Certificate: Any person performing any limited or special tasks in preparation for or ancillary to an asbestos project, such as a carpenter, electrician, plumber or similar occupation, or any other person who may potentially disturb friable or non-friable asbestos during the course of any employment (other than OSHA Class IV asbestos work), shall possess a valid allied trades certificate and shall have such certificate or a copy thereof in his or her possession at all times while working on the project. This person shall be aware of the health hazards of asbestos and take appropriate precautions to avoid any ACM, PACM or asbestos material disturbance throughout the course of their work. Abatement of any quantity of ACM, PACM or asbestos material is not allowed by this person under any circumstance. A person who possesses a allied trades certificate shall be responsible for the proper execution of his or her trade as it relates to an asbestos project.

Asbestos Project Air Sampling Technician Certificate: Any person who performs project air sampling shall possess a valid asbestos project air sampling technician certificate and shall have such certificate or a copy thereof in his or her possession at all times while working on the project. A person who possesses an air sampling technician certificate shall be responsible for the proper execution of his or her duties as they relate to an asbestos project.

Inspector Certificate: Any person who performs the limited tasks involved in the asbestos survey, identification and assessment of the condition of asbestos and asbestos material and the recording and reporting thereof, or who is involved in the collection of bulk samples of asbestos material or suspected asbestos material for laboratory analysis shall possess a valid inspector certificate and shall have such certificate or a copy thereof in his or her possession at all times while working on the project. A person who possesses an inspector certificate shall be responsible for the proper execution of his duties as they relate to an asbestos project.

Operations and Maintenance Certificate: Any person who performs operations, maintenance and repair activities which may disturb Minor quantities of ACM. PACM or asbestos material shall possess a valid operation and maintenance certificate and shall have such certificate or a copy thereof in his or her possession at all times while working on the project. Operation and maintenance certification permits the holder to perform OSHA Class III asbestos work only on Minor asbestos projects. These minor asbestos projects must be associated with repairs required in the performance of emergency or routine maintenance activity, and is not intended solely as asbestos abatement. Such work may not exceed minor quantities of ACM to be disturbed within a single glove-bag or a single negative pressure tent enclosure. A person who possesses an operation and maintenance certificate shall be responsible for the 'proper execution of his duties as they relate to an asbestos project.

Supervisor Certificate: Any person who performs supervision of persons (other than authorized visitors) permitted to enter the restricted area and regulated abatement work area, shall possess a valid supervisor certificate and shall have such certificate or a copy thereof in his or her possession at all times while working on the project. A person who possesses a supervisor certificate shall be responsible for the proper execution of his duties as they relate to an asbestos project. The supervisor is also responsible for performing the duties of the OSHA competent person for the asbestos project, consistent with current OSHA regulations.

Project Designer Certificate: Any person who plans the scope, timing, phasing and remediation methods to be utilized on any asbestos project shall possess a valid project designer certificate and shall have such certificate or a copy thereof in his or her possession at all times while working on the project. A person who possesses a project designer certificate shall be responsible for the proper execution of his duties as they relate to an asbestos project.

Project Monitor Certificate: Any person other than the asbestos abatement contractor's supervisor, who oversees the scope, timing, phasing and/or remediation methods to be utilized on and the completeness of any asbestos project shall possess a valid project monitor certificate or a copy thereof in his or her possession at all times while working on the project. A person who possesses a project monitor certificate shall be responsible for the proper execution of his duties as they relate to an asbestos project.

Management Planner Certificate: Any person who assesses the hazard posed by the presence of asbestos or asbestos containing material and/or who recommends appropriate response actions and a schedule for such response actions shall possess a valid management planner certificate and shall have such certificate or a copy thereof fn his or her possession at all times while working on the project. A person who possesses a management planner certificate shall be responsible for the proper execution of his duties as they relate to an asbestos project.

ASBESTOS PROJECT-PHASES OF WORK

<table>
<tr><td colspan="2">Phase I
(Prior to Asbestos Abatement Contractor Mobilization)
Pre-Abatement</td><td colspan="4">Phase II
Start -------------------------------- Abatement ---------------------------------End</td></tr>
<tr><td>A</td><td>B</td><td>A</td><td>B</td><td>C</td><td>D</td></tr>
<tr><td>Asbestos Survey, Planning & Design</td><td>Background Air Sampling</td><td>Regulated Abatement Work Area(s) Preparation & Enclosure Construction</td><td>Asbestos Handling including, Gross Removal or Abatement, Initial Cleans and Waste Removal</td><td>Final Cleaning & Clearance Air Samples</td><td>Final Waste Removal from Site</td></tr>
<tr><td colspan="6">Start -- Asbestos Project --End</td></tr>
</table>

Written Notification

ICR-56 requires that an asbestos abatement contractor notify the NYSDOL ten calendar days prior to a large project This notification must be in writing and accompanied by a fee ranging from $100 to $1000 if the amount of ACM to be abated is measured in linear feet and $100 to $1000 if the ACM to be abated is measured in square feet. If the project will involve both linear and square feet amounts of ACM, the respective fees will be added together with a maximum fee of $2000.

Piping, fittings and associated insulation are to be measured in linear feet except for breeching and large diameter [2 foot or greater) piping/fittings/associated insulation.

It is the responsibility of the property owner and asbestos abatement contractor to notify the occupants of the building ten calendar days prior to the abatement phase of the project [Phase II]. The written notification shall be given to those occupants who are located on the floor or floors where the actual project is to be conducted, and one floor above and one floor below the floor or floors containing the project In addition, notification shall also be given to occupants of adjacent buildings who have horizontal access to the abatement area.

For Small and Minor size asbestos projects: If the abatement phase of the asbestos project is scheduled to begin less than ten calendar days after the execution of the contract, the property owner and asbestos abatement contractor shall notify the occupants of the building three calendar days prior to commencement of work.

Building Survey

An asbestos survey must be conducted, by a New York State certified Inspector, to determine whether or not the building or portion thereof, to be demolished, renovated, remodeled or have repair work, contains ACM, PACM or asbestos materials. The exceptions to this are the following:

1. Agricultural buildings;
2. Buildings constructed on or after January 1974;
3. A structurally unsound structure as certified by appropriate personnel

NYSDOL BUILDING SURVEY ELEMENTS

- Review of building plans and records, if available;
- A visual inspection for PACM and suspect miscellaneous ACM;
- Sampling and analysis of suspect material;
- Identify and assess the locations, quantities, friability and conditions of all types of suspect materials at the affected portion of the building;
- Building location, owner's name and address, name and address of the owner's agent, the party performing the survey, the laboratory used, and all respective licenses and certifications for all parties involved;
- A listing of homogeneous areas identifying which ones are ACM and all laboratory analyses reports for bulk samples collected.

Should the building or portion that would be impacted by demolition, renovation, remodeling, or repair work contain asbestos, it must be removed prior to the work.

The completed asbestos survey:

- Shall be kept on the construction site throughout the duration of the asbestos project and any associated demolition, renovation, remodeling, or repair work.

- Shall be sent to the local government entity charged with issuing a permit for demolition, renovation, remodeling, or repair work.

- For controlled demolition or pre-demolition asbestos projects shall be submitted to the appropriate Asbestos Control Bureau district office.

When any construction activity reveals PACM or suspect miscellaneous ACM that has not been identified by the asbestos survey:

- All activities shall cease in that area;
- The building owner or their representative shall notify the Asbestos Control Bureau by telephone followed by a written notice as per the notification rules;
- Any un-assessed PACM or suspect miscellaneous ACM shall be treated and handled as ACM and assumed to be ACM, unless proven otherwise.

Variances

Should any requirements of the regulation pose a burden or be impossible to perform, a variance may be granted by the NYSDOL. The contractor, building owner or their agent must apply for a variance and justification must be given for the request. The variance request must also show what will be done to protect human health and the environment in lieu of compliance with Code Rule 56.

These can be site-specific, blanket, system-wide, or state-wide variances. The NYSDOL can also create prewritten variances called Applicable Variances (AV's). If the procedures listed match the situation faced on the upcoming asbestos project, then the AV could be used. As of September 5, 2006 all previous AV's were terminated and most of their content was incorporated into the respective sections of the revised Code Rule.

Recordkeeping

All abatement records shall be maintained by the contractor for a period of 30 years after the last day of the project. These records must be submitted to the DOL within 10 days upon receipt of written request or upon the revocation, expiration, or non-renewal of an asbestos handling license.

In-Plant Operations

If the asbestos work will be conducted within the premises of an employer, other than a public authority (governmental agency), NYSDOL allows for compliance with OSHA regulations in lieu of Code Rule-56 if all of the following criteria are met

1. Persons other than those directly involved in the work will not have access during the course of the work;

2. The work is performed in a manner which shall not expose the public to airborne fibers in excess of background levels or 0.01 fibers per cubic centimeter, whichever is greater;

3. The abatement will involve less than 160 square feet or 260 linear feet of ACM, PACM, or asbestos material; or will involve any quantity of Non-friable Organically Bound (NOB) asbestos material currently in a non-friable intact condition, provided the abatement methods will not render the asbestos material friable during the work;

4. The work is performed directly by employees of the employer (non-government agency) whose premises will be affected by the abatement project.

New York State Department of Labor (NYSDOL) Guidance Document

New York State has released a guidance document, the most recent being on Jan 30th, 2009 (version 2.0) that supplements the ICR 56 and is meant to provide technical guidance on the interpretation of the Code Rule.

New York City Regulations

Asbestos regulations in New York City are enforced by the New York City Department of Environmental Protection, Asbestos Control Program and the regulation is called:

New York City Title 15, Chapter 1 of the Rules of the City of New York (RCNY)

Notification of abatement projects inside New York City must be made to the appropriate federal, state and local agencies prior to the start of the project, regardless of building/property ownership. **For buildings/properties owned by an agency of the State of New York (e.g. the Metropolitan Transportation Authority), the abatement project falls under the jurisdiction of NYSDOL and ICR 56**. For buildings/properties not owned by an agency of the State of New York, the abatement project falls under the jurisdiction of the New York City Department of Environmental Protection (NYCDEP), Title 15, Chapter 1 (15 RCNY 1).

New York City does not license the company performing any of the tasks involved in asbestos abatement. NYC requires that such a company be licensed by the state.

However, New York City does issue worker certification in the following categories; Handler, Supervisor, Restricted Handler-Allied Trades, and Investigator. In order to perform asbestos abatement in New York City, an individual must be certified by both the state and the city of New York, unless a variance has been granted.

The City of New York requires that you take an examination administered by the training entity under the jurisdiction of the New York State Department of Health as well as a city-administered examination. Upon successful completion of both examinations, you will be issued a city certificate valid for two years.

New York City requires that you notify the NYCDEP 7 days prior to the abatement of greater than 25 linear feet or 10 square feet of ACM. In addition to the fees charged by the state, the city requires a fee ranging from $200 to $1200 dollars. The building owner or designated representative shall provide notification to all occupants of the work place and to immediate adjacent areas of the asbestos project. The notices shall be posted 7 calendar days prior to the start of the project and shall remain posted until clearance air monitoring is satisfactorily concluded.

In order to keep a better control on the illegal abatement of asbestos, New York City's asbestos program works in conjunction with the Buildings Department. In order to perform a renovation, alteration, or demolition of a building in New York City, you must receive a permit from the Buildings Department. In order to obtain that permit, you must submit in your Building Department application one of two forms addressing the asbestos issue: An "Asbestos Project Notification Form" (commonly called an ACP-7) or “Asbestos Assessment Report" (ACP-5). In circumstances where the filing for Buildings Department plan approval or permit issuance is not required, the notification of asbestos projects must be provided directly to the DEP.

Changes to the NYCDEP Asbestos Control Program

The New York City recently enacted a series of important local laws that reform the way in which asbestos abatement is to be performed. Along with these new laws, the NYCDEP promulgated a set of new rules to accompany the laws’ new mandates and to conform to the requirements of ICR 56 of the New York State Labor Law. The New Asbestos Rules took effect on November 13th, 2009.

Listed below is a summary of some of the major changes:

- Launch of the new Asbestos Technical Review Unit (A-TRU), a joint initiative with the Department of Buildings (DOB) to increase public safety at abatement sites Citywide while also enhancing the filing and review process for environmental contractors and members of the construction industry;
- Building Owners must obtain a new Asbestos Work Permit for abatement projects that impact fire and building safety in the work place;
- New electronic filing system the Asbestos Reporting and Tracking System (ARTS) that replaced the paper submission format;
- Projects requiring the abatement permit may include the submission of a Work Place Safety Plan (WPSP) prepared by a registered design professional;

- All variances must be prepared by a NYS certified Project Designer;
- Abatement projects required to use non-combustible or fire-retardant materials for construction of temporary enclosures;
- A negative air cut off switch required, centrally located for negative air machines in certain projects;
- Strengthening of Citywide smoking ban at work sites with a zero tolerance approach;
- At the conclusion of asbestos abatement , a Project Monitor will be required to submit a report after successful air monitoring results are taken;

Asbestos Project Notification (ACP-7)

The ACP-7 form documents for the Buildings Department that more than 25 linear or 10 square feet of asbestos will be disturbed. The building owner is required to address the asbestos problem prior to issuance of the building permit. The owner may abate the asbestos in any manner which, when complete, will not allow the asbestos to be disturbed during the scope of the renovation, alteration or demolition.

Asbestos Project Amendment (ACP-8)

Any amendment, modification, change, or addition to the ACP-7 the DEP must be notified using the Amendment form (ACP-8). The modification is only valid if it is received by the NYCDEP prior to the previously filed date of completion, except for start date changes that must be received by the original start date.

A modification may be modified no more than twice

Asbestos Assessment Report (ACP-5)

The asbestos assessment report (ACP-5 form) documents for the Buildings Department that 1) no asbestos is present within the proposed scope of work, or 2) the amount of asbestos present is at or below 25 linear or 10 square feet.

A New York City certified Investigator who, by affixing his/her signature and an official seal to the form, is liable and responsible for all the information contained therein must sign the ACP-5.

Although New York City does not require the inspection of all buildings for asbestos, anyone requiring a Buildings Department permit must first determine if asbestos will be disturbed within the scope of the work. This requires a survey.

The survey must be conducted by a New York City certified Investigator who is obligated to perform the survey in accordance with the AHERA regulation. Specifically, the number of bulk samples taken must be in accordance with the AHERA bulk sampling protocol.

Asbestos Variance Application (ACP-9)

As with the state, New York City may grant a variance to a building owner or contractor as long as the NYS certified Project Designer prepares the variance application (ACP-9) and the applicant submits a fee. The same stipulation of protecting human health and the environment along with justification for the variance applies for city variances as well as the state.

A NYS certified Project Designer is required to prepare all variances.

With the recent implementation of the new city regulations effective Nov 13th, 2009, for any project requiring the Department of Buildings Construction Document Approval, for example:

- Full demolitions
- Alterations, renovations or modifications
- Plumbing work (installation, alteration, or removal of fuel-burning equipment)

Prior to approval by the DOB, below is listed several different forms that would be required and is now a part of the Asbestos Control Program.

Form A-TR1: Technical Report Statement of Responsibility

For any asbestos abatement project requiring the filing of an asbestos abatement permit, for example:

- Obstruction of an exit door leading to an exit stair or the building exterior
- Removal or dismantling of standpipe systems or any part of a sprinkler system
- Removal of a non load bearing wall greater than 45 square feet (sf)
- Obstructions of exterior fire escape, fire – rated corridor
- Removal or dismantling of any fire alarm system component
- Any work that otherwise requires a permit from the Department of Buildings

A Registered Design Professional must prepare all the pertinent construction documents and upon approval of the work under that permit must then certify completion of the work under the asbestos abatement permit and file the Final Inspection “A-TR1” form with the DEP. Records of these final inspections are required to be maintained for a period of at least six years after the final inspection.

Project Monitor Report (ACP-15)

After successful air monitoring results for the abatement project, the project monitor must certify on an ACP-15 form, the date of inspection, and confirm the visual inspection was performed, with all work areas inspected free of visible asbestos containing debris or residue. This must be submitted by the building owner 21 calendar days after the end of the project.

Asbestos Project Conditional Close-out Form (ACP-20)

As stated in NYC regulations, "if an asbestos project has been performed but would be subject to the procedures of section 1-26(c)(2)(ii), a copy of the asbestos project conditional close-out form is issued to the building owner or its authorized representative by DEP".

Asbestos Completion Form (ACP-21)

After the asbestos project has been performed and the DEP is in receipt of the Project Monitor's Report and, if necessary the A-TR1 form filed by a Registered Design Professional, a copy of the asbestos project completion form is issued to the building owner or its authorized representative by the DEP.

Building Survey

Although New York City does not require the inspection of all buildings for asbestos, anyone requiring a Buildings department permit must first ascertain if asbestos will be disturbed within the scope of the work. This requires a building survey that must be conducted by a NYC certified investigator to be in compliance with NYC as well as EPA guidelines (EPA Purple Book and Pink Book).

NYCDEP does not recognize "In-Plant Operations" as per ICR 56

SUMMARY OF NOTIFICATIONS

	U.S. EPA	NYS	NYC
Large Asbestos Project ≥ 260 linear or 160 square ft	10 working days	10 calendar days	7 calendar days
Small Asbestos Project >25 linear, but < 260 linear feet >10 ft2, but < 160 ft2	NO	NO	7 calendar days
Minor Asbestos Project ≤ 25 linear or 10 square ft	NO	NO	No, but ACP-5 may be necessary

CHAPTER 3

Asbestos Exposure and its Effect on Health

Introduction

Asbestos exposure has long been associated with prolonged health effects primarily with asbestos mill workers and insulators. But what has been alarming are reports of second hand exposures and other low level exposure to building occupants such as school children and teachers.

It is important to note that the majority of people who have died as a result of asbestos exposure were workers who worked in the mining, milling, manufacturing and insulation industries day in and day out without any, or very little respiratory protection.

The asbestos abatement worker today employs proper respiratory protection and other personal protective equipment, along with other engineering controls to severely reduce any risks.

Asbestos fibers have some unique health effects on people. Of all the compounds capable of producing an adverse effect on the human body, asbestos may have a longer latency period between exposure and the subsequent appearance of disease than any other substance. For example, certain types of cancers that develop from asbestos exposure may not appear until forty years after the exposure occurred. The adverse health effects from asbestos exposure were first described in the early 1900's. Nevertheless, widespread concern about asbestos developed only recently because of the health problems that have emerged among people who were heavily exposed during and immediately after World War II. In addition to several types of cancer, asbestos can cause damage to the lungs in a way different from exposure to other materials. Individuals vary considerably in their ability to withstand the diseases associated with asbestos exposure.

The degree of health hazard posed by asbestos exposure depends upon:

- Fiber concentration in the air;
- Fiber type and form;
- Susceptibility of the individual;
- Pollutants in the air, most importantly cigarette smoke.

The adverse health effects associated with asbestos exposure have been extensively studied for many years. Results of these studies and epidemiological investigations have demonstrated that inhalation of asbestos fibers may lead to increased risk of developing one or more diseases. Exactly why some people develop these diseases and others do not remains a mystery.

The health hazards associated with asbestos are due to the strong, needle-like nature of the tiny fibers and to the fact that asbestos is not susceptible to bio-organic decomposition. The fibers that enter the body (mainly through inhalation) pierce through tissue membranes. The fibers are permanently embedded in the tissue the lungs or if ingested, the gastrointestinal tract.

Routes of Entry

There are three main routes of entry for toxins or contaminants. The primary route of entry and the one of greatest concern with the asbestos fiber is through inhalation, allowing fibers to be drawn through the lungs. The second route of entry through ingestion has not been proven to be a significant route of entry leading to disease.

The third route of entry is absorption through the skin. Asbestos fibers cannot be absorbed through the skin. Prolonged exposure to asbestos may cause irritation of the skin, some redness at the source of contact and possibly “asbestos warts”.

The Respiratory System

As we breathe in air through our lungs, air is drawn through the nose and mouth where it travels into the trachea (windpipe). The trachea then splits into two smaller airways called the bronchi, which leads directly into the lung. The lung is divided into two halves and sits in the pleural cavity. Each lung has a very thin lining surrounding it known as the pleural lining. This membrane which consists of mesothelial cells also line the peritoneal cavity (abdomen) and the diaphragm.

In the lung, the bronchi divide into smaller tubes (bronchioles) which terminate into grape-like clusters of tiny air sacs known as alveoli. The alveoli are the gas exchange areas. There are about 300 million alveoli in each lung.

A large blood vessel leaves the heart and divides into two pulmonary arteries, one to each lung. Within the lungs, the pulmonary arteries divide repeatedly into smaller arteries. The tiniest branches known as capillaries, form a network around the air sacs and bring blood cells to the membrane, where the exchange of carbon dioxide for oxygen takes place.

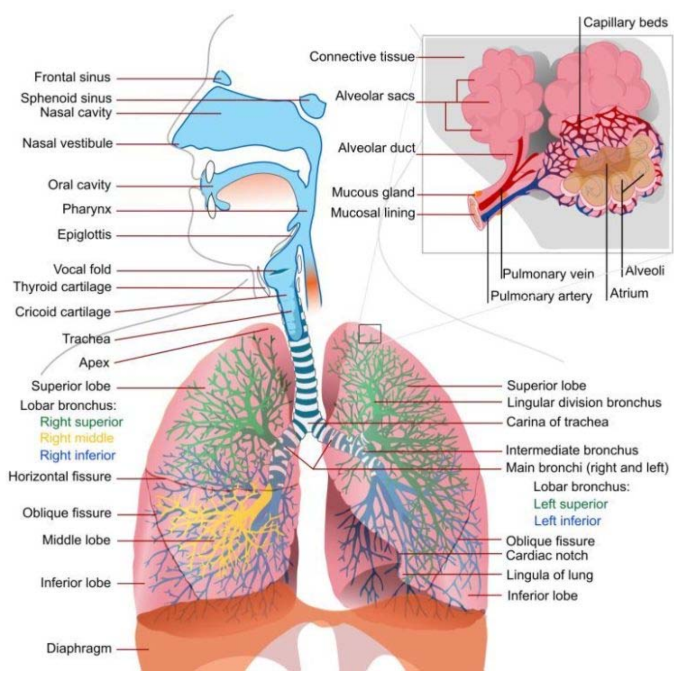
The Respiratory Body Defense Mechanisms

The nose is our first line of defense. It filters large particles of dust and fibers out of the air preventing them from reaching the lungs. Unfortunately this mechanism works so well, that strenuous exercise for example will force air to be drawn in through the mouth to get enough air thereby bypassing the nose filtering mechanism.

Coughing, the second level defense is a protective reflex that expels foreign bodies from the trachea and main bronchi, caused by the nose and throat dripping secretions into the trachea triggering the cough reflex.

The mucociliary escalator is a continuous cleaning mechanism that serves the nose, trachea, and bronchi. Secretions keep the lining of these passages coated with a thin sticky watery mucous which will trap dust and microorganisms that penetrate into these. The respiratory tract has thin hair like structures called "cilia" which act to sweep the mucous along the airways to the throat where it is spit out or subconsciously swallowed. The cilia beats in upwards of 1000 times per minute.

The final mechanism, the white blood cells send macrophage cells which engulf and digest the bacteria and virus. As dust or fibers are engulfed, the macrophages are often destroyed, and fibers will remain in the lung. Asbestos being indestructible and also chemically resistant, one can see how heavy, prolonged exposure to asbestos would create havoc in the lungs and subsequently lead to possible diseases to occur.



The Three Major Diseases

Asbestosis

Asbestosis is the scarring of the lung tissue. It is known as pulmonary fibrosis that may develop after many years of exposure to asbestos. Asbestosis is a restrictive disease. The alveolar wall thickening develops after the fibers lodge in the alveoli and is a result of the body's attempt to heal itself. Resultant scarring restricts the lung's ability to transfer oxygen from the air to the bloodstream.

The buildup of scar tissue in the lung occurs gradually over many years and it can progress even after exposure is discontinued. Workers exposed to high concentrations of asbestos may not show any symptoms for more than 10 to 30 years. Symptoms include: shortness of breath; clubbing of fingers and toes; mild cough and weight loss. Advanced cases will usually include cyanosis, a blue coloring of the mucous membranes visible in the mouth caused by the lack of oxygen.

The average latency period for asbestosis is 10 – 15 years**.** Latency is defined as the time between initial exposure and the time it takes for the disease to develop**.**

Lung Cancer

Lung cancer is a malignant tumor of the bronchi covering. The tumor grows through surrounding tissue, invading and often obstructing the air passages. Like asbestosis, it appears that a dose-response relationship exists between asbestos exposure and lung cancer. Simply put the greater the exposure to asbestos fibers, the greater the risk of developing lung cancer. Symptoms include a persistent cough, loss of weight, fatigue, severe chest pains.
The relationship between smoking and asbestos exposure have been well documented. This relationship can be described as "synergistic", which is the multiplying of the effects of asbestos exposure and cigarette smoke. View the table below to see the comparisons.

SMOKING VS ASBESTOS EXPOSURE	**RISK OF GETTING LUNG CANCER**
1. Non smoker and no asbestos exposure	1x greater chance
2. Asbestos exposure and non smoker	5x greater chance
3. Smoker and no asbestos exposure	10x greater chance
4. Asbestos exposure combined with smoking	50x – 90x greater chance.

Mesothelioma

Mesothelioma is a cancer of the pleural (lung) or stomach (peritoneum) lining. In rare cases it may occur in the heart cavity, which is termed pericardial mesothelioma. Mesothelioma is a rare form of cancer virtually never seen in the general population in the absence of asbestos exposure. This disease is the one of great concern as it is an incurable cancer and is usually fatal within 1 – 2 years. There does not appear to be any increased risk of mesothelioma for smokers, nor does there appear to be a dose-response relationship between asbestos exposure and mesothelioma. This disease is a malignant tumor that spreads throughout the cells of membranes covering the lungs and body organs.

Symptoms include shortness of breath, coughing up blood, blood in the stool, weight loss, and general flu like symptoms. Usually it is the most common symptoms, breathing difficulties and shortness of breath, which prompts patients to consult with their doctor. Approximately 7 – 10% of the asbestos worker population is expected to develop this disease.

Other Diseases

Several other diseases have been noted among people exposed to asbestos fibers. These include cancer of the larynx, esophagus, stomach and pancreas. An abnormality found on x-rays of persons exposed to asbestos is pleural plaque, a build -up of scar tissue on the lining surrounding the rib cage. Also other conditions in the pleurae include pleural effusion, a buildup of fluid in the pleural lining and pleural thickening, a hardening of this lining which causes pressure against the lung, causing restricted breathing.

Medical Surveillance

According to the OSHA Construction Standard, 29 CFR 1926.1101, an employer must institute a medical surveillance program for all employees:

- Who perform Class I, II, or III work for 30 days or more per year; or
- Who are exposed to fiber levels above the TWA or EL for 30 days or more per year; or
- Who are otherwise required to wear negative-pressure respirators.

The Importance of Medical Surveillance

It is important for all asbestos abatement contractors to establish an ongoing medical surveillance program for several reasons. The three major areas of concern are:

- the safety and health of all workers;
- regulatory requirements; and
- other legal liability concerns.

Through implementation of a sound medical surveillance program, an abatement contractor will be able to

- verify every employee's medical status at a particular time;
- comply with OSHA standards on medical surveillance of workers exposed to asbestos;
- reduce other possible liability risks.

In this section, these three concerns are addressed, in addition to several other considerations associated with medical surveillance programs.

OSHA Standards

According to the OSHA asbestos standards-29 CPR 1910.1001 for general industry 1915.1001 for shipyard employment, and 29 CFR 1926.1101 for construction and abatement workers – the employer/building owner must provide, at his/her own expense, medical examinations relative to their employees' exposure to asbestos. An acceptable medical surveillance program must include pre-placement and annual examinations unless sufficient evidence is provided demonstrating that an employee has been examined in accordance with the standard within the past one-year period. This standard also outlines the requirements for maintaining medical records on each employee. (Termination examinations are only required by the 1910.1001 standard).

Pre-Placement Exams

According to the OSHA standards, the required pre-placement examinations must take place before the employee starts the asbestos job. These examinations include:

- a comprehensive medical evaluation;
- a medical questionnaire/history to determine the presence of any possible respiratory diseases;
- pulmonary function tests including forced vital capacity (FVC) -(the maximum amount of air that can be expired from the lung after full inhalation), and forced expiratory volume at one second (FEV1.a)- (the amount of air forcibly expired in one second after full inhalation).

A chest X-ray (posterior-anterior 14 x 17 inches) is optional at the discretion of the physician; however, it is strongly recommended for the initial examination in order to establish baseline medical data for the employee.

The results of this examination will be used for determining the employee's baseline health status, as well as determining whether an employee is capable of safely working under the requirements set forth by the employer. A physician's report will then be finished to the employer for his/her files. The physician must provide to the employee a statement that the employee has been informed by the physician of the increased risk of lung cancer attributable to the combined effects of smoking and working with asbestos and the results of the medical examination. Also, the physician is not to reveal in the written opinion given to the employer specific findings or diagnoses unrelated to occupational exposure to asbestos. The employer must provide a copy of the physician's written opinion to the affected employee within thirty days from its receipt. It is very important for the employer to maintain the results of the examination on file for the duration of employment plus thirty years. In the event an employee files suit claiming a disability at some future date, the employer will be able to check his/her records for documentation when investigating whether or not the condition could have occurred as a result of employment with the company.

In addition to the medical reports, the employer must request that the physician provide a statement indicating whether or not an employee is capable of wearing a respirator. This statement should make reference to any lung restrictions that would prevent respirator usage as well as any other any limitations associated with their use.

Annual Examinations

According to OSHA 29 CFR 1910.1001, subpart (LX3) for general industry and OSHA 29 CFR 1926.1101 (M)(2), every employer must provide, or make available, comprehensive medical evaluations to each of their employees engaged in occupations which cause exposure to airborne asbestos fibers (ex., abatement workers, maintenance people, etc.). Such annual examinations must include, at a minimum:

- completion of a periodic (abbreviated) medical questionnaire;
- a physical examination;
- a study for determining the presence of any respiratory diseases;
- a pulmonary function test that includes FVC and $FEV_{1.0}$

A chest x-ray (posterior-anterior 14 x 17 inches) would only be required under the general industry standard, to be given at intervals as outlined in the OSHA standard.

The physician is able to compare the annual examinations with the pre-placement evaluations to determine if any changes in an employee's health status have occurred. If noticeable changes have occurred, the employer and the employee should both be notified, since the situation may require immediate action such as transferring to another job, discontinuing respirator use, or instituting other procedures.

