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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

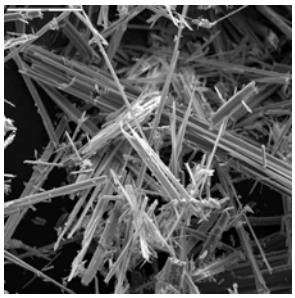
Asbestos Types

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

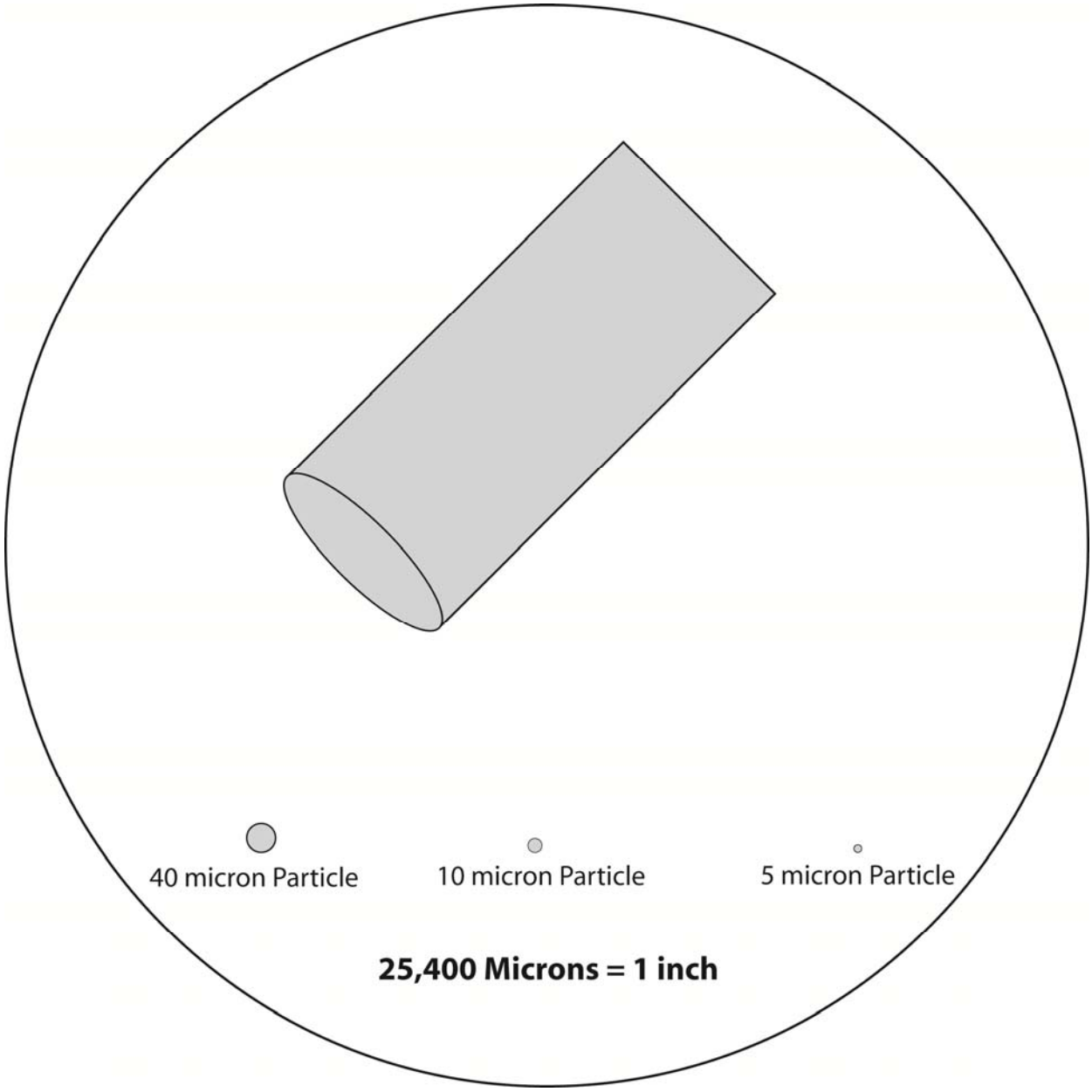
- Floor Tiles (VAT)
- Transite (Asbestos Cement)
- Roofing Materials
- Mastic
- Caulking

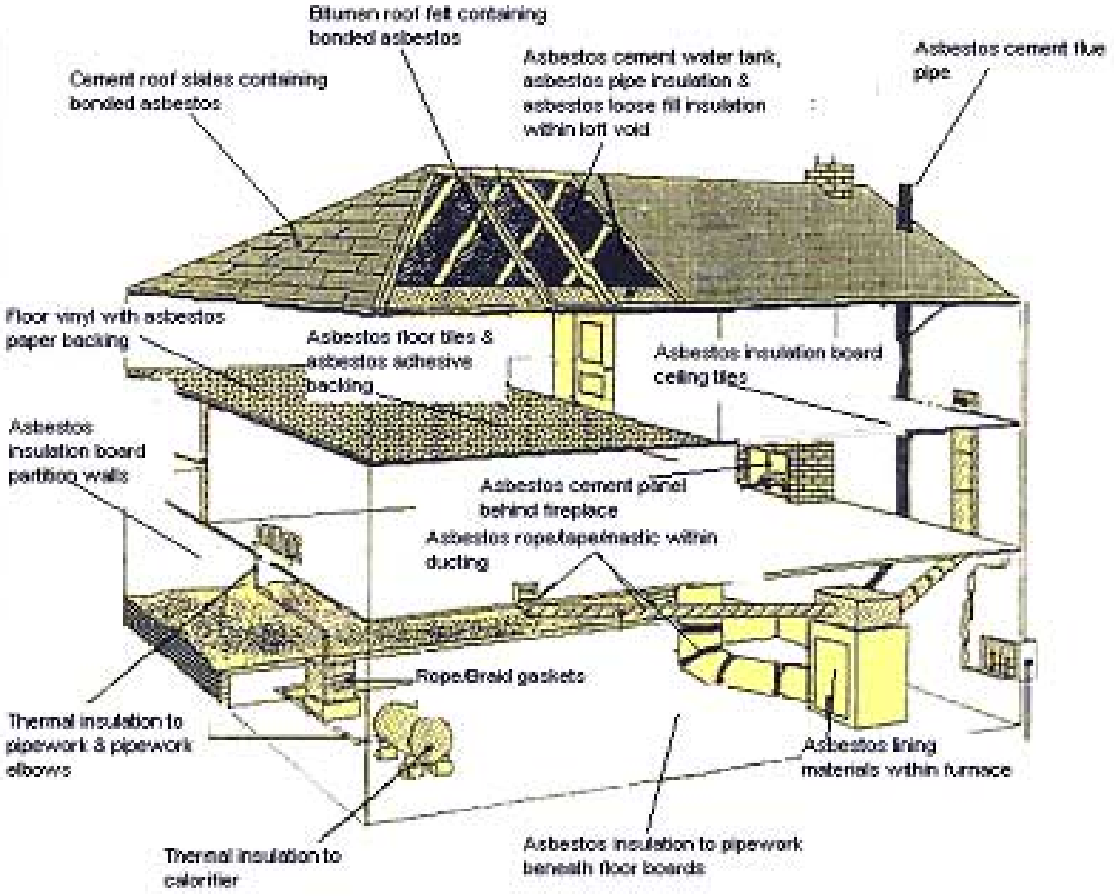
Properties and Uses of Asbestos

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
Asbestos cement water tank, asbestos pipe insulation & asbestos loose fill insulation within loft void
Asbestos cement flue pipe
Cement roof slates containing bonded asbestos
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:

   Category I materials (ACM packing, gaskets, resilient floor coverings and asphalt roofing)
   Category II materials (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)

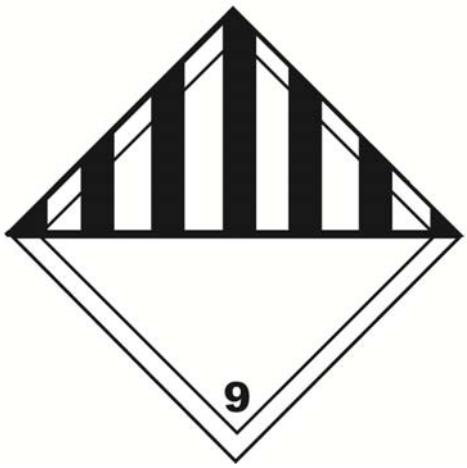
7. All asbestos waste must be disposed of in an EPA-approved landfill

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

COMMERCIAL NAME
ASBESTOS WASTE
PROPER SHIPPING NAME
ASBESTOS FIBRE
UN NUMBER
2590
WEIGHT (kgs)
21000 kg/40 FT CONTAINER

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.

NOTE: 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

Phase I (Prior to Asbestos Abatement Contractor Mobilization) Pre-Abatement		**Phase II** Start ---------- Abatement ----------End			
A	**B**	**A**	**B**	**C**	**D**
Asbestos Survey, Planning & Design	Background Air Sampling	Regulated Abatement Work Area(s) Preparation & Enclosure Construction	Asbestos Handling including, Gross Removal or Abatement, Initial Cleans and Waste Removal	Final Cleaning & Clearance Air Samples	Final Waste Removal from Site
Start ---------- Asbestos Project ----------End					

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.

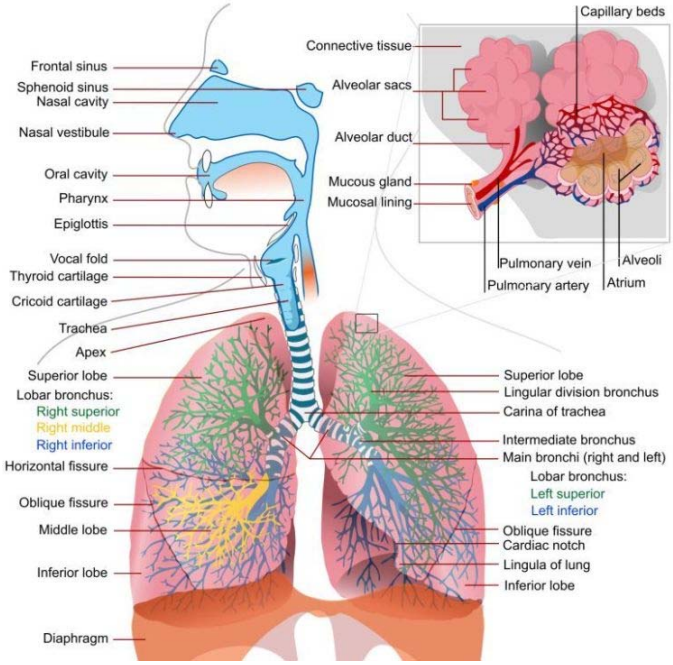
The Respiratory Body Defense Mechanisms

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.

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

(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

Pre-Abatement Procedures

Whenever asbestos containing materials are to be removed, regulations require that the release of these fibers be controlled. Control measures include sealing off the work area where removal will take place, constructing a worker decontamination unit, and in some cases a separate waste decontamination unit.

All of these tasks are combined in this chapter since these tasks are so closely related. However, you must always remember that each task is separate from the other and may not be done simultaneously.

Listed below would be a sequence of events that would take place from the time an asbestos project is filed all the way to the start of abatement.

A variance is needed to make changes to any component in the entire pre, during and post abatement sequence.

Notification

For a large project, abatement notification forms must be filed with the following agencies.

- NYS 10 Calendar days
- NYC 7 Calendar days (If project is in the 5 boroughs)
- EPA 10 Working days.

The building occupants must also be notified of an impending asbestos abatement project, a notice of abatement sign must be posted where there is typical ongoing public access, eg. entrance to the building main entrance, or elevator lobby. The notice must give the date of the project, the contractor, the abatement location and a telephone number for a building rep as a minimum.

This sign must be posted on the floor or floors where the actual project is to be conducted; one floor above and one floor below the impending project, at buildings that have direct horizontal access to the project, and at all direct means of access to the project. NYCDEP requires that the sign be in Spanish and English and at eye level in a well-lit place.

Vacate Area and Restrict Access

Building occupants and non-certified personnel must be removed from the work area before any work area preparation activities can take place and shall remain vacated until satisfactory clearance air sampling results have been achieved or the asbestos project is complete.

Entry to the regulated abatement work area shall be restricted to the asbestos contractors involved with the asbestos project, employees of the asbestos contractors, authorized visitors, and other public safety personnel. Police and fire officials may enter the work site and not be subject to this part only on an emergency basis.

Background Air Sampling

The 3rd party air monitoring company will conduct background air monitoring. This is done prior to the contractor begins any pre abatement activity. New York City refers to this as pre abatement air monitoring (see chapter 9).

Removal of Moveable Objects

All moveable furniture and other objects must be removed from the work area. This is typically done by the building personnel. If necessary then use appropriate wet clean methods and HEPA vacuuming prior to removal from the work area.

Code Rule-56 requires upholstered furniture and drapes be HEPA vacuumed twice before removal from the regulated abatement work area. Carpeting shall be HEPA-vacuumed twice and cleaned before removal.

In certain instances, carpeting may be left in place. In this case, the carpet must first be thoroughly cleaned, and covered with *3/8* inch thick plywood sheeting. Title 15, Chapter 1 requires that the carpeting be covered with *1/2* inch rigid flooring. Once these steps are completed, normal plasticizing of the area may commence.

Shut Down Electrical Power and HVAC System

All electrical power must be turned off inside the work area. Any equipment used must be connected to a GFCI source that is located outside the work area, which is connected to the building power supply. Also the HVAC system must be shut down inside the work area.

Acceptable means of HVAC system isolation include:

- *Shutdown and Isolation* - of HVAC systems to prevent contamination and asbestos dispersal to other areas of the building or structure.

- *Local Isolation* - of part of the system and provision for temporary HVAC.

- *Positive Pressurization*- of the HVAC system. The NYCDEP requires that this procedure only be applied under the direction and control of a PE, or other knowledgeable licensed professional, after approval by the department (see Code Rule-56 56-7.9(a)(3)(i-iii) for more details).

Both Code Rule-56 and Title 15 Chapter 1 gives exemptions from shutting down the electric power if electrical circuits, machinery and other systems in or passing through the work area must stay in operation due to health and safety requirements. The procedures for having the operational equipment in the work area include covering them with three layers of poly and posting specific warning signs [see Code Rule 56-7.7(a) for more details].

Posting of Asbestos Warning Signs

Asbestos warning signs are to be posted to all entrances and exits to the work area. NYC regulations mandate that signs also must display in the common language of the work crew other than English (see Title 15 Chapter 1 RCNY Subchapter F – Asbestos Control Program).

Asbestos warning signs, required as per current OSHA regulations shall be posted to restrict access to the regulated abatement work area. During abatement (NYSDOL Phase II A - D) activities, signs shall be posted at locations such that persons may take the necessary protective measures to avoid potential exposure. OSHA has established the exact wording for these signs and they are available from most abatement suppliers.

Construction of the Personal and Waste Decontamination Units

The personal decontamination system (commonly called the "decon unit") is designed to allow entering and exiting the work area during the abatement activities. Proper use of this system will minimize the release of asbestos fibers into uncontaminated areas. The combination of negative air filtration: full containment, wet methods, and proper decontamination procedures will provide adequate protection to adjacent areas and ensure that fiber levels remain low.

The personal "decon unit" consists of three rooms: clean room, shower and equipment room. An airlock, consisting of curtained doorways separated by a distance of at least three feet, separates each of these rooms. A decon unit is required at the entrance to each contained work area, as shown in the diagram on page 68.

The materials used to construct the "decon unit" vary from project to project. 2” x 4” wood studs are commonly used for the framework. Other framing materials commonly seen on abatement projects are metal studs, PVC piping, and other variations. Once the framework is in place, a minimum of two layers of 6-mil fire retardant opaque polyethylene (“poly” or “plastic”) sheeting to line the framing (NYCDEP- requirement). Code Rule 56 requires a minimum of one (1) layer of six (6) mil fire-retardant plastic sheeting shall be installed on the ceiling and walls of the enclosure system. In addition, New York State requires that the floor plastic of the “decon unit” be two layers fire retardant reinforced plastic sheeting.

When the decon unit is situated near an area of public access, it shall be fully framed, sheathed in plywood (or equivalent material) for safety and constructed to prevent unauthorized entry. The inside is then lined in two layers of 6-mil polyethylene. All decon units· should have lockable doors to prevent unauthorized entry.

On large projects, the personal/worker decon must be attached to the regulated asbestos work area. In specific situations both NYSDOL and NYCDEP will allow Remote Decontamination Enclosures (unattached to the work area). Where allowed, remote decons have a few extra rules designed to block off public access and prevent fiber release. Code Rule-56 requires two layers of protective clothing be worn when using a Remote Decon.

Code Rule-56 requires that the personal decon system must be kept clean, sanitary and climate controlled at all times in conformance with all federal, state and local government requirements. This system shall remain on-site, operational and be used until completion of Phase II C of the asbestos project (after final clearance air sampling results are satisfactory).

Curtained Doorways

A curtained doorway divides each room in the decon unit. A curtained doorway consists of three overlapping sheets of 6-mil fire retardant “poly” with alternating entrances and is weighted at the bottom of each flap.

Alternating entrances are achieved by attaching the first sheet of poly to the top of the decon frame and on the left-side only, attaching the second sheet to the right-side only, and attaching the third sheet to the left-side of the frame. The end result is alternating entrances or what is commonly called a "Z lock." Each curtain is weighted to ensure that it hangs straight and maintains a seal over the doorway. Although not required by the regulations, standard industry practice is to place arrows on each flap to indicate the direction of entry/exit.

Airlocks

An airlock is an area of "dead" space between the rooms of the decontamination unit. Its purpose is to reduce the potential for flow through contamination by allowing the curtained doorways to close off prior to entering the next room. Both regulations require two airlocks, one on either side of the shower room. All airlocks must be a minimum of three feet in length. Code Rule 56 requires that an airlock be a minimum of 3 feet in length by 3 feet in width by 6 feet in height. The six feet minimum height requirement goes for the other rooms of the decon as well.

Clean Room

The clean room is the first room you encounter when entering the worker decontamination unit. No asbestos--contaminated items shall be found in this room. Workers use this area to remove street clothing and jewelry, and also to don (put on) protective clothing and respirators. ICR-56 mandates that benches, lockers and hooks be provided for street clothes and shelving provided for storing respirators. Title 15, Chapter 1 mandates lockers or shelves, and clean sealable plastic bags for storage of street clothes, and shelves for storage of respirators. Both regulations mandate that the clean room be equipped with a lockable door to secure the work area during non-work hours. Also, both regulations prohibit using the clean room for storage of tools, equipment or materials (other than PPE), nor for use as office space.

For the clean room, Code Rule-56 mandates that a minimum of thirty-two (32) square feet of floor space be provided for every six (6) full shift abatement workers, calculated on the basis of the largest work shift. The NYSDOL has interpreted this to include handlers and supervisors but not Air Sampling Technicians and Project Monitors [see Guidance Document]. If the largest work shift consists of three (3) or less full shift abatement workers, the minimum requirement is reduced to twenty-four (24) square feet of floor space.

Shower Room

Workers pass through the shower room on their way into the work area. On the way out of the contaminated work area, the shower room becomes the most important room for decontamination. Once they have left the equipment room and all contaminated clothing behind, the worker enters the shower area with the respirator still on. It is here that the worker showers and the respirator are washed. According to ICR-56, multiple showers shall be simultaneously accessible (installed in parallel) to certified personnel.