Annual examinations are required for all workers enlisted in a medical surveillance program. With the exception of an abbreviated annual questionnaire, tests to be performed should be the same unless the physician deems other tests necessary for a complete evaluation. Temporary workers should be encouraged to obtain and preserve copies of their medical test results, as annual exams are not required if adequate records document that the worker has been examined in accordance with the construction standard within the past 1-year period.

Termination of Employment Examination

Within thirty calendar days before or after the termination of an employee covered by the OSHA general industry standard for asbestos (but not asbestos abatement/construction standard), OSHA requires that each employee exposed to asbestos receive a medical examination. This examination must entail the same items as the annual exam:

- a history for determining the presence of any respiratory diseases;
- pulmonary function testing that includes FVC and $FEV_{1.0}$
- a chest x-ray as outlined in the OSHA standard 1910.1001 (l)(4).

Records of these exams must be retained by the employer for a minimum period of thirty years to provide documentation of the health status of the employee. This thirty-year period is necessary because the latency period associated with asbestos-related diseases often ranges between 15 to 30 years. Thus, if an employee files a claim 25 years later, the employer will have records on file for reference.

Reasons for Specific Tests

All of the tests performed during pre-placement, annual, and termination medical examinations are required so that the human body systems that are most likely to be affected by exposure to elevated levels of airborne asbestos fibers can be properly evaluated by trained medical personnel. Some specific reasons for each test are discussed below.

Pulmonary History

This part of the examination is simply a questionnaire (contained in the appendices of the OSHA asbestos standards) that is completed by the employee and physician. This questionnaire identifies the potential for respiratory diseases. Several questions relate to chronic lung diseases, while other questions address the employee's personal habits, such as smoking. Smoking is often of particular concern for workers who may be exposed to asbestos because smoking is known to compound or intensify the effects of asbestos on the lungs. Studies indicate that an asbestos worker who smokes is at least 50 times more likely to develop lung cancer than nonsmokers who do not work with asbestos.

Physical Examination

Criteria to be evaluated as part of the routine physical examination often include a medical history, blood pressure, pulse, vision (depth perception, peripheral vision), an audiogram (hearing test), urinalysis, complete blood count (CBC), and follow-up classification with appropriate recommendations.

Pulmonary Function Tests

These tests are conducted to determine if a persons' lungs are expanding normally, and if adequate air movement in and out of the lungs is occurring. A spirometer is used for conducting the FVC and $FEV_{1.0}$ tests. If the $FEV_{1.0}$ is reduced, a possible obstruction or problem in an employee's lungs may be present. If the FVC or the ratio of $FEV_{1.0}$ to FVC is reduced, restrictive changes in the employee's lungs may have taken place.

Chest X-ray

X-rays (posterior-anterior 14 x 17 inches) are performed primarily to detect irregularities in the lungs or the heart, including any fibrosis or pleural plaques induced by a person's exposure to asbestos. Chest x-rays may be used as a baseline for comparing future x-rays.

Chest x- rays should be interpreted by a certified "B Reader," a physician (often a radiologist, occupational medicine physician or pulmonologist) who has received specialized training in the interpretation of chest x- rays, specifically relating to occupational lung diseases. ''B Readers" are required to pass a proficiency test administered by the National Institute of Occupational Safety and Health (NIOSH) in Morgantown, West Virginia. NIOSH is a federal agency under the Centers for Disease Control and Prevention.

An individual over 40 years of age or who is otherwise at increased risk when working with asbestos and when complying with OSHA asbestos standards- should have, as part of their physical examination, an electrocardiogram (EKG). The use of a respirator places an increased strain on the heart; for individuals with heart disease, appropriate actions should be taken (e.g., transfer to a job that does not require respirator use).

Physicians' Responsibility

The physician may not reveal any findings unrelated to wearing a respirator and working with asbestos, and must provide the employer the following:

1. Any medical conditions that would place the employee at risk of health impairment from exposure to asbestos.
2. Whether or not the employee can wear a respirator;
3. A statement that the employee has been informed by the physician of the results of the exam and of any pertinent conditions;
4. A statement that the employee has been informed of the increased risk of lung cancer associated with the synergistic effect of smoking and asbestos exposure.

CHAPTER 4

Respiratory Protection

Introduction

Asbestos fibers when inhaled or ingested over a prolonged period of time can cause various diseases. Federal and state regulations mandate the proper use of engineering controls, which when used with respirators provides the best possible protection for the worker.

Respirators are considered a workers first line of defense as they are preparing for abatement, however they are not meant to be relied on as the only method of protection since respirators do not reduce the hazard in the workplace. In addition if the employers' respiratory protection program is inadequate or workers don't follow proper procedures in wearing respirators they may indeed become unreliable.

All respirators used under the Occupational Safety and Health (OSHA) standards must be approved by the National Institute for Occupational Safety and Health (NIOSH), who has regulations for manufacturers of respirators and filters (42 CFR Part 84), as well as recommendations for respirator use. These standards are made when exposures might exceed Permissible Exposure Limits, or engineering controls prove not feasible or are inadequate. OSHA has general requirements for respirator selection and usage in the Respirator Protection Standard (29 CFR 1910.134) and specific requirements for exposure to asbestos in the Construction Standard for Asbestos [29 CFR 1926.1101(h)]

The remainder of this section describes the features of and the differences among the various types of respirators required under the OSHA standards, the selection and fit testing requirements, and respirator protection programs.

Classification of Respiratory Hazards

There are two categories of respiratory hazards

- Oxygen Deficiency
- Toxic Contaminants

Oxygen Deficiency

Although seldom encountered in asbestos abatement work, there is a severe hazard posed by oxygen-deficient atmospheres. Normal air contains approximately 21% oxygen by volume. For breathing purposes, air should not contain less than 19.5 percent or more than 23.5 percent oxygen. Entry into an oxygen-deficient atmosphere can rapidly lead to loss of consciousness and death. Oxygen deficiency is most likely to occur in unventilated confined spaces where oxygen may have been consumed by fire or chemical reaction, or displaced by a simple asphyxiant such as carbon dioxide. Accordingly, employees must exercise extreme caution before entering any confined space such as steam tunnels, boiler vessel, or storage vaults protected by deluge CO2 systems. If any doubt exists, employees should not enter such spaces until sufficient oxygen content can be assured by testing or forced ventilation.

Toxic Contaminants

The second, far more commonly encountered class of respiratory hazard consists of air contaminants, which can occur in a variety of physical states. Gaseous contaminants are gases or vapors generated by evaporation of liquids. Particulate contaminants can include dusts, mists, fogs, fumes, and smoke. Asbestos dust is a particulate contaminant. Nevertheless, those responsible for determining the respiratory protection required for abatement work must be alert to the possible presence of other air contaminants in their work environment. Respirator selection is determined by the type and amount of contaminants as well as the oxygen content.

Respirator Types

There are two basic types of respirators available to the asbestos worker: Air purifying respirators and atmosphere supplying respirators (supplied air).

I. Air Purifying Respirators (APR)

Respirators can be broadly categorized as either negative-pressure or positive pressure.

In a negative-pressure respirator, one or more air purifying filters or cartridges are attached via an inhalation valve to a tight-fitting rubber facepiece. The negative pressure created by inhalation draws the contaminated air through the purifying filters to the workers. Because of this operating principle, a leak proof seal between the facepiece and the workers face is essential for proper protection. Leaks may be caused by improper fit, the presence of facial hair and foreign substances under the sealing surface. Additional leaks may be caused by mechanical defects in the respirator such as cracked or damaged seals, valves, filters or cartridges. Air purifying respirators offer considerable resistance to the free flow of air. During inhalation (negative pressure phase), contaminated air will quite readily bypass the cartridge and follow the path of least resistance through any leaks that are present, thereby exposing the workers. Due to this fact, improperly fitted negative pressure respirators provide less protection than all other types of respirators.

Air Purifying Respirators Used In Asbestos Abatement

1. Half-Mask, negative pressure respirator

The half-mask respirator covers from under the chin to the bridge of the nose. Safely goggles should be worn because this respirator does not offer eye protection.

2. Full face, negative pressure respirator

The full face-piece respirator covers from under the chin to the forehead. This broader coverage provides a better-fit, higher degree of protection and gives eye protection. The respirator should be put on by placing the chin into the chin cup, then tightening the straps going from the bottom to the top.

3. Powered Air Purifying Respirator (PAPR), positive pressure respirator

Another type of air purifying respirator is the Powered Air Purifying (PAPR). The PAPR use a battery powered blower that passes the contaminated air through a cartridge or filter where the air is cleaned and forced through a hose to the face-piece. The face covering can be a half-mask, full-face mask, helmet (hat), or hood. This is not a supplied air respirator because it uses a filter to purify contaminated air.

The advantage of using a powered air purifying respirator is that it maintains air at four CFM positive pressure within the face-piece, helmet or hood and at least six CFM to a loose fitting helmet or hood. This provides a higher degree of protection than half face and full - face air purifying respirators.

Note: If an employee requests a PAPR instead of a Negative Pressure Respirator the employer must provide it as long as it provides adequate protection [29 CFR 1926.1101 (h)(3)(ii)]. Employees must also be informed that this option is available.

NIOSH Approval

As required by the OSHA Respirator Standard (29 CFR 1910.134), only approved respirators are to be considered in the selection process and, the respirator must be approved for protection against the specific hazards, asbestos for example. The National Institute for Occupational Safety and Health (NIOSH) is the testing agency to see if a respirator model can receive approval. If the entire respirator assembly, including cartridges/filters/hoses, passes its test, then they issue an approval number for that specific respirator assembly.

According to NIOSH 42 CFR Part 84, Subpart K- Non-Powered Air Purifying Particulate Respirators are classified into 3 series.

1	Not oil resistant	N- Series Filters	Restricted for use in those workplaces free of oil aerosols.
2	Oil resistant	R - Series Filters	Removes particulates that include oil-based liquid particulates. Limited to one shift (8 hours).
3	Oil Proof	P- Series Filters	Removes particulates that include oil-based liquid particulates.

Filters are then labeled according to series classification and efficiency level classification. The letters N, R, and P represent the series of the filter as to whether they can filter oil aerosols or not. The efficiency ratings of the filters are represented by three numbers: 95, 99 and 100. The designation 100 as an efficiency level does not mean 100% efficiency. If a filter were 100% efficient, air could not pass through it. The NIOSH rating for the filter combines a letter and number:

1. N100 & R100 & P100-Minimum efficiency level of 99.97%;
2. N99 & R99 & P99 - Minimum efficiency of 99%;
3. N95 & R95 & P95 - Minimum efficiency of 95%.

P100 filters for asbestos activities are to be color-coded magenta; all other filters are a color other than magenta.

Positive pressure tight fitting respirators must provide a minimum of 4 Cubic Feet per Minute (CFM) of air into the respirator in order to comply with current standards.

Chemical Cartridges and Filters

Air Purifying Respirators (APR's) employ air-purifying devices categorized as either Chemical Cartridges or Mechanical Filters. Chemical cartridges contain substances, which either absorb or adsorb specific gases or vapors from the air and are available in many different types. Mechanical filter cartridges are designed to remove particulate material from the air. The type of cartridge, and hence the particular hazardous substance which it provides protection against, is identified by labeling and a standardized color-coding of the cartridge. The color-coding used is published by the American National Standards Institute (ANSI Standard K13.1, "Identification of Air Purifying Respirator Canisters and Cartridges") and has been adopted in OSHA regulations.

The specific filter to be used for protection against exposure to asbestos dust is a **"High Efficiency Particulate Air (HEPA)"** filter, which has been assigned the code color magenta (purple). Regardless of manufacturer, HEPA cartridges are identified by both labeling and the code color magenta. Some manufacturers color the entire cartridge case magenta; some use a magenta stripe, while others print the label in magenta ink on a black background.

In 1998, OSHA revised the respiratory standard (29 CFR 1910.134), such that HEPA filters used for respiratory protection were reclassified as "P-100" filters.

IMPORTANT: HEPA filters (magenta) are the only type of air purifying filters that offer suitable protection against asbestos dust and, as such, are the only types of filter that may be used for asbestos abatement.

However, persons performing asbestos work should be alert to the possible presence of air contaminants such as organic vapors, welding fumes, carbon monoxide in their working environment.

For the rare situations where a multiple hazard is present, most APR's are capable of being specially fitted with stacking cartridges of two different types.

II. **Atmosphere Supplying Respirators**

An atmosphere supplying respirator (ASR) uses a system that delivers clean breathing air from a source found outside of the contaminated area. This air is generally supplied from an air compressor, a cylinder tank, or from a portable tank, through a supply hose connected to the worker's face-piece.

The ASR can be of the continuous flow type or pressure demand type. The continuous flow respirators continuously blow air into the face-piece. Pressure fluctuations and build up of negative pressure could possibly develop in continuous flow respirators and therefore pressure demand would be preferable.

There are two basic types of atmosphere supply respirators: the Type C airline and the self-contained breathing apparatus.

''Type C Airline Respirators": use an air system to provide an adequate supply of clean air from outside the work area. Air is delivered to the mask via an airline. ASR's do offer protection against oxygen deficiency.

A basic ASR for asbestos work employs a HEPA filter for backup. If airline pressure drops for any reason, a check valve opens allowing the workers to continue breathing through the HEPA cartridge. When this occurs, of course, the respirator becomes a negative pressure air-purifying type, with resultant drop in the protection factor.

❖ Type C Atmosphere Supply System

A type C supplied-air system normally consists of a compressor, air delivery lines, air cleaning apparatus, a reserve air supply, and NIOSH-approved masks. Instead of a compressor, the source of compressed air may also be a bank of high-pressure air cylinders, in which case, an air cleaning apparatus is not necessary. At a minimum, a type C system should provide the following:

- Continuous and sufficient supply of Grade D air
- NIOSH-approved respirators and supply hoses
- Adequate reserve or escape time
- Breathing air temperature control
- Continuous monitor and alarm for carbon monoxide (CO)

There are three types of airline respirators:

1. Demand Airline Device

In demand device, the air enters the face-piece only on "demand" of the wearer, ie. when the person inhales. This is due to the nature of the valve and pressure regulator.

2. Pressure Demand Airline Devices

The pressure demand device has a regulator and valve design such that there is a positive pressure during both inhalation or exhalation. The airflow into the mask creates a positive pressure outward. As such, there is no problem of contaminant leakage into the face-piece.

3. Continuous-flow Airline Device

The continuous-flow airline respirator maintains a constant airflow at all times and doesn't use a regulator, but uses an airflow control valve or orifice, which regulates the flow of air.

The maximum length of the airline according to OSHA regulations is 300 feet.

Limitations

1. Work in oxygen deficient atmospheres - These devices must not be used in atmosphere immediately dangerous to life or health without a five-minute escape bottle of compressed air. The airline user is dependent upon an air hose which, if cut, crushed, or damaged, leaves him/her with little or no protection.

2. Safety -The trailing air supply hose of the airline respirator severely restricts the wearer's mobility. They may make the airline respirator unsuitable for those who must move frequently between widely separated workstations.

Grade D Air

Grade D air is the minimum quality of compressed air allowed for routine use in supplied-air (or self-contained) breathing equipment. Common uses are in fire fighting, general industry, and asbestos abatement projects. The Grade D air specifications were established by the Compressed Gas Association, Inc. of New York and incorporated into the OSHA Respirator Standard (29 CFR 1910.134) by reference. The specifications themselves are contained in the Compressed Gas Association (CGA) Pamphlet G-7, entitled, "Compressed Air for Human Respiration."

Grade D Breathing Air Requirements

Oxygen	19.5 - 23.5%
Carbon Monoxide (CO)	10 parts per million, maximum
Carbon Dioxide (CO2)	1000 parts per million, maximum
Condensed Hydrocarbons	5 milligrams per cubic meter, maximum
Objectionable Odors	None

Normal air contains 20.9% oxygen. The oxygen content in supplied breathing air should always fall between 19.5% and 23.5%. Since the oxygen content of ambient air remains quite constant, and compressing the air does not alter the oxygen content, there is little concern that the asbestos abatement workers will not receive the proper percentage of oxygen.

Perhaps the greatest concern when dealing with type C supplied-air systems is the generation or presence of carbon monoxide. This contaminant may be introduced into the breathing air through compressor malfunction or, more common, it may be drawn into the compressor intake. The compressor may produce carbon monoxide if it overheats. The overheating causes the lubricating oil to break down with carbon monoxide being released. For this reason, high temperature alarms must be installed on compressors.

OSHA requires that oil-lubricated compressors have a high-temperature or carbon monoxide alarm, or both. If only a high temperature alarm is used, the air from the compressor shall be frequently tested for carbon monoxide.

One alternative is to use an oil-free compressor to eliminate the chance of oil breakdown if the compressor overheats. However, oil-free compressors usually require more frequent servicing, and the synthetic material used may release gaseous contaminants if the compressor overheats.

To avoid drawing carbon monoxide into the compressor directly, an extension intake flexible duct should be used to place the air intake at a remote location. The location chosen should be away from any combustion sources (i.e., vehicle exhausts, smokestacks, etc.). Frequently, the best location is 15 or 20 feet high, since it would be likely that a truck or car, lawnmower or other carbon monoxide producing vehicle could affect the supply. Be sure to place a coarse filter (screen) over the air inlet to keep leaves, bugs, etc., from being drawn into the compressor. Contractor supervisors should be aware of any other potential sources of toxic gases near the air intake. This would be especially important in industrial settings where gases are commonplace.

Air Processing

A properly established type C supplied-air system does not simply pump air to workers; the air also must be processed. Contaminates, water or oil vapor, dust, mist and carbon monoxide, must be removed by filters or chemical absorption before use.

Water vapor, when compressed, forms water droplets or condensation. If this water is not removed, it can build up in the airlines to the workers to the point where a solid "plug" of water is formed. This plug of water will quickly be forced into the respirator of the workers. It is quite likely that the workers will immediately discard the masks or be startled by the sudden flood of water, potentially causing an accident (fall from a scaffold or ladder). Accordingly, the air processing equipment must be capable of removing moisture from the supply air.

❖ Self-Contained Breathing Apparatus (SCBA)

As the name implies, SCBA is an atmosphere-supplying type of respirator, which employs a self-contained portable air supply, usually a pressurized cylinder, which is worn on the back. Different cylinder sizes are available to provide enough air supply from between five minutes (for escape purposes) up to one hour. SCBAs, when operated in the pressure/demand mode, offer the highest level of protection available against both oxygen deficiency and toxic contaminants.

Each employee designated to wear a respirator for asbestos must receive medical clearance and training annually and fit testing every twelve months. A qualified individual should conduct the training session to ensure that employees understand the limitations, use and maintenance of respiratory equipment.

Selection of the Appropriate Respirator

When respirators are necessary, selection of the proper respirator for the particular type and level of respiratory hazard present is the single most important aspect to ensuring worker protection. For general guidance on selection of respirators, the OSHA Respiratory Protection Standard (29 CFR 1910.134 (d) (1) (ii)) specifies the use of a NIOSH-certified respirator.

Protection Factors

Understanding the concept of Protection Factor" is important to the selection of the correct respirator. Protection Factor (PF) is defined as the ratio of contaminant concentration outside the mask to the contaminant concentration inside the mask or:

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

The Protection Factor numerically represents the particular respirator's ability to reduce the concentration of a particular contaminant against which it is used. Hence, the maximum concentration at which a respirator can be used can be determined by rearranging the equation:

> PF x PEL = Maximum Use Concentration**, (MUC)** where PF is the Protection Factor of the mask.

Although protection factors can be calculated as demonstrated above, OSHA has assigned respirator protection factors for asbestos and these must be followed regardless of the calculated levels.

$$\mathbf{PF = \frac{Cout}{Cin}} \qquad \textbf{Or} \qquad \mathbf{PF \times Cin = Cout}$$

(c- concentration)

The PEL's are typically substituted for the Cin, since they are the maximum allowable exposure for workers with no respiratory protection: **PF X PEL = Cout**

OSHA's ASSIGNED PROTECTION FACTORS [for Respirators typically used for Asbestos Exposure]	
HALF MASK, air-purifying	10
FULL FACE, air-purifying	50
Full-Face PAPR	1000
Full-Face SAR in continuous flow or pressure demand mode	1000

Note: SAR = Supplied Air Respirator

OSHA RESPIRATORY PROTECTION REQUIREMENTS

Each respirator has a limit as to the maximum concentration that it can protect people from. This limit is called the: **Maximum Usage Concentration (MUC).**

RESPIRATOR	PF	X	PEL	=	MUC
HALF-MASK, air-purifying	10	X	0.1 f/cc	=	1.0 f/cc
FULL FACE, air-purifying	50	X	0.1 f/cc	=	5.0 f/cc
Full Face PAPR	1000	X	0.1 f/cc	=	100.0 f/cc
Full Face SAR, Pressure Demand or Continuous Flow Mode	1000	X	0.1 f/cc	=	100.0 f/cc

Respiratory Fit Testing

One of the most important elements of an effective respirator program is fit-testing. The OSHA Respiratory Standard (29 CFR 1910.134) required that employees be fit tested every twelve months.

There are two major categories of fit testing, qualitative (pass/fail basis) and quantitative (scientific measure basis).

During any type of fit testing, the respirator straps must be properly located and adjusted to be as comfortable as possible. If over tightened, the straps will sometimes reduce facepiece leakage, but the wearer may be unable to tolerate the respirator during the work period. The facepiece should not press into the face and shut off blood circulation or cause major discomfort. When the respirator is issued and before fit testing, a visual inspection of the fit should always be made to make sure that there are not visible openings/leaks (around the nose). The respirator should appear properly adjusted and comfortable.

Qualitative Fit Tests

Qualitative fit tests involve the employee responding (voluntarily or involuntarily) to a chemical introduced outside the respirator facepiece. Two methods are an irritant smoke test and taste test.

Irritant Smoke Test

The irritant smoke test involves exposing the respirator wearer to an irritating smoke and observing if leakage is present by his/her actions. As a qualitative means of determining respirator fit, this test has a distinct advantage in that the wearer usually reacts involuntarily to leakage by coughing or sneezing.

Taste Test

This test relies upon the respirator wearer's ability to detect a chemical substance, usually sodium saccharin, by tasting it inside the respirator. To determine worker sensitivity, prior to the respirator test the worker is exposed to a known concentration. The test involves placing a hood over the respirator wearer's head and shoulders while they are wearing the selected respirator and spraying the test agent into the hood. If the wearer is unable to taste the chemical, then a satisfactory fit is achieved.

Quantitative Fit Test

Quantitative respirator fit tests involve exposing the wearer to a test atmosphere containing an easily detectable test agent and measuring the penetration of the test agent into the respirator. Fit testing is a necessary part of an effective respirator program. It is the key to detecting and correcting contaminant leakage around the facepiece to face seal.

The airborne concentration of the substance is measured outside and inside the respirator while the wearer performs the required exercises. The specific degree of protection (protection factor) can be determined for that wearer/respirator combination by performing calculations with the measured concentrations. The result is called a fit factor. According to OSHA, passing the fit test is when the overall fit factor is 100 or greater for a half-mask respirator and 500 or greater for the full face-piece respirator.

This type of fit-test may also be performed by a computer which measures the normal ambient particle concentration and compares it with the concentration inside the mask. A popular model of this computer is called a "Porta-Count" and does not require the use of a chamber.

User Seal Check Procedures

OSHA requires that the fit of a respirator be checked every time the respirator is put on. This is called a user seal check or more commonly referred to as the positive/negative pressure check

Negative Pressure Check

For this test, the user closes off the inlet of the cartridges or filters by covering with his palms or squeezing the breathing tube so it does not allow air to pass. Then inhale gently so the face-piece collapses slightly, and hold his/her breath for about ten seconds.

If the face-piece remains slightly collapsed and no inward leakage is detected, the respirator fits tightly enough. This test, of course, can only be used on respirators with tight-fitting face-pieces. It also has potential drawbacks, such as the hand pressure modifying the face-piece seal and causing false results.

Positive Pressure Check

This test is very similar in principle to the negative pressure test. It is conducted by closing off or covering the exhalation valve and exhaling gently into the face-piece. The test is easy for respirators whose valve cover has single small port that can be closed by the palm or finger. If the face pieces remain slightly inflated and no outward leakage is detected, a proper fit is achieved.

Factors Affecting Fit

The most notable and often controversial factor affecting respirator fit is facial hair, which may include beard, mustaches, sideburns, and/or razor stubble. Proper fit with a tight fitting respirator cannot be achieved when there is any hair growth between the skin and the sealing surface of the facepiece.

Other significant factors that may preclude achieving an adequate fit with a tight-fitting respirator, and may require re-fit testing with a different type of respirator, include but are not limited to:

- Facial scarring
- Congenital malformations
- Weight gain or loss (20 pounds or more)
- Extreme or unusual facial features
- Dental changes
- Reconstructive surgery

Eyeglasses will interfere with fit of full facepieces. Special spectacle kits, which are compatible with respirator use, are available from your Safety Administrator.

Respirator Maintenance

Cleaning and disinfecting procedures for respirators must ensure that the respirator is properly cleaned and disinfected in a manner that prevents damage to the respirator and does not cause harm to the user. The following recommended procedures are general in nature. More specific procedures are found in OSHA's 29 CFR 1910.134 Appendix B-2.

- Respirators should be disassembled and washed with detergent in warm water (110'F maximum) with a mild detergent using a brush or cleaner as recommended by the manufacturer. If possible, detergents containing a disinfectant should be used. Organic solvents (I.e., alcohol) should not be used as they deteriorate the rubber face-piece. If disinfecting detergent is not available, the detergent wash should be followed with a disinfecting rinse. Respirator manufacturers should be consulted for recommended disinfectants.

- Respiratory equipment should be thoroughly rinsed in warm clean water (110°F maximum) to remove all traces of detergent, cleaner and sanitizer, and disinfectant.

- Respiratory equipment should be allowed to air dry on a clean surface, or hand dried using a clean lint-free cloth before being reassembled.

When not in use, dry respiratory equipment should be sealed in plastic bags and stored in a single layer with the face-piece and exhalation valve in a non-distorted position, and kept out of direct sunlight. Repair or replacement of component parts must be done by qualified individuals. Substitution of parts from a different brand or type of respirator will invalidate the approval of the respirator and may adversely affect its performance. Never exchange parts between manufacturers.

Inspection for defects in respiratory equipment must be done before and after each use and during cleaning. The following lists some common respirator defects often encountered during an inspection and corrective actions to be taken should such a defect be found.

Air Purifying Respirators (half mask and full face-piece)

Component	Possible Problem	Solution
Rubber Face-piece	1. Excessive dirt 2. Cracks, tears, or holes. 3. Distortion 4. Cracked, scratched or loose-fitting lenses	1. Clean all dirt from face-piece. 2. Obtain a new face piece. 3. Allow face-piece to "sit" free from any constraints and see whether distortion disappears. If not, obtain new face-piece 4. Replace if possible or obtain new face-pieces.
Head-straps	1. Breaks or tears. 2. Loss of elasticity 3. Broken or malfunctioning buckles or attachments 4. Slipping face-piece	1. Replace head straps. 2. Replace head straps. 3. Obtain new buckles. 4. Replace head-strap.
Inhalation Exhalation Valve	1. Detergent residue, dust particles, or dirt on valve or valve seat 2. Cracks, tears, or distortion in the valve material or valve set 3. Missing or defective valve cover	1. Clean residue with soap and water. 2. Contact manufacturer for instructions, replace valve. 3. Obtain valve cover from manufacturer.
Filter Element(s)	1. Proper filter for the hazard. 2. Approval designation. 3. Missing or worn gaskets. 4. Worn threads- filter threads, face-piece threads 5. Cracks or dents in filter housing. 6. Missing or loose hose clamps.	1. Contact manufacturer. 2. Contact manufacturer 3. Replace whichever is applicable. 4. Contact manufacturer 5. Replace filter 6. Obtain new clamps

Atmosphere Supplying Respirators (SAR and self-contained)

Check face-piece, head-straps, valves, and breathing hose, as you would for air purifying respirators.

Component	**Possible Problem**	**Solution**
Hood, Helmet, Blouse, or **Full** Suit (if applicable)	1. Headgear suspension. 2. Cracks or breaks in face-shield 3. Protective screen to see that it is intact and fits correctly over the face-shield, abrasive blasting hoods, and blouses.	1. Adjust properly for worker. 2. Replace face-shield. 3. Obtain new screen.
Supplied Air System	1. Breathing air quality. 2. Breaks or kinks in air supply hoses and end filling attachments 3. Tightness of connection. 4. Proper setting of regulators and valves 5. Correct operation of air purifying elements and carbon monoxide or high-temperature alarms	1. Maintain Grade D breathing air. 2. Replace hose and/or fitting. 3. Adjust connection. 4. Consult manufacturer's recommendations 5. Consult manufacturer's recommendations

Respiratory Protection Program

When respirators are used the OSHA Respiratory Protection Standard (29 CFR1910.134) requires employers to establish and maintain a Respiratory Protection Program. The minimal elements required for an acceptable program are as follows:

1. Procedures for selecting respirators for use in the workplace.
2. Medical evaluations of employees who will use a respirator.
3. Fit testing procedures for tight fitting respirators.
4. Procedure for proper use of respirators in routine and in reasonably foreseeable emergencies.
5. Procedures and schedules for cleaning, disinfecting, storing, inspecting, repairing discarding and other maintenance.
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, the proper use of respirators, including putting on and removing them, any limitations on their use and their maintenance.
8. Procedures for regularly evaluating the effectiveness of the program.

If you have any questions regarding respiratory protection contact your Safety Administrator or Company Industrial Hygienist.

Designation of a Program Administrator

A respirator program administrator must be designated by name. This person is responsible for implementation of and adherence to the provisions of the respiratory protection program. It is also beneficial to designate the person responsible for enforcement of employee adherence to the respirator procedures at the job site. The person in charge of the respiratory protection program must be trained and experienced in the management of that respiratory program. Procedures should also be outlined for enforcement of the program.

Respirator Program Evaluation and Recordkeeping

The employer is also responsible for evaluating the respirator program at least once annually **and make program adjustments, as appropriate, to reflect air sampling or other evaluation** results. the employer should also review compliance with all aspects of the program outlined in this chapter (respirator selection, purchase of approved equipment, medical evaluation of employees, fit testing, issuance of equipment and associated maintenance, storage, repair and inspection, appropriate surveillance of work area conditions).

Attention should be given to proper recordkeeping. Records which should be kept include:

- names of employees who have been trained in respirator use;
- documentation of the care and maintenance of respirators;
- medical reports of each respirator user;
- test results showing possible airborne concentrations of asbestos fibers during work; and,
- instances of any problems specific to the use of respirator equipment .