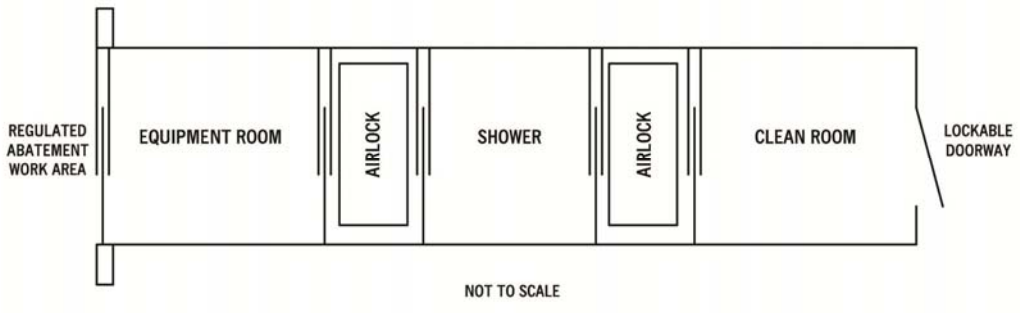
NYSDOL/NYCDEP - The shower room must have 1 shower per 6 workers (based on largest shift).

Each showerhead shall be supplied with hot and cold water adjustable at the tap. The shower enclosure shall be constructed to ensure against leakage of any kind. Uncontaminated (liquid) soap and shampoo, and towels shall be available at all times. Shower water shall be drained, collected and filtered through a system with at least 5.0-micron particle size collection capability. A series of several filters with progressively smaller pore sizes shall be used to avoid rapid clogging of the filtering system by larger particles. According to ICR-56, filtered wastewater shall be discharged in accordance with applicable codes. Title 15, Chapter 1 requires that the filtered wastewater be discharged either to a sewer or drummed and then property disposed. Contaminated filters shall be disposed of as asbestos contaminated waste.

Equipment Room

This is a contaminated area where equipment, boots or shoes, hardhats, goggles, etc. are stored. Upon exiting the work area, this is where the worker removes the disposable suit and places it in a properly labeled 6-mil polyethylene disposal bag (NYC) or a labeled container lined with at least a six (6) mil plastic bag (NYS). A limited supply of HEPA filters for the vacuums and ventilation equipment may be stored here, but they must be sealed in plastic bags.

NYSDOL ICR 56 PERSONAL DECON FOR LARGE PROJECTS
(OPTIONAL FOR SMALL PROJECTS)



Personal Protective Equipment (PPE)

Wearing the appropriate protective equipment is imperative to ensure safety and protection to anyone entering in an asbestos regulated area. Protective clothing for asbestos abatement projects usually consists of disposable coveralls, foot covering and head covering. The foot and head covering should be attached to the coveralls. Tight fitting bathing suits may sometimes be worn beneath the coveralls. Nylon suits work well and can be cleaned easily during showering. Gloves should be worn when inside the work area. Any article that cannot be decontaminated should remain in the equipment room or work area.

Other protective clothing and items such as hard hats and safety shoes or boots should remain in the work area or in the equipment room for the duration of the project. Upon project completion, these items can be cleaned, placed in a plastic bag, labeled as containing asbestos, and taken to the next project. If safety shoes or boots are not worn, it is wise to have workers wear rubber-soled, slip-on deck shoes, which would remain in the work area and disposed of as ACM after the project is complete.

Employers should provide and insure the use of head and foot protection in accordance with OSHA standards 29 CFR 1910.135 and 1910.136 respectively.

To summarize, below is a list of items normally worn by asbestos abatement workers:

- Disposable coveralls (includes foot and head covering)
- Tightly-fitting nylon swim suits or disposable undergarments;
- Waterproof safety shoes or boots (as required);
- Hard hat (as required)
- Gloves (cotton with Kevlar or other protective material on the palm);
- Eye protection (not needed if full face-piece respirators are used)

Proper Entry Procedures

1. Sign your name in the Entry/Exit Log Book.

2. Read and be familiar with all posted regulations, personal protection requirements, including regulated abatement work area entry and exit procedures and emergency procedures. The entry/exit log headings shall indicate, and the signatures shall be used to acknowledge that these procedures have been reviewed and understood by all persons prior to entry.

3. Enter Clean Room and remove all street clothing and store all street clothing as per applicable requirements.

4. Put on Personal Protective Equipment (PPE), including protective clothing, as appropriate for the project

5. Inspect your respirator for damage. Be sure to conduct the positive and negative pressure check. Place the hood of your coveralls over the straps of the respirator.

6. Proceed to the Equipment Room and put on any applicable personal protective equipment, i.e. boots, hardhats, etc. Collect any necessary tools then proceed to work area.

Proper Exit Procedures

1. Remove gross contamination on your suit, before you leave the work area. This can be accomplished by the use of a HEPA vacuum or wiping off the suit.

2. Proceed to Equipment Room and remove all clothing and personal protective equipment except the respirator. Place disposable clothing in the labeled waste bag (NYC) or a labeled container lined with at least a six (6) mil plastic bag (NYS). All individuals who enter the work area must sign in and out upon each entry and exit

3. Store any other contaminated articles (tools) and proceed to the shower.

4. In the shower, with the respirator still on, wet the face-piece and filters [keep in mind, that once the filters are wet they should be discarded since breathing will be difficult through wet filters]. Once thoroughly soaked, remove the respirator and wash it with soap and water. Next, fully and vigorously shower and shampoo to remove residual asbestos contamination. Proceed to Clean Room.

5. Dry off and get dressed. Dry and store your respirator.

6. Sign-out in the entry/exit log.

Waste Decontamination System

A waste decontamination unit is a structure similar to the worker decon unit but is used to remove waste bags from the work area. This procedure is commonly referred to as "load out" or "bag out".

NYSDOL WASTE DECON - required on large projects

A waste decontamination system enclosure shall consist of a washroom and a holding area connected in series but separated from each other by an airlock. There shall be a lockable door to the outside, and there shall be a curtained doorway between the washroom and the regulated abatement work area.

Washroom

A room/chamber between the regulated abatement work area and the holding area in the waste decontamination system enclosure, where equipment and waste containers are wet cleaned or HEPA-vacuumed. Adequate drainage and bag/container wash water shall be provided within the room/chamber, as well as a sufficient quantity of clean waste bags/containers.

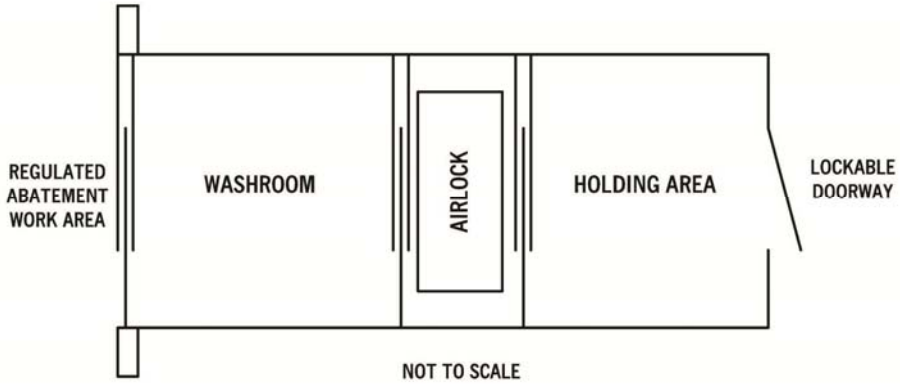
Equipment/Washroom Alternative

Where there is only one (1) exit from the regulated abatement work area, the holding area of the waste decontamination system enclosure may branch off from the equipment room of the personal decontamination system enclosure. The equipment room will also be used as a waste washroom.

Drains

The waste washroom shall be equipped with a wash bin of sufficient size to perform waste container washing operations and shall have a submersible pump installed to collect waste water and deliver it to the shower wastewater filtration system.

NYSDOL LARGE PROJECT WASTE DECON (OPTIONAL FOR SMALL PROJECT)



Shower/Washroom- Alternative - Small Asbestos Project

The personal decon may be used for small asbestos projects with only one (1) exit from the regulated abatement work area. In this case, the shower room of the personal decon may be used as a waste washroom. The clean room shall not be used for waste storage, but shall be used for waste transfer to carts, which shall be immediately removed from the enclosure. Waste shall be transferred only during times when the showers are not in use.

NYCDEP WASTE DECON - required on projects whenever 1,000 square or linear feet or more of ACM is removed.

When there is only one means of egress from the work area:

- The holding area of the waste decon may branch off from the equipment room of the worker decon. Thus the equipment room alternates as a waste washroom. In this case, the washroom must have a drain, installed to collect water and deliver it to the shower drain where it is filtered. Also, the holding area of the waste decon may branch off from the shower room of the worker decon; or

- If the asbestos project involves less than 1000 square or linear feet, the waste bags can come out through the worker decon. In this case, the clean room of the worker decon cannot be use for waste storage but can be used for waste transfer to carts, which are stored outside the clean room in a designated holding area.

Worker/Waste Decon Combination

Where allowed, the worker decontamination unit may be used to remove the waste bags provided that

1. Waste is never stored in the clean room. It is transferred to a separate holding area.

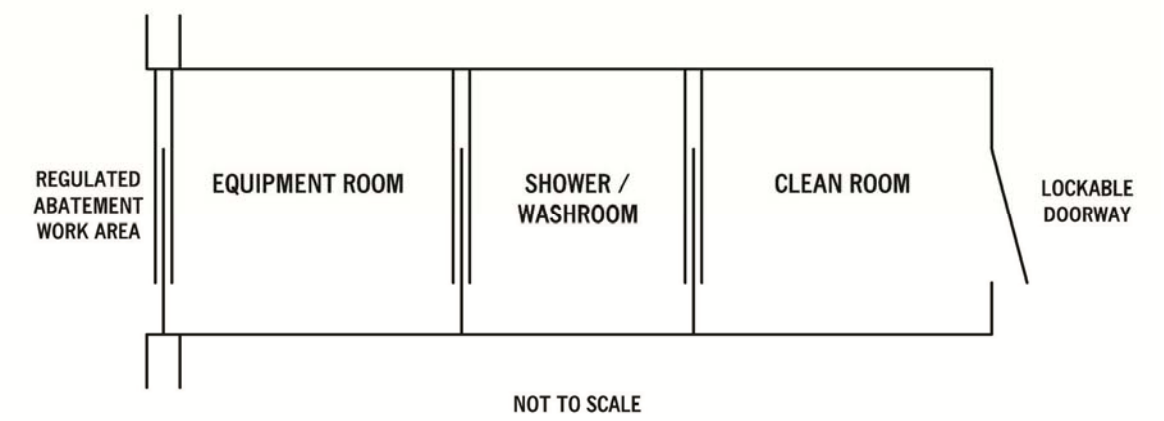
2. Workers are not using the decon while waste is being loaded out

3. Title 15, Chapter 1 requires that the decon is thoroughly cleaned twice before workers are allowed to use it for personal decontamination.

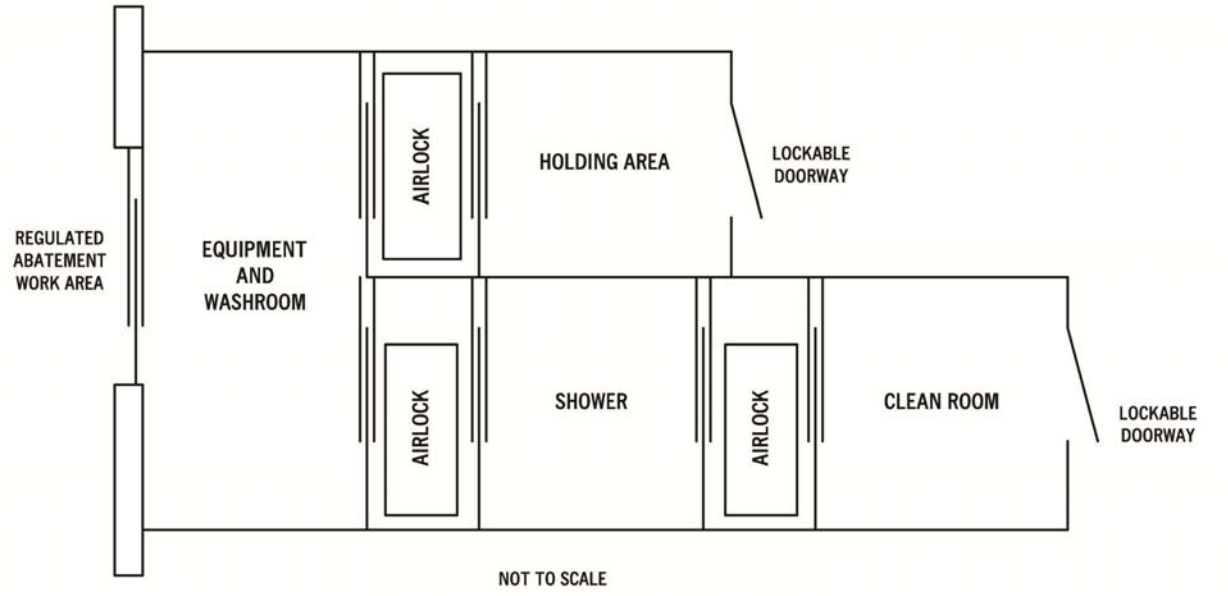
If you are using the worker decon as your waste decon, then a worker is stationed in each section of the decon. The bags are then handed "fire brigade" style through each section of the unit. The showers are used to wash the bags before double bagging. Waste bags cannot be stored in the clean room of the worker decon. They must be carted away immediately. Following the completion of load out, the interior of the worker decon must be cleaned twice

to ensure that all visible dust and debris have been removed. Workers may then be allowed to use the area for personal decontamination.

SHOWER / WASHROOM ALTERNATIVE – SMALL ASBESTOS PROJECT



EQUIPMENT / WASHROOM ALTERNATIVE



Worker Decontamination Unit NYS and NYC Comparison

Item	NYSDOL Industrial Code Rule 56	NYCDEP Title 15, Chapter 1
Construction	1. 3 rooms + 2 airlocks (before and after shower) 2. Decon lined on inside of framework with a minimum of one layer of 6-mil, fire retardant poly on ceilings, and walls. 3. 2 layers of 6-mil reinforced, fire retardant poly on the floor. 4. Curtain doorways not specified in front of the clean room. 5. If accessible to the public, it shall be fully framed and hard-wall sheathed.	1. 3 rooms + 2 airlocks (before and after shower) 2. Decon lined on inside side of 2. Decon lined on inside of framework with 2 layers, 6 mil fire retardant opaque poly. 3. If accessible to the public, it shall be fully framed and hard-wall sheathed. 4. Curtain doorways are specified in front of the clean room. 5. If outdoors, decon must be waterproof and windproof.
Clean Room	Benches, lockers, hooks, shelves, lockable door. 32 ft^2 of floor space for every 6 workers, or 24 ft^2 if 3 people will be largest shift.	Secure crew lockers or shelves; sealable plastic bags for storage of street clothes; shelves or appropriate facilities for storage of respirators; lockable door.
Shower Room	1. 1 shower for every 6 workers based on largest shift. 2. Hot & cold water adjustable at tap, uncontaminated soap, shampoo and towels. 3. Water filtration down to 5 microns and discharged in accordance with applicable codes. 4. Showers installed in parallel. 5. Contaminated filters shall be disposed of as asbestos contaminated waste.	1. 1 shower for every 6 workers based on largest shift. 2. Specifies liquid soap, shampoo, towels and hot & cold water adjustable at the shower. 3. Water filtration down to 5 microns and discharged either to a sewer or drummed and then properly disposed. 4. Contaminated filters shall be disposed of as asbestos contaminated waste.
Airlocks	1. 2 airlocks – one on either side of the shower 2. Minimum dimensions of 3 ft length x 3 ft width x 6 ft height	1. 2 airlocks – one on either side of the shower 2. Only specifies minimum of 3 ft length
Equipment Room	1. 1 day supply of replacement filters in sealed containers (NAU's/vac's) 2. A container, lined with a labeled, 6-mil, plastic bag for contaminated coveralls, etc.	1. Limited supply of replacement filters in sealed containers. 2. Labeled 6-mil plastic bags for contaminated coveralls.

The regulations require that a half-face negative air pressure respirator and disposable suit (at minimum) be worn while prepping the work area

A variance is needed to make changes to any component in the work area preparation requirements.

Pre Clean Around Critical or Isolation Barriers

All windows, grilles, openings, heaters must be pre cleaned using HEPA vacuuming techniques and wet wiping. Any areas in the work area not walls, floor or ceiling is considered a critical barrier.

Install Critical/Isolation Barriers

All critical barriers must be plasticized with two separate layers of poly, except any energized sources that may have remained in the work area, which would have three layers of poly with the appropriate warning signs.
Any openings greater than 32sf to the work area must have a solid wall and the two layers of poly

"Critical barriers" has long been a term used in the asbestos abatement industry but not found in regulations. ICR-56, effective September 2006, requires construction of critical barriers to seal off all openings and penetrations to the regulated abatement work area including, but not limited to:

operable windows	skylights	doorways	ducts	corridors (which shall not be used for passage)
HVAC system	diffusers	grills	seams	Any other penetrations to surfaces within the work area

Critical barriers shall be constructed using two independent layers of at least 6-mil fire-retardant plastic sheeting with each layer sealed separately with duct tape. Caulk and fire-retardant expandable foam may be used to seal small openings or penetrations. Doorways and corridors, which will not be used for passage during the asbestos project, shall also be sealed.

NYCDEP Title 15, Chapter 1 does not contain the term "critical barrier," but the concept described above is deemed an "isolation barrier: Each barrier must be constructed of two layers of 6-mil plastic sheeting sealed with [duct] tape.

These two layers are installed to be independent of each other so that if one layer should fall or be ripped down, the second layer is unaffected. After the barriers have been properly placed, the work area should be effectively "air tight".

"Isolation Barriers" as per Code Rule-56 are temporary hard-wall barriers to complete the containment enclosure and establish the asbestos project regulated abatement work area. It shall be constructed using the following framing, sheathing, sealing and plasticizing criteria:

A. **Framing** (studs) constructed of wood or metal is required in all openings larger than thirty-two (32) square feet except that where any one dimension is one foot or less, two-layers of the respective poly is adequate. Existing walls or framing may be used to support isolation barrier partition framing and sheathing. The NYCDEP rules call for conventional 2 x 3 (minimum) stud framing, 16" on center maximum to cover the large openings mentioned above (except for emergency exits).

B. **Sheathing** such as plywood or oriented strand board (OSB) sheathing material of at least 3/8 inch (NYS & NYC) thickness shall be fastened to the work area side of the barrier partition. The NYCDEP rules allow an additional layer of 6-mil plastic sheeting be substituted for the solid sheathing material when the work area is in secure interior areas not subject to access from the public.

C. **Sealing of Isolation Barriers**: The edges of the isolation barrier partition shall be sealed at the floor, ceiling, walls and fixtures using caulk, fire-retardant expandable foam or duct tape (not recommended) to form an airtight seal. The seams of the partition sheathing shall also be sealed airtight using these techniques.

Plasticizing Isolation Barriers. The regulated abatement work area side of the isolation barrier partition shall be covered with two (2) layers of, at a minimum, six (6) mil fire-retardant plastic sheeting with staggered joints and sealed airtight. All critical barriers and isolation barriers must be left in place until the completion of the project. Please note that once abatement starts, the supervisor must conduct daily inspections (even on days without work shifts) of the barriers and note the findings and any necessary repairs into their log book. For scheduled work days, this inspection and documentation must be completed twice per workshift.

Install Negative Air Filtration Units

Negative air filtration units must be operational inside the work area. The purpose is to maintain negative pressure inside the work area of at least -0.02 column inches of water pressure differential. This allows fibers that are disturbed to be trapped inside and be filtered through the units. These air units must run continuously until final clearance results are satisfactory for re-occupancy. The units are placed at the furtherest point from the decon to allow more fresh air to be drawn inside from the decon or makeup air inlets if necessary. Four air changes per hour are to be maintained throughout the project.

Negative air filtration units are known by several different names including Micro-Trap™, HEPA units and negative air units.

A typical unit is made of a metal cabinet on wheels with an opening at each end, one for air intake and one for exhaust. The cabinet is sealed to prevent asbestos containing dust from escaping during use, transport, or maintenance. This cabinet houses a centrifugal type blower and a series of filters typically placed-on the intake side of the blower. The blower draws contaminated air through the series of filters and discharges it through the exhaust end.

The exhaust from these units is vented out of the work area to the outside of the building and should never be exhausted in an occupied area.

There are typically three filters used with a unit, however smaller units may only use two filters. These filters include the pre-filter, the intermediate filter, and the HEPA filter. The pre-filter and intermediate filter is used to protect the HEPA filter by removing the larger particles, which will prolong the life of the HEPA filter.

1. Pre-Filter - This filter is used to filter out large particles in the air (particles 10 microns and larger). It should be replaced as necessary, approximately every few hours or so during the gross removal stage of the project and as needed at other times.

2. Intermediate Filter - This filter is used to filter out the medium size particles in the air (particles down to 5 microns). It should be replaced approximately every 24 hours during the project or as needed.

3. High Efficiency Particulate Air Filter (HEPA) - This filter is used to filter out asbestos fibers and is therefore mandatory. HEPA is a designation given to any filter that is at least 99.97% effective at filtering out particulates down to a size of 0.3 microns. HEPA filters should be individually tested and certified by the manufacturer. The filter should be marked with the name of the manufacturer, serial number, airflow rating, efficiency and resistance, and the direction of test airflow. This filter media is folded into closely pleated panels to increase surface area making it more effective. It must also be completely sealed on all edges with a structurally rigid frame. The HEPA filter is replaced, on average, every 700 hours.

Magnehelic Gauge

This measures the pressure drop across the filters that would indicate whether filters have become loaded and need to be replaced. The static pressure (resistance) across fillers increases, as they become loaded with dust, affecting the ability of the unit to move air at its rated capacity.

Automatic Shut-Down

An automatic shut down system would stop the blower in case of a major rupture in the HEPA filter.

Warning Lights, Buzzer

Indicate normal operation, when there is too high a pressure drop across the filters (i.e. filters overloading) or when there is too low a pressure drop (i.e. major rupture in the HEPA filter).

Elapsed Time Meter

Shows the total accumulated hours of operation of the negative air unit

Benefits of the Negative Air System

When properly set up, a negative air system will serve four functions. These functions will demonstrate why this system is critical during any asbestos abatement project.

1. Air filtration reduces the fiber count.

Air enters the work area from uncontaminated areas through the worker/waste decon, moves through the entire space, collects particulates and passes through the filters (especially HEPA-Filters) of the negative air machines to outside the building (or outside the work area where allowed). This process of air coming in, filtering and going out is called air exchange. The air exchange process happens on a continuous basis until the project is completed.

The air from outside the work area (uncontaminated areas) is typically called "make-up air." This make-up air needs to come into the work area and eventually exhaust out at a good rate (speed) for air filtration. If the air exchange is too slow, the air filtration will be inadequate. If the air exchange is too fast, the airborne fiber levels could be become too high and possibly overburden the system. NYCDEP AND NYSDOL regulations have air exchange requirements for during abatement as well as during final clearance air sampling. The proper air exchange rate will most effectively reduce the airborne concentration of fibers and other particulates from the air.

AIR EXCHANGES-IN THE WORK AREA

REGULATION	DURING ABATEMENT	FINAL CLEARANCE
NYSDOL ICR-56	At least 4 air changes per hour	At least 4 air changes per hour
NYCDEP Title 15, Chapter 1	At least 1 air exchange every 15 minutes	At least 1 air exchange every 15 minutes

2. Creates negative air pressure, decreasing the likelihood of fibers migrating to outside the work area.

The negative air unit is exhausted outside of the work area, thus drawing in the air from the work area and exhausting it to the outside. This creates a negative pressure environment inside the work area. If the work area were airtight, a vacuum would be created. However, an abatement area has, at minimum, a decontamination unit that allows workers to enter and exit the work area. This opening allows fresh outside air to be drawn into the work area, due to the negative pressure. The negative pressure environment is maintained to such a degree that should there be a rip or tear in the plastic barriers, outside air would rush in as it does through the decon unit. This keeps the asbestos fibers inside the work area and protects building occupants.

3. Defines the direction of air flow

The work area should be "airtight". Air should only enter the work area through makeup air vents and the decon area. Air flows through a decon area from the clean room to the equipment room and then to the negative air unit. So, moving the negative air units in the room will change the direction of the flow of air through the room and define the direction of airflow. This aids worker comfort because cooler fresh air from the outside can be brought to the worker by properly placing these machines. In order to create a uniform negative air pressure throughout the work area, the negative air units should be placed in an area of the work area that is furthest away from the decon units.

4. Eliminates the excess air supplied by Supplied Air respirators.

Tight-fitting positive pressure supplied air respirators are required to supply at least 4 CFM (cubic feet of air per minute) of air to each respirator. If, for example, you had five workers using supplied air equipment, the compressor would be required to supply at least 20 CFM of excess air into the work area. If there was no way to eliminate this excess air, then this air would force contaminated air out of the work area since two objects cannot occupy the same space at the same time.

Determining the Number of Negative Air Units

Determining the number of units needed on an abatement site depends on three major factors:

1) Volume of the work area
2) Capacity of the negative air unit
3) Time allotted for air exchange

Work Area Volume

The volume of a work area is obtained by multiplying its dimensions (measured in feet):

Volume of Work Area (ft3) = Length (ft) x Width (ft) x Height (ft)

This represents the amount of air that the work area can hold. This is the volume of air that will be exchanged throughout the project

Capacity (rating) of the Negative Air Machines

The capacity of the negative air unit is obtained by referring to the manufacturer's specifications. The capacity of these units is expressed in cubic feet per minute (CFM). In other words, the machines are rated as to how much air volume (ft3) they can pull in every minute. A typical negative air unit is rated around 1500 CFM. However, they are available from about 300 CFM to 2000 CFM.

Time allotted for air changes

NYSDOL and NYCDEP have set the time factor. Their regulations require the abatement contractor to provide at least one air change every 15 minutes (4 times an hour) during abatement.

In other words, this is the volume of air for the specific work area that will be moved (exchanged) once every 15 minutes. To determine the number of negative air units needed on a job site- first figure out the volume of the room and then divide it by the capacity of the negative air unit multiplied by time in minutes.

# of operating negative air units needed is calculated by:

$$\frac{\text{VOLUME OF WORK AREA (ft}^3\text{)}}{\text{CAPACITY OF MACHINE (ft}^3\text{/minute) x 15 (minutes)}}$$

Both New York asbestos regulations require that the contractor have at least one additional (backup) unit in case a unit breaks down or needs filter replacement. The back-up unit(s) must have a capacity of at least equal to that of the primary units. The unit(s) is set-up at the same time as the other units but is not made operational until needed.

THEREFORE:

# of total negative air units needed to be set-up is calculated by:

$$\frac{\text{VOLUME OF ROOM } (ft^3)}{\text{CAPACITY OF MACHINE } (ft^3/\text{minute}) \times 15 \text{ (minutes)}} \quad \textbf{Plus} \quad \textbf{1 back-up unit (at minimum)}$$

SAMPLE PROBLEM

For example, if we have a room that is 300 feet long, 150 feet wide and 15 feet high and a negative air machine with a capacity of 1500 CFM (ft^3/min) how many units would be needed to comply with the law?

First- determine volume of the room:

V=L x W x H V=300x150x15 Volume = 675,000 ft^3

Second - multiply the unit's capacity by 15 minutes (one air change every 15 minutes)

If the specification on the unit available is 1500 CFM, multiply it by 15 minutes:

1500 ft^3/min x 15 minutes = 22,500 ft^3

Finally, the equation is:

$$\frac{675{,}000\ ft^3}{22{,}500\ ft^3} = 30 \text{ units}$$

At least one back-up unit is required to be set-up. So, a total of 31 units are needed to be in full compliance.

In cases where there are decimal units, for example, if the calculation was 7.75 round this number to the next highest number, 8. Always round up to the next higher number (even if it was 7.111, round up to 8). Therefore 8 operational units are needed in this example..

Location of Units

The negative air units should be located so that make up air enters the work area through the decon units and, if needed, the make-up air vents. This allows fresh air to flow through as much of the work area as possible allowing it to dilute as much of the contaminated air as possible.

This is accomplished by positioning the negative air units as far away from the makeup air vents or the decon area as possible. Wherever practical, negative air' units should be located on the floor in or near unused exterior doorways or windows to facilitate exhausting the unit. The end of the unit or its exhaust duct should be placed through an opening in the plastic barrier or wall covering and sealed with tape.

Negative air units must be GFCI protected via a temporary power supply available to satisfy the requirements of all the ventilation units. All electrical cords should be suspended off the floor and out of workers' way to protect the cords from traffic, sharp objects, and pinching.

Sometimes additional makeup air may be necessary to avoid creating too high of a pressure differential, which could cause plastic sheeting and temporary barriers to detach from the walls and fall. Additional makeup air also may be needed to move air more effectively through the work area.

Auxiliary makeup air inlets should be as far as possible from the negative air units (e.g. on an opposite wall), off the floor (preferably near the ceiling), and away from barriers, that separates the work area from clean occupied areas. They should be constructed in such a fashion that allows the openings to seal by themselves in case of accidental loss of negative pressure. In addition, the openings must be resealed if the negative pressure system is turned off after removal has started. The number of auxiliary air inlets must be designed and placed in a manner to maintain adequate negative pressure and maximize air circulation throughout the work area.

Operation of Negative Air Units

The negative air units are started after the work area has been completely prepped. Negative pressure must be obtained before the asbestos removal is started. Once removal has begun, the units must run continuously to maintain negative pressure until the job is complete, 24 hours a day, seven days a week. Since airborne asbestos fibers are microscopic in size and tend to remain suspended in the air for a long time, the negative air units must keep operational throughout the entire removal, decontamination, and final clearance processes.
In the event of electric power supply failure:

- Abatement shall stop immediately and shall not resume until power is restored and exhaust units are operating fully.

- **In the event of extended power failure of longer than one hour(NYSDOL) or one half hour(NYCDEP**):
  - Evacuate all persons from the regulated abatement work area, and
  - The decontamination system enclosure facilities shall be sealed airtight

Continuous operation of the units during the final clean-up and clearance process allows the units to reduce the airborne fiber concentration. This is very important to a contractor who must rely on air sampling results to determine if the fiber concentration is in compliance for re-occupancy. In addition, continuous operation of the units will reduce the chance that contaminated air will leak outside the enclosure should the fiber levels be unusually high.

According to ICR 56-7.8(5),"ventilation unit exhaust ducting shall not exceed 25 feet in length, due to reduction in volumetric flow rates caused by friction". Openings made in the enclosure system to accommodate these units shall be made airtight, and where possible, the intake side of the negative air ventilation unit shall remain within the regulated abatement work area to permit filter changing, while minimizing equipment contamination and the likelihood of contamination of non-work areas. (ICR 565 -7.8(9))

Once installed and operational, daily inspections shall be conducted to insure the airtight integrity of the system, and the findings shall be documented by the asbestos supervisor in the daily project log.

Exhaust Location

The exhaust shall be vented to the outside of the building or structure, to a controllable area away from public access. Each negative pressure ventilation unit exhaust duct shall not terminate less than 15 feet from a receptor or adversely affect the air intake of any building or structure."

As per NYSDOL, if the exhaust duct termination location cannot be met due to allowable space restrictions or the regulated abatement work area being located above the ground floor, the exhaust shall terminate at the exterior of the building, and all receptors less than 15 feet from the exterior exhaust duct termination location shall be plasticized with two layers of at least six (6) mil polyethylene.

According to Code Rule-56: a four (4) foot high construction fence with appropriate OSHA warning signs shall be constructed at a minimum of ten feet from the end of the exhaust duct tube, or bank of duct tubes, to surround and control this area from public access. For ground level exhaust duct terminations at the immediate exterior of the building/structure, the fence shall be installed at the tube discharge location.

Exhaust tubes may be grouped together in banks of no more than five (5) tubes, with each tube exhausting separately and the bank of tubes terminating together at the same controlled area. **(see ICR 56-7.8(11))**

Exceptions to Exhaust Location Requirements:

1. Code Rule-56 states that HEPA-filtered vacuums used to exhaust Minor size tent enclosure regulated abatement work areas do not require exhausting to the exterior of the building/structure.

2. Title 15, Chapter 1 allows for exhausting indoors where exhausting outdoors is not possible. This is done by connecting two negative air units in series ("piggy-back") and exhausting to an unoccupied space with good non-recycling air circulation to the outside of the building.

Changing Negative Air Unit Filters

All filters of the negative air unit must be accessible from the work area or “contaminated” side of the barrier. Personnel responsible for changing filters while the negative air system is in use must wear approved respirators and other protective equipment. The operation life of a HEPA filter depends on the level of particulate

During use, filters become loaded with dust. This blockage increases the resistance of airflow, which diminishes the air handling capacity of the unit. The difference in the pressure drop across the filters between "clean" and "loaded" conditions is a good way to estimate the extent of air-flow resistance and determine when the filters need to be replaced.

When the drop in pressure across the filters - as determined by the magnehelic gauge on the unit - exceeds the pressure specified by the manufacturer, filters may need to be replaced. If the pressure drop exceeds the manufacturer's specified pressure after the pre-filter has been replaced, the intermediate filter is replaced then the HEPA filter should be replaced:

If pre-filter and/or intermediate filler replacement does not restore the pressure drop across the filters to its original clean resistance reading;

or

If the HEPA filter becomes damaged (HEPA filters will fail if they absorb too much moisture).

Prior to replacing the HEPA filter, the negative air unit should be shut off and disconnected from the power source. Used HEPA filters must be disposed of as ACM. The gasket between the filter and the housing should be inspected for any gaps or cracks. Worn gaskets should be replaced as necessary and a new HEPA filter should then be installed. Whenever the HEPA filter is replaced, the pre-filter and intermediate filter should also be replaced. .

When several negative air units are used to ventilate a work area, negative pressure can be maintained during the HEPA filter replacement. If only two exhaust units are operating on-site, a backup unit must be available and operating before an original unit is shut down for HEPA filter replacement. An abatement enclosure should never have only one negative air unit operating. A failure of this sole unit, for any reason, would eliminate the negative pressure in the work area. Thus, the risk of asbestos fiber release to the outside environment is increased. This can be controlled with use of additional spare units.

Conditions in the work area determine the frequency of filter changes. In a work area where fiber release is effectively controlled through welting and good work practices, fewer filter changes will be necessary than in the work areas where the removal process is not well controlled. NOTE: the collection efficiency of dust filters improves as particulates accumulate. So, filters can be used effectively until the resistance, caused by excessive particulate loading, lowers the exhaust capacity of the unit.

Testing Negative Air Units

The negative pressure system must be tested before any asbestos-containing material is wet or removed. Install the decon units, prepare the work area and install the exhaust units. Then start the exhaust units one at a time. Observe the barriers and plastic sheeting. The decon plastic curtains should move slightly in towards the work area. The use of smoke tubes and an aspirator bulb are another easy and inexpensive way to visually check system performance and direction of airflow through the decon unit. The smoke should be drawn into the work area. If the smoke is not drawn into the work area, then there is not enough negative air pressure inside the work area and more negative air pressure units should be installed.

Another test method for negative pressure is to use a manometer to measure the static pressure differential across a barrier. In the asbestos abatement industry this measuring device must be sensitive enough to detect a relatively low pressure drops. The pressure drop across

the barrier is measured from the outside by punching a small hole in the plastic barrier. Next, insert one end of a piece of rubber tubing connected to the "low pressure" tap of the instrument. The "high pressure" tap is left open to the atmosphere. Instruments are available which monitor the pressure drop continuously. These units are connected to a strip chart recorder to provide continuous documentation of negative pressure. An audible and/or visible alarm may be used to alert personnel of a severe drop in pressure. 15 RCNY 1 requires that a static pressure drop of 0.02 inches of water be maintained throughout the asbestos abatement project.

Pre Clean Work Area

The work area must be pre cleaned using HEPA vacuum and wet wiping techniques
Pre-cleaning is intended for preparation work, not gross cleaning of visible asbestos debris on floors or other work area surfaces. According to ICR-56, pre-cleaning shall be performed in the following order.

1. Pre-clean locations in which critical barriers and isolation barriers are to be installed using HEPA-filtered vacuum and wet cleaning methods.
2. Install barriers.
3. Start the negative air ventilation units.

Pre-clean the remainder of the work area before plasticization of the floor, walls and ceiling can begin.

Elevator Shutdown or Isolation

Elevators running through the regulated abatement work area shall be shut down where possible. Where it is not possible:

The door frames shall be enclosed with a hard-wall barrier similar to that described for isolation barriers. The barriers shall be covered with two seamless layers of at least 6-mil plastic sheeting duct taped and sealed airtight. NYCDEP calls for this poly to be lapped for 8 inches. A final larger layer of at least 6-mil plastic sheeting shall be duct taped and sealed airtight, but with slack, forming a larger perimeter diaphragm to sense air movement caused by elevator operation.

Code Rule-56 requires that the Elevator shaft ports when within the regulated abatement work area shall be vented to outside of the work area using oversized solid-walled ducts or chambers to help with pressure equalization. Both regulations call for the system to be subjected to and pass a negative pressure (smoke) test daily.

Preparation of the Work Area

NYSDOL ICR-56 Requirements:

All floor, wall and ceiling surfaces shall be covered with two layers of, at minimum, 6-mil fire retardant plastic sheeting. Plastic sheeting is not required to be placed on any surface where abatement of ACM/PACM will be performed.

1. The floor shall be plasticized first, and its plastic sheeting shall extend up the walls a distance of at least twelve (12) inches on all sides.
2. The walls shall then be plasticized by applying plastic sheeting from the ceiling to the floor, overlapping the floor sheeting by at least 12 inches.
3. The ceiling shall then be plasticized, overlapping the walls by at least 12 inches, to form a secure airtight seam.
4. This process shall be repeated for the second layer of plastic sheeting for the floor, walls and ceiling.
5. All seams within a layer shall be separated by a distance of at least six feet and sealed airtight with duct tape. All seams between layers shall be staggered at least two feet.

Code Rule-56 has exemptions to some of the barrier and plasticizing requirements. These exemptions cover tents, fire-retardant spray poly, special projects, removal of ceilings and components, and emergency exits.