Respirator Program Checklist

In general, the respirator program should be evaluated at least annually with program adjustments, as appropriate, made to reflect the evaluation results. Program function can be separated into administration and operation.

A. Program Administration

_____________ (1) Is there a written policy which acknowledges employer responsibility for providing a safe and healthful workplace, and assigns program responsibility, accountability and authority?

_____________ (2) Is program responsibility vested in one individual who is knowledgeable and who can coordinate all aspects of the program at the jobsite?

_____________ (3) Can feasible engineering controls or work practices eliminate need for respirators?

_____________ (4) Are there written procedures/statements covering the various aspects of the respirator program, including:

- _____________ designation of an administrator
- _____________ respirator selection
- _____________ purchase of approved equipment
- _____________ medical aspects of respirator usage
- _____________ issuance of equipment
- _____________ fitting
- _____________ training
- _____________ maintenance, storage and repair
- _____________ inspection
- _____________ use under special conditions and
- _____________ work area under surveillance?

B. Program Operation

(1) Respiratory protective equipment selection and assignment

_____________ Are work area conditions and employee exposures properly surveyed?

_____________ Are respirators selected on the basis of hazards to which the employee is exposed?

_____________ Are selections made by individuals knowledgeable of proper selection procedures?

______ Are only approved respirators purchased and used; do they provide adequate protection for the specific hazard and concentration of the contaminant?

______ Has a medical evaluation of the prospective user been made to determine physical and psychological ability to wear the selected Respiratory protective equipment?

______ Where practical, have respirators been issued to the wearers for their exclusive use, and are records covering issuance kept?

(2) Respirator fitting

______ Are the users given the opportunity to try on several respirators to determine whether the respirator they will subsequently be wearing is the best fitting one?

______ Is the fit tested at appropriate intervals?

______ Are those users who require corrective lenses properly fitted?

______ Is the face-piece-to-face seal tested in a test atmosphere?

______ Are workers prohibited from entering contaminated work areas when they have facial hair or other characteristics which prohibit the use of tight-fitting face-pieces?

(3) Respirator use

______ Are respirators being worn correctly (i.e., head covering over respirator straps)?

______ Are workers keeping respirators on all the time when necessary?

(4) Maintenance of respiratory protective equipment

(a) Cleaning and Disinfecting

______ Are respirators cleaned and disinfected after each use?

______ Are proper methods of cleaning and disinfecting utilized?

(b) Storage

______ Are respirators stored in a manner so as to protect them from dust, sunlight, heat, excessive cold or moisture, or damaging chemicals?

______ Are respirators stored properly in a storage facility so as to prevent them from deforming?

______ Is storage in lockers and tool boxes permitted only if the respirator is in a carrying case or carton?

(c) Inspection

__________ Are respirators inspected before and after each use and during cleaning?

__________ Are qualified individuals/users instructed in inspection techniques?

__________ Is respiratory protective equipment designated as "emergency use" inspected at least monthly (in addition to after each use)?

__________ Is a record kept of the inspection of "emergency use" respiratory protective equipment?

(d) Repair

__________ Are replacement parts used in repair those of the manufacturer of the respirator?

(5) Special use conditions

__________ Is a procedure developed for respiratory protective equipment usage in atmospheres immediately dangerous to life or health?

__________ Is a procedure developed for equipment usage for entry into confined spaces?

(6) Training

__________ Are users trained in proper respirator use, cleaning and inspection?

__________ Are users trained in the selection of respirators?

__________ Are uses evaluated using competency-based evaluation, before and after training?

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CHAPTER 5

Understanding Building Systems

Introduction

A person inspecting a facility for ACM should understand the interrelationships among building systems, recognize where asbestos is likely to be found and be familiar with blueprints and other resource material which may be available for his or her use. Knowledge of how buildings are constructed and operated is vital to conducting a thorough building survey for ACM.

The Interrelationships of Building Systems

Each building is a combination of four basic building systems. These systems are generally labeled for the engineering discipline responsible for their design and drafting.

The architect is the design professional who has overall responsibility for the project. The architect will hire consultants – electrical, mechanical and structural engineers – to bring specific knowledge to the design team. In addition, other consultants (e.g. acoustical engineers, interior designers, kitchen consultants, etc.) may be employed if the specific project warrants.

The structural system is the skeleton of the building and consists of beams, columns, bearing walls and foundations, which support the loads of the building and its occupants. The mechanical systems are the heating, ventilating and air conditioning (HVAC) and the plumbing systems of the building. The electrical systems are the power and lighting systems of the building.

To provide a complete building, all of these systems must meld into a coherent and consistent facility. The architect's responsibilities are to coordinate these systems, and to choose the exterior and interior finishes and materials which are not a part of the above described engineering systems.

Physical Plan Layout

When designing a building, the design team is typically faced with limitations, notably occupant and functional requirements, a budget, and building code regulations. Consequently, the physical layout of buildings can be very simple, with the structural systems being repetitive and the mechanical and electrical systems being served with minimal runs of ducts, piping and conduit.

In multi-story buildings, the systems are simplified vertically. Generally, a utility core runs vertically through the building. From this core, service runs branch to individual floors. Elevators are generally bundled and stair towers run vertically through the structure. Although this vertical utility core can be difficult to access, it should always be inspected for suspect ACBM.

The structural system is aligned vertically to simplify the skeletal frame. By simplifying the physical plan layout, the design team is able to achieve greater benefit within the restrictions placed upon the project. High-rise structural steel frame buildings nearly always contain spray-applied fireproofing. In such structures built before 1973, this spray-applied fireproofing is a highly suspect ACBM.

Mechanical Systems

Mechanical systems are those systems designed by mechanical engineers. They include the HVAC system, the plumbing system and in selected regions of the US, elevators.

Heating, Ventilating and Air Conditioning (HVAC) Systems

Individual spaces or zones in a building are served by supply and return air and a thermostat to control the HVAC system. The supply and return may be in ductwork or in a plenum. Plenums are spaces, for example, the space above a dropped acoustical ceiling and below the roof or floor above. In most cases, the plenum is used for return air, that is, the air leaves the room, enters the plenum, and is drawn into the mechanical room from the plenum.

All HVAC systems consist of a means of heat transfer. The heat transfer may occur in the central mechanical space or "plant", but in large buildings or complexes it will occur in individual mechanical rooms. From the mechanical room the supply is sent to individual spaces within the building, the return air is carried back to the mechanical room where it is filtered and re-conditioned. In addition, some make-up air is added from the outside to augment any air lost through the opening of doors and windows and to provide a source of fresh air to the building.

Heating and/or cooling of indoor air are both called air conditioning. For this reason you are likely to find "Air Conditioning Plans" included in the sets of working drawings for both heating and cooling systems.

By the engineering definition, heat transfer only occurs when a warmer object gives up some of its heat to a cooler object. Exactly how the transfer occurs is dependent upon the system being used. HVAC systems can be classified as follows:

- Air Systems

  There are two types of air HVAC systems – single duct and double duct. (This refers to supply only; return is accomplished in yet another duct.) A single duct system delivers either heated or cooled air at a constant temperature from the air conditioning equipment through ductwork. Often, a variable air volume system is used, wherein the air conditioning requirements of a space activate a damper that controls air flow based on those requirements. A terminal reheat unit, located near the point of discharge, may also be used to boost heating.

  When a double duct system is used, one duct carries cooled area while the other carries heated air. The two ducts meet at a mixing box, where the amount of heated or cooled air is regulated based on the requirements of the space(s) being served.

- Water Systems

  Heated and/or cooled water is delivered to a fan coil unit, where the air is introduced. Air is blown across coils as regulated by dampers, again activated by the requirements of the individual space. This air is introduced through a separate duct system from the mechanical or fan room, or from a direct connection to the outside, or may simply be ambient room air.

  Water systems are either two or four pipe systems. A two pipe system has a single supply and a single return pipe (thus the two pipes). With two pipes it is possible to either heat or cool at any given time, but not both at the same time. However, floors with mixed occupancy or exposure to more than one point of the compass often require heating and cooling at the same time. Conversation of a two pipe system to the heating or cooling cycle requires a shut-down and conversion of the system. This takes a matter of hours, and thus cannot be accomplished on those days where it would be beneficial to heat in the morning and cool in the afternoon.

  A four pipe system delivers both heated and cooled water (called "chilled water" as it is supplied by a chiller) at the same time. Two pipes supply and return heated water, and two other pipes supply and return chilled water. The heat transfer coil may then call for whichever water supply is required to meet the space needs.

- Refrigerant Systems

  These are normally pre-packaged units that supply heating or cooling directly to a space through a wall or roof. In general, these are used only in specialized installations in commercial buildings.

- Radiant Systems

  Radiant Systems include any number of devices which are either embedded in the wall or floor assembly, or are set as radiators, usually along an exterior wall. They are usually used for heating and function by radiating heat directly into a space. That is, no air is blown across the heat transfer surface.

The precise HVAC system layout and distribution is a product of the architectural design and engineering analysis of each individual building.

Since the primary function of the HVAC system is to heat and cool building spaces, insulation is used to inhibit unwanted heat transfer. Insulation is typically found on the outside of boilers (block, blanket, or board insulation) and on the breeching or flue which conveys waste gases from the combustion process. Blanket or batt insulation is sometimes found inside ducts and insulation is sometimes sprayed on the outside of the ducts. Each of these types of insulation should be considered suspect. In addition, gasket material on boiler doors, rope used as filler in openings, valve packing, fire stop packing and vibration-dampening cloth connecting sections of ductwork may contain asbestos. Pipe insulation is discussed below.

HVAC systems which use chilled water will typically include a cooling tower where excess heat is rejected to outdoor air. (The chilled water does not pass through the cooling tower, but rather tower water from the chiller passes through the tower.) Cooling tower baffles and sometimes filter media (fill) are constructed with ACM; the slats are frequently asbestos-cement boards.

Plumbing Systems

Plumbing systems include any water, gas or other fluid which is piped through a building and in some cases disposed of as waste. Also considered part of the plumbing system is air when used in a non-HVAC manner, such as compressed air in hospitals, factories or manufacturing facilities.

Plumbing systems consist of piping (horizontal pipes are called runs, vertical pipes are called risers). Other components may include valves, elbows, fittings, joints, etc.

The water systems in a building are of four types: consumed, circulated, static and controlled. The consumed system is potable water for use and consumption by building occupants. This is also referred to as "domestic water". Circulated water is water which is circulated from a "plant" to the HVAC equipment in a two or four pipe system, as described above. Static water is water used for fire protection, and controlled water is water used to maintain relative humidity within the building.

The use of asbestos in plumbing systems is usually for the purpose of temperature control. Generally it can be found on the piping and equipment which heat water and/or maintain water at a stable temperature. Insulating materials prevent heat losses from hot pipes and equipment and water condensation on the outside of cold pipes and equipment. Thus, insulating ACM is typically limited to consumed, domestic and circulated water systems.

In the consumed water system, domestic hot water (DHW) will be insulated to limit heat loss from the point of origin to the point of use. In large building complexes, a single water heater may be installed and a recirculating system will be operated to continually circulate the water from the heater to the points of use. This arrangement saves the user the inconvenience of having to wait for the hot water to arrive from the remote source. Anticipated asbestos use in these installations will be the insulation in and around the water heater and the insulation on the piping throughout the building.

In the circulated water system, heating water (HW) and chilled water (CW) are circulated from the boiler and chiller to the air handling units (AHU) in various parts of the building. The temperature at which the HW and CW arrive in the AHUs directly affects the potential of heat transfer. To maintain the temperature from the source to the point of use, insulation is required along the entire pipe runs. This insulation may contain asbestos.

In addition to plumbing insulation, asbestos cement pipe may have been used in the plumbing systems, waste systems and roof drains. The pipe is concrete-like in appearance and is known by the trade name "Transite".

Electrical Systems

Electrical systems within a building may appear very complex, but are simple in their basic design. Each building includes a primary electric service entrance; the point where the energy enters the building. This is where the meter is located.

In large buildings, transformers will be set on site to reduce the high voltage supply from the electric company to lower voltage used within the building. In smaller buildings, the transformer will be outside the building either on a pad or on a pole. Once the voltage has been reduced, the service is then divided into individual circuits. The size and capacity of each circuit is based on the anticipated energy requirements of items served by that circuit. The division into circuits occurs at a panel(s).

Asbestos use in electrical systems has included:

- Asbestos-cement ducts for electrical cable runs;
- Partitions in electrical panels;
- Asbestos cloth to bind bare cables ; and
- Insulation on stage lighting and on the wire to those lights.

Of great concern in inspecting electrical systems is the potential hazard to the inspector from unsafe inspection procedures. Some guidelines for work in and around electric equipment include:

- Whenever possible, conduct the inspection accompanied by a building operator (specifically an electrician, if possible) who is familiar with the electrical equipment, its operation and location.
- Look for and heed any “Danger High Voltage” signs.
- Ask that the system be de-energized before taking samples.
- Use extreme care not to cut into or through cables or cable insulation.
- Be wary of electrical insulation which can flake off with time and heat.
- Beware of exposed electrical wires and components.
- Do not use a wetting solution near an electrical system.
- When taking samples of surfacing or other suspect materials be careful not to penetrate to electrical components that may be located underneath, or behind. Unless electrical power can be shut off, it may be best to assume certain electrical components to be ACBM.

CHAPTER 6

The Building Inspection

Introduction

Assessing the potential hazard to occupants due to the presence of asbestos in building materials is a subjective process which generally includes a visual inspection of the building, bulk sampling of suspected asbestos-containing materials (ACM), evaluation of the ACM, and a determination of the appropriate response actions. It is important to understand that the mere presence of asbestos in a building does not necessarily constitute a hazard or unacceptable risk to health. However, the assessment process must be thorough and complete to assure all forms of ACM are identified and evaluated. Only after all data have been assembled and reviewed can one determine the extent of any hazard and select an appropriate procedure for its mitigation. These "response actions" may include the removal, encapsulation, or enclosure of ACM. At times, an abatement procedure may not be immediately necessary. In these instances, and in all cases where ACM is not removed, an operations and maintenance program should be instituted to prevent any future hazards.

Building Inspection Requirements

Asbestos Hazard Emergency Response Act (AHERA)

Currently, the only federal regulation which requires inspections for ACM is the Asbestos Hazard Emergency Response Act (AHERA). This law, commonly known as "AHERA", was signed into law by President Reagan On October 22, 1986. The final rules and regulations were published in the Federal Register on October 30, 1987. The AHERA regulations are applicable to public and non-profit private elementary and secondary school buildings. Other buildings are not yet under the jurisdiction of AHERA. Legislation was introduced in Congress in December 1988 to extend the AHERA requirements to federal, commercial, and possibly private buildings. However, states or localities may require inspections of other buildings for ACM. For example, Public Law 76 in New York City requires asbestos investigations as a condition of a building demolition or renovation, and NYS mandates survey requirements outlined in ICR 56-5.1 – "Asbestos Survey Requirements for Building/Structure Demolition, Renovation, Remodeling and Repair."

The AHERA regulation is quite comprehensive. It includes detailed requirements for the following:

1. Initial inspections of buildings by accredited inspectors
2. Sampling and analysis of suspected ACM
3. Assessment of ACM (current condition and potential for future damage)
4. Determination of response actions by accredited management planners
5. Operations and maintenance programs
6. Training and periodic surveillance
7. Management plans (reports of the inspection and recommended actions)
8. Recordkeeping
9. Warning labels for the identification of ACM in mechanical areas
10. Periodic re-inspections

The regulation requires the identification and classification of all known or assumed ACM into specific categories. These categories are based on:

(1) The type of ACM which is either a surfacing material (for example, acoustical plaster on a ceiling or spray fireproofing on structural members), thermal system insulation (for example, pipe or boiler insulation), or miscellaneous material (all others);

(2) The extent of present damage;

(3) The potential for future damage.

Once the ACM has been identified and classified, a management planner must determine the appropriate response action for each material. The selection of the method of abatement may consider such factors as feasibility, cost, and timeliness, but must always assure the "protection of human health and the environment." Thus, the Environmental Protection Agency (EPA) is not specifically mandating the removal of all ACM from school buildings. Other methods of abatement such as encapsulation or enclosure are permitted.

Originally, the final rules required all inspections and management plans to be completed by October 12, 1988. Due to the large number of buildings that required inspection, the comprehensive nature of the task, and the limited number of trained personnel, this completion date was considered to be infeasible. The date for submission of the management plans has since been extended until May 9, 1989. Once a management plan has been approved by the state, a local education agency must implement the plan by July 9, 1989.

Training and Accreditations for Asbestos Inspectors

Those individuals performing asbestos inspections and assessments should have a background and adequate training in diverse areas, in addition to expertise in asbestos evaluations. This would include a basic understanding of building construction and mechanical systems including air distribution systems (HVAC). The ability to interpret and utilize construction plans (blueprints) is critical. Training in the techniques for collecting bulk samples of suspect ACMs is necessary. Associated with bulk sampling is the use of personal protective equipment. Thus, the inspector must know how to utilize respiratory protection and protective clothing in order to prevent exposure to asbestos during the inspection process.

Typically, the inspectors are industrial hygienists, engineers or other environmental professionals. They commonly have a university degree in science, engineering or other related field. However, there is no substitute for experience. Previous work and the knowledge gained from past inspections have proved to be invaluable.

The federal AHERA regulation currently requires accreditation for those individuals performing inspections of schools and completing the management plans. AHERA clearly assigns separate and specific duties to each role; thus, the accreditation for “inspector” and “management planner” are separate and distinct.

According to AHERA and NYS Code Rule 56, the Inspector must complete a 3-day course and successfully pass the examination. To maintain certification, a 1/2 day refresher training is required annually. NYC Title 15, Chapter 1 accepts the same training requirements as the State, but requires proof of considerable education and experience in order to become a NYC certified Investigator.

The Inspector must identify all friable and non-friable building materials and group them into Homogeneous Sampling Areas. The term "Homogeneous Area" is defined as any material which is uniform in color and texture. Inspectors must check all spaces in a building including halls, closets, attached spaces, and tunnels. They must carefully inspect walls, ceilings, beams, ducts, and any other surfaces. Asbestos-Containing Building Material (ACBM) is often found in inaccessible areas (e.g., behind walls, false ceilings, etc.). Sampling in these areas requires permission and cooperation with the building owner because of damage that may be caused by accessing a restricted area. If sampling is not feasible, the Inspector should assume that suspect asbestos-containing materials exist in these areas and advise the building owner and document accordingly.

The AHERA definition of ACBM is somewhat limiting and vague. ACBM is defined as any ACM that is found in or on interior structural members or other parts of a school building. Due to potential liability, most inspection protocols that are being followed, typically call for locating all ACM both inside and outside of a school building. In non-school buildings, the current ASTM

International "E2356 - Standard Practice for Comprehensive Building Asbestos Surveys" could be followed. ASTM goes beyond the AHERA requirements on several issues, including surveying for all ACM not just ACBM.

*** The term "Homogeneous Area" is defined as any material that is uniform in color and texture.**

The following is a summary of the main responsibilities for a building inspector as per AHERA:

1. **Inspect for Friable and Non-Friable ACBM by:**
   a. Collecting bulk samples and having them analyzed; or
   b. Assume a material contains asbestos.

2. **Conduct a Physical Assessment of Friable Materials:**
   a. Check the current condition of the material; and
   b. Estimate the potential for damage of the material.

3. **Write an Inspection Report:**
   a. AHERA lists the requirements for the Inspection Report, which is a summary of the inspection and physical assessment results [See 763.85].

Pre Inspection

The inspection process should commence with an on-site meeting with an inspection team that should include but not necessarily be limited to:

1. The building owner's representative - (facilities manager or LEA);
2. The original architect (if available);
3. The building engineer/custodian;
4. Any health and safety officials;
5. The Inspector.

These individuals have intimate knowledge of their property and mechanical systems. At this meeting it is important to discuss the following:

Define the scope of the project - Determine and agree on the purpose and limitations, if any, of the inspection. Is it necessary to survey the entire building? How many buildings are located at the site? Is exploratory demolition required to gain access to material concealed in chaseways or walls? For compliance with AHERA, the entire building must be inspected. Perhaps the owner is concerned with only one floor or area to be renovated. In this instance, the inspection will not necessarily have to include other areas.

Discuss the building construction, operation, and nature of activities – Request available drawings such as floor plans and mechanical or architectural drawings. Have there been any additions or renovations to the building or any work on mechanical systems? What is the nature of the activity in the building? Schools tend to have fairly typical areas of classrooms, offices, shops and gymnasiums and mechanical spaces. High-rise buildings may be typically limited to office spaces. However, do not assume. Health care facilities and power stations are extremely complex. Some special operations may have required unusual renovations, e.g., fireproofing, which contains asbestos for a storage or vault area or electrical closet.

Determine the operation of the air distribution system (HVAC) – How is air distributed throughout the building? Are there return air or, in some rare cases supply air plenums above the ceilings? Is there interior or exterior insulation on the ductwork? An understanding of the air distribution is critical in evaluating the potential for the dispersal of asbestos fibers throughout the building.

Outline the inspection procedures - Determine when the building is occupied and what hours are available for inspection. Discuss the need to access all spaces included in the inspection (crawl spaces, pipe chases, areas above ceilings). This may require keys to locked or secured areas which may belong to tenants. Also, resolve the issue of notification of the building occupants. The occupants will naturally be curious when strangers tour their area, particularly when wearing respirators to inspect above the ceiling or collect samples. The building owner or manager should be responsible for notifying all occupants in advance and discussing the inspection in whatever detail is deemed appropriate. Complete honesty is recommended as the best policy.

A thorough discussion with the building representative will allow the inspection process to be completed successfully and with a minimum of delay and disruption. It will also facilitate a continued relation with the building representatives if all parties understand their roles in this endeavor.

Review of Building Records

Following the on-site meeting the inspector(s) should review all available records provided by the building representatives. In particular, the plans and specifications should be thoroughly investigated. These documents will describe the nature and location of the materials used in the construction of the building and, thus will help identify any ACMs.

Unfortunately, the original plans or as-built drawings and specifications are rarely available. They may have been misplaced over the years or lost as a result of numerous transactions between building owners. A word of caution; the prudent inspector should never rely solely on building records to indicate the presence or absence of ACMs. The decisions based on the inspection findings can have severe legal and financial impacts; thus, the asbestos content of any material should always be confirmed by the collection and analysis of bulk samples. The review of plans and specifications will help orient inspectors toward particular areas of concern. Also be sure to document whatever records are reviewed for inclusion in the inspection report.

GENERAL CATEGORIES OF BUILDING AREAS TO BE INSPECTED

I. MECHANICAL AREAS

- Basement/Sublevel Service Areas
  - Boiler/Chiller Rooms
  - Generator Rooms
  - Elevator Equipment Rooms
  - Telephone/Electrical rooms
  - Mechanical Feed Distribution Rooms
  - Fan Rooms
  - Basements
  - Furnace Rooms
  - Tunnels and Crawl Spaces
- Mechanical Floors including Penthouses (which may contain the above rooms as well)
  - Attics
  - Air/Duct Shafts
  - Pipe Chases
  - Air Plenums
  - Elevator Shafts and Machine Rooms

II. COMMON AREAS

- Entrance and Exit Areas
- Lobbies
- Hallways
- Stairwells
- Meeting Rooms (e.g., auditoriums, conference rooms, lounge areas)
- Garages

III. LIVING/WORKING AREAS

- Offices
- Hotel Rooms
- Rooms in Apartments or Single Family Houses
- Hospital Rooms

IV. SPECIAL USE ROOMS

- Kitchens
- Dining Rooms
- Laundries, vaults, athletic facilities (e.g. pools, gyms, locker rooms)

Review of Drawings

The working drawings or plans are a set of drawings which indicate the finished appearance and construction of the building. They are not a set of exact instructions for the contractor. As such, they do not precisely reflect the building as it was constructed. For this reason, it is mandatory that all information gathered from the plans be verified.

A title block will appear along the right side or in the lower right hand corner of each sheet of the set of drawings. When beginning your review of the drawings carefully examine the title block for the following information:

- The name of the project (i.e., original construction vs. any addition or renovation);
- The name of the architectural or engineering firm;
- The date of the drawings;
- The sheet numbers; and
- The project number

Compare the sheet numbering to the Index of Drawings on the cover sheet to determine 1) that you have a complete set; and 2) that all the sheets have the same date. The project number and date are your clues to whether you are reviewing plans for the same project. Over the life span of a building several renovation projects are likely to have been completed. An inspector will want to systematically review the set of drawings for each project individually.

The sheet numbering system for the entire set of drawings reflects the manner in which the drawings were prepared. Just as the design of the building is a collaborative effort of an architect and engineers, the drawings and specifications are prepared by each of these professionals. Altogether, a complete set of drawings will likely include:

- Civil
- Architectural
- Structural
- Mechanical (HVAC)
- Plumbing
- Electrical

When examining the numbering of the drawings, you will find that the drawings are divided by discipline. That is, the architectural drawings are together, the structural drawings are together, and so on. The numbering is then dependent on the discipline. It is typical that the structural drawings will be identified with an S and then the sheet number, e.g. S-1, S-2, S-3. Architectural drawings will be identified with an A, civil drawings with a C, the mechanical

(HVAC only) with an M, the plumbing with a P, and the electrical with an E. Miscellaneous other drawings may include landscaping (L), fire protection (FP), etc.

Regrettably, there is no standardization in the production of drawings, and thus no set of rules can be given for the way that each architect or engineer prepares not only a set of drawings but also individual items within that set. You may even find inconsistencies within a particular set of drawings, as the drawings are developed by different people in different offices.

Drawings can be divided into several generic types:

Floor Plans – drawings of the building as viewed from above, these include floor plans, foundation plans, framing plans, roof plans, electrical plans, and should not be confused with the entire set of drawings which is also referred to as the “set of plans”;

Elevations – generally, drawings of the building as viewed horizontally from outside; these can also be elevations of interior components or finishes;

Sections – drawing cut (vertically) through the building or building parts;

Details – expanded views of small areas that can be drawn in plan, elevation or section;

Notes, symbols, legends, abbreviations – comments and explanations;

Schedules – a tabular display of information (i.e., door schedule, room finish schedule, mechanical equipment schedule, etc.)

As you review the drawings, be sure to check for a list of symbols. Each building material in a set of drawings is depicted, when cut in section, by a material indication. If a legend appears in the set, use it as your guide.

Symbols are also used for a variety of items on drawings, other than materials. These are called reference symbols. Again, if a legend is included in the set of drawings, use it.

A drawing reference that you may encounter on a set of building plans is a revision. It is depicted by a triangle around a number; a portion of the drawing itself may also be clouded, to further indicate where the revision applies. The number identified the revision. The key to the numbering is found in the area adjacent to the title block. Revisions can be added on the drawings when changes have occurred:

- After the drawings have been issued for bid or
- As a result of the plan check/permitting process.

Architectural Drawings

Architectural drawings show finished surfaces and materials. Of note is the floor plan, which is cut horizontally through the building at about four feet above the floor. The floor plan is the basis for the mechanical, plumbing and electrical drawings.

Another important drawing is the demolition plan, which represents those portions of the building which will be demolished as a part of a renovation project. In many projects, improvements including removing (demolishing) existing walls, replacing floor coverings and other changes. The existing walls, windows, doors and built-ins are all indicated much lighter in contrast to the areas to be demolished. The difference in thickness of lines on the drawing signals the areas where work is to occur.

Commercial buildings often have repetitive units – rooms, doors and windows. To organize these spaces, schedules are developed to identify and describe specific rooms, doors and windows. The specific item is referenced to the schedule with a symbol as shown on the legend in the set of drawings. Use extreme care when working with room, door and window designations as the same number may be used repetitively, and the only difference will be in the symbol in which the number is lettered.

Be aware of differences between the room numbering scheme in the plans and the current numbering of the rooms in the building. It may be necessary to cross-list the numbers to equate the design information with the information determined from on-site investigation.

The room finish schedule will guide the inspector through the finishes or surface treatments used in the individual rooms. The schedules read like a graph with columns titled – floors, base, wainscot, walls and ceilings. Any changes may be an indication of prior renovation that may have added ACBM.

When reviewing drawings, your intention should be to familiarize yourself with the layout of the building, and then examine in detail the finishes, or details at the exterior wall and other areas where you suspect ACM may be found.

Often, when referenced on the drawings, a material will be listed with the notation, "OR EQUAL". This notation allows for the contractor to make a substitution of another equivalent material. The determination of what is equal is usually at the architect's or engineer's discretion, as elaborated upon in the specifications. This determination is based on descriptive literature forwarded by the contractor, for the architect's or engineer's review and owner's approval; usually by change order.

Structural Drawings

Structural drawings will consist of foundation plans, floor framing plans, roof framing plans, structural elevations, details, notes and schedules. All structural drawings are drawn without finish (architectural) materials or other engineering systems, and are intended only to indicate the structural elements of the building.

When you review the structural drawings, you will need to be familiar with the building in general, and in particular with structural members – beams, columns and slabs.

Many building's use a structural grid, referenced by numbers or letters at the building's column lines. The grid provides a way to organize the building and to communicate about specific areas.

If the building has fireproofing, it may not be indicated on the structural drawings, as it is a finish or surfacing specified by the architect usually, to be applied to the skeleton, not part of the skeleton. This it is the architect's responsibility not the structural engineers'. However, to understand where the fireproofing has been applied, where the beams are located that it is applied to, and the amount of area covered, the inspector will need to examine the structural drawings.

Structural notes will often include a building code reference. These codes identify the name and the year of the official building code(s) – city, county or state – which governed the design of the structural elements. This reference can be an invaluable tool. Building codes in effect when the building was erected may have specified fireproofing and other materials which are likely to contain asbestos.

Mechanical Drawings

The mechanical engineer prepares drawings for both the HVAC system and the plumbing system. Mechanical drawings consist of the mechanical plans, which are based on the building's floor plans. They indicate the routing of ductwork and piping systems (necessary for HVAC), as well as details, notes, schedules, sections and elevations (if required). Mechanical plans may include a system schematic, or flow diagram, to indicate how the HVAC system operates.

When reviewing the mechanical drawings, the inspector needs to become familiar with the kind of HVAC system used, and the location of the various parts of the system. It is necessary to verify information obtained from these drawings by field inspection.

Plumbing Drawings

Plumbing drawings include plumbing plans, which are based on floor plans, notes, schedules, riser diagrams and other required supporting drawings.