NYCDEP Title 15, Chapter 1 Requirements:

The DEP requires the poly be placed on the floor and walls only, except if vinyl asbestos floor is abated, in which case the floor does not need to be sealed. The other requirements are similar except that the floor poly extends up the wall 6 inches in NYC. Also, NYCDEP requires seams between adjacent layers be a distance of at least 6 inches.

Emergency and Fire Exits

Emergency and fire exits from the regulated abatement work area shall be:

A. Established and maintained or alternate exits established;
B. Have appropriate signs marking the exit;
C. NYCDEP requires that the exits be checked daily for exterior blockage or impediments.

Securing the Work Area

Securing the work area against non-essential personnel is extremely important in protecting unwary persons from possible asbestos contamination. Many abatement projects operate on a 24- hour shift, so this makes security less of a problem. The asbestos abatement contractor must provide security against unauthorized entry on projects which shut down at certain periods. The ultimate liability for security rests with the contractor as well as the building owner.

All entrances to the work area (worker and waste decontamination units) must have secure, lockable doors. Once these doors are shut, negative air pressure is reduced. Contractors may place secure vents in the door so that make-up air is continually drawn into the area.

While the abatement is progressing, all exits from the area should be unlocked. Alternative exits should be clearly marked and identified to workers. The Supervisor's log book is important in identifying all persons going in and out of the work area.

Pre Abatement Inspection

Once the work area is plasticized, the 3rd party monitoring representative will conduct a pre-abatement inspection prior to abatement. The inspection involves checking for the current integrity of the plastic on the critical barriers, walls, floor and if necessary ceiling (NYS requirement), the continuous operation of the negative pressure units and the decontamination units.

4-HR Pre Abatement Wait Period

After the work area is cleared by the 3rd party air monitoring representative NYS requires a minimum of a 4 hr pre abatement wait period. This is to ensure the plastic inside the work area remains intact during the operation of the negative pressure ventilation equipment. NYC regulations do not require this, and therefore abatement would begin right after the pre abatement inspection.

BEGIN ABATEMENT (See Abatement Methods)

CHAPTER 6

Abatement Methods

Introduction

Although most people associate asbestos abatement with removal, there are a number of other abatement methods available. According to ICR-56, abatement is defined as any portion of an asbestos project that includes procedures to control fiber release from asbestos containing material. This includes removal, encapsulation, enclosure, repair, or handling of asbestos material that may result in the release of asbestos fibers.

The key element of any abatement method is to prevent the release of asbestos fibers into the air where they may prove harmful to building occupants, visitors, etc. A building owner takes many factors into consideration when choosing an abatement method.

Feasibility	Can the abatement method be done effectively and with as few complications as possible?
Time	Is there enough time to complete the abatement?
Health and Safety	Will the method chosen protect occupants?
Building Use	Will this type of abatement be effective given the use of the building? Are any renovations planned in the near future?
Cost	Is it affordable? Are there any future costs associated with this work?

Each factor must be taken into consideration before deciding on the appropriate abatement method. This is a decision, which cannot be taken lightly since the liability of asbestos-related actions taken today may return to haunt the building owner in future years. In that regard, careful consideration must be given to the pros and cons of each form of abatement.

The contractor and building owner must consider that any form of abatement used must comply with all federal, state, and city regulations for asbestos abatement. The same requirements for notification; work area preparation including pre-cleaning, barriers, and negative air exhaust; daily cleaning, final cleaning and final clearance apply to all forms of abatement, not just removal.

Engineering Controls

Before beginning the abatement, it is critical to maintain good engineering controls. This helps ensure minimum release of asbestos fibers from the work area. Listed below are some of the methods employed:

Wetting the Asbestos

The law requires that asbestos be adequately wetted and sufficient time be allowed for penetration to occur prior to abatement. The EPA, OSHA, NYS and NYC all require that asbestos must be removed and contained during the abatement process. Asbestos is wetted for the same reason that a grounds crew at a baseball stadium wets down the infield before a game begins - to prevent dust. Wetting asbestos coats the fibers with moisture and makes them too heavy to become airborne. **The law requires that asbestos must be wet prior to removal.**

To wet the asbestos, a contractor will use Amended Water. Amended water is water that has a surfactant (poly oxy-ethylene ether + poly oxy-ethylene ester) added to it. Adding a surfactant to the water reduces the surface tension of water allowing it to wet the asbestos material more effectively. Reducing the surface tension allows the water to penetrate inside the fiber making it less aerodynamic and easier to filter or drop to a surface where it could be cleaned. **Amended water makes wetting and penetrating the asbestos containing material more effective.**

During abatement, all friable asbestos materials shall be thoroughly saturated. All non-hygroscopic (material that resists wetting- i.e.: tremolite or amosite) asbestos material shall be thoroughly wetted on all surfaces prior to and during abatement.

Damp Rags

Wet methods are the process of using damp rags and mops, among other techniques, for cleaning up asbestos dust and debris from the abatement site. The use of damp rags instead of dry rags is more effective since dry rags will only push the dust around while dust will cling to damp rags.

Spray Misting

Spray misting is a process used to create a fine mist of water to knock down fibers from the air when they become airborne. This is the same principle used in aerosol deodorizers. The principle behind an air deodorizer is to create a fine mist to bombard the particles creating the odor. These odor particles get coated with moisture which increases their weight. The particles then fall to the ground more quickly.

HEPA Vacuum

A HEPA vacuum is a regular vacuum equipped with a HEPA filter. The HEPA filter, which is 99.97% effective at removing particles greater than or equal to 0.3 of a micrometer in size, will filter out asbestos prior to exhaust. A regular vacuum must never be used for asbestos because a regular vacuum will not filter asbestos dust and its exhaust will become contaminated with asbestos fibers. **The HEPA filter is 99.97% effective at removing particles 0.3 microns or bigger. It will filter asbestos prior to exhaust.**

Negative Air Filtration

Use of Negative Air Filtration in conjunction with the other engineering controls will remove asbestos fibers from the abatement area and should there be a breach in the contained area, it will confine the fibers to the work area (see chapter on pre-abatement procedures).

Removal

EPA, OSHA, New York State and New York City require that any asbestos removed must be kept wet during the removal and when it is bagged. Two advantages to the use of wet methods for removing asbestos materials include a reduction in airborne fiber concentrations, which are generated during removal, and a reduction in the effort required removing the material.

Wet removal is based on the ability of water to lower the potential for the asbestos-containing material to release airborne asbestos fibers and increase the settling rate of fibers that are released. Airborne fiber concentrations may be reduced significantly by using wet removal techniques rather than dry.

Removal of Sprayed or Troweled Friable Surfacing Materials from Ceilings

At this point of the abatement project, the work area has been sealed off with at least two layers of 6-mil polyethylene on the floors and two layers of 6-mil polyethylene on the walls (see "Pre-Abatement Procedures”). The decontamination unit and negative air filtration units are in place, and the scaffolding, ladders, various sizes of short-and long-handled scrapers and other removal equipment have been brought into the work area.

Wetting

The first step in the removal process is to thoroughly wet the ceiling material within a low pressure mist of amended water. The material should be misted lightly with amended water to initially wet the surface, and then a saturation coat is applied. The material can be wetted using

a low pressure pump system or water hose with garden sprayer attached which can mix the wetting agent with the water.

A hand pump garden sprayer can be used for small projects. Application with large pump systems or airless sprayers may cause leakage behind the barrier seals resulting in contamination of the walls and floors. Also, the initial impact of water applied with high pressure may cause elevated airborne fiber concentrations, therefore low pressure and careful technique in application should be used. Material will be continuously wetted while being removed.

Removal of ceiling material is carried out in two stages - gross and secondary removal.

Gross Removal

Gross removal is when most of the material is abated. Some of the workers will use scrapers to remove the material, while others will be involved with keeping the material wet and packaging the debris into the appropriate container. Wide blades can be used if the material comes off easily. Workers on the ground package the moist material as soon as there is enough debris to fill the 6-mil plastic bags or plastic-lined fiber drums. Rubber dust pans, plastic snow shovels and squeegees should be used to collect and bag the wet material. Avoid using metal shovels or dustpans that can cause inadvertent tears in the polyethylene floor barriers. The crew that bags the material also repositions the scaffold as needed, re-locking the wheels after each move.

If several crews are removing material, it may be more time efficient to designate a "spray" person, who walks from one area to the next, keeping the material on the ceiling and the floor wet and misting the air to maintain low airborne fiber concentrations. The spray person can also check for damaged floor barriers and promptly repair them.

ACM or PACM, on detachment from the substrate, shall be directly bagged or dropped into a flexible catch basin and subsequently (Title 15, Chapter 1 uses the word "promptly") bagged or containerized. Additional amended water shall be added as necessary to the waste bags/containers to ensure that all waste remains adequately wet within the bag/container.

*** Asbestos debris must be bagged immediately upon detachment from the substrate.**

Bagging out

Bags containing the waste material are processed for waste load-out, either by wet wiping, placing in another "clean" bag, or placing into drums. All bags should be removed from the work area at least by the end of the workday. Removal of bags on a continual basis provides for easier movement (particularly if workers are wearing air-supplied respirators) in the work area.

Secondary Removal

After removing as much of the spray-on material as possible with scrapers, crews begin secondary removal. Depending on the type of substrate (material underneath the friable insulation), various techniques and tools may be required. Common types of ceiling construction to which friable insulation materials may be applied include concrete, 3 coat plaster system, suspended metal lath, concrete joists and beams, metal deck, corrugated steel, steel beam or bar joist. The surface substrate may be smooth, rough, or pitted and this will affect the difficulty of secondary removal. Typically a combination of brushing and wet wiping is used to remove the remaining residue. Nylon bristled brushes should be used instead of wire brushes, which may break the small fibers into smaller fibers. The rags used for wet wiping should not leave any fabric fibers on the substrate which might be mistaken as visual contamination. High efficiency particulate air (HEPA) vacuum cleaners are also useful for removing "hard-to-get-to" residue.

While crews are working from scaffolds or ladders to remove all remaining residues from the ceilings, workers should also be cleaning material off the polyethylene wall barriers and any stationary objects in the area. Wet rags, or squeegees are good for this purpose. Secondary removal is finished when all visual contamination is removed from the ceilings.

According to ICR-56, cleanup of accumulations of loose debris/waste material shall be performed whenever enough loose debris/waste material has been removed to fill a single leak-tight container appropriate for the type of ACM being removed. Cleanup of all remaining waste generated shall be performed at least once prior to close of each work shift. All waste material shall be kept adequately wet at all times. Accumulations of dust or debris shall be cleaned off all surfaces on a daily basis using HEPA-vacuum or wet-cleaning methods or both.

Decontamination system enclosures shall be HEPA-vacuumed or wet-cleaned or both at the end of each work shift. The regulated abatement work area, holding area, waste trailer and hardtop dumpster areas must be kept free of uncontainerized asbestos waste/debris at all times. The next phase is final cleanup.

Removal of Thermal System Insulation from Pipes, Boilers and Tanks

There is a wide variation in the types of asbestos-containing thermal system insulation used on pipes, boilers, and tanks. Pipes may be insulated with preformed fibrous wrapping, corrugated paper, and chalky mixture containing magnesia, fiber felt, and insulating cement. (Note: There are older materials labeled "magnesia" which contain asbestos and new materials also labeled "magnesia" which contain glass fiber rather than asbestos). Usually a protective jacket, which may also contain asbestos, made of paper, tape, cloth, metal, or cement covers the insulation materials. Boilers and tanks may be insulated with asbestos "blankets" on wire lath, preformed block, or the chalky magnesia mixture which is typically covered with finishing cement.

Different approaches are typically required for removing these asbestos-containing materials than sprayed-on or troweled-on ceiling insulation; however, the same protective measures are used. Careful handling and packaging is required in many cases because of the metal jackets, bands, or wire associated with the insulation materials.

Glove-bags, which can be sealed around sections of pipe to form "mini-containment areas", may be used in some situations for removing pipe insulation. Insulated objects, which are not readily accessible or are too large or hot for application of the glove-bag technique, may require a full area enclosure with modified removal techniques.

Removal of insulation from pipes, tanks or boilers can be accomplished by two-person teams. Cuts or slits are made in the insulation material, a spray nozzle is inserted, and the material is wetted to the extent feasible. One worker cuts away the insulation and bags it while the other continuously sprays the material with amended water. Any metal bands or wire that is removed should be folded or rolled and placed in polyethylene to avoid lacerating personnel.

After the gross material is removed, nylon brushes are used to thoroughly clean the pipes, tanks, or boilers. (In cases when pipes are extremely hot, nylon brushes may melt and wire brushes may be the only tools available). Particular care must be taken to clean the fittings and joints where a cement-plaster type material has been removed. After brushing, the surfaces are wet wiped and the final cleanup phase begins.

Dry Removal Techniques

Dry removal, which requires specific EPA, State and/or City approval, may be appropriate for some types of asbestos-containing materials which have been previously encapsulated and will not absorb amended water. There are special conditions which preclude the use of water such as a room containing electrical supply lines which cannot be de-energized during the removal project, hot steam pipes, crawl spaces, work in below freezing temperatures, etc. Dry removal techniques can be used successfully but require much skill and attention to critical details in order to minimize airborne fibers in the workplace and to adequately confine all airborne fibers to the workplace enclosure. In NYC and NYS a site- specific variance may be required for dry removal.

Proven procedures include use of large vacuum systems, small area containment with localized HEPA filtered exhaust, and re-circulating HEPA units inside the work area. The dry removal procedures selected for a given situation must be carefully matched to the existing work area conditions, the type of asbestos and the skill of the work force. Adding layers of enclosure plastic, adding airlock chambers to the decontamination units, providing double or triple rigid primary barriers (in addition to several layers of primary polyethylene), and increasing the number of negative pressure machines may be precautions that are required beyond the normal wet removal procedures. These confining and minimizing measures obviously add costs to the project. It is always much easier to control airborne fibers using wet techniques. It is recommended that all reasonable and safe avenues for wet removal be thoroughly explored before resorting to dry removal.

Enclosure

Enclosure involves the construction of airtight walls, ceilings and floors between the asbestos materials. The purpose of constructing an enclosure is to isolate ACM from building occupants and the building environment. Types of material used to construct enclosures may include PVC (polyvinylchloride), aluminum, wallboard, wood, and steel. Suspended ceilings with in-lay panels or tiles are not considered an asbestos enclosure since they are not airtight and may allow easy access to the material.

Enclosures shall be designed to be permanent and shall be constructed to provide an airtight barrier. The enclosure sheathing material shall be impact resistant and shall be installed with adequate supports, reinforced to withstand local environmental conditions, casual contact and any internal pressures developed within the enclosure structure.

An enclosure should not be placed around pipes, boilers, etc. electrical wires, phone or computer lines, or other items that may require service and/or maintenance in the future. The intent is to enclose items which do not require access thus reducing the chances of exposure.

Advantages	1. Reduces potential for exposure. 2. Typically, not as much debris/waste is generated as compared to removal. 3. No replacement costs. 4. Initial costs may be lower than removal, provided utilities or pipes do not need to be relocated and the construction of the enclosure will not require major structural elements.
Disadvantages	1. Asbestos remains and must be continually monitored. 2. Access to enclosure must be controlled and perhaps need an operations and maintenance (O&M) program. 3. Periodic re-inspection is required to check for damage. 4. Long-term costs may be higher and removal might eventually be required in the future adding more cost. Examples of long-term costs include: O&M program costs- training/certification, medicals, and respirator fit-tests for workers; maintenance of equipment; replacement of materials, etc.)

Enclosure Procedures:

Use of Amended Water
Areas that may be disturbed during the installation of support/framing materials for the enclosure shall be sprayed with amended water. ICR-56 adds that these areas shall be kept damp to reduce airborne asbestos concentrations.

Loose and Hanging Asbestos Material
Loose or hanging ACM or PACM shall be removed prior to installing an enclosure.

Repair of Fireproofing and Thermal Insulation
After installation of hangers, brackets or other supports, and before installation of enclosure sheathing material, damaged areas of fireproofing and thermal insulation shall be repaired using a non-asbestos material. ICR-56 adds that surfaces shall be prepared and replacement material applied in accordance with the manufacturer's recommendation.

Ducts
Ducts insulated with ACM or PACM shall not be enclosed as per ICR-56.

Air Plenums
Air plenums, which are not readily accessible for inspection, and contain ACM or PACM shall not be enclosed- as per Code Rule-56.

Utility Maintenance
Utilities shall be lowered as necessary and reinstalled in a manner which allows proper utilization, and does not disturb the integrity of the enclosures. Utility maintenance shall not require the enclosures to be opened or disturbed.

Marking or Labeling
Enclosed asbestos material shall be conspicuously marked or labeled in order to warn persons of its presence.

Waste Cleanup/Final Cleaning/Final Clearance Air Sampling
According to ICR-56, waste cleanup, final cleaning and final clearance air sampling shall be conducted as per applicable regulations.

Title 15, Chapter 1 - Recommended Enclosure Maintenance Procedures

- Periodic inspection and maintenance program, consisting of an inspection at least annually to check for damage to all enclosed surfaces.
- Recordkeeping on the locations and condition of the enclosed material and on alteration, renovation, or other procedures resulting in ACM disturbance.
- If conditions change and enclosure is no longer appropriate, additional abatement methods should be conducted.

Encapsulation

Encapsulation involves spraying the ACM with a bonding agent called a sealant. Encapsulation may be appropriate if the following conditions are met:

1. Material is granular and cementitious;
2. Damage to the material is unlikely;
3. Material is not highly accessible.

All material used for repair or encapsulation of asbestos material shall have a flame spread rating, fireproofing and smoke characteristics similar to the material being repaired or encapsulated. Also, the encapsulants shall not alter the insulating characteristics of the material subject to encapsulation, and shall not add excess weight to the material increasing the potential that the material may delaminate from itself (cohesion failure), or from its substrate (adhesion failure).

Advantages	1. Reduces fiber release from the material. 2. Typically, have initial lower costs than removal. 3. Does not require replacement materials.
Disadvantages	1. Asbestos remains and may be very expensive to remove later. Encapsulated asbestos often resembles cement and may be quite labor-intensive to remove. 2. Re-encapsulation may be necessary to maintain integrity. 3. If ACM is not in good condition, or too thick, the encapsulant may not adhere properly, causing delamination. 4. Long-term costs (Maintenance, re-encapsulation, monitoring) may be higher than removal. 5. Very susceptible to water damage.

Encapsulation Procedures:

Regulated Abatement Work Area Preparation

The regulated abatement work area shall be pre-cleaned, isolated and negative air established.

Repair Materials

Damaged and missing areas of existing materials shall be repaired with non-asbestos material. The material shall adhere to existing surfaces and provide a base for application of encapsulating agents.

Asbestos Material Removal

Loose or hanging ACM or PACM shall be removed prior to encapsulating.

Testing of Encapsulants

Encapsulants shall be field tested prior to use by applying each to a small area to determine suitability for the material to be encapsulated. Both NY regulations require that testing be conducted only after the isolation barriers are in place. ICR-56 adds that negative air has to be established prior to testing.

Methods of Application

Encapsulants shall be applied using airless spray equipment as follows:

- Spraying shall be performed at the lowest pressure range possible to minimize asbestos fiber release.

- The optimum spray tip shall be chosen on the basis of the viscosity and percent solids of the encapsulant (As per ICR-56).
- Each subsequent coat of encapsulant shall be applied at a 90-degree angle (right angle) to the preceding coat application or per manufacturer's specifications.
- The encapsulant solvent or vehicle shall not be or contain a volatile material. It shall not release hazardous air pollutants, as defined by NYS DEC 6 NYCRR 200.1 (ag), into the air when applied or during curing.

Marking or Labeling

Encapsulated asbestos material shall be conspicuously marked or labeled in order to warn persons of its presence.

Waste Cleanup Final Cleaning Final Clearance Air Sampling

According to ICR-56, waste cleanup, final cleaning and final clearance air sampling shall be conducted as per applicable regulations.

Title 15, Chapter 1 - Recommended Encapsulation Maintenance Procedures

- Periodic inspection and maintenance program, consisting of an inspection at least annually to check for damage to all encapsulated surfaces.
- Recordkeeping on the locations and condition of the encapsulated material and on alteration, renovation, or other procedures resulting in ACM disturbance.
- If conditions change and encapsulation is no longer appropriate, additional abatement methods should be conducted.

There are two categories of encapsulants that can be used:

BRIDGING	**PENETRATING**
A bridging encapsulant forms an impervious membrane on the surface of the ACM	A penetrating encapsulant actually penetrates, or soaks into the asbestos containing material where, as it dries, it binds the asbestos fibers and other material components together.

Whichever method of encapsulation is chosen, the encapsulant must be pigmented and will usually require at least two coats before the material is property encapsulated. Each coat of encapsulant must have a different color. This is to ensure that the contractor has coated all surfaces evenly before applying the next layer.

1. Bridging Encapsulants

It is recommended that a contractor purchase a bridging encapsulant specially formulated for asbestos use.

- Bridging encapsulants shall be-applied to provide the manufacturer's specified *minimum dry-film thickness* over sprayed asbestos surfaces.
- When using bridging encapsulant, a *different color for each coat* shall be used.
- As per ICR-56, *latex paint shall not be used* as a *bridging encapsulant.* It shall be considered a dilute lockdown encapsulating agent and used only as a coating for lockdown purposes for surfaces during cleanup procedures.
- Title 15, Chapter 1- adds that latex paint with solids content greater than 15 percent may be used as an encapsulant only as a lockdown sealant for coating all nonmetallic surfaces, or for sealing of cementitious ACM.

2. Penetrating Encapsulants

Most encapsulants can only penetrate an inch or two into the material, so it is unlikely that it will bind thicker material to the substrate. Penetration to the substrate is key to holding the material secure to the building. Without it, the encapsulated material may fall or "slide" off the wall or ceiling.

- Penetrating encapsulants shall be applied and penetrate existing asbestos material to the substrate.
- During treatment with a penetrating encapsulant, selected random core samples of asbestos material shall be removed and checked to verify full depth of penetration.
- Each coat of penetrating encapsulant shall be color coded as per manufacturer's recommendations, if any, except for the prohibition of pigment use.

CHAPTER 7

Clean-Up Procedures

Introduction

Post-abatement clean-up procedures often take longer than the abatement itself. Careful cleaning of the work area is paramount to achieving final air clearance results, thus allowing occupants to re-enter the area. Failure to perform the cleanup procedures may result in high fiber levels, forcing the contractor to re-clean the area and final air tests to be re-run. This re-cleaning is required by NYC and NYS regulations and could prove to be expensive and may not have been included in the contract signed with the building owner and contractor.

New York City and New York State regulations vary the most when it comes to the final cleaning procedures, with the State regulations being considerably more stringent than the City's. This must be taken into account when planning the amount of time for an abatement project since a contractor and building owner are obligated to follow the state regulations when they are more stringent.

Any cleaning of the work area is to be accomplished by wet wiping and/or HEPA filtered vacuuming. The contractor will choose the appropriate method based on the surface to be cleaned. An important point to remember when discussing the clean-up procedures is that all surfaces are included in the cleaning, including the Decon(s), floors, walls, and the surfaces where asbestos has been abated. Negative air filtration must continue through all cleanings and their subsequent waiting periods.

This section of the manual will discuss the general or daily clean-up procedures required on all abatement, then the final clean-up procedures.

During-Abatement (Daily) Clean-Up Procedures

NYCDEP Title 15, Chapter 1	NYSDOL Code Rule-56
The following requirements shall be followed on all large asbestos projects: 1. Visible accumulation of waste must be bagged whenever there is enough to fill a bag or at the end of each shift whichever shall occur first. 2. Non-metal shovels and/or HEPA vacuums (i.e. dust pans, squeegees etc.) allowed. 3. Accumulations of dust cleaned daily. 4. Waste decon shall be cleaned twice after the removal of waste. When worker decon is used for waste, shower shall be cleaned with a detergent prior to wet-cleaning of decon. 5. Worker decon cleaned, as appropriate, after each shift change and meal break. 6. Excessive water accumulation or flooding shall require work to stop until water is collected.	The following requirements will be required on all large and small projects: 1. Cleanup of accumulations of loose debris/waste material shall be performed whenever there is enough to fill a single leak-tight container appropriate for the type of ACM being removed. Cleanup of all remaining waste shall be performed at least once prior to close of each work shift. 2. No metal shovels allowed. 3. Accumulations of dust or debris shall be cleaned off all surfaces on a daily basis using HEPA-vacuum or wet-cleaning methods or both. 4. Decontamination system enclosures shall be HEPA-vacuumed or wetcleaned or both at the end of each work shift. 5. The regulated abatement work area, holding area, waste trailer and hardtop dumpster areas must be kept free of uncontainerized asbestos waste/debris at all times.

Final Clean-Up Procedures

NYCDEP Title 15, Chapter 1	NYSDOL Code Rule-56
1. First cleaning. All surfaces are HEPA vacuumed first and then wet cleaned. 2. Apply a thin coat of a lockdown encapsulant to all surfaces except abated surface or surfaces. 3. Wait 12 hours. 4. Remove the cleaned layer of poly sheeting. Isolation Barriers and Decons remain in place. 5. Second Cleaning. All surfaces HEPA vacuumed and wet cleaned again. 6. Wait 4 hours. 7. Remove remaining layer of poly. Barriers and Decons remain in place. 8. Third Cleaning. Wet clean and/or HEPA vacuum all surfaces. All equipment (except NAU's) and tools shall be removed and properly decontaminated. 9. Wait until at least 1 hour after the area is dry from the 3rd cleaning and no visible pools of water or condensation remain. 10. Visual inspections conducted by both the asbestos abatement contractor's supervisor and a project monitor. 11. Maintain air filtration for at least four air changes per hour at this point. 12. Begin aggressive/final clearance sampling.	1. First Cleaning. All surfaces are wet-cleaned using rags, mops and sponges. 2. Apply a thin coat of a lockdown encapsulant to all surfaces except abated surface or surfaces. 3. Conduct appropriate waiting/settling, or drying time (see table on next page). 4. Remove the cleaned, exposed top layer of plastic sheeting. Barriers and Decons remain in place. 5. Second Cleaning. All objects and surfaces cleaned using HEPA vacuums and then wet cleaned. 6. Conduct appropriate waiting/settling, or drying time (see table on next page). 7. Remove remaining bottom layer of poly. Barriers remain in place. 8. Third Cleaning. All objects and surfaces cleaned using HEPA vacuums and then wet cleaned. All equipment (except NAU's) and tools shall be removed and properly decontaminated. 9. Conduct appropriate waiting/settling, or drying time (see table on next page). 10. Visual inspections conducted by both the asbestos abatement contractor's supervisor and a project monitor. 11. Maintain air filtration for at least four air changes per hour. 12. Begin aggressive/final clearance sampling.

NYSDOL ICR-56 Waiting/Settling and Drying Times Requirements

The following waiting and drying times per material abated shall be observed for each stage of cleaning:

Material To Be Abated	Waiting/Settling/Drying Time
Fireproofing, plaster, TSI and other friable materials	12 Hours
Abrasive removals of floor tile/mastic with machinery (such as a bead blaster, grit blaster, etc.)	12 Hours
Manual removal of floor tiles/mastic	4 Hours
Manual abatement of interior non-friable materials	4 Hours
Incidental disturbance asbestos project	4 Hours
Tent with glovebag abatement of TSI	2 Hours
Intact transite panel removals indoors	2 Hours
Exterior non-friable ACM abatement without negative pressure enclosure	None

Visual Inspections

The ICR-56 amendments, effective March 21, 2007, and for Title 15 Chapter 1 effective Nov 13th, 2009 specifically mandated that both the **supervisor and a project monitor conduct a visual inspection after 3rd cleaning and prior to final clearance air sampling.** In fact, ICR-56 mandates that the Supervisor conduct a visual inspection prior to the start of the Project Monitor's visual inspection.

The visual inspections are completed to: 1. confirm that the scope of abatement work for the asbestos project is complete; and 2. confirm that no visible asbestos debris/residue, pools of liquid or condensation remain.

An appropriately trained and certified project monitor, contracted by the building/structure owner, independent of the asbestos abatement contractor, shall complete the visual inspection. The project monitor visual inspection for completeness of abatement and completeness of cleanup shall be performed as per the provisions of the current ASTM International Standard E1368 "Standard Practice for Visual Inspection of Asbestos Abatement Projects".(ICR 56 requirement)

If the property owner is the asbestos abatement contractor for the specific asbestos project, the owner shall contract with an independent project monitoring firm asbestos contractor for the necessary visual inspection for that project.

The asbestos abatement contractor and property owner, prior to the scheduling of the required visual inspection, shall provide a complete abatement scope of-work for the asbestos project to the project monitor. An entry shall be made into the asbestos abatement contractor supervisor's daily log by both the supervisor and the project monitor, detailing the findings of the visual inspection. The full name and NYSDOL asbestos handling certificate number of the certified individual performing the inspection shall also be documented in the supervisor's daily log.

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CHAPTER 8

Operations and Maintenance (O&M)/ Minor Project Work Practices

Introduction

This section summarizes work practice requirements under the New York State Department of Labor (NYSDOL), Industrial Code Rule 56 (ICR-56) and the New York City Department of Environmental Protection (NYCDEP), Title 15, Chapter 1 (15 RCNY 1) and makes comparisons between the two regulations.

ICR-56 Work Practice Requirements

On March 21, 2007, ICR 56 was amended (revised). This section includes those revisions.

A minor asbestos project is an asbestos abatement project involving the removal, disturbance, repair, encapsulation, enclosure and or handling of 10 square feet or less of asbestos-containing material (ACM), or 25 linear feet or less of ACM. Furthermore, ICR-56 states that only workers who possess valid Operation and Maintenance certificates issued by NYSDOL are allowed to perform minor asbestos projects. (Note: Workers who possess handler or supervisor are also allowed to perform minor asbestos projects).

For minor asbestos projects, ICR-56 states that removal shall be performed using either glovebag or tent procedures. If removal of minor amounts of ACM are performed without using glovebags and/or tents, then a variance must be obtained from NYSDOL prior to the start of the project.

The March 21, 2007 amendments to ICR 56 revised the requirements for work area preparation, decontamination units (decons), and work practices. The following table summarizes the revised requirements for types of work area containments and decontamination units. Exceptions to this table can be found in ICR 56, Subpart 56-11, *Special Projects.*

Project Type	Containment Type	Decon Type
Large Project Friables	Full Containment	Attached Personal and Waste Decon
Unlimited Non-Friables	Negative Pressure Tent	Remote Personal Decon
Unlimited Glovebag Removal of Pipe Insulation	Negative Pressure Tent	Remote Personal Decon
Minor Project Friables	Negative Pressure Tent*	Remote Personal Decon
Small Project Friables without Glovebag	Negative Pressure Tent	Attached Personal Decon

• Note: For an isolated event necessary for repair associated with normal operations and maintenance activities, a single glovebag operation may be performed without a negative pressure tent enclosure.

As shown in the above table, as of March 21, 2007, ICR 56 requires that for the abatement of minor quantities of friable ACM without using glovebags, the personal decontamination unit must be attached to the negative pressure tent.

Tent Construction

- Tents with greater than twenty (20) square feet of floor space, or tents that are scheduled for gross removal of friable ACM, PACM, or asbestos material, shall be constructed of two (2) layers of six (6) mil fire-retardant plastic sheeting and shall include walls, ceiling and a floor (except for portions of walls, floors and ceilings that are the removal surface) with double-folded seams. Seam shall be duct taped airtight and then duct taped flush with the adjacent tent wall.

- Tents with twenty (20) square feet or less of floor space and no gross removal of friable ACM, PACM or asbestos material, shall be constructed of one (1) layer six (6) mil fire-retardant plastic sheeting and shall include walls, ceiling and a floor (except for portions of walls, floors and ceilings that are the removal surface) with double-folded seams. Seams shall be duct taped airtight and then duct taped flush with the adjacent tent wall.

- Tents or tent-like structures or enclosures shall be adequately supported and reinforced to withstand local environmental conditions and the negative pressures developed within them.

When utilizing a tent for Minor size asbestos projects, the following shall be required:

1) Personal/Equipment Decontamination Room or Area

An existing room or area that is adjacent to the regulated abatement work area shall be used for the decontamination of personnel and equipment. The room or area shall be covered by an impermeable drop cloth on the floor or horizontal working surface. The room or area must be of sufficient size to accommodate cleaning of equipment and removing personal protective equipment.

Work clothing must be cleaned with a HEPA vacuum before it is removed. All equipment and surfaces of asbestos waste bags/containers must be cleaned prior to removing them from the decontamination room or area. All personnel must enter and exit the regulated abatement work area through the decontamination room or area.

2) Attached Airlock

An airlock shall be constructed as per Section 56-7.5(b)(11) at the entrance to each tent that utilizes remote decontamination system facilities. Each tent and airlock shall be cordoned off twenty-five (25) feet from its perimeter, or the interior space/room where the tent and airlock is located shall be secured from non-certified personnel or public access, and signage shall be installed as per Section 56-7.4(c).

3) Personal Protective Equipment

All persons shall don appropriate personal protective equipment before entering the tent in compliance with current OSHA regulations. Authorized visitors entering the tent shall also don NIOSH-approved respiratory protection.

4) Exhausting the Tent

A HEPA-vacuum or other negative pressure HEPA-filtered ventilation equipment shall be used to continuously exhaust the tent in accordance with Sections 56-7.8(a) and 56-7.11 (f)(1).

5) Amended Water

All material to be removed shall be saturated with amended water as specified in this Part.

6) Abatement Procedures

Asbestos material shall be removed and sealed in plastic bags prior to removal from tent. Edges of asbestos material remaining shall be encapsulated or sealed with wet-table cloth.

7) Sealing of Surfaces and Edges

The substrate from which ·asbestos was removed and any exposed edges shall be sealed with encapsulant.

8) Clean Up

- All accumulations of asbestos waste material shall be containerized and removed. HEPA-vacuums shall be used to clean all surfaces after gross cleanup.
- Contaminated equipment and all containerized waste shall be removed from the regulated abatement work area.
- All surfaces in the regulated abatement work area shall be wet-cleaned using rags, mops or sponges.
- Negative pressure HEPA-ventilated air equipment shall be operated for a minimum of twenty (20) minutes following completion of final wet cleaning.

9) Visual Inspection

Once final cleaning is complete, a visual inspection shall be completed by the asbestos abatement contractor's supervisor to confirm that the scope of abatement work for the asbestos project is complete, and no visible debris/residue, pools of liquid, or condensation remain.

10) Removal of Personal Protective Equipment

The worker's disposable protective clothing shall be removed and left in the tent upon exiting.

11) Exiting Procedures

After exiting the tent, workers shall immediately don clean protective clothing. Workers shall then seal the tent exit and, upon tent collapse, shut down the HEPA-vacuum.

12) Collapsing and Containerizing the Tent

The plastic sheeting which formed the tent, and the contents thereof, shall be fully collapsed, starting from the top and working downward. The tent and contents shall be placed in at least a six (6) mil plastic bag or hard wall container, sealed airtight with duct tape and removed for disposal.

13) Showering

Workers shall proceed immediately to a shower for decontamination.

14) Failure

Actions to be taken in the event of loss of tent integrity are detailed within Section 56-8.4(j)

Air Sampling for Minor Projects

Air sampling is not required for Minor projects, unless there is glove bag or tent failure.

ICR-56 Clearance Rules for Minor Projects & Minor Size Regulated Abatement Work Areas

1. The minor project clearance rules apply to the following activities:
    a. If a Minor size regulated abatement work area is part of a Small or Large project;
    b. If there is glove-bag or tent failure or loss of integrity;
    c. If it is an incidental disturbance project.

2. A minimum of two samples shall be collected. One sample shall be collected IWA and one sample shall be collected OWA, within the building, in an uncontaminated area within ten feet of the isolation barriers.

NYCDEP Requirements

If a project in a building in New York City requires a building permit, then prior to the project either an ACP-5 (Not An Asbestos Project Notification) form or an ACP-7 (Asbestos Project Notification) form must be submitted to the New York City Department of Buildings (NYCDOB). According to 15 RCNY 1, removal of ACM in the amounts of 10 square feet or less or 25 linear feet or less is not considered to be an asbestos project and would be included on the ACP-5 form. In such a case, the abatement should be performed according to ICR-56 regulations for a

minor project, which would include the use of glovebag and/or tent procedures, unless a variance from ICR-56 requirements was granted by NYSDOL.

Title 15, Chapter 1 states that no worker shall engage in an asbestos project, or in asbestos abatement activities on a minor project unless that worker possesses a valid NYCDEP Asbestos Handler Certificate.

Glove-Bag Removal

A glovebag consists of six mil polyethylene bag fitted with long sleeve gloves, a tool pouch, and a small opening which may be used for insertion of a water sprayers and/or HEPA vacuum nozzles. Glovebags are approximately forty to fifty inches wide by forty eight to sixty inches long. The used glovebag should be disposed as ACM waste, i.e. it should be "double-bagged". When disposing of glovebagged waste, it is necessary to ensure that the outermost bag contains the required wording as per federal regulations.

In addition to the glovebag itself, there are a variety of standard tools and materials necessary to successfully complete the procedure. The following is a list of these tools and materials:

Materials

1. Glovebag (one or more depending on project size)
2. Pump-up garden sprayer (2-3 gallon size)
3. Amended water (surfactant)
4. Duct tape (3-inch width)
5. Polyethylene disposal bags (6mil) labeled per OSHA, EPA and DOT regulations
6. Smoke tubes with aspirator bulb
7. HEPA-filtered vacuum cleaner
8. Wire saw
9. Utility knife with retractable blade
10. Wire cutters
11. Tin snips (if aluminum jacket is present)
12. Polyethylene plastic
13. Respirators with P-100 cartridges
14. Disposable full-body suits with hood and feet covering
15. Small scrub brush (nylon brush)
16. Several rags
17. Wet-table cloth or other patching material
18. Asbestos danger signs and labels

Before Starting the Project

Before any work begins, all necessary materials and supplies should be brought into the work area. This work area should be roped off and danger signs posted on the perimeter to minimize the chance of visitors entering this area. Barrier tape (3-inch) with a preprinted asbestos warning works well for this purpose. The HVAC system serving the work area should be shut down, if possible. Employees should be trained in emergency procedures in the event the glovebag ruptures. These emergency procedures usually include wet cleaning and/or HEPA vacuuming procedures and a shower available at a remote location. With this phase completed, the following generic guidelines may be used for most pipe lagging projects. It is important to not attempt to conduct glovebag removal on hot pipes (over 150F) due to the possibility of the bags melting over the worker's hands and arms or starting a fire.