When reviewing the plumbing drawings, you need to be concerned with where the various equipment is located, how the system works, and whether the information on the plans is verified upon inspection. Be alert to pipe chases, utility cores or tunnels, or other inaccessible spaces that may enclose ACBM.

Electrical Drawings

Electrical drawings consist of the floor plan-based power and lighting plans, notes, schedules, details (if required) and calculations to support the load requirements. A cursory review of the electrical drawings is normally all that is required to familiarize yourself with the location of equipment and equipment rooms. Electrical drawings are largely schematic. The exact location of all items, except panels, lighting, switches and receptacles, is determined in the field, and as such needs to be verified by a site visit.

Specifications

Specifications (specs) are a written set of standards and procedures, which inform the contractor of what materials, and standards are necessary for the successful completion of the building. The specs are generally in book form and will provide the inspector with a lot of information on what materials were used in the actual construction.

As-Built Drawings

Many times during the course of construction, interference arise between building systems, which will not permit a pipe run, or a window, etc., to be installed where indicated on the plans. In this case the plans are modified in the field to indicate the new location or modifications required overcoming the interference. These plans or details are called 'as-built" drawings and are intended to record these modifications for future reference. As such, their availability should assist the inspection process, and the Inspector should know they exist. The as-built drawing may explain any discrepancies the inspector finds in the field, compared to the drawings he reviewed prior to the inspection.

Shop Drawings and Submittals

During the course of constructions, detailed drawings or descriptions of certain items are needed before they are installed in the building. These items are called for in the specifications. Shop drawings and/or submittals (drawings or descriptive literature) are prepared by the contractor or his or her subcontractors or vendors and are reviewed by the architect and/or his or her appropriate consulting engineers. If these are available they can reveal significant information about equipment (mechanical and electrical) and may disclose the use of ACM.

Other forms of submittals are operating manuals and brochures which are transmitted to the owner after construction. These too may indicate materials containing asbestos. When available, they are a good resource for information on suspect materials.

Record Documents

As noted above, numerous changes can be made to a set of construction documents during bidding and construction. Because initial plans and specs are not exact instructions, they may be substantially changed by the time construction is completed. Drawings and specs which reflect the way a building was actually constructed are known as "**record documents".** Building owners should have a set of plans and specs which accurately represent their facility. Plans and specs often contain a provision for as-built drawings and specs to be delivered to the owner, by the contractor, upon completion of construction.

Record documents reflect the construction on the date produced and are in part, outdated as soon as any modification, renovation, or remodeling occurs. Unfortunately, it is a rare building owner who has accurate records of all construction data which are kept updated throughout the life of the building. Inspectors should verify the accuracy of the resource material in the field.

Visual Inspections

Perhaps the most important aspect of the determination of asbestos hazards in buildings is the actual walk-through and visual inspection. This is a systematic process of investigation and must include all areas of the building (unless limited in scope). It is absolutely essential that the inspection be thorough and complete. Crawl spaces, pipe tunnels, pipe chases, areas above finished ceilings, inside air handling units, etc., must all be included.

It is typically not necessary to demolish building structures to gain access to interior areas of the building. Inspectors can often make judgments based on visible and accessible areas. For example, a wall would not need to be demolished to inspect the pipes behind it. The inspector can usually observe the material at access hatches or other areas.

However, if the building is to be demolished or renovated, which would involve the destruction of walls or ceilings, selected exploratory demolition is appropriate. Otherwise, ACM could be disturbed without knowledge of its presence in the building.

The inspection process can be summarized as follows:

1. Review building drawings
2. Perform walk-through inspection
3. Locate functional spaces
4. Locate suspect material and determine homogeneous sampling areas
5. Develop sampling scheme; sample and analyze
6. Assess all friable known and assumed ACBM and record

Begin the inspection with a brief walk-through of the entire building or, in the case of a high-rise structure, a typical representative floor. This will help familiarize the inspector with the layout, construction, and existing mechanical systems in the building. List the obvious suspected ACMs observed during the walk-through. These should be classified as follows:

Thermal system insulation - "Material applied to pipes, linings, boilers, tanks, ducts, or other structures to prevent heat loss or gain, water condensation or other purposes.

Surfacing - "Material that is sprayed-on, troweled-on, or otherwise applied on surfaces for acoustic, fireproofing, or other purposes." Some examples are fireproofing, acoustical ceiling plaster.

Miscellaneous - "Material on structural components, members, or fixtures such as floor or ceiling tiles." This category essentially comprises any ACM that is not surfacing or thermal system insulation. Next, return to the boiler room or mechanical equipment rooms. This is usually where many of the ACMs are found, and thus, it is a logical starting point for a comprehensive investigation. Make a complete visual inspection of the area. Look for insulation on the pipes and other mechanical equipment. Are there any surface coatings on the walls, ceilings, or floors? Again, be sure inspect all areas – even inside air handling units which may have insulation on steam or chilled water lines servicing the coils.

Besides identifying all suspect ACM, inspectors will want to complete several additional tasks which will aid in the hazard assessment. These are summarized below:

1. Determine friability. A material is considered friable "if, when dry, it can be crumbled, pulverized, or reduced to powder by hand pressure". While the degree of the friability of various materials is extremely subjective, most can agree if a material is friable as opposed to being considered "non friable". Some examples of friable materials are the fluffy, "cotton candy" type of fireproofing and pipe insulation that does not have a protective jacket. Vinyl floor tile, which may contain asbestos, is generally regarded as nonfriable.

2. Evaluate the physical condition of the suspect ACM. Does the material appear to be damaged in any way? Are there water stains or other evidence of water damage? Is there a secure, protective jacketing over the pipe insulation? Look for the presence of debris on the floor or other surfaces. Materials that show evidence of deteriorating conditions should be considered damaged.

3. Estimate the quantity of the suspect ACM. Quickly and with reasonable accuracy estimate the length (linear footage) and diameter of pipe insulation and the area (square footage) of other types of ACM. The quantity of ACM is important for determining the appropriate number of bulk samples and the estimated costs for abatement.

4. Collect bulk samples. A sufficient number of samples must be collected for analysis to adequately determine the asbestos content of the material. Mark the location of the samples on the building floor plans. (This is discussed in the next section.)

5. Record all information. Photographs of the various types and condition of the ACM may be useful.

Proceed to inspect all other areas of the building. If certain areas are not accessible, note them for future reference. Return to inspect at a later date or document these areas in the final report. Many inspectors find it helpful to work from the lower levels of the building up to and including the roof. However, any systematic approach which assures the inclusion of all areas is acceptable.

Determining Functional Spaces

According to the AHERA rule, the basic unit used to determine the location of homogeneous material and to assign physical assessments of those homogeneous materials confirmed or assumed as ACBM, is the functional space. Functional spaces are spatially distinct units within a building that sometimes contain different populations of building occupants. For example, a classroom is a function space because it is enclosed and separate from the rest the building. In the same vein, a boiler room is also its own functional space. Pipe chases, airshafts, elevator shaft and return air plenums are also separate functional spaces, even though they do not contain occupants of the building.

Considerable latitude is allowed to the building inspector under AHERA when determining functional spaces. For instance, a long corridor could be divided into separate functional spaces if the inspector finds it useful in identifying important distinctions in the conditions and/or disturbance potential of ACBM. This allows the Inspector to isolate the problem area; thus giving the management planner and building owner better options for response actions. There is no reason to isolate an entire corridor if only a small section of it is damaged.

One homogeneous material may be found in several functional spaces. For example, sprayed-on ceiling material covering an entire floor comprised of many classrooms, offices, bathrooms, etc., could be a single homogeneous area for the purposes of bulk sampling. That is to say, the same suspect material may have been sprayed on every ceiling in every room on the floor. A few sites would be selected among all the functional spaces for sampling purposes, and the sampling locations would be documented according to functional space.

For example: Sample 019 taken in functional space 12.

A unique number should be assigned to each functional space. Although you can use the actual name of the room as opposed to a numbering scheme, consistency is most important. Try using the existing identifiers (e.g., room numbers). For unnumbered areas such as corridors, rest rooms, auditoriums, etc., letter codes could be used.

Each of these unique numbers, letters, or names will be written on the floor plans and the drawings will be maintained in the management plan. A simple legend explaining your terminology would be extremely helpful.

*The assessment of the condition of homogeneous material is performed per functional space.

Functional Space Designation Example

Legend:

The first numeral or letter denotes the floor in which the space is found.

B= Basement	M = Mezzanine
1 = First Floor	2 = Second Floor

The second set of numerals or letters denotes the actual space.

A1 = Main Auditorium	BL = Boy's Locker room
A2 = Little Theatre	CL= Closet
BR = Boiler Room	GB = Girl's Bathroom
BB = Boy's Bathroom	GG = Girl's Gym
BG = Boy's Gym	GL = Girl's Locker room

Below are a few examples of Functional space identifiers.

1. 115 - This simply means, room number 115
2. B-BR1 - Basement, boiler room number 1
3. 3-GB2 - The second girl's bathroom on the third floor
4. 2-H1 - Hallway or corridor number one on the second floor

Once you have established all functional spaces, it is very easy to identify the location of the homogeneous material and location of all bulk samples taken.

HOMOGENEOUS MATERIAL	FUNCTIONAL SPACE LOCATION
1. Green, 1'x1' floor tile	1-H1; 1-H2; Class Rooms 2-34; 1-BB; 1-GB; 2-BB; 2-GB
2. Air cell pipe insulation	B-BR; B-H1; 1-BB; 2-BB

Looking at the chart above, we know that the green floor tile is found in the first floor hallways one and two, classrooms 2-34, first and second floor boy's bathroom, and the first and second floor girl's bathroom.

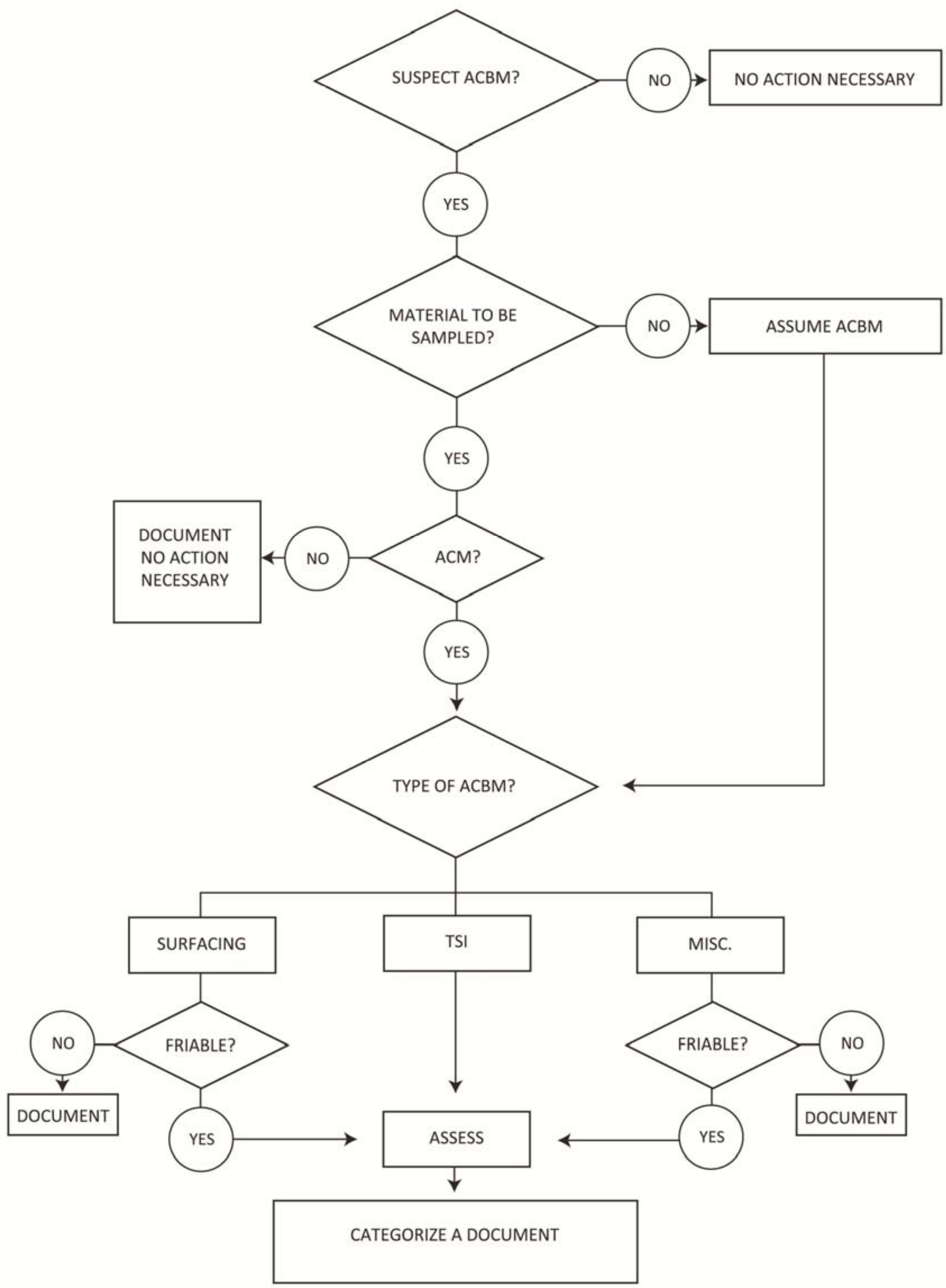
We also know that the air cell pipe insulation is found in the boiler room, the first basement hallway, and the first and second floor boy's bathroom.

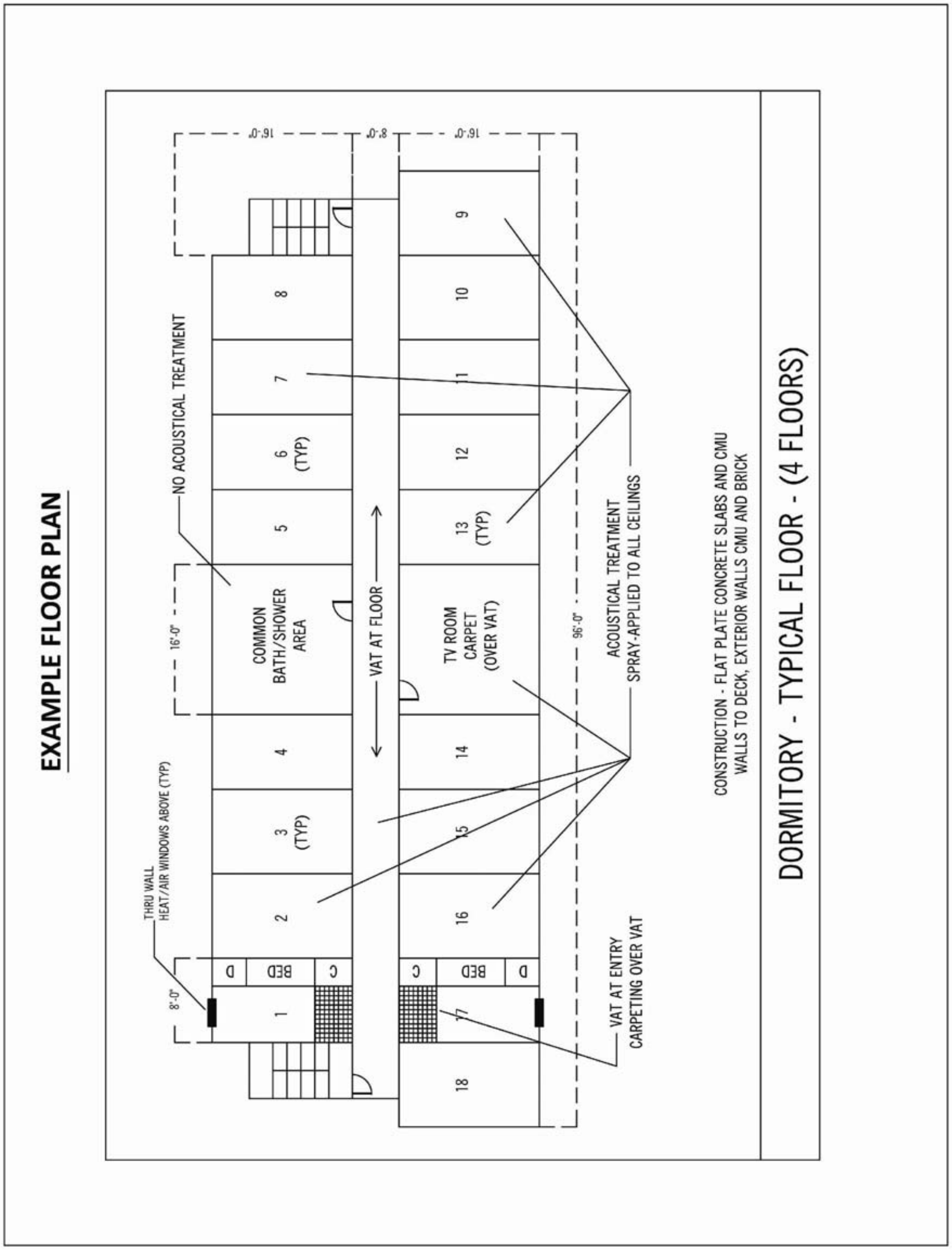
EPA Partial List of Suspect and Non-Suspect Materials

MATERIAL	SUSPECTED ACBM	NOT COVERED BY AHERA RULE
Concrete		x
Cinder block		x
Surfacing Materials	x	
Blackboards		x
Wall boards	x	
Pressed wood		x
Thermal system insulation	x	
Corrugated-like paper (TSI)	x	
Wall or ceiling carpet		x
Gaskets	x	
Floor tile (includes adhesive)	x	
Ceiling tile and panels	x	
Exterior roofing shingles		x*
Auditorium curtains		x*
Cement asbestos water pipe	x	
Chemical lab table and desk tops		x*
Fire doors	x	
Fire brick for boilers	x	
Suspected ACBM stored in school		x*
ACBM cloth adjoining air-ducts	x	
Chemical lab gloves		x*
Fire blanket		x*
Glass		x
Steel		x
Sheeting in fume hood	x	
Brake shoes		x*
Kiln bricks and cement		x*
Bunsen burner pads		x*

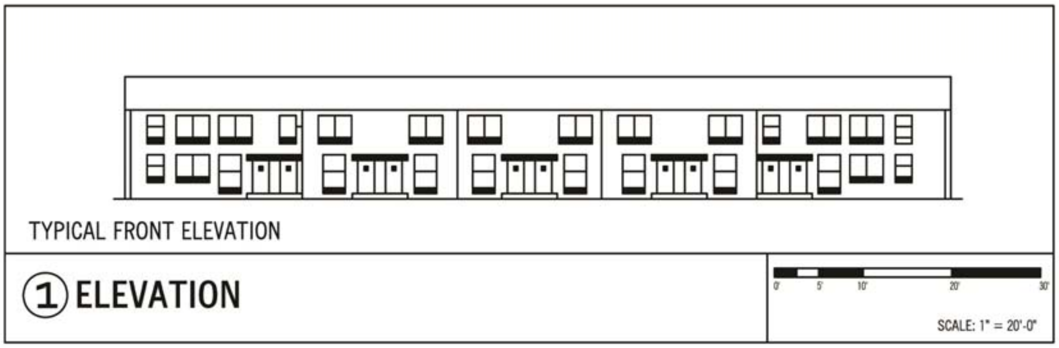
* could contain asbestos

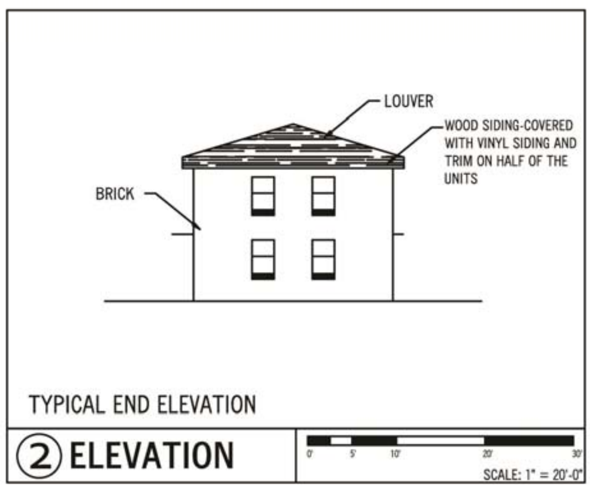
SUMMARY OF AHERA INSPECTION SAMPLING AND ASSESSMENT REQUIREMENT



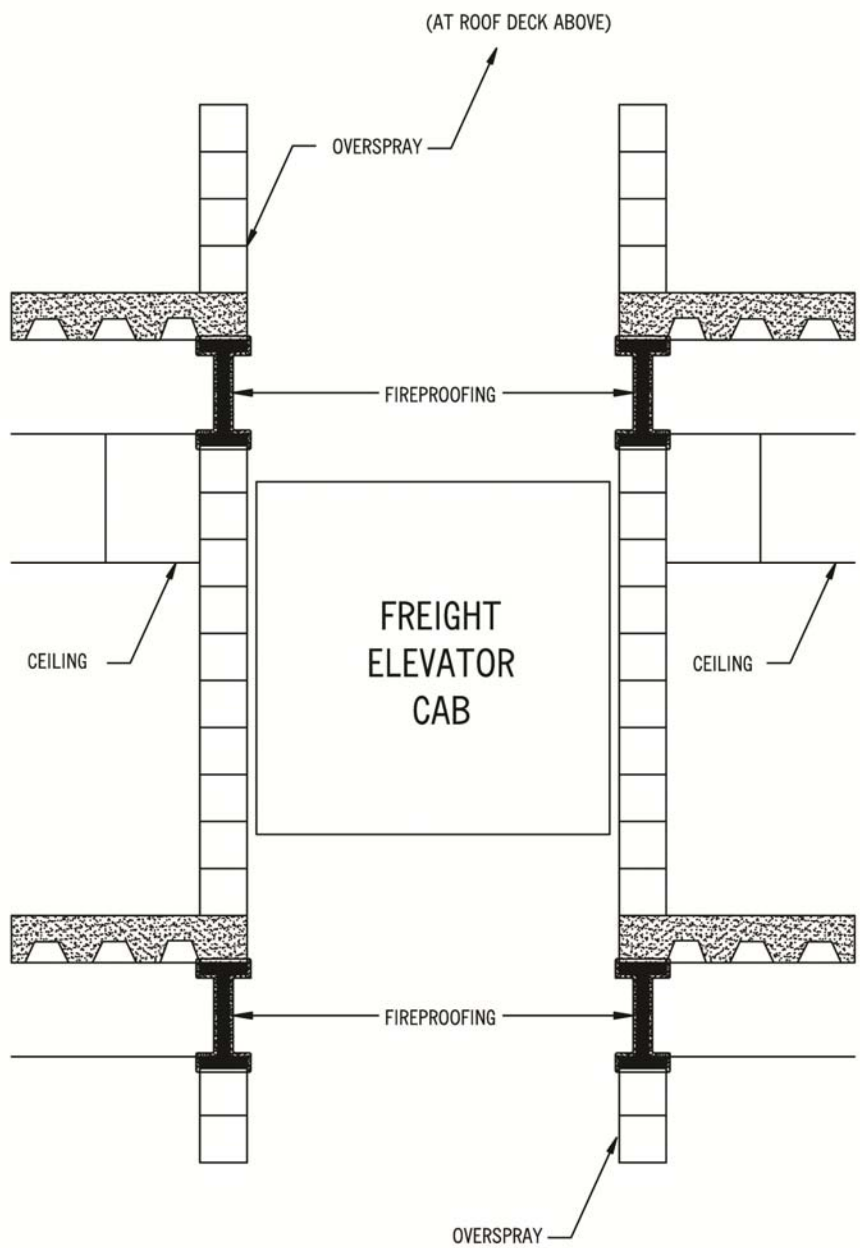

EXAMPLE FLOOR PLAN
NO ACOUSTICAL TREATMENT
THRU WALL HEAT/AIR WINDOWS ABOVE (TYP)
COMMON BATH/SHOWER AREA
VAT AT FLOOR
TV ROOM CARPET (OVER VAT)
VAT AT ENTRY CARPETING OVER VAT
ACOUSTICAL TREATMENT SPRAY-APPLIED TO ALL CEILINGS
CONSTRUCTION - FLAT PLATE CONCRETE SLABS AND CMU WALLS TO DECK, EXTERIOR WALLS CMU AND BRICK
DORMITORY - TYPICAL FLOOR - (4 FLOORS)
16'-0"
8'-0"
96'-0"
BED
1
2
3 (TYP)
4
5
6 (TYP)
7
8
9
10
11
12
13 (TYP)
14
15
16
17
18

EXAMPLE OF AN ELEVATION DRAWING



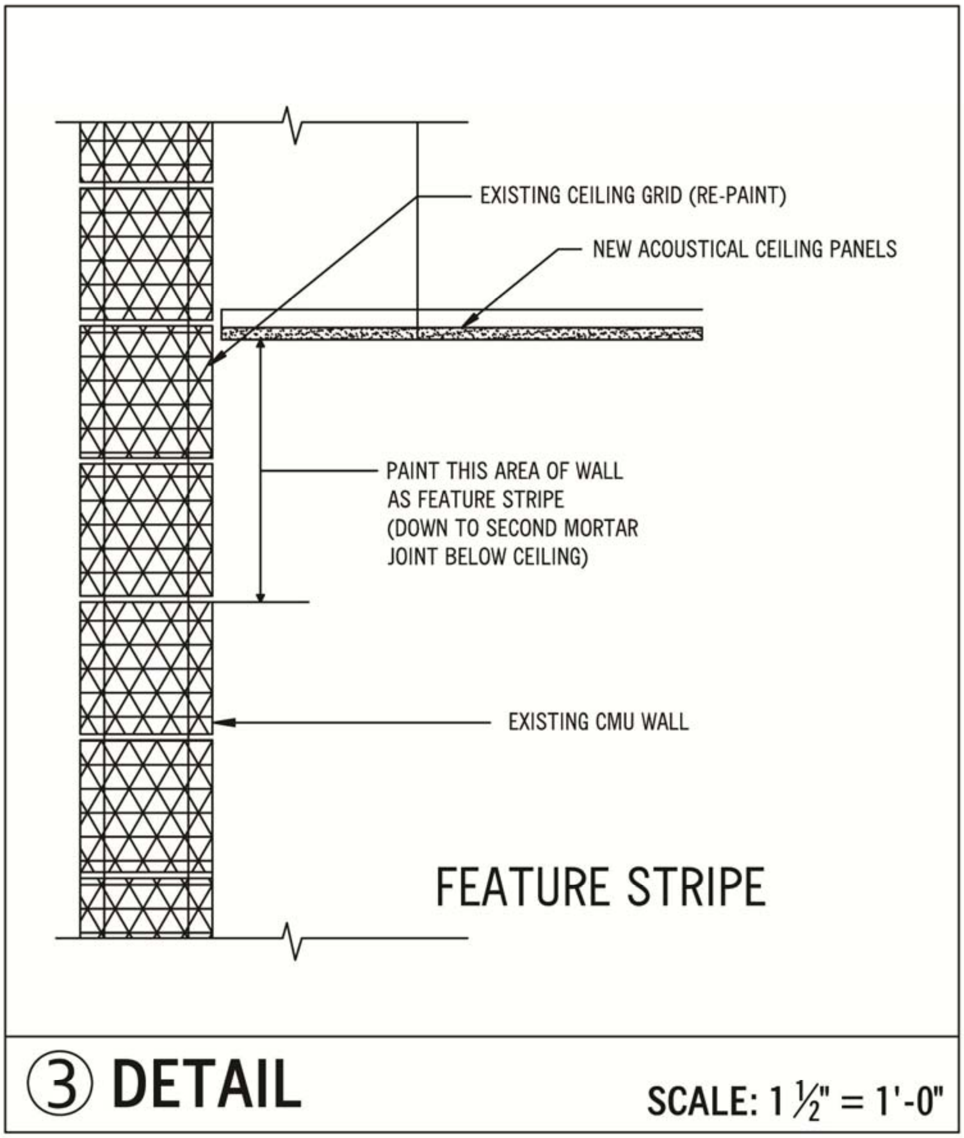


EXAMPLE OF A SECTION DRAWING



TYPICAL SECTION @ SHAFT

EXAMPLE OF A DETAIL DRAWING



EXAMPLE OF DRAWING NOTES

General Notes

1. Perform work as required for proper completion of the job. Drawings do not propose to show all existing items or conditions. Contractor shall not receive extra payment for requirements which can be inferred through observation of existing conditions at the site. In the event concealed conditions are encountered which may vary significantly from those indicated on the drawings, notify the architect before proceeding with work.

2. All dimensions and locations shall be checked and verified by the contractor on site and the architect shall be notified of any deviations from these drawings prior to commencement of work.

3. Any fixture substitutions shall be approved by architect prior to installation. Contractor to submit for architect's approval, complete photometric data and pre-wired 120 volt operating sample of any proposed substitution.