Removal Procedures

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

2. Have each employee put on high efficiency cartridge respirator approved for use against asbestos and check the face-fit.

3. Have each employee put on disposable full-body suit. Remember that the hood goes over the respirator straps.

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

5. Open the top of the glovebag and cut down the sides to accommodate the size of the pipe (about two inches longer than the pipe diameter). Some bags have zippers or two-sided tape' on top and straps at each end facilitating easier installation of the bag on the pipe.

6. Place the necessary tools into the pouch located inside the glovebag. This will usually include the flex-saw, utility knife, rags, scrub brush, wire cutters, tin snips and wet-table cloth. **Note:** It may be easiest to pre-cut the wet-table cloth at this point. Cut out a donut shape with the inner diameter 1/2-inch smaller than the diameter of the pipe beneath the insulation. The outer diameter of the donut should be three inches longer than the diameter of the pipe insulation being removed. Finally, cut a slit in each of the two donuts so they can be slipped around the pipe. (Putting the wet-table cloth in a small airtight zip-loc bag may make it easier to handle.)

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

8. Place the glovebag around the section of pipe to be worked on. If the bag has double-sided tape at the top, a preliminary seal can be made at this point. Next, fold the flap back and tape it down with a strip of duct tape. This should provide an adequate seal along the top. Duct tape the ends of the glovebag to the pipe itself, previously covered with plastic or duct tape.

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

10. According to ICR 56-8.4(a)(3)(i & ii) which states "(i) Smoke testing should not be completed using a **positive pressure test.** The glove-bag, once secured in place, should be placed under negative pressure, utilizing the HEPA-vacuum, and a smoke tube should be aspirated to direct smoke at all seals and seams from outside the glove-bag. (ii) If there are any leaks, they will be detected by the smoke entering the bag. All leaks shall be duct taped airtight".

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

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

13. With the insulation exposed, use the flex-saw to cut the insulation at each end of the section to be removed inside the glovebag. (Note: A flex-saw is a serrated heavy gauge wire with ring type handles at each end.) Throughout this process, water is sprayed on the cutting area to keep dust to a minimum.

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

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

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

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

18. Wet the donut-shaped pieces of wet-table cloth over the exposed ends of insulation remaining on the pipe. Wet-table cloth is plaster impregnated fiberglass webbing available at many hardware and/or plumbing supply stores.

19. Remove the water wand from the water porthole and attach the small nozzle from the HEPA vacuum. Turn on the vacuum only briefly to collapse the bag.

20. Remove the vacuum nozzle, twist the water porthole closed, and seal with duct tape.

21. Starting outside the bag, pull the tools through the glove and away from the bag. Then twist it to separate it from the bag. Place duct tape over the twisted portion. Cut the glove from the glovebag, cutting through the twisted/taped section. In this manner, the contaminated tools may be placed directly into the next glovebag without cleaning. Alternatively, the glove with the tools can be placed in a bucket of water, opened underwater, and the tools cleaned and dried without releasing asbestos into the air. Note: Rags and the scrub brush cannot be cleaned in this manner and should be discarded with the asbestos waste.

22. With the removed insulation in the bottom of the bag, twist the bag several times and tape it to keep the material in the bottom during removal of the glovebag from the pipe. (A HEPA vacuum may help suction air out of the glovebag.)

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

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

25. Slip a second disposal bag over the first disposable bag.

26. Twist the top of the bag closed, fold this over ("gooseneck' style), and seat with duct tape. Ensure that the outermost bag is appropriately labeled per OSHA, EPA and DOT regulations.

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

28. Asbestos-containing material must be disposed of at an approved landfill in accordance with EPA regulations.

29. Air sampling should be conducted during and after completion of glovebag, projects to determine if undetected leakage occurred. A qualified person should do sampling. Once a good visual inspection has been conducted, it will be possible for re-entry by unprotected personnel. Reinstallation of the insulation may also occur at this point.

CHAPTER 9

Air Sampling Procedures

Introduction

Air sampling (or as it is often called, air monitoring) is performed for a number of different reasons.

1. For comparison with specific federal, state, and local air sampling requirements;
2. To select appropriate respiratory protection;
3. General public protection;
4. Clearance of abatement sites;
5. Legal documentation that air is in compliance with applicable regulations.

Air sampling involves drawing a known volume of air through a filter and analyzing that filter for the presence of fibers. The filter is housed in a plastic cassette, which is attached to a sampling pump with flexible tubing. The sampling pump can be either electric (plug in) or battery powered and is calibrated to draw a known volume of air through the filter material over a given period of time (usually expressed in liters of air per minute (LPM)).

Two basic air-sampling methodologies are area and personal monitoring. Specific techniques for the collection of area and personal air samples as they pertain to asbestos abatement projects will be detailed later in this chapter.

According to the New York City and New York State asbestos regulations, anyone who performs area air sampling on asbestos projects must be certified as a New York State Asbestos Project Air Sampling Technician.

Air Sampling Pumps

Pumps are the backbone of the air sampling process, providing the means by which air is drawn through the filter that is housed in the cassette. Sampling pumps are typically categorized as either high volume (electric), or low-volume (personal) pumps, which are usually battery powered. High volume pumps are typically larger and heavier than battery-powered pumps and draw up to 20 LPM through the filter. Typically, high volume pumps are used for area air sampling.

One advantage of high volume pumps is their ability to draw large volumes of air through the filter in a relatively short period of time. Since being able to detect low concentrations of airborne asbestos fibers relies, in part, on sampling large volumes of air, high volume pumps are useful for sampling in environments where low levels of airborne asbestos are expected (e.g. outside of a work area containment, or following the clean-up of an abatement project).

Battery powered, or personal sampling pumps, are small, lightweight pumps usually encased in a hard plastic shell. These pumps typically draw from one-half to 4 liters of air per minute through the filter and are ideal for indexing workers' exposure (or potential exposure, when wearing a respirator) to airborne asbestos fibers. Characteristically light weight, these pumps are easily worn on a worker's belt with little discomfort.

Filters

Two main types of filter material are used to sample for airborne asbestos fibers. Mixed cellulose ester (MCE) or membrane filters are the most common and have the widest use. MCE filters are cellulose strands bound together in a web called "tortuous pore" and display a very irregular surface when observed under magnification. Polycarbonate filters, on the other hand, are thin sheets of plastic with holes punched in them by neutrons and enlarged by an alkali bath. Once quite popular for applications such as final clearance air monitoring (where analysis was to be performed by electron microscopy), polycarbonate filters should be used with caution and are being used less frequently because of fears of fiber loss from the smooth filter surface during sample handling and transport.

Regardless of the type used, filters are characterized by their diameter (of exposed surface) and their pore size. All filters are housed in a sampling cassette, which includes a cap, extension cowl or retainer ring, the filter, a MCE diffuser when collecting TEM samples, a support pad, and a cassette base.

Once the cassette is attached to the tubing and the pump is started, air is pulled in past the filter and any particulates in the air will be trapped and deposited onto the filter. The mixed cellulose ester filter is designed to trap microscopic sized particles. This design is called a "tortuous pore" due to the spider web-like looking filter. To the naked eye, this filter looks incredibly thin, but it is the right size for trapping the microscopic sized particles typically associated with asbestos.

Tiny pores in the filter allow the air to pass through the cassette on a continuous basis. The diameter of these pores marks one of the main differences between filters used for PCM versus ones used for TEM.

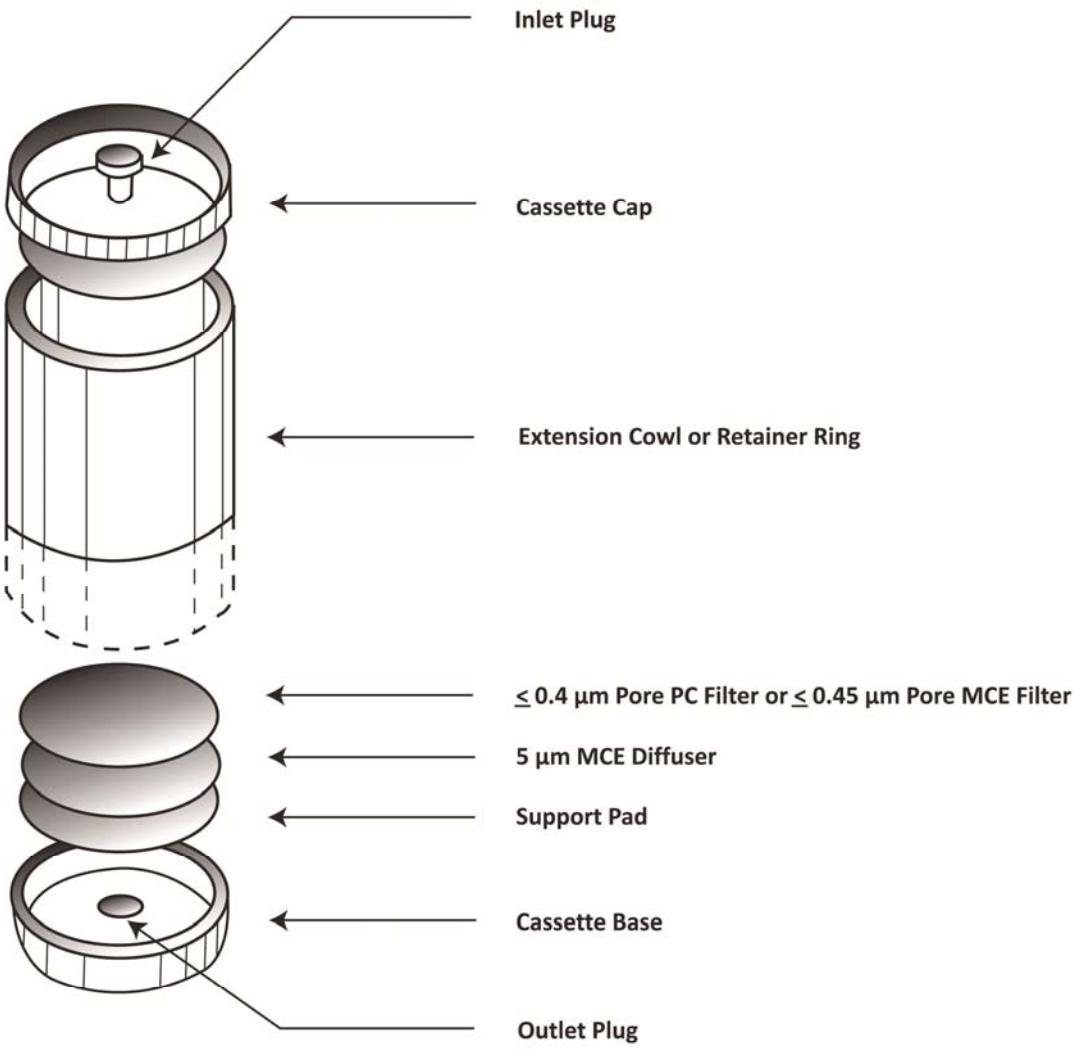
ANALYSIS METHOD	**PORE SIZE**
PCM	0.8 microns (µm)
TEM	0.45 microns (µm)

Besides having a different pore size than PCM, a TEM cassette also has two filters in it. The NIOSH 7400 Method (for PCM) states that the higher pressure drop of the TEM filters precludes their use with personal sampling pumps.

In other words, never use a TEM filter/cassette to conduct personal air sampling.

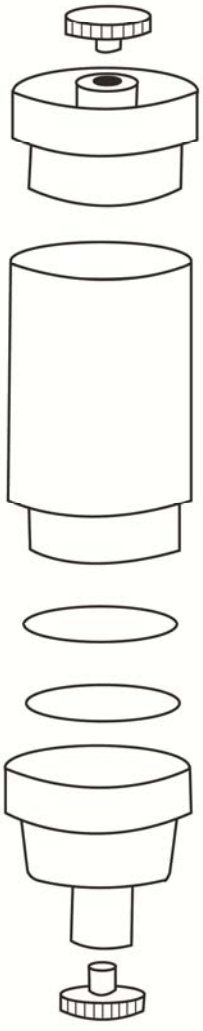
25-mm TEM Cassette and Filters

Exploded View



25-mm PCM Cassette and Filter

Exploded View



End Cap Plug
- In place for shipping

End Cap
- Must be removed for sampling asbestos "open faced"

50mm extension cowl
-Must be made of conductive material

0.8 µm Pore Size Mixed Cellulose Ester Filter
- Lot certified for asbestos counting by manufacturer

Backup Pad

Base
-Allows uniform dynamic pressure across filter face

Base Plug
- In place for shipping

Pump Calibration

Calibration is defined as determining, within specified limits (±1-5% in this case), the true value of an instrument's indications. An air sampling pump is calibrated by comparing it to the reading of a second instrument - a reference calibration source. The indications of a calibrator must be accurate and reliable.

Categories of Calibration Sources:

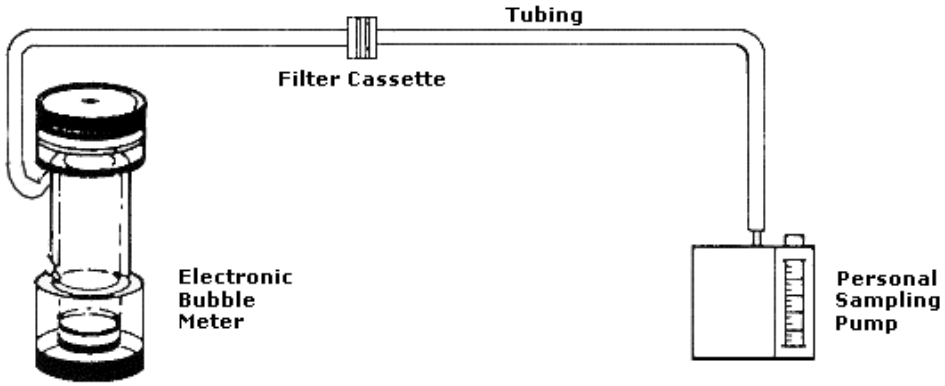
1. Primary Standard

A device having a fixed, measurable volume independent of the calibration process. In other words, a primary standard technically does not have to be calibrated itself. Therefore, the primary standard's readings indicate the "true value" of the flow rate. The most common example of a primary standard is a manual bubble burette also called a soap-film burette.

A manual bubble burette consists of a long plastic or glass tube with markings at the top and bottom. The volume of the space between the two markings represents one liter. The manual bubble burette uses a visual determination in the form of a soap film or "bubble". The soap bubble will not impede the normal flow of air through the burette.

When the pump is properly attached to the burette, air is drawn from the bottom to the top. As it passes through a soap solution at the bottom of the burette, a bubble is created. Since the inside of the tube is a known volume of space (one liter), anything which moves through that space can be "clocked" to determine the speed in liters per minute (LPM). A stopwatch is used to measure the amount of time it takes for the bubble to pass from point "A", at the bottom of the scale, to point "B" at the top.

Calibration example



2. Intermediate Standard

A device which demonstrates precision similar to a primary standard, but does not meet the same requirements because it must be periodically calibrated (typically once a year).

These devices are allowed to be used as a primary standard. An argument could be made that the manual bubble burette process is also not a true primary standard because the stopwatch would need calibration.

Examples of intermediate calibration sources include wet test meters [electronic bubble burette, pictured at right] and dry gas flow meters.

An electronic bubble burette [ex: "Gilibrator:' "Buck Calibrator:' etc) is a device that measures the speed of the bubble electronically giving instant results and makes it simple to use. An electric "eye" clicks when the bubble passes the bottom point, thus establishing the beginning of the bubble's journey. When the bubble passes the second electric eye located at the top of the tube, the internal computer instantly calculates the flow rate of air through the burette. A gas flow meter [ex: "DryCal"-] uses similar principles but uses a light source and gas to calculate the flow rate of air.

It would not be practical to take a manual bubble burette (primary standard) out in the field because of its size and also the possibility of a broken glass hazard. An electronic bubble burette or a gas flow calibrator (intermediate standards) would be more convenient, but their higher costs as sensitivities make it unlikely that air sampling technicians will have access to these instruments in the field. However, in order to correctly take air samples, the technician must be able to measure the flow rate of the pump.

The dry gas meter used as a calibration standard for volume measurements shall be calibrated before initial use and annually or every 200 hours of operation, whichever is more frequent. Dry gas meters shall be calibrated with a wet test meter or spirometer.

3. Secondary Standard

A rotameter is a device that measures the flow rates of sampling pumps in the field. It is considered a secondary standard of calibration because it is not as accurate and needs to be calibrated itself.

Rotameters come in many sizes and models, but all share the tube-like shape of the bubble burette. Air is drawn through the

bottom of the rotameter from another opening at the top. As air passes from bottom to top, it causes a "ball" in the device to float. The location of the ball within the rotameter indicates the speed of the air passing through the pump.

There are several markings on the outside of the rotameter which usually indicate liters of air per minute (LPM). For example, when the air passes through the equipment and causes the ball to float at the number marking "5", it should indicate to the technician that air is being pulled into the pump at a rate of 5 liters per minute. However, because a rotameter is a secondary standard, it is not entirely accurate. As a secondary standard, the rotameter must be calibrated to a primary standard before use and every three months thereafter. This is done to find out what the actual (or true) flow rate is when the ball of the rotameter floats at the specified marking. If the rotameter is set to 5 LPM, the actually reading might not be exactly 5 LPM and could be higher or lower.

There are four primary agents that cause a rotameter to change its calibration and provide inaccurate readings to the sampling technician.

1. Over a period of time, dirt collects on the rotameter walls which increases the air velocity (but not the flow) causing the ball to float higher at the same flow rate.

2. Filters of different resistances or a given filter changing resistance while sampling (i.e., clogging) affects the density within the sampling system, thus changing the height of the ball at a given flow rate.

3. Atmospheric conditions also affect air density and can contribute to calibration shift.

4. Recalibration can also affect pump performance.

Whatever the reason, the rotameter must be calibrated to a primary or intermediate standard first in order to determine what all the number markings actually mean.

These four problem areas must be accounted for. Also, rotameters must be removed and cleaned according to manufacturer's directions. When calibrating, use the same sampling cassette and filter that will be used during the sampling process. This will ensure that the resistance encountered is representative of actual sampling conditions.

NYSDOH-ELAP mandates that rotameters be calibrated before use and every 3 months thereafter.

The following describes the set-up of the Rotameter calibration ("calibration train"):

The tubing from the sampling pump is attached to the top of the filter/cassette. The bottom of the cassette is then connected to the top of the rotameter. The connection at the bottom of the rotameter is attached to the primary/intermediate calibration standard.

The rotameter needs to be calibrated to many settings on the primary or intermediate calibration device. By doing so, the field technician has available to them several flow rate choices. Once the flow rate is established on the rotameter for the first setting, 3 flow rate readings are taken using the primary/intermediate standard calibration device and then averaged. This process is repeated for several settings. The average flow rate obtained from the primary/intermediate standard for each setting represents the "true value of that flow rate. This average flow rate is plotted on a graph versus the rotameter settings.

Once all the points are plotted, a "best-fit straight line" is created by connecting as many of the points as possible with an equal number on either side of the line. This calibration graph can also be created with a computer using a statistical formula called regression.

The calibration graph is generated for each specific rotameter, and should be carried with the rotameter in the field. If the air sampling technician is asked to set their pumps at 7 LPM, they need to know where to set the rotameter in order for the pump to actually run at 7 LPM. This is done by looking for 7 LPM on the actual flow rate (primary/intermediate standard) scale of the graph and following it up to where it intersects the calibration line. Once it hits the line, follow it over to the rotameter (secondary standard) scale and note the flow rate reading.