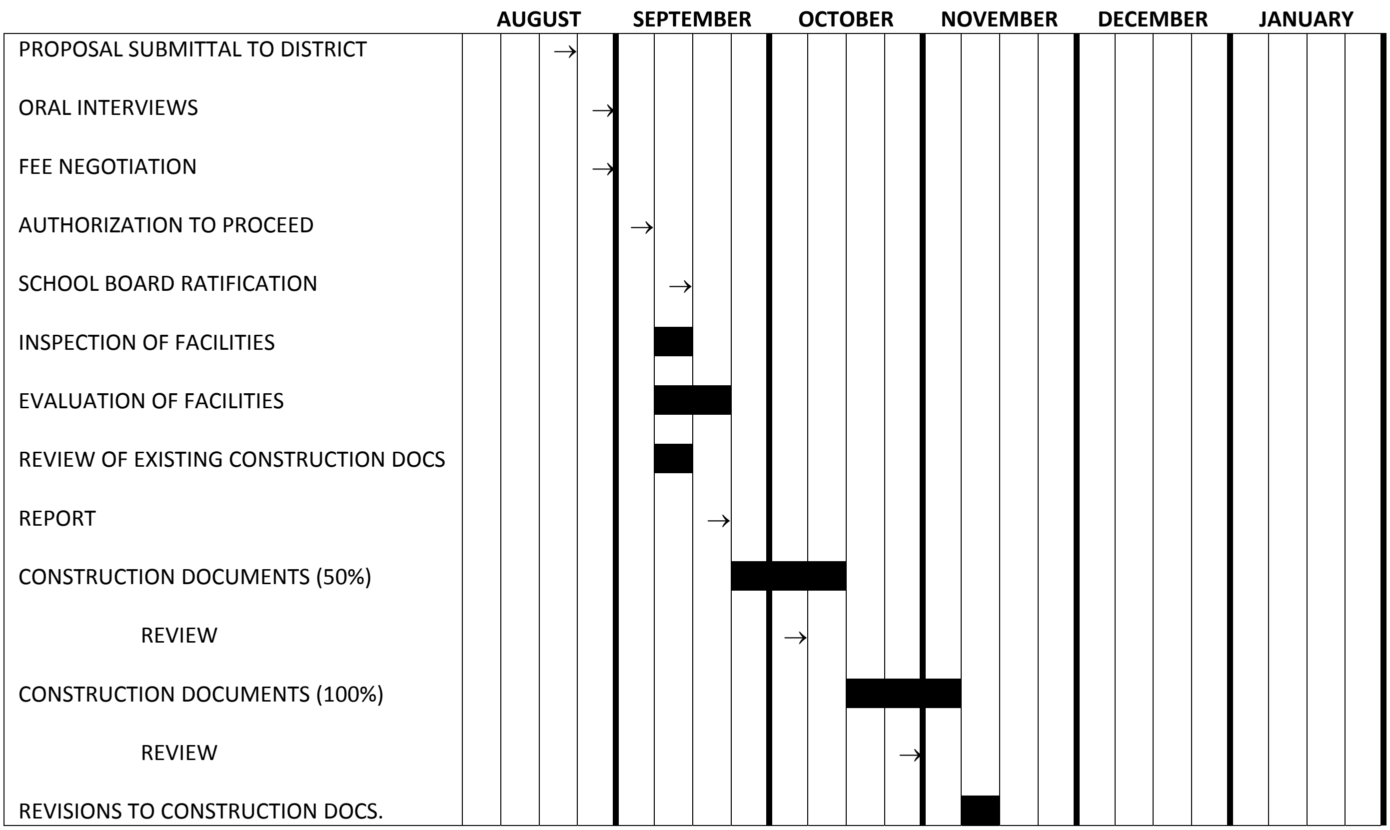
4. Overloads which may result from new fixture reconnections to be checked by contractor. If overload is found, notify architect before proceeding with work.

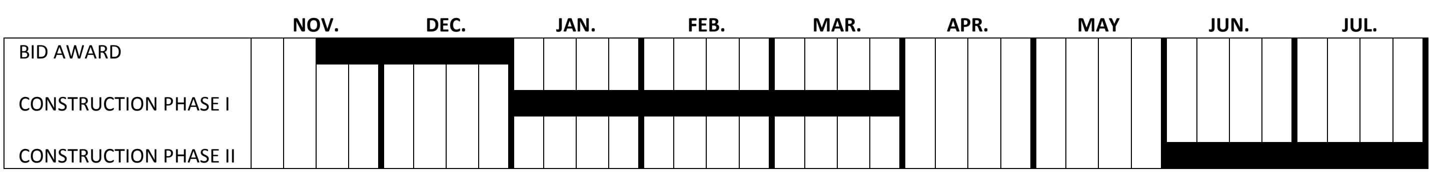
5. Any circuit with no load due to work from this contract shall be disconnected at breaker and all unused wiring to be removed.

6. All conduit penetrations through firewall to be enclosed with approved fire stops to maintain rated fire separation of existing wall.

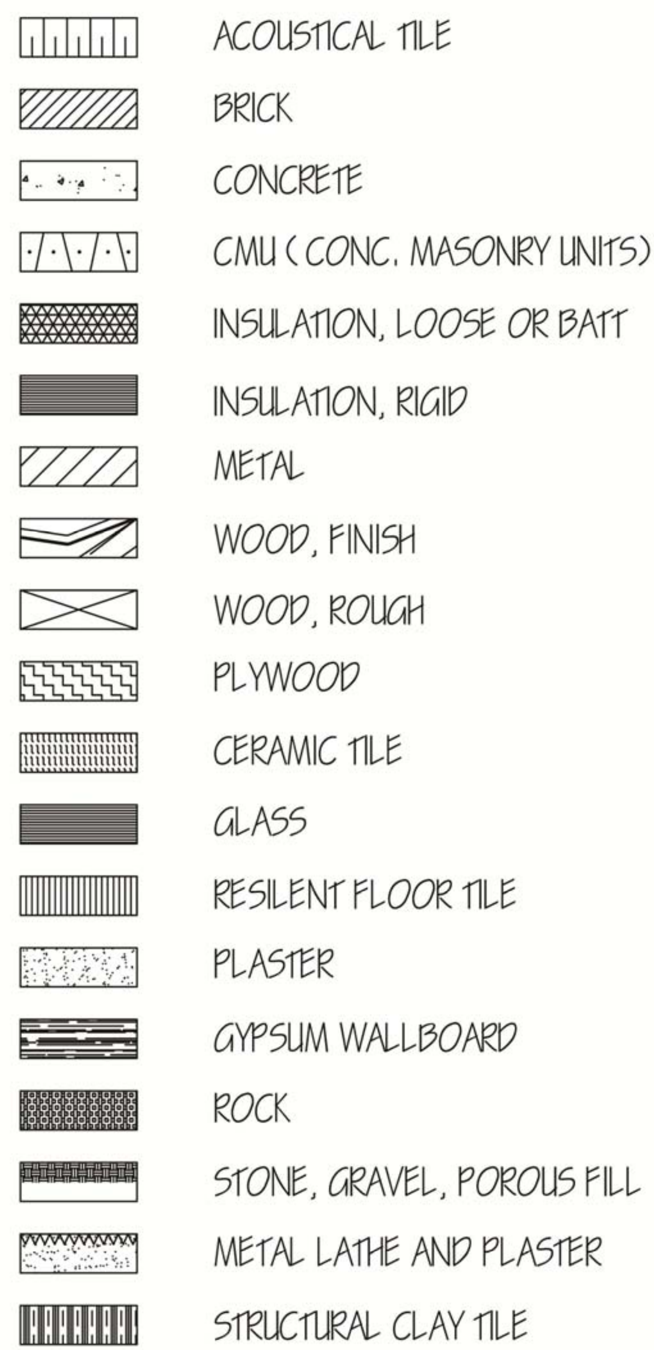
EXAMPLE OF MASTER SCHEDULE

(For Selection/Design/Bid-Award/Construction)

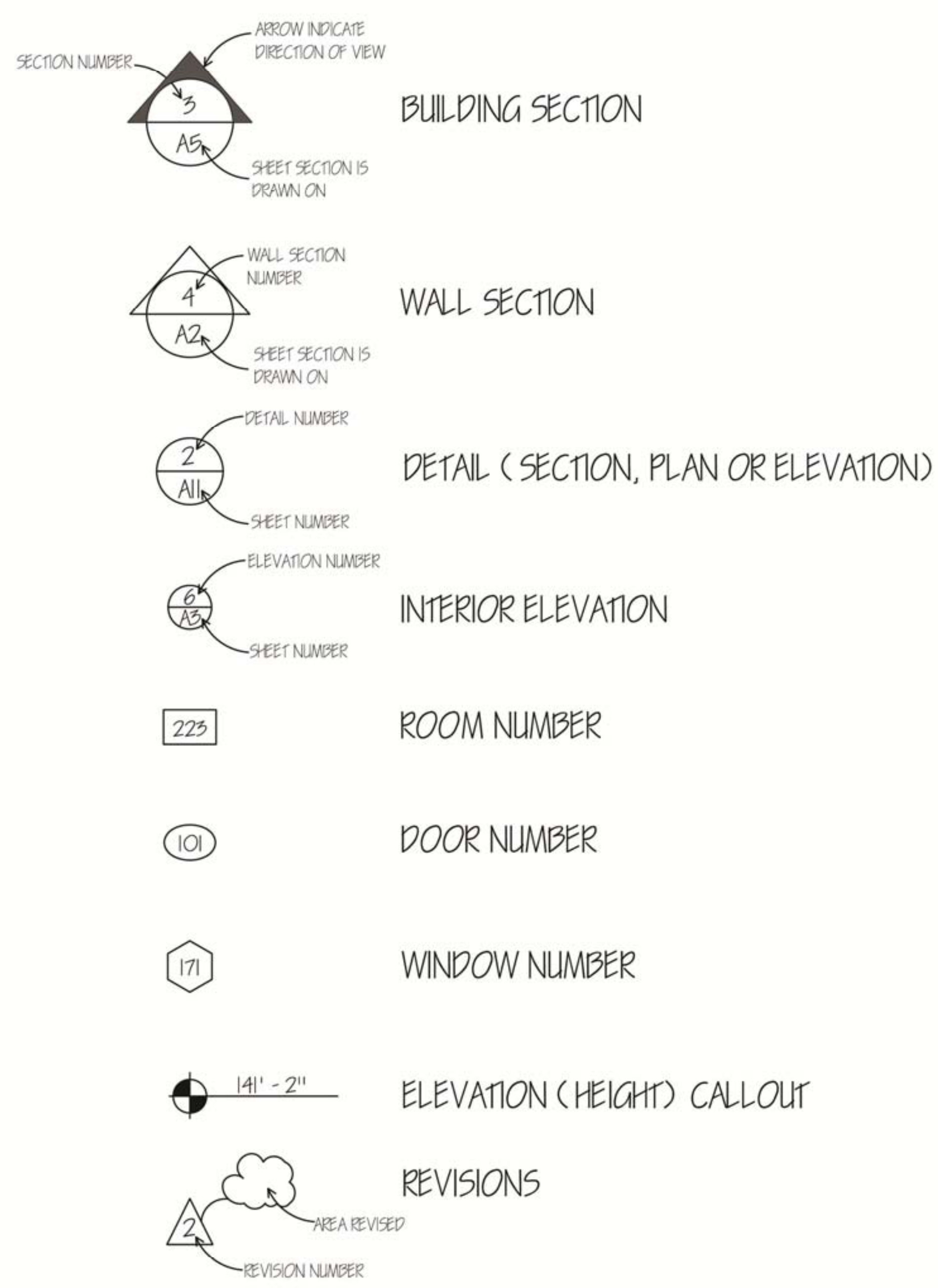




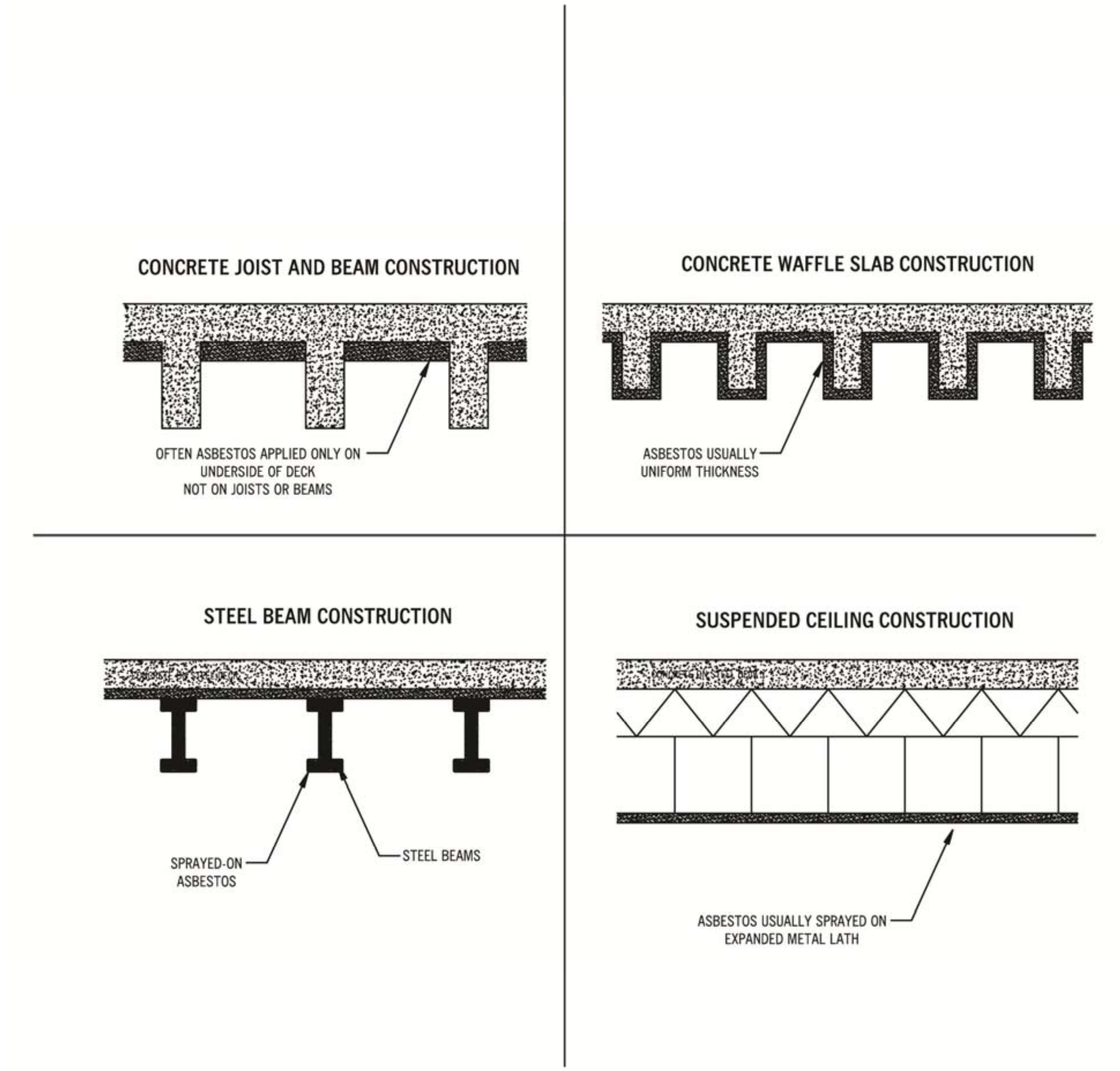
MATERIAL INDICATIONS



REFERENCE SYMBOLS



<u>TYPES OF CEILING CONSTRUCTION</u>



SPECIFICATIONS EXAMPLES

Proprietary

"…starting at the low edge, apply one 18" wide, then over that one full 36" wide JM (Johns-Manville) Asbestos Finishing Felt."

Non-Proprietary

"Asphalt Saturated Asbestos Felt shall be 15 pound perforated complying with ASTM Designation D 250, latest edition."

Proprietary

"Insulation shall by Pyrospray Type T, by Baldwin-Ehret-Hill, Inc.; Asbestospray by Asbestospray Corporation; Sealspray by Sealite Insulation Manufacturing Corp., Waukesha, Wisconsin; Spray Craft, Type S by Smith and Kanzler Company; or Spraydon Standard by Spraydon Research Corporation"

Non-Proprietary

"Insulation shall be a quality controlled mixture of virgin asbestos fibers and mineral wool fibers blended with inorganic binders and rust inhibitors. Binder, after setting, must be unaffected by water, moisture and condensation"

REPRESENTATIVE LIST OF MATERIALS LIKELY TO CONTAIN ASBESTOS

The following list of materials likely to contain asbestos is by no means all inclusive. Materials not appearing on this list, in some cases, may also be considered suspect and should be treated according to applicable regulations and good work practices. Conversely, many materials which appear on this list are currently made with non-asbestos materials.

Material Types:

M = Miscellaneous Material
S = Surfacing Material
TSI = Thermal System Insulation

Plans:

Which drawings to reference for material location

A = Architectural Drawings
M = Mechanical Drawings
P = Plumbing Plans
E = Electrical Plans

Specs:

Which division used from uniform Construction Index Numbers 6-16.

LIST OF SUSPECT MATERIALS

SUSPECT MATERIALS	MATERIAL TYPES	PLANS	SPECS
Cement Asbestos Insulating Panels	M	A	6
Cement Asbestos Wallboard	M	A	6
Cement Asbestos Siding	M	A	6
Roofing, Asphalt Saturated Asbestos Felt	M	A	7
Roofing, Reinforced Asbestos Flashing Sheet	M	A	7
Roofing, Asbestos Base Felt	M	A	7
Roofing, Asbestos Finishing Felt	M	A	7
Roof, Paint	S	A	7
Roofing, Flashing (tar and felt)	M	A	7
Roofing, Flashing (plastic cement for sheet metal work)	M	A	7
Waterproofing, Asbestos Base Felt	M	A	7
Waterproofing, Asbestos Finishing Felt	M	A	7
Waterproofing, Flashing	M	A	7
Dampproofing	M	A	7
Putty and/or Caulk	M	A	7
Door Insulation	M	A	7/9
Flooring, Asphalt Tile	M	A	8
Flooring, Vinyl Asbestos Tile	M	A	9
Flooring	M	A	9
Vinyl Sheet	M	A	9
Flooring, Backing	M	A	9
Plaster, Acoustical or Decorative	S	A	9
Ceiling Tile	M	A	9
Insulation, Thermal Sprayed-on	S	A	9
Blown-in Insulation	M	A	9
Insulation, Fireproofing	S	A	9
Taping Compounds	S	A	9
Paints	S	A	9
Textured Coatings	S	A	9
Packing or rope (at penetrations through floors or walls)	M	A	9

SUSPECT MATERIALS	MATERIAL TYPES	PLANS	SPECS
Laboratory Hoods	M	A	11
Laboratory Oven Gaskets	M	A	11
Laboratory Gloves	M	A	11
Laboratory Bench Tops	M	A	11
Fire Curtains	M	A	12
Elevators, Equipment Panels	M	A	14
Elevators, Brakes Shoes	M	A	14
Elevators, Vinyl Asbestos Tile	M	A	14
HVAC Piping Insulation	TSI	M	15
HVAC Gaskets	TSI	M	15
Boiler Block or Wearing Surface	TSI	M	15
Breeching Insulation	TSI	M	15
Fire Damper	M	M	15
Flexible Fabric Joints (vibrating dampening cloth)	M	M	15
Duct Insulation	TSI	M	15
Ductwork Taping	M	M	15
Flue, Seam Taping	M	M	15
Cooling Tower, Fill	M	M	15
Cooling Tower, Baffles or Louvers	M	M	15
Valve Packing	TSI	M	15
Plumbing, Piping Insulation	TSI	P	15
Plumbing, Pipe Gaskets	M	P	15
Plumbing, Equipment Insulation	TSI	P	15
Electrical Ducts (cable chases)	M	E	16
Electrical Panel Partitions	M	E	16
Electrical Cloth	M	E	16
Insulation, Wiring	M	E	16
Stage Lighting	M	E	16
Incandescent Recessed Fixtures	M	E	16
Chalkboards	M	A	10

TRADE NAMES OF ASBESTOS CONTAINING PRODUCTS

The following list contains trade names which have been or are being used on products containing asbestos. This list is not all inclusive.

From: Sourcebook on Asbestos Diseases: Medical, Legal and Engineering Aspects. Volume 2.
George A. Peters and Barbara J. Peters. Garland Law Publishing, New York 1986.

Aboglas
Accobest
Accobest AN-8012
Acoa
Aertite
AFD
Aircel
Aircell
Akoustikos Felt
Aland
Albaseal
Aluma-Seal
Alum-I-Flex
Amberlite
Amerbestos
American Colonial
Anti-Sweat
Apac
Apac Board
Applon C TFE
Applon T TFE
Armaturo Asbestos Tape
Armor Spray
Armor Temp
Armstrong LT Cork Coatings
Asbaltic
Asbestall
Asbestex
Asbestibel
Asbestile
Asbestite
Asbestoboard
Asbestocel
Asbestocite
Asbestogard
Asbestolux
Asbeston
Asbestos Ebony
Asbestos-Ebony
Asbestos Firetard Jacket
Asbestos Grapevine Finish Felt
Asbestos Liquid
Asbestos Luminclad
Asbestos Millboard
Asbestos Sponge
Asbestos Sponge Felt
Asbestos Roll Fire Felt
Ascarite
Astrolan
Atlas
Aubeston
BB
BBA
Bellowseal
Best Felt
Bes-Tos
Bestolite
Bestphalt
Beswick
Black Top Asbestos
VBlastape
Calidria Asbestos
Cal Temp
Caposite
Carbac
Carey
Careybesto-Board
Careycel
Careyclad
Carey Duct
Careyflex
Careysote
Careystone
Careytemp
Cemesto
Cemesto Structural Insulating Panels
Centripac
Century
Century Apac
Certain-Teed
Chemlon
Chempac
Chemstone
Chemlite
Chesterton Sixty Four
Chesterton 1,000
Chroma-Tex
Chroma-Tone
Chrom-Tex
Cleanguard
Cogasa
Cohrlastic
Colonial
Colorator
Colorbestos
Color Ground
Cololith
Color-Tex
Contico
Copperclad
Coronet
Covergard
Crystal White
Cumo
C.W.
Deltabeston
Designer Solids
Dominique
Doublex
Double Sanded Asbestos
Dualay

Asbestone 400
Asbestone Standard 400
Asbestoroc
Dura Shake
Durocell
Du Shield
Ebonized Asbestos
Electrobestos
Enduro
Eternit
Eternit Stonewall
Excelon
Face Span
Featherweight
Felbestos
FI-ACS
Fiberock
Fiberock Asbestos Felt
Fiber Shake
Fiberspray Asbestos
Fibra Flow
Fibre Coating Asbestos
Fibre Kote
Fibrocel
Fibro-Cell
Fibrofil
Fibro-Fill
Fibroid
Fibroid Stove Putty
Fil-Insul
Filpaco
Fire Chex
Fire-Chex
Fireclad
Fire Felt
Firegard
Firegard Jacketing
Fire Halt
Firetard
Flamegard
Flamemaster
Flamesafe
Flexchrome
Flexboard
Flexgold
Flex-Slate
Cedargrain
Cellamite
Cell-O-Tone
Form Pack 2
Foster
Frost Proof
GAF
Gardian Line
Gardwell
Gardwell Products
Goetze Metallic Gaskets
Gold Bond
Grafel
Gralam
Grizzly
G.T. Ring
Gum-Bestos
Herco
Hi Seal
Hoodex-22
Hopaco
Horneblende
Hy Temp
Imperial
Imperial Excelon
Imperial Pipe Covering
Industrial
Industro_Tile
Insulation Seal 820
Insulcolor
Isobestos
Jamobestos
Janos
Jewett
JM or Johns-Manville
Kaobestos
Kaylo
Kearsarge
K-Fac
Klimgerit
K&M Aircell
Kormetal
K Therm
Lasco
Linalbestos
LK
Duplex
Dura-Color
Duraform
McKim
Micabestos
Mightyplate
Mimco
Minkote
Modernaire
Monobestos
Monoblock
Montasite
Multi-Ply
Mundet
New Era
Niagarite
Nicolet
Non-Con-Dux
Noriscell
Novabestos
Nu Grain
Nu Side
Nu Way
Ohmstone
O.N.C.
One Cote Cement
Pabco
Pakmetal
Pal-Lite
Palmetto
Palmetto Cutno
Palmetto Super Sheet
Pamco
Panelstone
Permaboard
Permatherm
Permatone
Piedra
Plastibest
Plastic
PlastiClad
Plasticrylic
Pliaboard
Plia-F-Lex
Pluto
Portugese Asbestos

Flexstone
Flinite
Florobestos
F-M-C
F.O.P.
Pyrotex Felt
Q-Beston
Quinorgo
Quinterra
Ranch Style
Red Mastite
Rendevous
Resistal
Ring-Tite
Ripple Tone
R-M or Raybestos-Manhattan
RM 7504
R/M 24 H12R/M E-660
Roca
Rock Slate
Romanaire
Rondelle
Rubber Coat
Salamander
Salon
Sal-Mo
Scandiva
Sea Ring Packing
Selko-Flor
Service Sheet Packing & Cut Gaskets
Shasta Snow
Sheetflextos
ShingleSeal
Simco
Sindayano
Soundgard
Spintex
Spiroflex
Spirotallic
Splashgard
LO-CA
Lok-Tab
Marinite
Mastic
Maticove
Spray-Core
Spray Craft
Sprayed Limpet Asbestos
Sta Safe Long Life
Sterlbestos
Stik-On
Stone Chip
Stoneglow
Stonewall Board
Stratalite
Stri-Color
Strip-N-Lay
Summit
Superbestos
Super Cumo
Superheat
Super X
Super 66
Supradur
Sure-Stik
Tadpole
Target
Tempcheck
Terraflex
Terratex
Thermal Kote
Thermalon
Thermalite
Thermobestos
Thermo-Bord
Thermofelt
Therm-O-Flake
Thermoflex
Thermomat
Thermo-Pac
Powminco
Prasco High Temperature
Prenite
Prismatic
Profile
Thermostone
Thermotape
Thermotex B
Thermo-Wrap
Thrift T
Thru/Chip
Tile-Tex
Tilostone TK 33
Transhield
Transite
Transite-Korduct
Transitop
Tru Flame
Tropag
U.F.P.
Unibestos
Unibestos 750
Unibestos 1200
Uni Syn
Uni Syn Style No. 239
V Dent
Ventsulation
Victopac
Vitribestos
Vitrobestos
Vulca-Dek
Weldgard
White Top Asbestos Jacket
Whittaker
Wirepack
Woodflex
York Asbestos
Zerogloss
Zeroseal
Zetabond
Zip Stik

CHAPTER 7

Bulk Sampling

Introduction

A bulk sample is a sample taken of a material in order to determine the presence and amount of asbestos. The standard method of analysis for bulk samples is Polarized Light Microscopy (PLM) which will detail the type of asbestos found in the sample and the quantity of asbestos. ***In order to take* a *bulk sample, an individual must be certified* as a *New York State Inspector.***

Bulk sampling is the technique used to collect samples of suspect asbestos-containing materials, such as fireproofing, pipe and boiler insulation, acoustical plaster, etc. This sampling is usually conducted during the building inspection/hazard assessment and provides data for decisions on control measures. If bulk sampling data is not available to the contractor during his walkthrough survey, he may choose to have an accredited inspector collect some bulk samples at that time

A small sample of suspect material is carefully collected and placed in an air-tight container. Further guidance may be found in “Guidance for Controlling Asbestos Containing Materials in Buildings” (Purple Book – EPA 560/5 – 85 – 024) and “Asbestos in Buildings: Simplified Sampling Scheme for Friable Surfacing Materials” (Pink Book – EPA 560/5 – 85 – 030a).

Anyone taking bulk samples in a school, industrial facility, public or commercial building must be accredited according to U.S. EPA regulations, and should wear, at a minimum, a half-face, negative pressure air-purifying respirator and, when dirty conditions are encountered, disposable coveralls. An analytical laboratory, using Polarized Light Microscopy (PLM) to determine the presence, type, and percentage of asbestos in the sample, should analyze bulk samples. In accordance with the New York State Department of Health, Environmental Laboratory Approval Program (ELAP), bulk samples of non-friable, organically bound (NOB) materials must be analyzed by Transmission Electron Microscopy (TEM) to confirm that they do not contain asbestos. This is due to the fact that NOBs, such as vinyl floor tiles, roofing materials, etc., could contain asbestos that was processed into very small and fine fibers, and the fibers are bound in the tar-like organic material, making them harder to see under PLM.

Settled Dust

Sometimes, it is beneficial to determine whether the settled dust within a facility contains asbestos. For instance, during the building inspection/survey when investigating for the presence of asbestos-containing materials (ACM), an owner may request that the inspector determine whether asbestos fibers are being released in the building environment. In the past, an air sample might have been collected to determine whether airborne asbestos fibers are present. However, the EPA does not recommend the use solely of air sampling for this purpose, as it tends to provide only a "snapshot" picture of building conditions. In the EPA publication Managing Asbestos in Place (Green Book) (EPA 20T-2003, July 1990) EPA does say that a well-designed air sampling program used in conjunction with comprehensive physical and visual inspections as part of an O&M Program may provide useful information. As an alternative to the use of air sampling, samples of settled dust may be collected to indicate fiber release from ACM.

Sampling settled dust could be accomplished in many ways. Dust can be collected by scraping an area (with a credit card, for instance) and placing the material in a small container for analysis as a "bulk" sample by polarized light or electron microscopy. Alternatively, samples can be collected by "micro vacuuming" an area with a filter in a cassette which is attached to a sampling pump. The filter can be analyzed by polarized light microscopy, or preferably, by electron microscopy. Other techniques for dust sample collection include wipe sampling (where a filter or other material is used to wipe an area) or tape sampling (where cellophane or similar tape is used to collect the dust). The U.S. EPA and the American Society for Testing and Materials (ASTM) are currently developing protocols for settled dust collection and analysis.

It is important to note that most settled dust sampling will typically provide only qualitative results and that any quantitative results must be interpreted with caution. Currently, there are no asbestos regulations that specify a maximum allowable quantity of asbestos in settled dust. Therefore, when obtaining a quantity of asbestos fibers in settled dust, one must compare it to quantities that are considered "normal" for the type of building where the sampling took place. This involves researching the latest literature for studies done of asbestos in settled dust for comparison purposes. In the absence of a standard to compare to, dust samples should only be used to determine the presence or absence of asbestos fibers in accumulated dust, and not as a tool to determine the amount of asbestos fibers being released from a particular material or the likelihood that these fibers will become airborne again. Also, the absence of asbestos fibers in settled dust does not necessarily mean asbestos fibers are not being released, just that none were present (or detected) in that particular accumulation of dust.

I. Surfacing Material

The EPA guidance book "Simplified Sampling Scheme for Surfacing Material ('Pink Book)" lists the following sequence of steps for bulk sampling of friable surfacing material:

1. Identify all friable surfacing materials and group them into homogeneous Sampling Areas. A homogeneous Sampling Area contains material that is uniform in color and texture.

2. Prepare diagrams of each Sampling Area to allow selection and documentation of sampling locations.

3. Divide the Sampling Area into 9 equally sized sub-areas. This helps obtain samples that are representative of the entire Sample Area.

4. Determine the number of samples. The proper number of samples is based on the size of the homogeneous sampling area.

5. Determine the sampling locations. The locations are chosen to obtain a representative sample and to avoid biases that could be introduced if personal judgment alone were used.

6. Collect samples. Follow guidelines designed to minimize fiber release.

7. Follow a Quality Assurance program. This involves collecting extra samples to ensure reliability of the laboratory analyses.

8. Send the samples to a qualified laboratory for analysis by polarized light microscopy (PLM).

9. Interpret the results. If any sample has more than 1% asbestos, as determined by PLM, assume that the entire sampling area contains asbestos.

Identifying Sampling Areas

The inspector should group friable surfacing material into "homogeneous" sampling areas. A homogeneous sampling area contains friable material that is uniform in texture, color, date of application, and appears identical in every other respect. Materials installed at different times belong to different homogeneous sampling areas. If there is any reason to suspect that materials might be different even though they appear uniform, assign them to separate homogeneous sampling areas. For example, material in different wings of a building, on different floors, or in special areas such as cafeterias, machine shops, band rooms, etc., should be assigned to separate homogeneous sampling areas unless there is good reason to believe that the material is identical throughout.