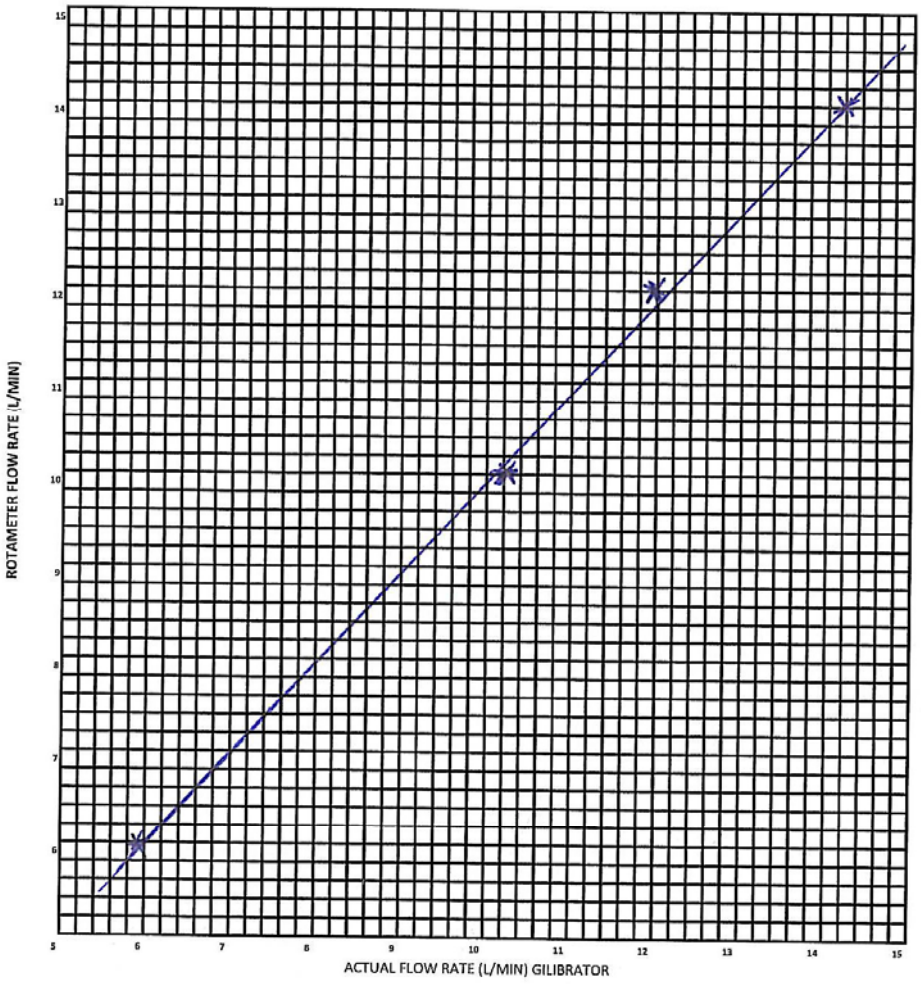
For example, on the following graph, 7 LPM from the actual flow rate scale yields a rotameter reading of 7.2 LPM. This means that in order to set the pump to run at 7 LPM, that specific rotameter must be adjusted to 7.2 LPM. However, 7 LPM is what is recorded on the data sheet, as it is the actual flow rate

As previously mentioned, calculation of air sampling results are dependent, in part, on the total volume of air sampled. The total volume of air sampled is the flow rate of the sampling pump (liters of air per minute or LPM) multiplied by the time (in minutes) the pump ran. Accurate calibration of the pump flow rate, then, is very important in the calculation of sample results. The EPA and OSHA recommend that sampling pumps be calibrated before and after each use, and it is good practice to maintain these calibration records together with other sampling data.

Although not always practical, a primary calibration standard is the best way to determine the flow rate of a sampling pump. A primary calibration standard is one that is known to have the highest degree of accuracy and repeatability when determining a pumps flow rate. Typically, a one-liter flow bubble burette or equivalent is used as a primary calibration standard for air

sampling pumps. From this, a rotameter, which is smaller and more durable, yet less accurate than the flow bubble burette, can be calibrated and taken into the field to calibrate each sampling pump before and after each use.

It is important to ensure that persons performing air monitoring are routinely calibrating their sampling pumps. Regular requests of calibration data, or requiring this data to be included in reports of sample results are two ways to help maintain the technical and legal validity of sampling data.



NAME	ROTAMETER #	FLOW RATE ROTAMETER (Y)	ACTUAL FLOW RATE GILIBRATOR (X)
P. BROWN	CNS – 001	6.00	5.81
		10.00	10.23
		12.00	11.94
		14.00	14.19

Methods of Air Analysis

The primary analytical techniques used for analyzing airborne fibers collected on a filter are: Phase Contrast Microscopy (PCM) and Transmission Electron Microscopy (TEM**)**

Phase Contrast Microscopy (PCM)

Phase Contrast microscopy (PCM) is a technique using a light microscope equipped to provide enhanced contrast between the fibers collected and the background filter material. Samples for analysis by PCM are collected on either a 25 mm or 37 mm mixed cellulose ester (MCE) filter with a 0.45 to 1.2 micrometer pore size. Filters are then prepared by either a liquid chemical solution or an acetone vapor that renders the filter material optically transparent. The filter is then examined under a positive phase contrast microscope at a magnification of approximately 400X. Fibers are sized and counted using a calibrated reticule fitting into the microscope eyepiece. PCM is inexpensive ($5 to $15 per sample) compared to the other analytical methods for air samples.

PCM is the analytical method specified in the Occupational Safety and Health Administration (OSHA) Asbestos Standard, and also New York State and New York City asbestos abatement regulations. PCM was first used to monitor asbestos workers' exposure in asbestos product manufacturing or milling operations - for prevention of asbestosis. This method does not identify the fibers it counts and only counts those fibers longer than 5 micrometers and wider than about 0.25 micrometers. Because of these limitations, analysis by PCM typically provides only an index of total concentration of airborne fibers in the environment monitored. As the proportion of the airborne fibers that are less than 0.25 micrometers in diameter increases (ie. non-industrial settings such as asbestos abatement projects), PCM becomes a less reliable analytical tool.

There are two primary fiber-counting methods for phase contrast microscopy. The NIOSH 7400 method is a sample collection and analysis procedure, which has been refined over the years to provide fiber counts with a reliable limit of detection and which are reproducible. The OSHA reference method (ORM) is specified in the OSHA Asbestos Standards and contains modifications to the procedures outlined in the NIOSH 7400 method.

Transmission Electron Microscopy (TEM)

Transmission Electron Microscopy (TEM) is a technique, which focuses an electron beam onto a thin sample mounted in the microscope column (under a vacuum). As the beam transmits through the sample, an image resulting from the varying density of the sample is projected onto a fluorescent screen. Air samples for TEM analysis can be collected on either mixed cellulose ester or polycarbonate fillers and are prepared using direct transfer techniques (per EPA regulations). Direct preparation allows for the transfer of a carbon-coated replica of the filter material (with embedded fibers and particulates, etc.) right on to a copper grid suitable for TEM analysis. Indirect transfer techniques require an intermediate step that may break-up fiber bundles, resulting in an increased fiber count

Several methods exist for the preparation and analysis of air samples by electron microscopy. Most significant are the mandatory and non-mandatory TEM methods set forth as appendices to 40 CFR 763, Subpart E (AHERA Regulations). These methods are to be used, with restrictions, for analysis of final clearance air samples on school abatement projects. Other methods include the NIOSH 7402, the Yamate Method, and the Burdett and Rood Method. Depending on the method used, preparation of the sample can take as much as 24 hours (or more) and analysis can take several hours to a day or more. Costs for TEM analysis typically range from about $50 to $75 per sample.

Sampling Strategies and Procedures for an Abatement Project

Monitoring of an asbestos abatement project through the use of air sampling is a complex task involving both personal and area samples. Air samples can be taken under such widely varying conditions that no two-sample results are alike, even in the same containment area on the same day. The following section outlines some of the fundamental ways air sampling is used to monitor asbestos abatement projects.

Phase IB Background Sampling (NYSDOL)/ Pre-Abatement Sampling (NYCDEP)

Area air sampling conducted before abatement activities begin to estimate the existing airborne fiber concentrations inside and outside the building is termed background air sampling. Results can be used as control data for comparing sample concentrations detected during and after the abatement project. Background air sampling provides good data for documentation purposes. It is particularly useful when an abatement project is conducted in a portion of a building while other areas of the building remain occupied. Airborne fiber levels

monitored in these occupied areas during the abatement project should never exceed the indicated background level in these areas before the project began.

These samples are collected in the proposed work area prior to the asbestos abatement contractor's activities. The regulations do not specify how far in advance these samples could or must be collected. However, the concept is to obtain sample results that are representative of normal activities of that site and are usually collected within a few days of the scheduled asbestos project.

ICR-56 mandates that background samples be collected inside and outside the proposed work area as with Title 15, Chapter 1. New York City however uses "pre-abatement "air sampling to describe the same procedure. The number of samples is equal to and taken in the same locations as the final clearance samples since the results will be compared to each other. The concentration of fibers in the air prior to the project will also be representative of the air that is brought through the work area during the project. The concentration of fibers in the air after final clearance sampling must be at least the same as the air levels obtained prior to the start of the project.

Number of Samples to be collected prior to the project:

Project Size	NYSDOL ICR-56 Background Samples	NYCDEP Title 15, Chapter 1 Pre-Abatement Samples
Large	5 Samples IWA and 5 Samples OWA	5 Samples IWA and 5 Samples OWA
Small	3 Samples IWA and 3 Samples OWA	3 Samples IWA and 3 Samples OWA

Both New York regulations require that additional background/pre-abatement samples be collected if the size of the work area exceeds 25,000 square feet. Therefore, the 5 IWA/OWA samples are the minimum requirement for up to and including 25,000 square feet. For work areas that exceed 25,000 square feet, one additional sample is mandated for every additional 5,000 square feet of work area. For example, if the size of the work area is between 30,000 - 35,000 square feet then 7 samples would be required. This same additional sample requirement also applies when conducting final clearance sampling as per both regulations.

***If the size of the work area exceeds 25,000 ft^2 one additional sample shall be taken for every additional 5,000 ft^2 of work area.**

*** Both NYS and NYC mandate that the air sampling technician be on-site for the duration of the air sampling activity.**

Phase IIA Work Area Preparation Sampling (NYSDOL)/ During-Abatement Sampling (NYCDEP)

Samples are collected during the preparation or set-up of the work area and decontamination units according to both New York regulations. However, preparation of the work area, as per NYCDEP rules, is considered an abatement activity and air monitoring requirements for during abatement activities must be followed. NYSDOL rules distinguish between preparation and asbestos handling activities as different phases of the project. However, the air sampling requirements, in terms of number and location of samples, for both phases are the same. Air sampling conducted during prepping of the work area will indicate whether or not fibers are being released during this activity.

***NYCDEP considers preparation of the work area to be part of abatement activities, therefore the sampling requirements are the same for both activities.**

Code Rule-56 also has similar rules for preparation and abatement sampling activities; however they are treated as different phases. Work area preparation samples shall be conducted daily for the full work-shift, for all large projects with Class I or Class II friable ACM subject to abatement. If more than one daily work-shift is required, air sampling shall be performed on each shift. Air sampling is not required on days when there are no Phase IIA preparation activities being conducted.

A minimum of five samples shall be taken on a daily basis. The locations of samples to be taken are as follows:

1) A minimum of two samples shall be taken outside the regulated abatement work area, within ten feet of the isolation or critical barriers.

    a) When positive pressurized HVAC ducts are located within the regulated abatement work area, one of these samples shall be collected within ten feet of an HVAC diffuser, at the downstream side of the positive pressurized HVAC ducts, in adjoining non-work areas.

2) A minimum of one sample shall be taken outside the regulated abatement work area, within ten feet of and within proximity to each entrance or exit from the regulated abatement work area.

3) One ambient air sample shall be taken outside the building or structure within twenty-five feet of the building.

a) Where the entire building/structure is the regulated abatement work area, an additional exterior ambient air sample, remote from the required exterior sample, shall be taken.

4) Once the negative air systems have been established, one sample shall be taken in front of and within ten feet of each unobstructed, negative pressure ventilation equipment exhaust or bank of exhausts- but not within a duct itself. A bank of exhausts is a grouping of not more than five exhaust ports at one termination area.

5) Once the negative air systems have been established, where negative ventilation unit exhaust ducts run through the non-work area portions of a building to access the exterior, one sample shall be collected in the building, within ten feet of the duct system.

6) If remote decontamination units are used, one sample shall be collected at each entrance/exit from each personal decontamination and waste decontamination unit.

Work Stoppage Criteria during Work Area Preparation through Final Cleaning Procedures [NYSDOL- Phase IIA through IIC Activities]

According to **ICR-56**, if air samples collected outside the regulated abatement work area indicate airborne fiber concentrations at or above 0.01 fibers per cubic centimeter (f/cc), or the established background level, whichever is greater, work shall stop immediately for inspection and repair of barriers and negative air ventilation systems as necessary. **Title 15, Chapter 1** calls this level an Action Criteria. When fiber concentrations are greater than the larger of baseline levels or 0.01 f/cc, then work shall stop for inspection.

In other words, the work stoppage criteria (NYS) or action criteria (NYC) is simply the reverse of the respective clearance levels. At no time during the project should airborne levels be higher than the levels acceptable for work area re-occupancy.

If the work stoppage criteria is exceeded, ICR-56 mandates the clean- up of surfaces outside of the regulated abatement work area using HEPA-vacuums and wet-cleaning methods be performed prior to resumption of preparation, abatement or cleaning activities. A summary of clean -up activities and the results of barrier inspections including any necessary repairs shall be documented in the supervisor's daily project log. Work methods shall be altered accordingly to reduce fiber concentrations to acceptable levels.

Title 15, Chapter 1 adds that the integrity of the barriers, if disturbed, be restored. It also states that HEPA-vacuums or wet-cleaning be used if the levels exceed the action criteria.

Submission of Elevated Air Sample Results Collected During Work Area Preparation through Final Cleaning Procedures [NYSDOL- Phase IIA through IIC Activities]

ICR-56 states that the air sampling asbestos contractor shall submit to the Commissioner of Labor, all PCM air sample results for air samples collected during Phase II A through II C along with background results, if they are greater than or equal to 0.01 f/cc or the established background level, whichever is greater. Upon receipt of elevated air sample results, the air sample results shall be submitted immediately, within the same business day, to the Commissioner in care of the appropriate district office of the Asbestos Control Bureau, where the project takes place.

Title 15 Chapter 1 mandates that any air sampling results/reports be submitted directly to the NYCDEP Asbestos Control Program (ACP) within five calendar days *upon request.*

Phase IIB Asbestos Abatement Sampling (NYSDOL)/ During-Abatement Sampling

Area air samples are collected outside the work area daily to monitor and document that the airborne fiber concentrations outside the work area are under the allowable limits as specified by ICR 56 and Title 15 chapter1. If the airborne fiber concentrations outside the work area exceed 0.01 f/cc, or the background level, whichever is higher, than the abatement contractor should stop work and immediately clean the work area until a return to acceptable levels. Both NYS and NYC have specific requirements for the number and placement of air samples during abatement, depending on the size of the project.

These samples are especially important in situations where unprotected people are occupying other areas of the building. Potential leakage points where sampling should be conducted include the clean side of the containment barriers separating the work area from occupied parts of the building and inside the clean room of the decontamination unit. If the configuration of the work area is such that sealing the area is difficult due to interference from piping systems running through the area, it is especially critical to sample outside the work area. If the abatement project is being conducted in a multistory building, area air samples should be collected from floors above and below the abatement activity.

Code Rule-56 mandates the same number, location, and daily sampling requirements for during abatement as for work area preparation sampling. [See previous discussion on "Work Area Preparation Sampling"] However, daily air sampling activities are not required during exterior asbestos projects with abatement of non-friable ACM roofing, siding, caulking or glazing compound, tars, sealers, coatings or other Non-Friable Organically Bound (NOB) ACM's, unless the ACM is rendered friable during removal or debris falls inside the building.

According to **Title 15, Chapter 1**, there is no set number of samples to be taken when conducting area sampling during abatement. The number of samples is directly related to the individual work area. Prior to conducting during abatement sampling, a person must understand the scope of work in order to know how many samples will be taken.

On all large asbestos projects, the following area samples shall be taken on a daily basis as per NYCDEP:

1. Two samples shall be taken outside the work area and the enclosure, but within the building or structure. These samples shall be located within ten feet of any isolation barriers. Where a negative air exhaust duct runs through the uncontaminated area, one of these two samples shall be placed near the duct. Where adjacent areas do not exist, one outdoor sample shall be taken.

2. One area sample shall be taken within the entrance of the worker and waste decontamination units. In New York City, a separate waste decontamination unit is required on all projects that meet or exceed 1,000 square or linear feet unless a variance has been granted.

3. One area sample shall be taken within 5 feet of each negative air exhaust - if exhausted indoors.

Minimum Sample Duration (time) and Volume, and Allowable Flow Rate Ranges

The amount of time that pumps could run is calculated by taking the required volume of air (measured in liters) which must pass through the pump and dividing it by the flow rate of the pump. The flow rate of the pump is the amount of air that passes through every minute [measured in liters per minute (LPM)

$$\text{Time (min)} = \frac{\text{Volume (L)}}{\text{Flow Rate (L/min)}}$$

The NYCDEP ACP requires the following schedule for pre-abatement and during abatement sampling:

Samples Analyzed By:	Minimum Volume of Air	Allowable Flow Rate Range
PCM	560 liters	5-15 liters/minute
TEM	560 liters	1-10 liters/minute

It is good practice to run your pumps somewhere in the middle of the required flow rate range. The longer you sample, the greater the accuracy of the results. Also, it is desirable to get the best representation of the air before or during abatement. If you run a pump at the maximum flow rate, you will only sample a short time and will have a less statistically accurate representation of the air for that day.

Let's try a simple calculation for understanding how to determine the minimum amount of time that the regulations allow you to sample. Suppose you are conducting pre-abatement sampling in a 2,500 square foot area in New York City. These samples will be analyzed by PCM. Since this is a large asbestos project we know we must place 5 pumps randomly throughout the proposed work area. We also know we must collect a minimum of 560 liters of air according to the chart above.

For this example, all our pumps will be calibrated to run at 8 liters per minute. This is well within the range of 5-15 liters required by the regulation. We simply divide the volume of air required for pre-abatement sampling (560 liters) by the flow rate of our pumps (7 liters per minute):

$$\frac{560 \text{ Liters}}{8 \text{ liters/min}} = 70 \text{ minutes}$$

In this example, once all the pumps have run for at least 70 minutes, the pre-abatement/during abatement sampling is complete provided that the shift is over. The sampling should continue to represent the actual conditions of the abatement. Either keep the same filter/cassette connected to the pump or replace it with a new one if it is becoming overloaded with particulate.

Code Rule 56 does not contain any minimum volume or allowable flow rate range requirements. It only specifies that area air samples, except for background and clearance air samples, shall be collected and run for each entire work shift. Also, area air samples must be collected with a minimum flow rate capacity of two liters per minute and a maximum flow rate consistent with the applicable accepted air sampling and analysis methodology [NIOSH 7400 Method for PCM or AHERA, Appendix A for TEM].