In a multi-story building, a separate homogeneous sampling area for each floor may not be necessary. If the material appears identical on every floor, several floors can be grouped into one homogeneous sampling area. Do not group floors if it is known that the material was applied at different times, or if there is some other reason to suspect that the material might not be homogeneous. The selection of homogeneous sampling areas is a subjective process. When in doubt, assign materials to separate homogeneous sampling areas.

Both the minimum AHERA requirement as well as the EPA "Pink Book" recommendation for each homogeneous area of surfacing material is summarized below:

Square Footage	Minimum Samples	Recommended Number
$< 1{,}000\ ft^2$	3	9
$> 1{,}000$ but $\leq 5{,}000\ ft^2$	5	9
$> 5{,}000\ ft^2$	7	9

Nine samples were recommended for each homogeneous area of surfacing material, because surfacing material was mixed on-site when it was originally applied- making the distribution of ACM irregular. By making a grid of nine equal size areas and taking a sample within each one, the inspector is lowering the possibility of missing ACM that might be present.

Preparation of Diagrams

For each homogeneous sampling area, use a prepared diagram or prepare a diagram approximately to scale showing all friable materials in the sampling area. Where the suspect material is only on horizontal surfaces; a to-scale floor plan could be used. An example of a diagram is shown in Figure 1 (page 118). The homogeneous sampling area diagram should include:

- An identification number;
- Brief description of the sampling area;
- Area dimensions and scale;
- Name and telephone number of the asbestos program manager (the "designated person" according to AHERA);
- Name of inspector and date of inspection; and
- Name of person preparing the diagram and date prepared.

If the homogeneous sampling area contains areas of friable material that are not adjacent (for example, homogeneous areas on consecutive floors of a building), sketch each separate area and place all sketches on the same graph as close together as possible. The sampling area may contain areas that are not in one plane; for example, a ceiling and a wall with the same type of friable material. In this case, sketch each flat surface and place the sketches on the same graph as close together as possible. The sampling area diagrams should be retained as part of the building owner's permanent asbestos program file.

Selection of Sample Locations

In this sampling scheme, sample locations are selected so that they are representative of the sampling area. When nine (9) samples are collected, they are distributed evenly throughout the sampling area. If fewer than nine (9) samples are collected, a random sampling scheme is used to determine their location. Choosing sample locations according to personal judgment produces samples which may not be representative and can lead to a wrong decision about the presence of absence of asbestos. The sampling scheme described here avoids this problem and controls the frequency of mistakes.

Divide the sampling area into 9 equally size subareas. This is done by dividing the length and breadth of the sampling area into 3 equal lengths. Drawing a grid over the diagram can be done carefully by estimation as exact measurements are not needed.

If the sampling area does not easily fit into a rectangular shape, parts of the grid might not be in the sampling area. This is not a problem in most cases. If, however, a large part of the grid falls outside the sampling area, subdivide the area differently. For example, if the Sample Area is L-shaped, it is advisable to divide the sampling area into two or more separate Sampling Areas, each of which is approximately rectangular, and select sample locations by applying the sampling scheme to each sampling area.

For greatest coverage, one sample from each of the nine regions should be collected. (If fewer samples are to be collected, the diagram in Figure 3 (page 120) shows which sub-areas to use in order to follow a random sampling scheme).

For the first area to be sampled, locate the nine sub-areas as shown in Figure 2 (page 119) for Homogeneous Area No.1, using the table in Figure 3 (page 120). If three samples are needed, take from the sub-areas marked 1, 2 and 3. If 5 samples are needed, take them from the sub-areas marked 1, 2, 3, 4, 5, and so on. Take samples from approximately the center of a sub-area or as close as possible to the center, if accessible, unless the presence of light fixtures, etc., makes sampling from the center location impractical. If a subarea is specified that falls entirely outside the sampling area, use the next specified sub-area instead. For example, if sub-area 3 falls outside the sampling area, take the third sample from sub-area 4.

For very irregularly shaped areas, the sampling area may be divided into 9 approximately equally sized sub-areas that do not necessarily form a rectangular grid. The diagrams in Figure 3 (page 120) will then need to be adapted to the specification.

Figure 4 (page 121) shows an example of a Y-shaped Sampling Area that was divided into nine equally sized subareas. When adapting sampling diagrams, retain the order of the number of sub-areas from left to right and top to bottom whenever possible.

For each sampling area, use the corresponding sampling locations found in the table in Figure 3 (page 120). If you have more than 18 sampling areas, start again at the top of the table in Figure 3 (page 120) to determine sampling locations for the Homogeneous Sampling Area.

Example

The sampling procedure is illustrated by this example. A school was visually inspected for friable materials. The Activity Center Annex was found to contain friable materials. All materials were believed to be the same, and thus comprise one sampling area. Approximate room dimensions were obtained and diagrammed as shown in Fig 1 (page 118).

There were not enough funds for nine samples to be collected in every homogeneous sampling area. Therefore the minimum number, based on area, was calculated. The total area of friable materials is $10{,}080 ft^2$ (square feet) as calculated by:

$$\text{Area} = (60ft \times 90ft) + (12ft \times 90ft) + (60ft \times 60ft)$$

$$= 10{,}080 ft^2$$

Since this area is greater than 5,000 square feet, a minimum of seven samples should be collected.

The sampling area diagram was divided into 9 sub-areas. Let us assume this is the second sampling area to be sampled, the second diagram of Fig 3 (page 120) is used. The region marked “6” in the diagram does not fall within the sampling area. Therefore the regions marked 1 – 5 and 7 and 8 were used to obtain 7 samples. These 7 locations were marked on the sampling area diagram as shown in Fig 2 (page 119). Each sampling location was assigned a unique, non-systematic sample ID number and this number was marked on the sampling area diagram.

II. Thermal System Insulation

The concept of homogeneous sampling areas applies equally well to thermal system insulation (TSI) as to surfacing material. Thermal system insulation is defined as insulation that was used to insulate hot or cold equipment in order to prevent heat loss or gain, or to prevent condensation. Examples of TSI include insulation on steam and domestic hot and cold water pipes, boilers, boiler breeching, tanks, chiller pipes, etc. A "typical" building or industrial facility may contain multiple insulated pipe runs from any combination of the following major categories.

- Hot water supply and/or return
- Cold water supply
- Chilled water supply
- Steam supply and/or return (watch for different pressure/temperature steam lines)
- Roof or system drain
- Chemical or waste transport

Each of these systems may have been installed at different times and insulated with different materials. Therefore, it is best to first identify the building system in question and use this information in conjunction with the physical appearance of the insulation to delineate homogenous sampling areas.

Each system may be composed of a variety of materials. For example, the following list contains 9 different types of thermal insulation:

- Corrugated cardboard-type ("air-cell") pipe insulation
- White chalky pipe wrap
- Fibrous glass insulation covering a pipe wrap of unknown characteristics
- Cementitious "mud" around pipe fittings
- Hard, canvas-wrapped insulation on pipe elbows
- Block insulation on boilers
- White batt insulation on boiler breeching
- Black batt insulation inside ducts
- Rope around pipe sleeves in ceiling and floor slabs

Consideration should be given to the amount and extent of damage to TSI, which also may occur as a result of bulk sampling. Some building owners may not want "destructive sampling" conducted on their TSI that is be in good condition. The AHERA regulations require random sampling, which may dictate that samples will be collected from TSI in good condition. The building owner and Building Inspector should decide prior to conducting the survey whether sample collection and the associated damage that will result is necessary or if assuming the insulation contains asbestos and maintaining its condition is best. "Convenience" sampling or collecting samples from exposed asbestos or damaged areas, may be more appropriate for non-AHERA inspections, such as those performed for environmental site assessments or non-school buildings.

Main Rule for TSI:

1. Collect, in a randomly distributed manner: at least three bulk samples from each homogeneous area of thermal system insulation that is not assumed to be ACBM.

Exceptions to the Main Rule for TSI

1. Collect at least one bulk sample from each homogeneous area of patched thermal system insulation that is not assumed to be ACBM if the patched section is less than 6 linear or square feet.

2. Collect samples in a manner sufficient to determine whether the material is ACBM or not ACBM from each insulated mechanical system that is not assumed to be ACBM where cement is used on tees, elbows, or valves.

3. Bulk samples are not required to be collected from any homogeneous area were the accredited inspector has determined that the thermal system insulation is fiberglass, foam glass, rubber, or other non-ACBM. **NYS however does include "coverings over fibrous glass insulation" as a suspect material in the TSI category (see ICR56-5.1(f)(1)(i)(b)(3).**

III. Miscellaneous Material

Miscellaneous materials are all other suspect ACM that are not either surfacing materials or TSI. Many miscellaneous materials are non-friable and, therefore, bulk sampling is typically more difficult and destructive. EPA does not recommend sampling these materials. Instead, they should be identified as suspect and documented as such in permanent records. However, if any suspect miscellaneous materials are scheduled to be disturbed due to renovation, demolition or construction activity, such materials should be sampled and analyzed to verify if the material is ACM and then such material should be removed according to applicable regulations.

Some building owners wish to have miscellaneous materials sampled and analyzed anyway. Ceiling and floor tiles are probably the most frequently sampled of materials in the miscellaneous category. If sampling is desired, try to identify separate homogeneous areas just as you would for surfacing material and thermal insulation. (You will probably find that many different types, colors, and vintages of both floor and ceiling tile can be found in a building). Then collect bulk samples in inconspicuous locations. A Building Inspector may choose to follow the sampling protocol developed for surfacing material when sampling miscellaneous material. Very hard materials like asbestos-cement wallboard (transite) typically are not sampled and are generally assumed as ACM.

The minimum AHERA requirement is to collect samples in a manner sufficient to determine whether the material is ACBM or not ACBM from each homogeneous area of miscellaneous material.

Based on the word "samples," it has been interpreted that a minimum of 2 samples must be collected per homogeneous area. However, it is a common practice/recommendation to take a minimum of 3 samples per homogeneous area of Miscellaneous Material. The theory is that 3 samples that give negative results are a better minimum number than 2 or less in terms of forecasting that the entire homogeneous area does not contain ACM.

Collecting Bulk Samples

Personal Protective Equipment

Since inhalation of asbestos fibers, which might be released during hundreds of inspection and sampling jobs, may pose a serious health hazard, the use of personal protective equipment by Building Inspectors is crucial during the sampling process. As a minimum level of protection, Inspectors should wear a respirator, either a full or half face mask with High Efficiency Particulate Air (HEPA) filter cartridges. (See Chapter 4 for more information on respiratory protection). Full-face masks will prevent eye irritation from dust, fibers, and debris released during the sampling operation. Disposable clothing should be worn during sampling if the sampling operation is likely to dislodge pieces of suspect material or if the environment is extremely dusty. (e.g. crawl space, dirty mechanical room). Hearing protection should be used if a Building Inspector must spend a considerable amount of time in a mechanical room, processing plant, or similar location where operating machinery produces significant noise. Inspectors should have plastic bags, twisters, and labels with them to handle the disposal of cartridges, protective clothing, wet cloths, and debris. These waste materials should be stored pending survey results. If laboratory reports establish the presence of asbestos containing materials, these waste materials should be disposed of as asbestos containing wastes.

Bulk Sampling Equipment

- A ladder and flashlight are needed to access areas and aid vision;
- Airtight sample containers;
- A plastic spray mister bottle with amended water to spray the area to be sampled;

- Plastic drop cloths to spread beneath the area to be sampled;
- A knife, linoleum cutter, cork borer, or other tool appropriate for extracting samples;
- A caulking gun and compound for filling holes once a sample has been extracted;
- Spray acrylic or adhesive to encapsulate sample extractions;
- Duct tape or other suitable patch material for repairing thermal system insulation jackets;
- Cloths (pre-moistened) for cleaning up debris and tools;
- A vacuum cleaner equipped with high efficiency particulate air (HEPA) filters, if available; Note: non-HEPA vacuums should not be used.
- Indelible ink pen for labeling sample containers;
- Camera for photographic documentation; and
- Tape measure

Administrative Supplies

Inspectors will need various tools and aids to accomplish their sampling tasks. In addition to sampling area diagrams (see Figure 1 – Figure 4), data forms for bulk samples will be needed in the field. Identification labels for sample containers, packing enclosure warnings and forms, plastic bags, sturdy cartons, sealing tape and writing materials (pens, pencils, clip-board) are also needed.

Given the amount of equipment needed for bulk sampling, the inspector will likely need assistance. A pushcart or table on wheels is worth considering to aid in the inspection and sampling operation.

Bulk Sampling Procedures

If possible, collect samples after working hours or when the building is not in use. Steps for sampling surfacing material, thermal insulation, and miscellaneous materials are set forth below.

Surfacing Materials

1. Spread the plastic drop cloth and set up other equipment, e.g., ladder.

2. Put on protective equipment (respirator at all times, protective clothing if needed).

3. Label bulk sample container with its identification number and record number sample location, and type of material sampled on a sampling data form. Always place the label on the container itself, not on the lid, as lids can inadvertently switched by a laboratory when handling numerous sample containers.

4. Mark the location of the sample on the sampling diagram and record the sample identification number on the plan diagram as well. Consider photographing the bulk sample collection site for project records.

5. Moisten area where sample is to be extracted (spray the immediate area with water).

6. Extract sample using a clean knife, cork borer, or other similar *device* to cut out or scrape off a small piece of the material. Be sure to penetrate all layers of material. Be careful not to disturb adjacent material.

7. Place sample in a container and tightly seal it.

8. Wipe the exterior of the container with a wet wipe to *remove* any material that may *have* adhered to it during sampling.

9. Clean your tools with wet wipes and wet mop or *vacuum* area with a HEPA *vacuum* to clean all debris.

10. Fill hole with caulking compound on highly friable material and/or spray with an encapsulant (to minimize subsequent fiber release) or for appearance.

11. Repeat the *above* steps at each sample location. Place sample containers in plastic bags.

12. Discard protective clothing, wet wipes and rags, cartridge filters, and drop cloth in a labeled disposal bag. Seal and retain the bag until lab results are *received,* at which time dispose of the bag as asbestos-contaminated if tests were positive for asbestos. (Disposal bags must be properly labeled. Disposal should be made in a state-approved landfill). Note: Unless every sample tests negative for asbestos, discard waste as asbestos-containing material).

Thermal System Insulation

Sampling thermal system insulation materials follows the same sequence as laid out above. Obtain samples from exposed/damaged areas if possible. However, random sampling will require sampling of some intact material. Sampling holes can be patched with plastic spackling, caulk or lag cloth.

Laboratory Analysis for Bulk Samples

The National Institute of Standards and Technology (NIST) administers a quality assurance program for bulk samples called the National Voluntary Laboratory Accreditation Program (NVLAP). Selection of an analytical laboratory should be based on successful participation in NVLAP. The AHERA regulation requires that all bulk samples collected in a school must be analyzed by a laboratory that participates in the NVLAP program.

***The main method of bulk sample analysis for asbestos is polarized light microscopy (PLM)**

Additionally, the New York State Department of Health administers a laboratory quality assurance program called the Environmental Laboratory Accreditation Program (ELAP). All bulk samples collected in New York State must be analyzed by a laboratory that participates in the ELAP program.

For analyzing bulk samples for asbestos content, the EPA-requires the use of polarized light microscopy (PLM) with dispersion staining and stereo-binocular examination. It is an analytical technique, which is based on the optical properties of crystalline and non-crystalline substances. The identification of fibers is determined by the visual properties displayed when the sample is treated with various dispersion staining liquids. Identification is substantiated by the actual structure of the fiber and the effect of polarized light on the fiber, all of which are viewed by the trained analyst. It is a very specific and rapid means of positive identification that also gives an estimate of asbestos content. The major disadvantage to this method is the limit of detection of PLM (about 1%), which is not reliable for detecting samples that contain extremely small amounts of asbestos or small asbestos fibers.

Polarized Light Microscopy (PLM) accomplishes two things:

- **Identifies asbestos fibers in a material**
- **Reports a percentage (%) of each fiber type that was identified**

The percentage given by PLM analysis is an estimate based on comparing the percentage of each of the types of fibers identified. Since ACM is defined in the NESHAP regulation as any material containing >1% asbestos via PLM, the fact that the percentage is estimated is not a comforting thought (especially in light of the fact that if ACM is found in materials that will be part of a renovation or demolition project, the costs of that project will greatly increase).

To rectify that situation, both the EPA and the NYSDOH-ELAP require that a "point- counting" methodology be used for PLM. This is a more quantitative method than estimating percentage (%) by comparison of fibers. The NYSDOH-ELAP requires "point-counting" for all bulk samples while the EPA only requires it when PLM reports percentages between 1-10%.

Laboratory Reporting

A competent analytical laboratory should provide a detailed bulk sample analysis report that includes the following information at a minimum:

- Client sample identification number
- Laboratory sample identification number
- Analytical technique used
- Laboratory quality control procedures
- Physical description of sample, as received
- Type(s) and estimated percentage of non-asbestos fibers
- Type(s) and percentage of other components
- Date of analysis;
- Analyst's signature

This information, along with data generated in the field (e.g., location of sample of material, photo references, etc.), should be maintained as part of an overall building inspection and recordkeeping program.

Quality Assurance

Quality Assurance (QA) procedures are employed to ensure reliable results for analyses of bulk samples. The first step to assuring quality is to choose a laboratory that is competent and reliable. Laboratories should be chosen from the list of laboratories accredited through the NYS DOH (ELAP) Environmental Laboratory Accreditation Program.

A quality assurance program is important to ensure the reliability of results from laboratory analyses. Identical samples are submitted for analysis and are compared. These quality control (QC) samples are labeled and handled in the same way as ordinary samples. Collect at least one (1) QC sample per building or one (1) QC sample per twenty (20) samples, whichever is larger. The QC sample should be analyzed by the primary laboratory or at a second lab to confirm the results of the first analysis. Any disagreements about the presence or absence of asbestos should be investigated reanalyzing the samples or collecting additional samples.

Non-friable Organically Bound Materials (NOB's)

According to NYSDOH-ELAP, non-friable organically bound materials (**NOB's)** must be analyzed by Transmission Electron Microscopy (**TEM**) for a conclusive negative result for asbestos content in a bulk sample. In other words, PLM cannot give a conclusive negative result for NOB's.

Examples of non-friable organically bound materials (NOB's) include: vinyl asbestos (floor) tile [VAT]; mastics/adhesives; roofing materials; cove-base (baseboard molding); caulking, window glazing, and other vinyl and asphalt materials.

The first problem that PLM has with NOB's is that the organic binder masks any fibers that may be present. To combat this- a process called "gravimetric reduction" is conducted. This process involves burning off the organic binder with high temperature ashing and an acid wash. The remaining residue is weighed and compared to the weight of the material before the gravimetric reduction. If the residue is more than 1%, further testing is needed. PLM could be conducted at this point, to identify large fibers that may be present. If the PLM result at this point is ≤1 %, TEM must be used to identify the microscopic size fibers that PLM cannot detect. TEM uses a magnification of approximately 10,000X for identification of asbestos fibers in bulk samples, while PLM uses up to 400X.

If the NOB method is not used, a disclaimer must accompany the PLM, negative results. The EPA requires that a laboratory provide the best service available regarding sample analysis. Clearly, using the NOB method is better for analysis of such materials than relying solely on PLM.

INSPECTION SAMPLING AND ASSESSMENT REQUIREMENTS UNDER AHERA

Activity	**Surfacing Material**		**Thermal System Insulation**	**Misc. Material**	
	Friable	Non-Friable	Friable/Non-Friable*	Friable	Non-Friable
Inspection & Documentation	Yes	Yes	Yes	Yes	Yes
Sampling	Between 3 and 7 random samples**	As determined by an accredited inspector***	-At least 3 random samples of most TSI -1 sample of patched TSI if it is <6 linear or square feet -As determined by an accredited inspector for mudded joints and fittings	As determined by an accredited inspector	
Assessment	Yes	No	Yes	Yes	No

* Thermal System Insulation shall be treated as non-friable unless it is damaged. However, AHERA still requires that TSI be assessed during inspections.

** Minimum based on square footage

*** An Inspector may want to consider increasing the number of samples collected from this material, since asbestos content of non-friable surfacing material may vary.

Figure 1

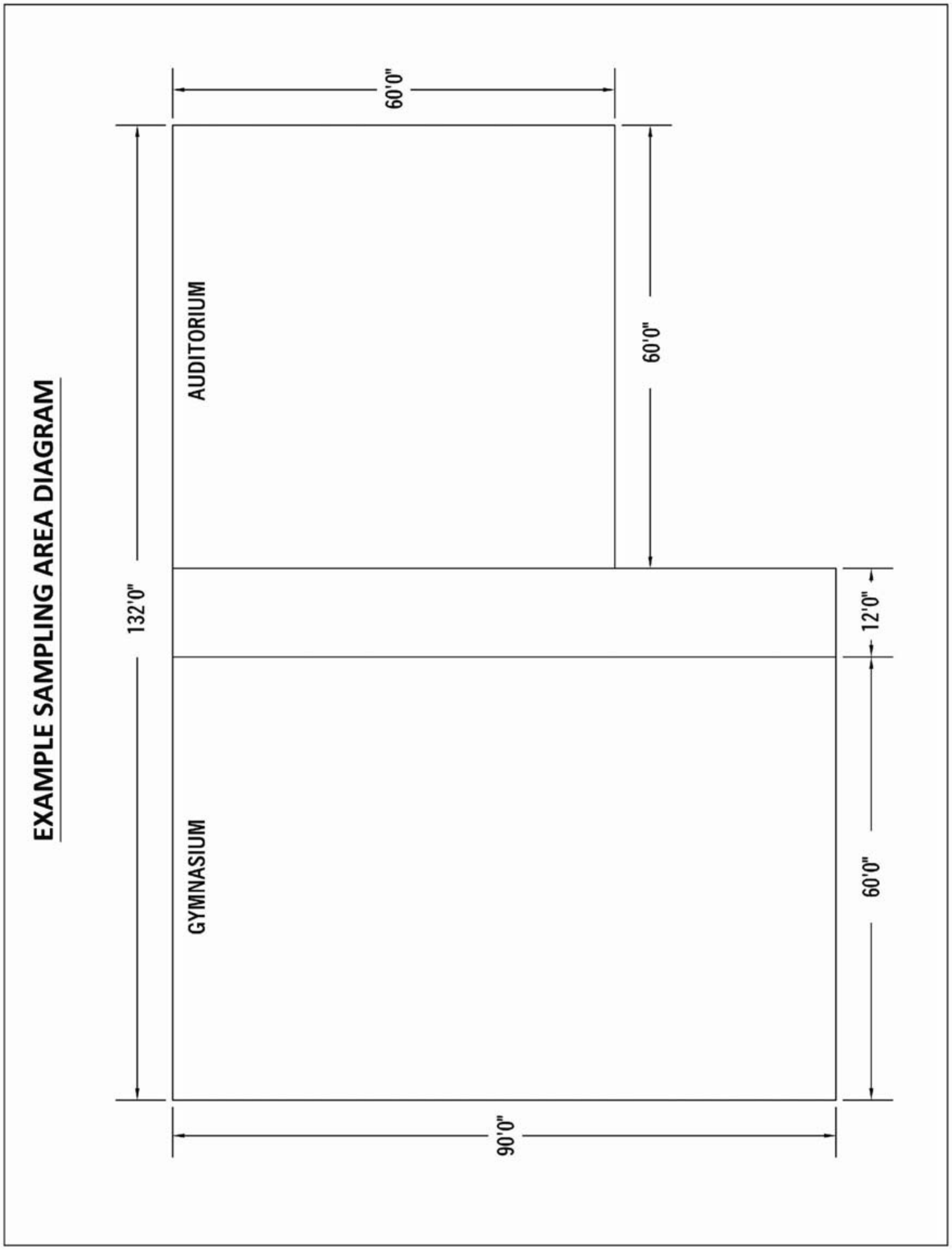

EXAMPLE SAMPLING AREA DIAGRAM
60'0"
AUDITORIUM
60'0"
132'0"
12'0"
GYMNASIUM
60'0"
90'0"

Figure 2

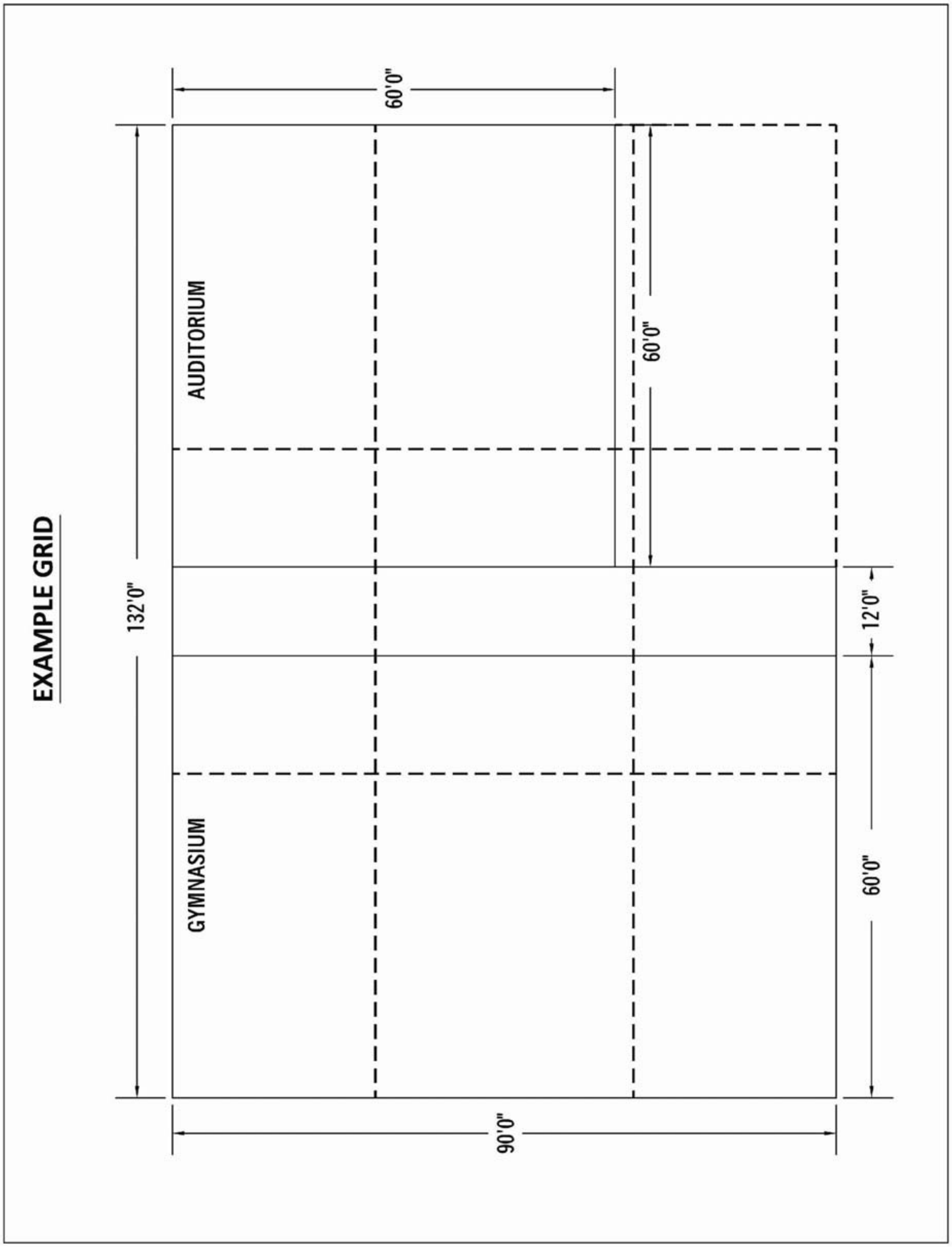


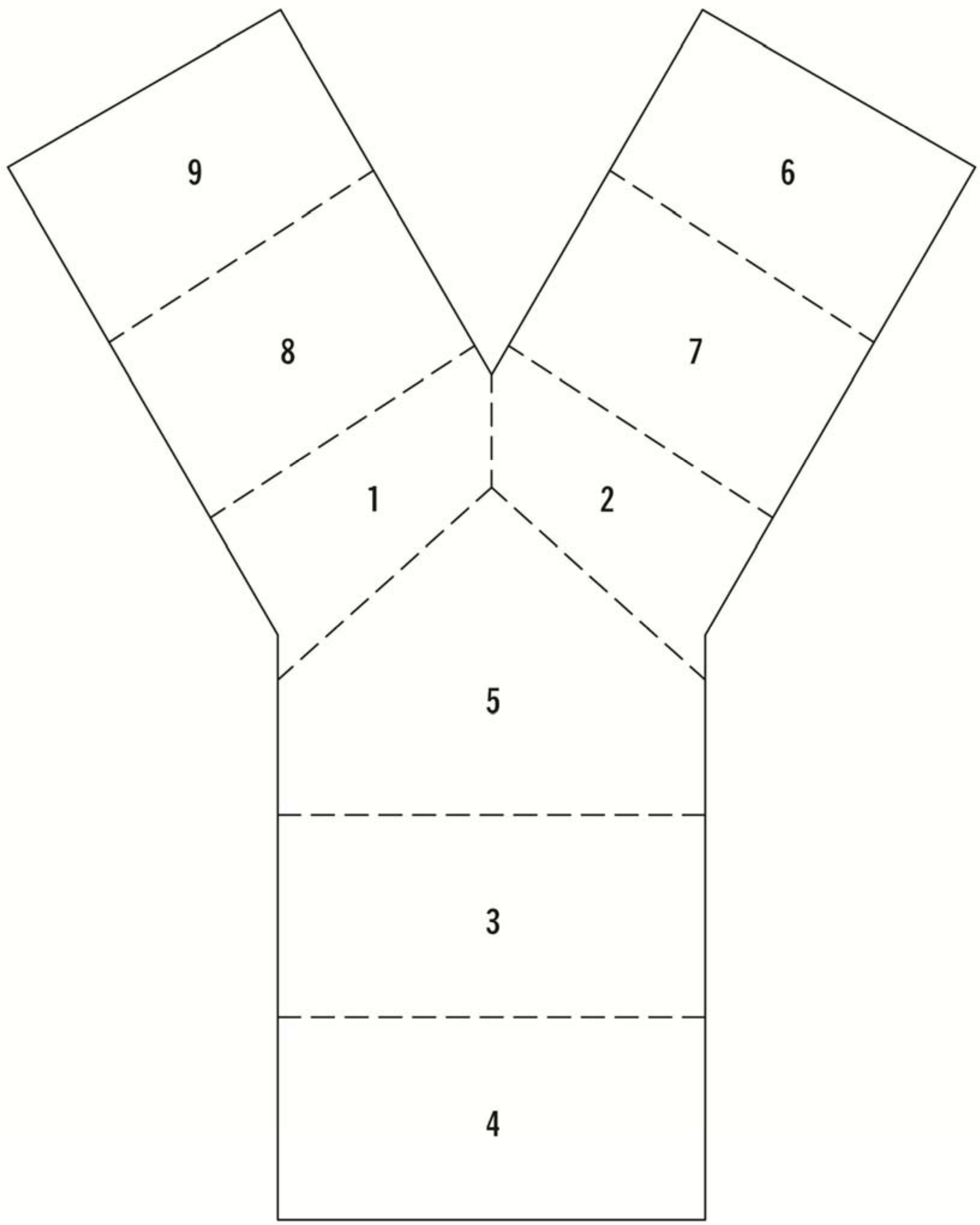
Figure 3

RANDOM NUMBER DIAGRAMS

Sampling Areas	Sampling Locations		
	9	8	1
1	2	7	6
	5	3	4
	8	7	1
2	3	9	5
	4	2	6
	4	1	7
3	2	9	6
	8	5	3
	6	1	8
4	5	9	3
	2	7	4
	6	4	3
5	1	5	8
	9	2	7
	7	4	3
6	6	1	5
	2	9	8
	5	8	1
7	4	3	6
	2	7	9
	5	7	1
8	6	3	4
	2	8	9
	3	6	4
9	9	2	7
	5	8	1
	5	7	3
10	8	1	6
	2	9	4
	5	1	6
11	3	4	9
	7	8	2
	7	1	9
12	2	4	5
	6	8	3
	8	5	2
13	3	6	9
	7	1	4
	4	1	6
14	3	9	7
	8	5	2
	3	5	6
15	9	2	8
	7	4	1
	4	8	3
16	2	5	9
	7	1	6
	8	2	7
17	4	5	3
	1	9	6
	2	5	9
18	6	1	8
	4	7	3

Figure 4

EXAMPLE Y-SHAPED SAMPLING DIAGRAM



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CHAPTER 8

The Physical Assessment

Introduction

AHERA specifies that the building Inspector must conduct a physical assessment of all friable confirmed and assumed ACBM. It is then up to the Management Planner to determine the hazard posed by the material, and rank the hazards according to seriousness. The physical assessment consists of assessing the following:

1. The condition of the material
2. The potential for future disturbance.

***AHERA specifies that the building Inspector must conduct a physical assessment of all friable confirmed and assumed ACBM. Once the assessment is complete they must be placed in one of the seven categories of condition and potential for disturbance.**

Following the assessment, all assessed ACBM is placed in one of the seven categories of condition and potential for disturbance. This is the most difficult job of the Inspector since the assessment is based on the Inspector's opinion and is therefore subjective. In theory, there is no right or wrong assessment as long as the assessment is justified by the Inspector.

The Inspector must view this aspect of the inspection process as if a map is being drawn for the Management Planner. Although most management plans are written by the same individual who performed the inspection, the assessment process - the entire inspection process - should be approached as if a total stranger is reading the report. From the Inspector's report, the Management Planner should have enough knowledge concerning the ACBM in that building to make an evaluation of the hazards posed to occupants.

***AHERA makes it very clear that the Inspector must justify the assessment and explain the reasons behind each decision.**

Although in theory there is no right or wrong assessment AHERA makes it very clear that the Inspector must justify the assessment and explain the reasons behind each decision. Simply assessing a sprayed-on decoration as significantly damaged without explaining the nature of the damage is unacceptable.

There are a number of approaches to the physical assessment process. It is up to the Inspector to determine what approach feels most comfortable and use that approach consistently throughout the inspection report. Variations from the constant need to be explained in detail.

The traditional approach to assessing hazards from airborne contaminants is to measure the concentration of the contaminants in the air. Indeed, many industrial work places are monitored continuously for a variety of contaminants. (regular if not continuous, air monitoring is necessary to adequately capture variations in air levels). Unfortunately, routine air monitoring in schools or commercial buildings is expensive and highly impractical.

The method for measuring asbestos required by OSHA for workplace settings where levels are expected to be elevated (e.g., an abatement work area) is called Phase Contrast Microscopy (PCM). PCM analysis is relatively inexpensive and thus somewhat practical for routine use. However, it is not an accurate gauge of asbestos levels in other settings. The reasons are three-fold.

1. PCM measures fibers in general and cannot distinguish asbestos fibers.
2. PCM cannot detect thin fibers (less than about 0.25 micrometers in diameter) which comprise the majority of airborne asbestos fibers in a building with ACM.
3. Results may vary from analyst to analyst

PCM will be influenced by a variety of non-asbestos fibers, and may miss high levels of asbestos if the fibers are thin.

A better method for measuring asbestos is Transmission Electron Microscopy (TEM). TEM can distinguish between asbestos and non-asbestos fibers and can detect extremely thin fibers. Unfortunately, TEM is very expensive. This means that a properly designed air monitoring program will cost tens of thousands of dollars annually.

For these reasons, EPA does not recommend - and the AHERA rule does not mention - air monitoring for assessment purposes. Instead, the Inspector must visually inspect the condition of the material and take into account a number of factors (such as use of the room, etc.) to judge the likelihood of damage and fiber release. Some building owners prefer to "spot test” for high levels of asbestos by using air monitoring. This can often placate needless fears of building occupants who discover they are working in an environment which contains asbestos material. On the other hand, a high reading may indicate a problem overlooked by the Inspector, or a problem which could not be seen by the Inspector. For this reason, it is wise for an Inspector to be knowledgeable about air monitoring techniques.

***TEM can distinguish between asbestos and non-asbestos fibers and can detect extremely thin fibers.**

Determining the Method of Physical Assessment

Various methods have been proposed and used to assess the tendency of ACM found in a particular location to release fibers and thus increase the potential for exposure of workers and building occupants. Some methods employ numerical scoring schemes often referred to as "algorithms." The advantage of an algorithm is that scores (e.g., 0-100) are automatically produced which can then be used to define the degree of hazard or potential for exposure, and the urgency for a response action. However, EPA has studied the use of algorithms and concluded that they may not be reliable estimators of hazard or exposure potential. Rather, they tend to give the assessment - a subjective process - a false sense of precision. They may also be extremely complicated and time-consuming, leading to short-cuts in the process.

Various non-numerical or quasi-numerical approaches have been developed for conducting physical assessments of ACM. Most employ many of the same factors used in numerical schemes. The difference is that evaluating each factor leads to a categorical outcome (e.g. "present/absent", "high/medium/low”) instead of a numerical score.

It is up to the Inspector to choose the method of assessment. For this reason, EPA does not specify a method but leaves it to the Inspector to make the correct decision. In other words, any assessment method can be used as long as the assessed material is placed in the correct category of damage and potential for damage by the Inspector, and the response action(s) allowed by AHERA are recommended by the management planner and selected by the LEA.

Functional Spaces

As discussed in the Inspecting section of this manual, functional spaces play a key role in the overall process of inspecting and assessing. First, the functional spaces are used to determine where each homogeneous material is located. For example:

Homogeneous Material "A" - 3,500 square feet of white sprayed-on ceiling material was found in functional spaces 5 through 27; hallway 1; hallway 2; girl’s bathroom, and lunch room.

Functional spaces are also used to pinpoint where samples were taken. For example:

Sample 001 was taken of Homogeneous Material "A" in functional space number 15.

Functional spaces will now be used to divide the homogeneous area in order to provide a physical assessment on a space by space basis. This is done because the condition of a particular homogeneous material may be different in each functional space. So our assessment of the homogeneous material may be different from functional space to functional space. In other words, the white sprayed-on ceiling material mentioned above may be in excellent condition in functional spaces 5 through 27, but there is a large amount of damage in hallway 1, minor damage in hallway 2, and the girl's bathroom and lunch room have the potential for significant damage. This means that our assessment of Homogeneous Material A uses four different assessment categories, depending on its location.

It is the Inspector's job to assess each friable homogeneous material as it appears in each functional space. The inspector does not assess the homogenous material as a single unit, but assesses it according to its condition in each functional space. Therefore, the physical assessment must be conducted per functional space.

***The Inspector should assess the condition of each homogeneous area of material as that material is contained in each functional space.**

The Physical Assessment

Introduction

1. The first job in the assessment process is to assess the current condition of the ACBM. (Remember you must view the homogeneous material as it appears in each functional space and give your assessment based on the individual space, not the homogeneous material as a whole.) The Inspector can do this one of two ways.

    a. The first choice is to go from functional space to functional space and assess all materials in the functional space. Some functional spaces may have two, three, or four homogeneous materials within the space. For example, a boiler room may have sprayed-on fireproofing, block insulation around the boiler, and pipe insulation. Each of these materials will be treated separately are given a separate assessment.

    b. The second choice is to pick your first homogeneous material and go to each functional space in which it appears and assess the material. Either way is acceptable as long as the material is fully assessed.

2. The second job of the assessment process is to assess the potential for damage or significant damage to all friable ACBM and assumed ACBM.

The final task in the assessment process is to determine the cause of damage or potential damages, that the cause can be corrected by the building owner. It would be of little value to repair the damaged ACBM if the cause of the damage is not also corrected. It is the inspector's responsibility to determine the cause of damage or potential damage and include that information in the inspection report.

AHERA Condition Classifications

"AHERA" gives the Inspector only seven categories in which to assess the current condition and potential for damage

1. Damaged or Significantly Damaged Friable Thermal System Insulation
2. Damaged Friable Surfacing Material
3. Significantly Damaged Friable Surfacing Material
4. Damaged or Significantly Damaged Friable Miscellaneous Material
5. ACBM with the Potential For Damage
6. ACBM with the Potential For Significant Damage
7. Any Remaining Friable ACBM or Friable Suspected (assumed) ACBM

Categories 1-4 reflect the current condition of material and categories 5-6 represent the potential a material has for damage. Category 7 is for material which will not fit in any of the other categories. In other words, category 7 is for material which is friable, in good condition, and has virtually no potential for future damage.

Assessing the Current Condition of Surfacing Material

Assessing the current condition of friable surfacing material may be your most important job. Usually, friable asbestos-containing surfacing material possesses the greatest potential threat. AHERA divides the assessment of its current condition into three categories; good, damaged, or significantly damaged.

Good Condition	Material with no visible damage or deterioration, or showing only limited damage or deterioration
Damaged	Material which has deteriorated or sustained physical injury such that the internal structure (cohesion) of the material is inadequate or which has delaminated such that its bond to the substrate (adhesion) is inadequate, or which, for any other reason, lacks fiber cohesion or adhesion qualities...flaking, blistering, or crumbling; water damage, significant or repeated water stains, scrapes, gouges, mars or other signs of physical injury
Significantly Damaged	Damaged friable surfacing ACM in a functional space where the damage is extensive and severe.

The Inspector must decide whether the surfacing material is simply damaged or if the damage is significant in nature. At this point the previously mentioned algorithms or non-numerical assessment may be used. The EPA recommends a non-numerical method and the method found in their guidance documents is commonly called the "10/25 Rule". The 10/25 Rule is used to determine if a surfacing material is damaged or significantly damaged (category 2 or 3). The 10/25 Rule method of determining damage is a recommendation only and not required by the AHERA regulation.

Assessing the Current Condition of Thermal System Insulation

The only AHERA category addressing thermal system insulation is "Damaged or Significantly Damaged Thermal System Insulation," Category 1. There is no difference between that insulation which is damaged and that which is significantly damaged. The most likely explanation for this is that thermal system insulation is usually very treatable. A quick repair job with a role of duct tape can return the insulation to good condition. Although better and stronger methods than duct tape are recommended pipe insulation can usually be repaired with minimal time and expense.

Pipe insulation which is in good condition with no potential for damage would most likely be given a category 7, or, "Any Remaining Friable ACBM or Friable Suspected ACBM."

Assessing the Current Condition of Friable Miscellaneous Materials

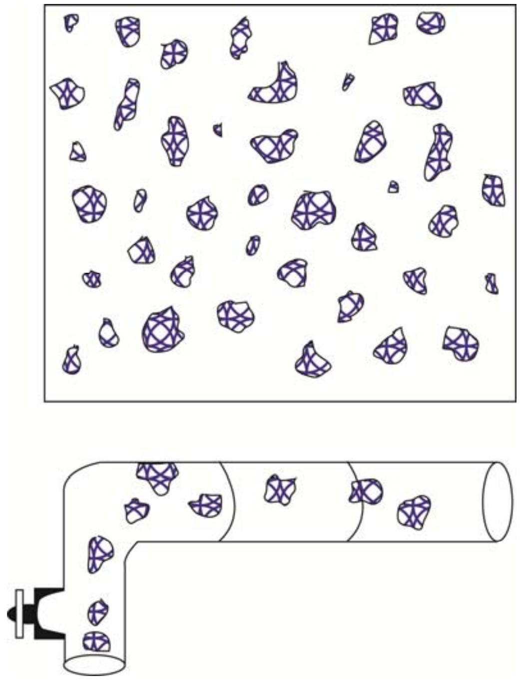
The only AHERA category for friable miscellaneous material is Category 4, "Damaged or Significantly Damaged Friable Miscellaneous Material." Most of the miscellaneous material an inspector will encounter in a building is either ceiling tile or floor tile. There may be many types of miscellaneous material in a building (e.g., theater curtains, lab table tops), but the inspector must determine if they are building materials. Theater curtains are not a building material and therefore do not have to be assessed under the AHERA rule.

The decision to address asbestos-containing non-building material is up to the inspector and building owner. Documentation of all the asbestos found in the building is certainly the better route to follow. However, it does not have to be done by the inspector.

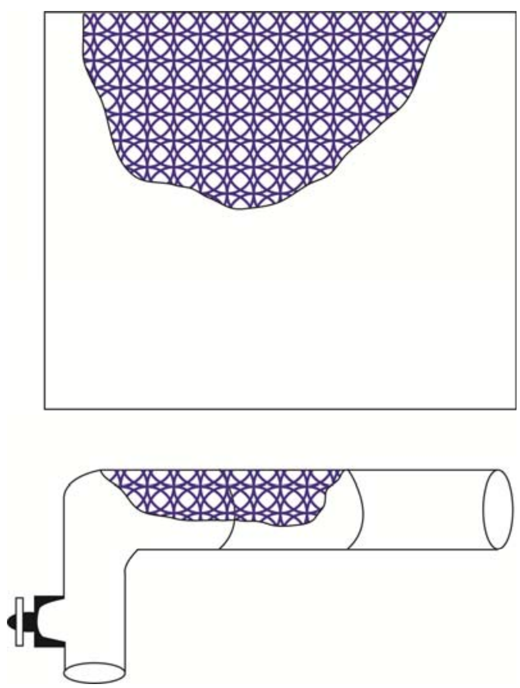
The one assessment category for miscellaneous materials follows the same theory as thermal system insulation. If asbestos ceiling tiles are damaged or significantly damaged, they can be easily replaced. Floor tile, on the other hand requires no assessment since it is normally a non-friable material. Should asbestos floor tile be in a friable condition, then the inspector would assess them as a category 4 and the response recommended by the planner would most likely be removal.

Friable miscellaneous material which is an ACBM and in good condition must be viewed for its potential for damage. If no potential for damage exists, then the assessment category number 7, "Any Remaining Friable ACBM or Friable Suspect (assumed) ACBM" would be acceptable.

REPRESENTATION OF TEN PERCENT (10%) DISTRIBUTED DAMAGE



REPRESENTATION OF TWENTY-FIVE PERCENT (25%) LOCALIZED DAMAGE



Assessing Potential for Damage

Introduction

The potential for building occupants to be exposed to asbestos depends on the condition of the ACBM, the likelihood of disturbance, and the potential for fibers to be transported. The following are a few types of activities are that may release or re-suspend fibers into the air:

- Renovation projects
- Repair and maintenance activities
- Routine cleaning
- Operation of building systems
- Activities of occupants other than service workers
- Deterioration/aging of the ACBM

Exposure factors must also be considered when assessing the potential for disturbance. For example:

Non-Visible Materials	This refers to the common situation that if an ACBM is not immediately visible, the occupants may forget its presence and accidentally expose it in a manner which may result in fiber release.
Accessibility	The degree to which the material can be easily reached by the general building occupant. ACBM that is easily accessible can be just as easily disturbed.
Friability	Is material friable?
Barriers	Are there barriers to casual contact? If so, are they permanent or temporary? How easily can these barriers be breached?
Ventilation	Is the material a part of the building's air stream?
Air Movement	Air erosion may occur in a return air plenum or fan room. This movement may erode the ACBM causing potential exposure problems.
Air Plenum	Is the air plenum used for return air? If so, material in this area may be dispersed throughout the building.
Activity	Heavy activity such as in a gym or machine shop versus the more sedate activity found in a library must be evaluated.
Vibration	Vibration from mechanical equipment, subway tunnels, buses, loud noise, and other causes of vibration could eventually loosen the material.
Character of Occupants	The occupants of a school pose a different assessment problem than the occupants of a commercial building.

AHERA has two categories to address potential for damage; Category 5 - ACBM with the Potential for Damage or Category 6 - ACBM with the Potential for Significant Damage. There is no delineation between surfacing, miscellaneous or thermal system insulation.

Taking all the exposure factors mentioned previously, the inspector must assess all ACBM for its potential for damage. The difference between potential for damage and potential for significant damage plays an important role in this assessment.

AHERA Definition of Potential Damage

1. Friable ACBM is in an area regularly used by building occupants, including maintenance personnel in the course of their normal activities.

2. There are indications and/or there is a reasonable likelihood that the material or its covering become damaged, deteriorated, or delaminated due to factors such as changes in building changes in O&M practices, changes in occupancy, or recurrent damage.

AHERA Definition of Potential for Significant Damage

1. Same as potential for damage, plus:

2. The material is subject to major and/or continuing disturbance due to factors including but not limited to, accessibility or, under certain circumstances, vibration or air erosion

As underlined above, AHERA lists the factors which must be considered in assessing potential for significant damage versus potential for damage:

a. Contact
b. Air Erosion
c. Vibration

To help determine the difference between Potential for Damage and Potential for Significant Damage, the following tools can be used. Match the ratings in the table below with the examples given on the *Factors to be Used in Determining the Potential for Disturbance of Suspect Materials* following the table.

<u>Assessing Potential for Damage</u>

Potential Disturbance	Potential for Contact	Influence of Air Erosion	Frequency of Vibration
"Potential for Significant Damage"	Any rating of HIGH		
"Potential for Damage"	Any rating of MODERATE or MEDIUM		
Low or No Potential	Any LOW rating		

Factors to be used in Determining the Potential for Disturbance of Suspect Materials

<u>Potential for Contact with the Material</u>

High
- → Service workers work in the vicinity of the material more than once per week, or
- → The material is in a public area (e.g., hallway, corridor, auditorium) and accessible to building occupants

Moderate
- → Service workers work in the vicinity of the material once per month to once per week, or
- → The material is in a room or office and accessible to occupants

Low
- → Service workers work in the vicinity of the material less than once per month, or
- → The material is visible but not within reach of building occupants

<u>Influence of Vibration</u>

High
- → Loud motors or engines present (e.g., some fan rooms), or
- → Intrusive noises or easily sensed vibrations (e.g., major airports, a major highway)

Moderate
- → Motors or engines present but no obtrusive (e.g., ducts vibrating but no fan in the area), or
- → Occasional loud sounds (e.g., music room)

Low/None
- → None of the above

<u>Potential for Air Erosion</u>

High
- → High velocity air (e.g., elevator shaft, fan room)

Moderate
- → Noticeable movement of air (e.g., air shaft, ventilator air stream)

Low/None
- → None of the above

Assessment Examples

Example 1:
Homogeneous Material A, white sprayed-on ceiling material as it appears in functional space 15 is in good condition with the potential for damage. The material is in a classroom and has a moderate to slight potential for contact. Currently, the material shows no damage and has been in place for 23 years. There is no reason to believe its condition will change in the near future.

In this example the Inspector explains that although the material has the potential for damage, as most materials do, the likelihood is low. Unfortunately, the inspector justified this decision by stating that there has been no damage for 23 years. This should not be a factor in the decision making process. The decision should be based on the three factors for potential damage.

Example 2:
Homogeneous Material A, white sprayed-on ceiling material, appears in functional spaces 16 and 17 in good condition, however, there exists the potential for significant damage. Classrooms 16 and 17 are currently housing 8th grade students. In the near future, these two classrooms will be combined to become a gymnasium for all kindergarten students.
There exists a very high potential for contact.

Example 2 describes material which is in good condition, but for some reason has the potential for significant damage. By explaining the reason (the change of the space's function), the inspector alerts the planner to a potential hazard.

Example 3:
Homogeneous Material E, air cell pipe insulation, appears in functional spaces B-H1, B-H2, B-BR and is significantly damaged thermal system insulation and has the potential for significant damage. The insulation has been scraped and gouged by ladders and other maintenance equipment. It is also at waist level in the two basement hallways and therefore has an extremely high potential for contact.

The pipe insulation in example 3 appears in three different areas and the inspector has not only assessed its current condition as significantly damaged, but has further explained that more damage is extremely likely. This clearly outlines a potential hazard.

Figure 1 is a flow chart the inspector can use when assessing material and provides an excellent summary of the second portion of the inspector's job. Figure 2 is an example format for quick summarization that differs from the examples above.

Conclusion

The Inspector is drawing a map for the management planner with each assessment. An assessment significantly damaged friable surfacing material is a clue to the planner that this material is in bad shape. The description of the damage or reasons for potential damage will further enhance the planner's view the situation. A clear and concise inspection report will be valuable to the planner as he or she begins the difficult task of assessing the hazard posed by the ACBM.

ASSUMED ACBM LOCATION FORM

Building ______________________________

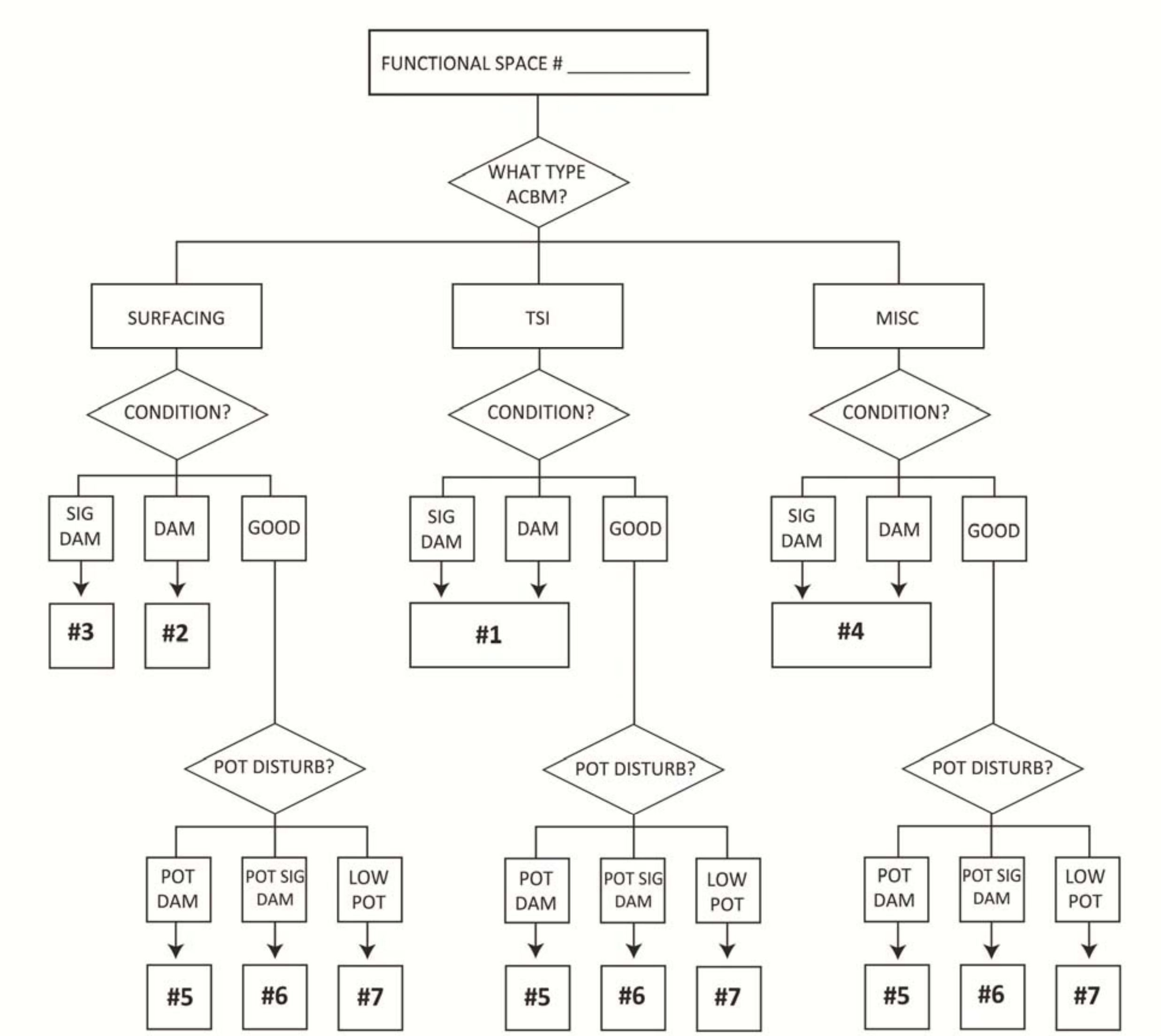
Location		**Type of Material**				**General Condition**
Functional Space #	Floor	SM	TSI	Misc.	Describe	(Describe)

Note:
SM = surfacing material
TSI = Thermal System Insulation

Inspector ______________________________

Date: ______________________________

CATEGORIZING ASSESSED MATERIAL (Figure 1)



EXAMPLE FORMAT FOR SUMMARIZING INSPECTION AND ASSESSMENT RESULTS (Figure 2)

BUILDING			
Functional Space #		Type:	Location:
Type of Suspect Material:	Surfacing:	TSI:	Other:
Description			
Approximate Amount of Material (linear or square feet):			
CONDITION			
Percent (%) Damage		Localized:	Distributed:
Type of Damage	Deterioration	Water:	Physical
Description			
Overall Rating	Good:	Fair:	Poor:
POTENTIAL FOR DISTURBANCE			
Frequency of Potential Contact	High:	Moderate:	Low:
Description			
Influence of Vibration	High:	Moderate:	Low:
Description			
Potential for Air Erosion	High:	Moderate:	Low:
Description:			
Overall Rating	Potential for Sig. Damage	Potential for Damage	Low Potential for Damage
Comments:			
Signed:			Date:

CHAPTER 9

Legal Liabilities of the Inspector

Introduction

Inspectors are exposed to liability due to the critical role they play in the asbestos management process. The inspection report will be the basis for all subsequent actions taken by a facility manager to control asbestos containing materials. The assessment report provides guidance for the development of operations and maintenance strategies, the determination of response actions and it is an integral part of any management plan.

If an asbestos inspector fails to properly identify an area of asbestos containing material in a facility, or improperly assesses its condition, liability under several scenarios is possible. The facility owner may initiate a claim against the inspector for breach of contract. Occupants of the facility who are exposed to asbestos as a direct result of a faulty assessment may claim personal injury. Contractors who proceed in reliance on a deficient assessment could sue the inspector for injuries suffered as a result of exposures, delay or lost profits when they are surprised by the discovery of asbestos. If the facility owner is sued as a result of a deficient assessment, the inspector would almost certainly become involved in the litigation as a third-party defendant.

Liability of Inspectors

The inspector faces four areas of potential liability: contractual, regulatory, criminal and tort.

Contractual Liability

The inspector is liable for breach of contract if the services are not performed in accordance with the explicit and implicit meaning of the agreement. A contract need not be written to be enforceable; contracts can be oral as well as implied by a court from behavior of the parties. If a court finds that there was mutuality of obligation, a meeting of the minds, and that the agreement is not against public policy, the court will attempt to strictly enforce a contract. In a contract action, the court will look to the agreement to determine the intent of the parties. The court will then enforce a contract in order to avoid unjust enrichment and in an attempt to place the parties in the position they would have been in had the agreement been performed faithfully. In terms of remedies, the court will assess financial awards; it is very rare that the court will order the parties to specifically perform the agreement.

When a contract is written, the court will first decide if the written agreement was intended to embody the entire agreement. If the court decides that the contract integrates the entire agreement between the parties, the court will focus only on the language of the contract to determine the rights of the parties. In this context, any attempt by a party to contradict the explicit terms of the contract with testimony regarding oral promised or representations will fail. The court will strictly interpret the written agreement.

Contractual liability is one of the greatest sources of liability facing an inspector. The number of contract actions is a direct result of poor drafting of both proposals and contracts. Reliance on boilerplate language in proposals and contracts is the single most common reason for arguments which lead to lawsuits alleging breach of contract. The failure to ensure a “meeting of the minds” by drafting a specific contract that defines the agreement is a recipe for legal actions.

The second most common cause of contract suits is the fact that more emphasis is placed on the price of the contract rather than the scope-of-work. By definition, a contract to perform an asbestos assessment is a contract to define an unknown. In other words, how much asbestos is present in a building. A properly performed asbestos survey will allow the conditions on-site (i.e., the number, types and locations of suspect asbestos containing materials) to determine the scope-of-work (i.e., survey duration and number of samples). However, emphasis is placed on the price of the assessment. Many breach of contract suits result from an inspector not being able to perform both professionally and profitable.

Perhaps the best example comes from the public bidding process where selection on the basis of price is required by procurement regulations. In schools, most inspection contracts bid on a competitive, fixed-fee basis after the school system has presented the building plans as a basis of the bids. In this context, the price of the contract, not the number of samples necessary to professionally define all suspect materials, becomes the focus. The only way to ensure profitability is to perform the assessment with haste and limit the number of samples. Low bid leads directly to low quality. Low quality is often the basis of a breach of contract action.

Clarity in contract language is the best means of avoiding disputes. If the inspector contracted to inspect a given number of square feet based on information provided by the building owner, the owner would pay an additional amount if the square footage estimates are inaccurate. If the inspector were to win a bid to inspect “all the buildings”, the inspector would be liable for the inspection of all areas without a square footage limitation. Does this contract include roofing materials?

The timing of the completion of an inspection can be of great concern to the school and the subject of breach of contract action. If the school officials have a timetable by which they must solicit bids from contractors, the completion of the inspection becomes an important contractual consideration. Liquidated damages are often defined in the contract and are claimed against the inspector for failure to complete on time.

The extent of sampling and documentation of results are other areas in which the building owner and inspector should have a clear contractual understanding. The inspector should not enter into a contract in which an insufficient number of samples are specified so that the presence of asbestos may not be detected. The appropriate type of laboratory analysis at a certified laboratory should be specified in the contract. The building owner may save money in the short run by economizing on sampling; however, such practices could cause legal problems for both the building owner and the inspector later.

Furthermore, if the contract calls for “best practices” or state-of-the-art protocols for sampling then provide insufficient funds for sampling, the inspector would be caught in a situation in which he could be open to:

1. Later litigation if there is asbestos-related damage and

2. Breach of contract action by the school or building owner.

The records turned over to the school or building owner by the inspector are the end product of the contracts. Not only should the nature and form of these records be specified, but also any special procedures to be followed in developing the set of records. Assuring the chain-of-custody of samples between the inspector and laboratory is an example of where the inspector might be personally liable to re-sample all areas of the school if proper custody procedures are not followed.

Regulatory Liability

An inspector can be held liable for non-compliance with federal, state or local regulations. Consistent with the hazardous nature of asbestos, any assessment for the presence of asbestos is understood to be a critical task. Therefore, regulatory agencies on all levels have adopted diverse and explicit regulations concerning the performance of asbestos assessments. A primary area is the compliance with inspector certification requirements. Not only must the inspector take an EPA approved course and pass and examination as required by the federal government, he or she must also comply with state, county and local regulations for certification. Other regulations that the inspector must comply with relate to the use of respirators and protective clothing while conducting an inspection.

The failure to comply with regulations can result in both fines and revocation of inspection certifications. These actions are taken by an administrative agency, such as the Environmental Protection Agency (EPA). Any arguments made by an inspector against the administrative penalty must first be argued before a hearing officer. It is very difficult to successfully overturn an administrative penalty in an administrative hearing. Only after "exhausting administrative remedies" should an inspector attempt to obtain relief from an administrative action by going to court.

Simply stated, failure by an inspector to follow regulations can lead directly to administrative sanctions from a variety of government agencies. Once the sanctions are assessed, it is difficult for an inspector to successfully overturn any administrative penalties.

Criminal Liability

Although remote, it is possible for an inspector to be held criminally liable. In the criminal context, it is the government that is prosecuting the action. Importantly, a criminal conviction is very serious and may involve both fines and incarceration. A criminal conviction will all result in a record.

To be held criminally responsible, the inspector must meet two elements. First, the inspector must know his actions are wrong. Second, the inspector must perform a guilty act. An example would be the inspector who consciously failed to define the asbestos content of a material, was aware that the material was suspect, and was aware that his action would lead directly to extensive contamination and exposure. In this context, a District Attorney may choose to prosecute a criminal action.

Tort Liability

A "tort" is a generic legal term for a class of theories advanced in civil litigation. Common tort theories include: negligence, fraud, misrepresentation, assault and battery.

The most common tort theory advanced against an inspector would be negligence. A negligence claim alleges that the inspector failed to perform his or her work in accordance with the skills of the profession. To win a negligence suit, the plaintiff must prove that the inspector failed to perform the services in a professional manner, using that degree of care and skill ordinarily exercised by and consistent with the standards of competent consultants practicing in the same or a similar locality. The plaintiff must prove each of the following items:

- **Duty**
  The inspector had a duty to the plaintiff that is recognized in a court of law.

- **Breach of Duty**
  The inspector's actions constituted a breach of the duty owed to the plaintiff.

- **Unreasonable**
  The inspector's actions were not objectively reasonable: in other words, a "reasonable inspector" would not have performed as the inspector did. As elements of proof, state of the art practices, regulatory guidance documents and industry standards would be offered to show that the inspector's actions were unreasonable.

- **Injury**
  The plaintiff must show that he/she was "injured" by the inspector's actions. Fear of future consequences usually does not suffice; the plaintiff must show real-time injury such as clinical medical tests or the loss of a sale of real estate.

- **Proximate Cause**
  The plaintiff must prove that the inspector's action was the direct cause of the injury. The two events should be connected closely in time and space.

- **Damages**
  The court will award damages in the form of monetary awards, to compensate for the injury. Some jurisdictions also allow punitive damages in addition to compensatory damages.

Negligence can arise from the inspector failing to document an area of ACM or improperly taking samples. One of the great difficulties in defining a potential liability due to negligence is the lack of universally accepted performance standards for asbestos inspection activities. Three examples will illustrate this problem.

Example A:

An inspector is called upon to assess the condition of a material. A great deal of subsequent abatement activity depends on this assessment. There does not exist at present any definitive distinction between what is damaged material and what is significantly damaged material. No precise instrument measures this damage; only the inspector judges the ACMs condition. Such assessments could change from one inspector to another or may change as more is learned about the mechanism of fiber release.

Example B:

The inspector is called upon to assess the potential damage of ACM, i.e., the potential of the material to release fibers in the future. The potential for damage depends upon other factors, including the activities in the areas of ACM and the operation of the ventilation system of the school. There is no precise approach at present to such an assessment. In addition, the use of the areas may change from the time the inspector made his or her potential damage determination. The inspector can try to protect himself in the inspection contract from liability of future fiber release due to altered activity patterns in the school. The inspection contract could include a "change conditions" or a "differing site conditions" clause which provides some protection to the inspector if physical conditions occur at the site which differs from those originally observed.

Example C:

Where previous inspections have been performed, before using the results, it must be determined whether the inspection was properly designed and performed and whether the inspection was performed by a personal competent in this area. Reliance upon previous inspections without these confirmations may results in improper conclusions being drawn and improper responses being taken.

Legal Considerations of Insurance

Obtaining professional liability insurance is the normal method for a professional, such as an Asbestos inspector, to secure protection from litigation arising from his professional activities. These policies are often referred to as Errors and Omissions (E&O) policies.

Many owners require that all professionals involved in asbestos-related work have liability insurance in order to have some financial security for significant claims that may arise. In addition, under certain state and local laws, general liability insurance in specified amounts is often required.

A related aspect of this issue is the necessity for indemnification clauses in the contract, whereby the professional is obligated to indemnify and defend the owner against claims brought against the owner arising out of the inspector's work. At the same time, inspectors need such insurance to protect themselves against claims which can be financially ruinous, and to provide for legal defense costs against claims. While work done in accordance with specifications and applicable regulations may ultimately shield the inspector from liability, the assumption of defense of a legal action by the insurance carrier, or the client (building owner) who indemnifies the inspector, is a significant benefit.

It is obvious that insurance adds to the inspector's cost of performance and this is eventually paid by the owner. Complicating the asbestos management issue is the difficulty most professionals involved in asbestos are having obtaining meaningful insurance at any price. Due to the current relative unavailability of insurance, and the expense of substantive E&O policies, many owners have considered dropping or reducing insurance requirements, and sometimes are forced to do so to obtain professional services.

The relative unavailability of insurance has forced asbestos professionals in some cases to purchase any insurance available, without paying adequate attention to whether risks are covered or the strength or credibility of the carrier. Similarly, owners are accepting insurance certificates without analyzing the coverage being offered. Changes in the type and scope of coverage offered by the insurance industry must therefore be analyzed carefully to accomplish the goal of insurance. Rather than protection against liability, insurance for some has become a "license to work" in the asbestos industry.

Those asbestos professionals who purchase insurance, regardless of the cost or quality of coverage, can obtain work. Others are forced to attempt to negotiate alternatives with owners to providing such insurance. However, unless the insured understands what coverage is being purchased, the insured may be left unprotected by merely buying a "license to work".

Types of Insurance Coverage

Errors and Omissions

Building inspectors will normally look for "Errors and Omissions" insurance to protect them against misjudgments made during building inspections. The mistake may take the form of an inadvertent error (i.e., miscalculation of area square footage) or an unintentional omission of some nature (i.e. not enough samples collection). Errors and Omissions (E&O) coverage is written for specific professions. Many professionals (architect, engineer, designer, etc.) have E&O coverage to protect them; however, asbestos related professionals may have difficulty obtaining full coverage due to the great exposure for loss in their activities. If E&O insurance is found by the asbestos professional, the coverage might be very expensive. As of this writing it would not be uncommon for E&O premiums to cost in the range of $40,000 as an annual premium to ensure $1,000,000 in coverage, with a $20,000 deductible on a per occurrence basis.

General Liability Insurance

Another type of coverage that building inspectors might pursue, general liability insurance, is available and may serve as protection for events that occur during building inspections. As the name implies, general liability coverage is suitable for situations arising in the normal course of business and not related to the inspector's delivery of professional opinions. The drawback to this type of insurance is that it will likely contain a pollution or asbestos exclusion, rendering the policy essentially ineffective for asbestos related claims.

Occurrence Insurance

In the past, liability insurance has been written on an "occurrence" basis. Under such a policy, if an incident "occurs" while the policy is in force, coverage is afforded even if the actual claim is made some years later and even if the insured is no longer insured by the same carrier. As a result of this type of coverage, insurance carriers must defend claims brought years after companies are no longer insured by the carrier. With the long latency period of asbestos related disease, occurrence coverage can result in great losses to carriers who have not received premiums over a period of time. As a result, the carriers have been adding exclusions to existing policies for asbestos related third-party claims and generally have changed the coverage from occurrence to "claims made".

Claims Made Insurance

Under a "claims made" policy, coverage exists if a claim is made while the policy is in force. In certain situations, a claim may be made during an extended reporting period ("tail", which may require an additional premium. For many risks, the difference between occurrence and claims made coverage is not significant since the liability causing event is obvious and claims are generally asserted shortly after the event occurs. However, the release of asbestos fibers from an asbestos abatement project may be obvious, and injury may not be detected for twenty years. Thus, if claims made coverage is obtained, it may not be of value in such cases of (1) the insured changes insurance carriers before a claim is made, (2) the carrier terminates coverage under a policy, or (3) the carrier withdraws from the market before a claim is filed. Nevertheless, it is likely that the primary type of coverage to be available in the future is claims made, and thus another analysis must be made by the inspector to understand the coverage that is actually being purchased.

There is no single definition of what "claims made" means; it is mandatory that the insured read and understand the coverage provided under its policy. All exclusions, conditions and definitions must be carefully analyzed. For example, a general liability policy written for an asbestos contractor often includes a "pollution exclusion". This excludes coverage for any personal injury or property damage caused by a broad list of substances. Generally, asbestos is included on the list and consequently the policy provides no coverage for asbestos risks.

True "occurrence" coverage is rare. The terms of the policy must be reviewed carefully. Some "occurrence" policies have conditions or exclusions that negate coverage. The name of the policy makes no difference. Claims made policies may, in some situations, cover claims which arose in prior years, similar to "occurrence" policies.

The insurance certificate provides little or no information of benefit to an owner or professional consultant. The policy itself must be reviewed.

The insurance carrier must be very carefully evaluated. Does the carrier understand the industry, and is it committed to writing proper coverage? Again, the policy terms are important.

Bonding

The difficulties in obtaining insurance have spread to the bonding industry. Traditionally, three types of bonds have been required in the construction industry to protect the owner or lender against the contractor's financial default:

- Bid bonds, under which a surety agrees to pay a percentage of the bid price if the contractor does not honor their bid;

- Payment bonds, under which a surety company agrees to pay for labor and materials supplied to a project in the event the contractor fails to do so and;

- Performance bonds, under which a surety agrees to complete performance of a project if the contractor fails to do so.

Abatement contractors who have had their insurance canceled or not renewed are experiencing difficulties in obtaining bonding. Bonding companies rely on the financial ability of the principal (the contractor) to respond to claims under payment and performance bonds. If a company is not insured against catastrophic liability, the financial underpinnings of the company are weakened, and the bonding company becomes apprehensive over issuing bonds. In a similar vein, lenders are reacting adversely to the no insurance/no bonding problems of such companies. Lenders are advising companies who find themselves in such positions that lines of credit will not be renewed, for the same reasons given by the bonding companies.

The difficulty being encountered by asbestos abatement contractors in obtaining bonding is severe. For reasons similar to those which caused the asbestos abatement insurance crisis, many contractors are unable to obtain sufficient bonding and in some case any bonding. In addition to the general underwriting concerns about the contractor's ability to perform their work, another reason some bonding companies are unwilling to write bonds for asbestos abatement work relates directly to liability insurance problems. Because the bonding contract often has requirements for the contractor to obtain and maintain certain liability insurance coverage on the project, the bonding companies fear that if the contractor has insurance problems, such as improper coverage or cancellation during the policy period, the potential loss that may otherwise be covered by liability insurance might be covered by the contractor's performance bond.

While the traditional concepts of bond underwriting may not be applicable to abatement contractors; it is nevertheless useful to understand them. The primary consideration of the bonding company in determining whether to bond a contractor is the ability of the contractor to perform the work and the contractor's financial ability. A proven track record of successfully completed projects, without ensuing litigation, is very helpful to the contractor in demonstrating to the bonding company its ability to perform the work. Financial stability is important not only with respect to the contractor's ability to perform the work, but also its ability to satisfy its indemnity obligation to the bonding company in the event a loss is suffered under the bonds. Unlike insurance, a payment or performance bond gives the bonding company the right to recover back against the contract for any losses sustained by it under the bond. A somewhat more intangible, yet important, factor is the contractor's good character. Despite satisfactorily proving all of these items, a contractor may still not be able to obtain sufficient bonding in today's market. In such events, an owner may waive or refuse bonding requirements or arrange other contractual mechanisms to assure payment of performance.

There are numerous legal considerations involved in the evaluation of insurance and bonding coverage. The cost of insurance for asbestos abatement is significant, and if such expense is going to be undertaken, the coverage obtained should be satisfactory. While there are no easy solutions in this decision-making process, it is mandatory that contractors, consultants and owners undertake to become knowledgeable purchasers of insurance.

The shift in the types of coverage written for the contracting industry from occurrence to claims made and the difficulty in obtaining bonds have placed greater emphasis on the contractor's commitment to the performance of work in a quality manner, the carrier's commitment to continuing to insure asbestos abatement contractors, and the quality of the carrier's coverage and insurance program in general. This makes the process of purchasing insurance more complicated but a thorough review of the considerations outlined above will greatly assist the contractor, consultant or owner in making a knowledgeable choice.

CHAPTER 10

Public Relations

Requirements and Recommendations

The Occupational Safety and Health Administration (OSHA) Worker Exposure Rules for Asbestos (1994) include requirements for notifications, warning signs and labels, and education programs on the part of any employer whose employees are exposed to asbestos fiber levels above the exposure standard. The permissible exposure limit (PEL) is currently 0.1 fibers per cubic centimeter (f/cc) of air, averaged over an 8-hour day. OSHA has established an excursion limit (EL) as well. If employees are exposed to a time-weighted average of 0.1 f/cc over an 8-hour period (the PEL), employers must begin compliance activities such as notification, air monitoring and employee training. The excursion limit is 1.0 f/cc averaged over a 30 minute time period, and is generally targeted for those individuals who may be exposed to high airborne asbestos fiber concentrations for short time periods. The Regulatory Review section of the course notebook covers the activities which trigger the requirements of the OSHA regulations in greater detail.

The Environmental Protection Agency (EPA) recommends that building owners inform building occupants of the presence and location of asbestos-containing materials (ACM) and the need to avoid disturbing them even if fiber levels are below the OSHA exposure limits. Accidental disturbance of the ACM could easily raise airborne fiber levels to or above the OSHA exposure levels mentioned above.

The local education agency (LEA)/building owner has three major concerns. First, building occupants should be informed of any potential hazard in the building. Second, building occupants who are informed and instructed about ACM are less likely to disturb the material and cause fibers to be released. Third, early and full disclosure may reduce legal liabilities and the likelihood of future litigation.

The best approach to handling public, employee and building occupant relations when dealing with asbestos involves three principles:

- Bring it up early
- Tell the truth
- Communication with all affected parties

Relevance to Building Inspectors and Management Planners

Both the building inspector and management planner have a stake in assisting the LEA or building owner in developing a public relations program. The inspector is likely to have the first contact with building occupants and workers and should be prepared to explain his/her activities in an accurate and acceptable (to the building owner) manner. The building owner may also want to initiate a full disclosure program at the time of the inspection rather than waiting for the results of the inspector's survey. If ACM is found, the management planner should work with the LEA to develop a more complete public relations program.

Disclosure can begin before the inspection is done or the results are known and can include the following as a typical disclosure/information outline:

1. Inspection activity/access
2. Purpose of inspection – to determine whether asbestos is present
3. Information available – upon receiving lab results
4. Possible response actions
5. Concern for maintaining safe environment
6. Person/office to contact for additional information

Building Inspector

At a minimum, the building inspector and those assisting him/her must reach an understanding with the LEA or building owner on how questions from building employees and occupants are to be handled. It is necessary to know how your client wants you to deal with requests for further clarification from persons observing your activities. You may be authorized to elaborate on the inspection, or you may be told to refer all persons making inquiries to the building owner or his representative. In no case should the inspector provide or present information which is not true.

Management Planner

The management planner is likely to be called upon to assume a prominent role in planning the LEA's public relations program. The planner will provide expertise, credibility and assurances to effectively deal with questions and concerns of building workers and occupants.

Communication

Building occupants, whether employees of the building owner or not, can be informed of potential or confirmed building hazards in at least three ways:

- By distributing notices
- Posting signs, and
- Holding awareness or information meetings.

The method(s) chosen may depend upon the type and location of the ACM and on the number of people affected. Some states have “right-to-know” laws. In such states it may be required that all occupants as well as visitors to buildings with ACM be informed that asbestos is present.

The US EPA has issued notification requirements associated with its targeting and implementation of asbestos regulations for schools and these requirements may make useful guidelines for notification in non-school settings as well. Under the 1982 Friable Asbestos-Containing Materials Schools: Identification and Notification Rule, administrators of primary and secondary schools were required by EPA to inform employees and parent-teacher groups about the presence of any friable asbestos in their schools. In addition, administrators were required to distribute specific instructions on handling ACM to custodial and maintenance workers.

The Asbestos Hazard Emergency Response Act (AHERA) adopted many of the 1982 rule’s requirements and expanded upon them. A building owner or LEA can use the information generated by the building inspector’s activities in a comprehensive public relations program which will provide accurate and reliable information to building occupants. An overview of an LEA’s notification responsibilities is presented in the management planner’s notebook under the section “Developing and Implementing an Operations and Maintenance Program”.

OSHA requires that building or facility owners notify their own employees, tenants and the employees of other contractors on a multi-employer worksite prior to beginning certain activities involving the removal or disturbance of asbestos. This includes identifying the presence, location and quantity of ACM or presumed ACM (PACM).

Signs and Notices

Under AHERA, signs containing the words:

CAUTION
ASBESTOS-HAZARDOUS
DO NOT DISTURB WITHOUT PROPER
TRAINING AND EQUIPMENT

are required to be placed immediately adjacent to any friable and non-friable ACM as well as suspected ACM located in routine maintenance areas. All signs must be prominently displayed in clearly visible locations. They must remain posted on all ACBM until it is removed. Warning signs will serve to alert and remind building occupants not to disturb ACM. Frequently, areas such as boiler rooms are posted with signs which restrict access to everyone except service personnel who need to work there.

The specific wording of notices and signs is important. From a legal perspective, the presentation may affect the building owner's liability if building occupants are exposed to asbestos. To be effective communication devices, warning signs or notices should:

- Be tailored to the people and the environmental in which they are used.
- Communicate in a language understood by the audience.
- Be practical; they cannot prohibit activities necessary for individuals to perform their assigned jobs.
- Attract attention.
- Be durable and be replaced as necessary.

The OSHA standards require the establishment of regulated areas where airborne concentrations of asbestos exceed or are expected to exceed the PEL or EL, or where certain activities take place. The information contained on these warning signs is prescribed by OSHA and must state:

DANGER
ASBESTOS
CANCER AND LUNG DISEASE HAZARD
AUTHORIZED PERSONNEL ONLY

Education

The OSHA standards state that the employer/building owner must develop and present a training program for all employees who will remove, disturb or contact ACM or PACM. This program must be provided to all current employees, to all new staff prior to or at the time of initial employment, and the training must be repeated on a yearly basis thereafter. The detail of the training will vary according to the degree of activity and disturbance of the asbestos-containing material. (See the Regulatory Review section for more detail on OSHA training requirements).

Any educational effort undertaken by a building owner should include the following information:

- Asbestos is present in the building;
- The type and location of the asbestos;
- The potential health effects of asbestos exposure;
- Plans to deal with the problem;
- Instructions to avoid disturbing the ACM (e.g. do not hang plants, do not move ceiling tiles, etc.);
- Procedures to report any disturbance or damage to ACM;
- Additional sources of information;
- A record of all attendees and the dates of training

Information/education sessions reinforce and clarify written notices. In addition they provide an opportunity to answer questions, transmit accurate information, provide assurances that responsible, appropriate action is being taken and to defuse unwarranted concerns.

Timing

Credibility is what the employer, building owner or school administrator is seeking in a public relations effort. Information flow should begin before the inspection process to establish credibility and should be reinforced by timely updates as further information becomes available for distribution. Presenting the logic and rationale for the actions being taken may encourage cooperation.

It is in the best interests of the building owner to schedule any announcements or distribute written notices to building occupants simultaneously. Establish a fixed time and place to meet with all concerned parties. Allow sufficient time to respond to questions and address concerns. Identify person(s) to contact regarding questions that arise in the future.

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CHAPTER 11

Recordkeeping and Reporting

Procedures for Sample Labeling and Shipping

To ensure that the samples collected are neither lost nor their identity confused, the handling of all samples from point of collection to receipt at a testing laboratory requires adherence to procedures and detail. The procedures outlined below are intended as an illustrative model. The purpose of the sampling protocol is threefold:

I. Protect the samples from damage
II. Reduce the possibility of misidentifying individual samples
III. To provide a means for tracing any samples that may be lost

Prior to Sample Collection

Determine a scheme for assigning sample identification numbers. For example, starting with 1000, label each sample consecutively through 1010. The next sample you take is a Quality Assurance (QA) sample, number it 2010. Resume consecutive numbering with 1011 and continue through 1020, at this point you will take another QA sample, number it 2020. This scheme allows you to quickly distinguish regular and QA samples.

At the Point of Sample Collection

After placing a sample in a container according to the procedures outlined earlier, affix a sample identification sticker on the container. Peel-able, self-stick labels are available in various sizes and work well for this purpose. Enter the identification number on the Chain-of-Custody Sheet. On the building floor plan map, mark the location from which the sample was drawn, and record the sample identification number. Place the sample containers in a plastic bag. Where possible, and especially in maintenance areas, directly mark the sample location with the sample number. This may not be feasible with flooring materials, but works very well with TSI in particular.

If an independent laboratory is to be employed to analyze QA samples, separate Chain-of-Custody – Sheets for each laboratory will be needed, one to accompany regular samples, one to accompany QA samples. Place all QA samples in separate plastic bags.

Upon the Conclusion of Sampling

Remove the containers holding the samples from the plastic bag, checking to see that the cover and label are securely fastened. Place them in a shipping box with appropriate packing material (bubble pack or other stuffing material). Duplicate the completed Chain-of –Custody –Sheet(s) and place the original in the shipping box, retaining a copy for your records. Place the warning label in the box and securely seal the box. Completion of a laboratory generated data sheet may be required by the lab. Ship or hand- deliver regular samples and QA samples to the appropriate testing or QA laboratory.

At the Laboratory

Upon receipt of samples from the Building Inspector, the laboratory should check and sign the Chain-of-Custody Sheets, copy them and return the original(s) to the Inspector. It is important that this or a similar arrangement for sample accountability be agreed upon by the laboratory prior to sending samples for analysis.

Samples will be analyzed for asbestos and results will be sent to the inspector. You may opt to have the lab retain and store the samples, usually for a fee, or return them to you for future disposition.

Reporting

Laboratory Report

Accredited Laboratories will provide clients with a written report containing the results of their analyses. The report must contain the following information:

I. The name and address of the laboratory
II. The date of analysis
III. The name and signature of the person performing the analysis
IV. The result of the analyses.

The Building Inspector is responsible for submitting this information to the designated person responsible for implementing the AHERA requirements at a school, or the Asbestos Program Manager for a building or facility employing his/her services.

Inspection Report

Within 30 days of conducting a school building inspection a full written report is to be submitted to the school district or the district's designated representative. AHERA prescribes that the following information be included in the report:

- The date of the inspection
- The name and signature of the accredited person conducting the inspection, collecting samples, and making the assessment. The state of accreditation and, if applicable, the accreditation number of each inspector is to be provided in the report.
- The location of each homogeneous sampling area from which samples were collected, the exact location where each sample was obtained, the date that each sample was collected, the location of each homogeneous sampling area where suspect ACBM was assumed to be ACM, and the location of assumed ACBM. Homogeneous sampling areas should likewise be clearly identified on drawings and diagrams for future reference. Real or artificially designated area boundaries should likewise be clearly identified.
- A discussion of the manner used to determine sampling locations. Logic used in choosing sample locations should be presented and defended in writing. Sample locations should be selected for their ability to be representative of selected areas. To enable the samples to be statistically random, a protocol like that provided in the EPA guidance publication "Simplified Sampling Scheme for Friable Surfacing Materials" should be used.

All areas are to be identified by material types as either surfacing material, thermal system insulation or miscellaneous material.

Following receipt of the results of laboratory analyses, each sample and each homogeneous sampling area should be designated as ACM or non-ACM on building records.

The assessment of the ACBM and suspected ACBM into one of the following categories:

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

The contents of the Building Inspector's report will be incorporated into the Management Plan to be developed in the next phase of compliance with AHERA.

NYCDEP
Asbestos Investigator Compliance Guide

The Department of Environmental Protection periodically schedules audits of recordkeeping by certified asbestos investigators. Audit inspections are performed randomly or may be triggered by the ACP5 review process or by enforcement investigations at specific sites. Investigators must make records available during normal business hours without cost or restriction for inspection by a representative of the Department.

Incomplete records, improper or inadequate surveys or assessments, or submittal of false statement or false documentation to the Department will result in the issuance of Notices of Violation. The penalties for violation of Title 15, Chapter 1 of the Rules of the City of New York range from $1,100 to $10,000 per infraction. In addition, the Department may convene a hearing to revoke or suspend certification.

Asbestos survey records must accurately reflect the site conditions at the time of investigation.
Only individuals certified as asbestos investigators by the Department can engage in building survey and hazard assessment for asbestos. Such individuals have satisfactorily demonstrated an ability to identify the presence and evaluate the condition of asbestos in buildings or structures.

A non-certified individual may participate in an asbestos survey being conducted by a NYC certified investigator only if such individual works in the presence of the investigator and under direct and continuing supervision.

Sampling

Only persons certified by the Department as asbestos investigators or by the New York State Department of Labor as Asbestos Inspectors may select and collect bulk samples for analysis.

The investigator must assume that some or all of the areas investigated contain ACM, and for each area that is not assumed to contain ACM, collect and submit bulk samples for analysis. Collection and submittal of samples must be in compliance with Title 15, Chapter 1 of the Rules of the City of New York §1-36, §1-37, and §1-44, and EPA publications 560/5-85-024 and/or 560/5-85-030A.

- Bulk sample analysis (PLM) must be performed by laboratories within the Environmental Laboratory Approval Program (ELAP) administered by the New York State Department of Health.

- Bulk samples must be taken by whatever method minimizes the potential for fiber release. Any material that remains exposed as a result of the sampling procedure must be sealed.

- Sampling results/reports must be submitted directly to the Department upon request within five calendar days.

Note: When samples cannot be obtained because surfacing material is not present (e.g. bare boiler, pipe, etc.), photographs should be taken and included in the records.

Recordkeeping

Asbestos investigators must maintain a permanent record (survey report) for every building survey/hazard assessment for asbestos.

For each building survey/hazard assessment conducted prior to preparation of either DEP form ACP7 or ACP5, the investigator must compile a record that includes at a minimum:

- A detailed written description of procedures employed to detect the presence or absence of ACM.

- A blueprint, diagram, drawing, or written description of each building or portion thereof inspected by the investigator that clearly identifies each location and approximate linear or square footage of any area where material was sampled for ACM.

- The exact locations where bulk samples were collected, the date of collection, and the location of any areas assumed to have ACM.

- The printed name and signature of any and all persons who collect bulk samples for the purpose of determining the presence of ACM.

- The name and address of the laboratory analyzing the samples, the date of analysis, the results of the analysis, the method of analysis and the name and signature of the person performing the analysis.

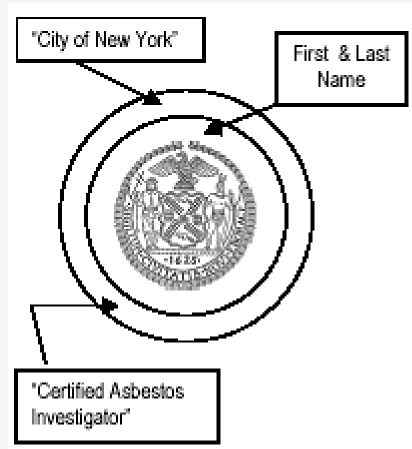
- A detailed written description of proposed demolition, renovation, alteration, or modification work to be performed, including the techniques to be used and a description of affected facility components.

- A specific description of all activities performed by non-certified individuals, including name, address, telephone number.
  ACP5 forms are notification forms and are not survey reports. Investigators must maintain adequate backup documentation. A detailed survey report is required for each and every asbestos survey.

All forms must have the seal of the NYC DEP Certified Asbestos Investigator.

Seal

Any plan or report submitted to any client or any city, state, or federal agency must have the investigator's seal and signature affixed. Photocopies of the seal and signature are not permitted. Any plan or report submitted without the investigator seal and signature is considered invalid.



Seals must be circular in shape, approximately one and three quarter inches in diameter, with three concentric circles. The inner circle must contain an accurate representation of the great seal of the City of New York. The legend at the top of the outer band shall read "City of New York" and the bottom "Certified Asbestos Investigator". In the inner circle above the great seal of the City of New York shall be shown the name of the certified asbestos investigator.

Certification Renewal

Renewal applications must be submitted five to six weeks prior to the expiration date of the certificate.

If applicable, evidence of payment of fines imposed by the Environmental Control Board (ECB) for violation of Title 15, Chapter 1 of the RCNY must be provided for renewal consideration. Adherence to a payment plan is acceptable.