For PCM, NIOSH lists an allowable flow rate range of 0.5 -16 LPM. ICR 56-4.7(b) states however that " Area air samples must be collected with a minimum flow rate capacity of two (2) liters per minute and a maximum flow rate consistent with the applicable accepted air sampling and analysis methodology. The flow rate for each air sample shall be pre-calibrated and post-calibrated at the beginning and end of each air sample collection. The calibrations shall be recorded." Therefore, it can be deduced that the NYSDOL would require an allowable flow rate range of 2-16 LPM for PCM air sampling.

Air Sampling After Final Cleanup of Work Area (Clearance Air Sampling)

Phase IIC Clearance Sampling (NYSDOL)/Post-Abatement Sampling (NYCDEP)

Area air sampling is conducted upon conclusion of an asbestos abatement project to estimate the airborne concentration of residual fibers. The area must pass a thorough visual inspection for remaining material before final clearance sampling is initiated.

Final clearance air samples are typically collected using high volume pumps to draw a pre-determined volume of air. ICR 56 and 15 RCNY 1 have specific requirements for the number and placement of clearance air samples, depending on the size of the project. Samples should be collected using aggressive techniques. Aggressive air sampling involves physically or mechanically agitating the air in the work area during the sampling process. Typically, a 1 horsepower leaf blower is used on all surfaces in the work area to dislodge any residual fibers. Then, a standard box fan is left on for the duration of sampling to keep any dislodged fibers airborne. As of March 21, 2007, ICR 56 states that in lieu of PCM clearance air sampling and analysis, the building/structure owner may elect to utilize TEM air sampling and analysis to meet clearance air sampling requirements. As discussed earlier, TEM is the analytical method recognized as having the best resolution and positive fiber identification capabilities, and is required when performing clearance sampling in schools under the AHERA regulations.

Aggressive Sampling

As opposed to the passive or stationary sampling done for background/pre-abatement and daily sampling, final clearance sampling requires the Air Sampling Technician to perform an aggressive technique. The reason for aggressive sampling is to agitate any settled asbestos fibers so they will float in the air where they will be collected by the filter/cassettes of the air sampling pumps. ICR-56 and Title 15, Chapter 1 have the same aggressive sampling requirements:

***Prior to final clearance sampling, the area must be clean, free of all visual dust and debris, dry, and have visual inspections before aggressive sampling can begin.**

Pre-Sampling Agitation

The exhaust of forced air equipment (i.e. a 1-hp leaf-blower or like device) is aimed at all walls, ceilings, floors, ledges, and other surfaces to stir up the air. This agitation must continue for 5 minutes for every **1,000 square feet of floor area.**

For example, an abatement area of 6,000 square feet would require that the technician agitate the air for at least 30 minutes. Pre-sampling agitation is conducted prior to running the clearance sampling pumps.

Ongoing Agitation

At least a 20-inch box fan shall be placed in the center of the work area (or randomly scattered throughout). One fan per 10,000 ft3 of room space must be used. Fans must be pointed toward the ceiling and operated at the "slow' speed. These fans run at the same time and for the same duration of the final clearance air sampling pumps.

Final clearance sampling is a comparison to the pre-abatement (NYC) or background (NYS) levels; therefore, the technician should use the same sample locations for both.

Number of Samples to be collected for Final Clearance:

Project Size	NYSDOL ICR-56 Clearance Sampling	NYCDEP Title 15, Chapter 1 Post-Abatement Sampling	AHERA Completion of Response Action Sampling
Large	5 Samples IWA and 5 Samples OWA	5 Samples IWA and 5 Samples OWA	5 Samples IWA and 5 Samples OWA via TEM
Small	3 Samples IWA and 3 Samples OWA	3 Samples IWA and 3 Samples OWA	5 Samples IWA via PCM

The same pre-abatement/background sampling requirement for additional samples also applies to clearance sampling:

***If the size of the work area exceeds 25,000 ft , one additional sample shall be taken for every additional 5,000 ft^2 of work area.**

PCM sampling requires a minimum of two field blanks or 10% of the set be submitted, while TEM sampling requires two field blanks and one sealed blank be submitted per set.

ICR-56 states that if the entire building is the regulated abatement work area, one sample shall be collected outside the building within ten feet of isolation barriers for both small and large projects.

According to NYSDOL ICR-56: There is no exemption from the above requirements for Small or Large size negative pressure tent enclosure work areas. The amount of material abated within each regulated abatement work area determines the project size clearance air sampling requirements for each regulated abatement work area.

Final Clearance air samples are not required for the following activities:

- **Minor projects, unless there is glove bag or tent failure.**
- **Exterior asbestos projects completed without a negative pressure enclosure.**

When clearance sampling is not required, once the final cleaning is complete, the appropriate waiting/settling or drying time requirements shall commence and then a visual inspection shall be completed by the asbestos abatement contractor supervisor and the project monitor.

ICR-56 Clearance Rules for
Minor Projects & Minor Size Regulated Abatement Work Areas

1. The minor project clearance rules apply to the following activities:
    - If a Minor size regulated abatement work area is part of a Small or Large project;
    - If there is glove-bag or tent failure or loss of integrity;
    - If it is an incidental disturbance project.
2. A minimum of two samples shall be collected. One sample shall be collected IWA and one sample shall be collected OWA, within the building, in an uncontaminated area within ten feet of the isolation barriers.

PCM Final Clearance Criteria:

NYSDOL Clearance Level	Final clearance is achieved when every sample is **less than 0.01 f/cc or the background level,** whichever is greater	**NYSDOL** **<0.01 f/cc**
NYCDEP Clearance Level	Final clearance is achieved when every sample is **less than or equal to 0.01 f/cc or less than the ambient concentration**, whichever is greater	**NYCDEP** **≤0.01 f/cc**
AHERA Clearance Level	The response action is considered complete when the concentration for each of the five samples is less than or equal to 70 structures/mm²	**AHERA** ***≤70 structures/mm²***

ICR-56 states that the same NIOSH approved methodology for required project air sampling and analysis shall be used at all phases of an asbestos project, with the possible exception of clearance air sampling. PCM shall be the minimum acceptable method of analysis. In lieu of PCM clearance air sampling and analysis, the building owner may elect to utilize TEM to meet the clearance requirements.

If PCM air sample analysis results fail, then TEM analysis of the entire set of clearance air samples may be used, provided that a standard NIOSHI NYSDOH-ELAP accepted laboratory analysis method is used. The method shall report each air sample result in fibers per cubic centimeter, for appropriate correlation to the original unsatisfactory PCM results and the established background levels.

Submission of Satisfactory Clearance Air Sample Results

According to ICR-56- if the PCM results are greater than or equal to 0.01 *f/cc,* but less than the background levels- the results are considered satisfactory. If this is the case, the air sampling asbestos contractor shall submit these satisfactory PCM clearance air sample results along with background results to the NYSDOL.

Also, all sets of satisfactory TEM analyses of previously unsatisfactory PCM clearance results along with the unsatisfactory PCM results have to be submitted. These air sample results shall be submitted, within two business days of receipt of satisfactory clearance air results, to the appropriate district office where the project takes place.

Title 15, Chapter 1 requires final clearance air monitoring results be submitted to the NYCDEP ACP within 24-hours of request.

Unsatisfactory Clearance Air Sample Results

Title 15, Chapter 1 requires that any work area which does not meet the clearance criteria shall be thoroughly re-cleaned using wet methods and re-tested. The process is repeated until the work area passes the test.

ICR-56 - states that if the clearance air sampling results are unacceptable, the following requirements apply:

a) **If the results of the IWA samples are unsatisfactory**, re-cleaning of the work area surfaces using wet methods, followed by another drying time period and then collection and analysis of an additional full set (both IWA and OWA samples) of clearance air samples is required.

b) **If only the results of the OWA samples are unsatisfactory**, clean-up of surfaces outside of the work area using HEPA vacuums and wet-cleaning methods shall be performed prior to retesting of an additional group of OWA clearance samples.

c) This re-cleaning/clean-up and sampling process shall be repeated until satisfactory clearance air sampling results have been achieved for all asbestos project non-exempt regulated work areas throughout the entire work site.

TEM Final Clearance Criteria:

Both New York asbestos regulations refer to AHERA for TEM clearance criteria and sampling protocols. These protocols can be found in the Response Actions section of AHERA [763.90 (i)(1) - (4)], as well as in Appendix A, 11- Mandatory TEM Method.

AHERA requires TEM for final clearance for all projects greater than 260 linear feet or 160 square feet. For our purposes, we will say that TEM is required for large projects in schools (K-12th grade, etc.).

Title 15, Chapter 1 mandates TEM for final clearance for all projects greater than or equal to 10,000 linear or square feet of ACM. TEM clearance is not required for projects in boiler rooms, for glove-bag work, or for pre-demolition projects.

ICR-56 does not have a direct requirement that mandates TEM analysis for clearance sampling in terms of the size of the project. However, as stated earlier, whichever method of sampling is chosen at the beginning- must be used throughout the project. Therefore, ICR-56 would mandate TEM for final clearance only if TEM was chosen for background sampling. In other words, if the project is started with TEM, it must end with TEM.

AHERA has two options for TEM clearance levels:

1. Z-test calculation:
This is a statistical calculation that compares the average concentration of the IWA air samples to average of the OWA air samples. The abatement is considered complete if the average of the five IWA samples **is not statistically significantly different** than the average of the five OWA samples; and the average of the three blanks is below the filter background level.

2. Filter Background level:
An abatement project is also considered complete if the minimum volume achieved is 1,199 liters of air and if the average of the five IWA samples does not exceed the filter background level of **70 structures per square millimeter [70 s/mm^2].**

If the average of the five IWA samples does exceed the 70 s/mm2 criteria, then either the Z-test can be calculated or the work area can be re-cleaned, re-tested, and the results compared to 70 s/mm^2 again. Most people use this filter background level criterion for TEM clearance.

The abatement project is considered complete if the average of the five IWA samples are **≤70 structures / mm^2** via TEM

Minimum Sample Volume and Allowable Flow Rate Ranges for Final Clearance Sampling

Title 15, Chapter 1 requires the following schedule for clearance sampling:

Samples Analyzed By:	Minimum Volume of Air	Allowable Flow Rate Range
PCM	1800 liters	5-15 liters/minute
TEM	1250 liters	1-10 liters/minute

NYSDOL ICR·56 does not specify a certain type of analysis nor does it require a specific flow rate range or a minimum volume of air. As mentioned earlier, ICR-56 refers to the NIOSH 7400 Method for PCM air sampling and analysis protocols. Therefore, the flow rate ranges and minimum volumes specified in the NIOSH 7400 Method for PCM should be used for New York State projects [See the "During Abatement section for more discussion]. If TEM is used, the AHERA protocol must be followed at minimum.

Personal Air Sampling

Personal sampling is conducted during a renovation or abatement project to determine employees' exposure (outside the respirator) to airborne fibers. Data from personal monitoring serves many purposes. Monitoring during an abatement project is required by the OSHA Asbestos Standards (29 CFR 1910.1001 and 1926.1101). Under OSHA and hazard communication laws, employees have the right to know the asbestos concentrations to which they are exposed and what measures are being taken to protect them. Also, results of personal sampling can be used to select proper respiratory protection for an employee if conditions warrant something other than Type C (airline) respirators (see Respiratory Protection Section). Data from personal monitoring can be used as an indication of effective removal or control techniques, which result in the lowest employee exposure. This, in turn, reduces the potential of asbestos-related diseases and the risk to the worker.

Personal samples should be collected during the first full day of removal activity. It is generally accepted that this "initial" monitoring must be performed on at least 20% of the work force involved in the project and that it is required regardless of the respiratory protection used (no waiver for Type C respirators). Initial monitoring must be conducted to determine both the 8-

hour time weighted average and the 30 minute short-term excursion exposure. Even though 20% of the work force is used, “OSHA requires that a **"representative" number of workers be sampled who are performing different job functions within a regulated area”**

Periodic monitoring must be performed when the type of material being removed or the location of removal changes. For the OSHA Construction Industry Standard (29 CFR 1926.1101), the exception to this requirement involves workers using supplied air, positive pressure (Type C) respirators. Also, when monitoring indicates exposures below the PEL (0.1 f/cc) and/or the excursion limit (1.0 f/cc), daily monitoring may be terminated until conditions significantly change. However, it is prudent to conduct personal sampling on a periodic basis regardless of the type of respiratory protection used.

Samples for asbestos exposure should be taken to determine the 8-hour, time-weighted concentration, as well as the 30-minute excursion limit. Over an eight-hour period, filters may have to be changed several times to prevent overloading. Results of each sample are put into the following equation to obtain a time-weighted average concentration for the total sampling period:

$$\frac{C_1T_1 + C_2T_2 + C_3T_3 +}{T_1 + T_2 + T_3 +} = \text{Time Weighted Average}$$

Where C is the fiber concentration expressed as f/cc and T is the duration of sample in minutes.

The abatement contractor's supervisor is responsible for ensuring that these personal samples are collected as per OSHA's requirements. Personal samples are collected by using low-volume or "personal" pumps.

Once the pump is in place, the following information must be recorded: the name and social security number of the worker; the date of the measurement; the operation involving exposure to asbestos; sampling and analytical method used; the number, duration and results of the air samples; and type of protective devices worn (ie. type of respirator). The employer must maintain the exposure records for 30 years.

The employer must notify affected employees of the results of monitoring representing the employees' exposure in writing either individually or by posting at a central location as soon as possible upon receipt. This location must be accessible to all employees and be outside the work area.

According to the OSHA Reference Method (ORM), 29 CFR 1926.1101, Appendix A, the following protocol shall be followed:

- The sampling filter/cassette shall be a 25mm diameter cassette with a 50mm electrically conductive extension cowl, and a mixed cellulose ester (MCE) filter. When sampling, the cassette shall be open faced.
- **An air flow rate shall be selected between 0.5 - 2.5 liters per minute.** (29 CFR 1926.1101, Appendix B, which is non-mandatory, recommends a flow rate of 0.5 -5.0 liters per minute).
- Where possible, a sufficient air volume for each sample shall be collected to yield between 100 and 1,300 fibers per square millimeter on the membrane filter. If a filter darkens in appearance or if loose dust is seen on the filter, a second sample shall be started. [If too much dust is allowed to load onto the filter, it can become ·overloaded with particulate." If an analyst designates a filter as ·overloaded," it means that the particulate masked the fibers to the extent that they can't be counted and therefore a sample result in f/cc is impossible.)
- The samples shall be shipped in a rigid container with sufficient packing material to prevent the dislodging of fibers (Do not use packing material with a high electrostatic charge on its surface e.g. expanded polystyrene);
- **Calibrate** each pump before and after use with the appropriate filler cassette installed between the pump and calibration device;
- The personal samples shall be taken in the "breathing zone" of the worker.

CHAPTER 10

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 158). 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 160) 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 159) for Homogeneous Area No.1, using the table in Figure 3 (page 160). If three samples are needed, take from the sub-areas marked 1, 2 and 3. If 5 samples are needed, take from the sub-areas marked 1 – 5 and 7 and 8 were used to obtain 7 samples. 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 160) will then need to be adapted to the specification.

Figure 4 (page 161) 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 160). If you have more than 18 sampling areas, start again at the top of the table in Figure 3 (page 160) 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 158).

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 10,080ft² (square feet) as calculated by:

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

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

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 160) 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 159). 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 $\leq$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

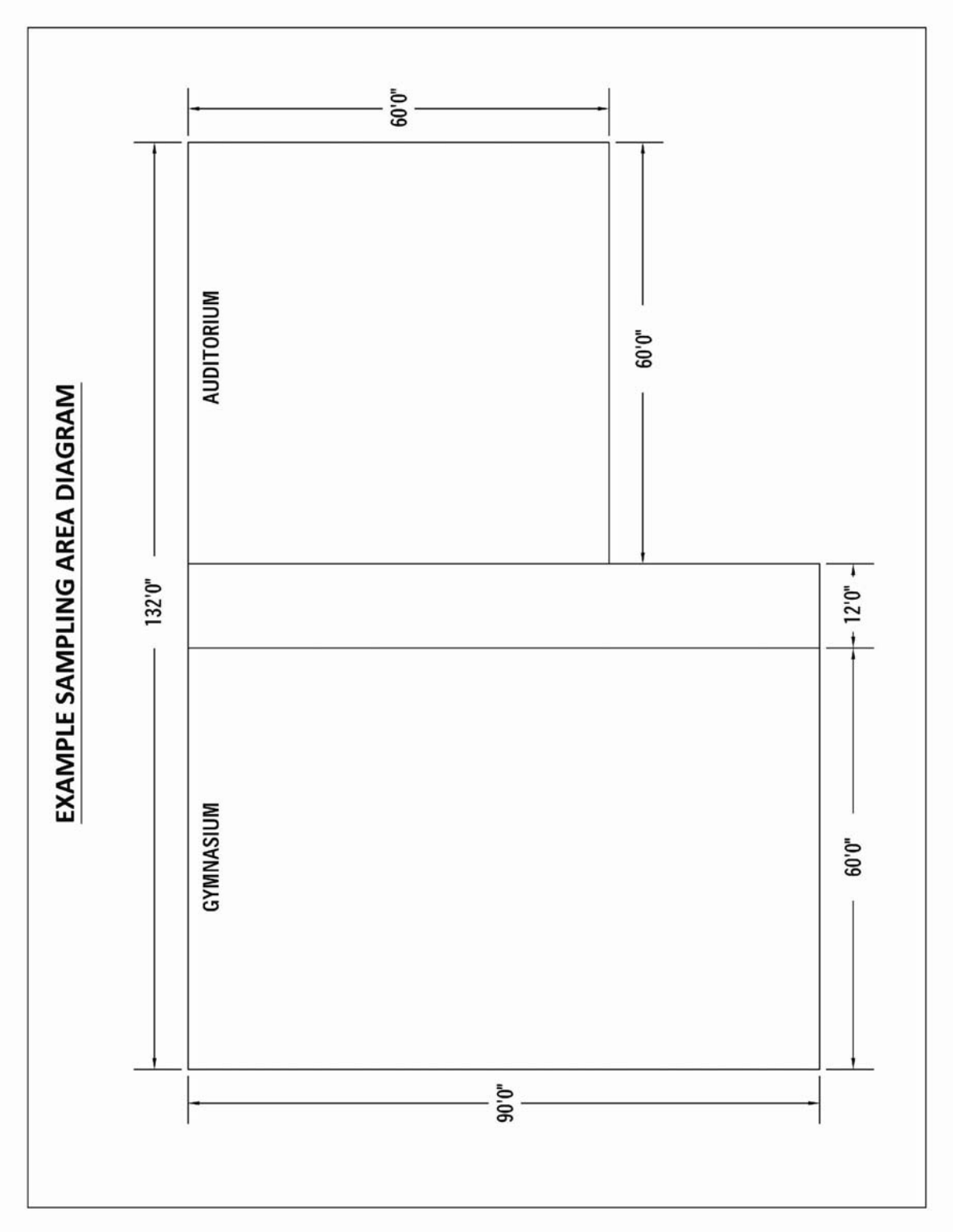

EXAMPLE SAMPLING AREA DIAGRAM
AUDITORIUM
GYMNASIUM
60'0"
60'0"
12'0"
132'0"
60'0"
90'0"

Figure 2

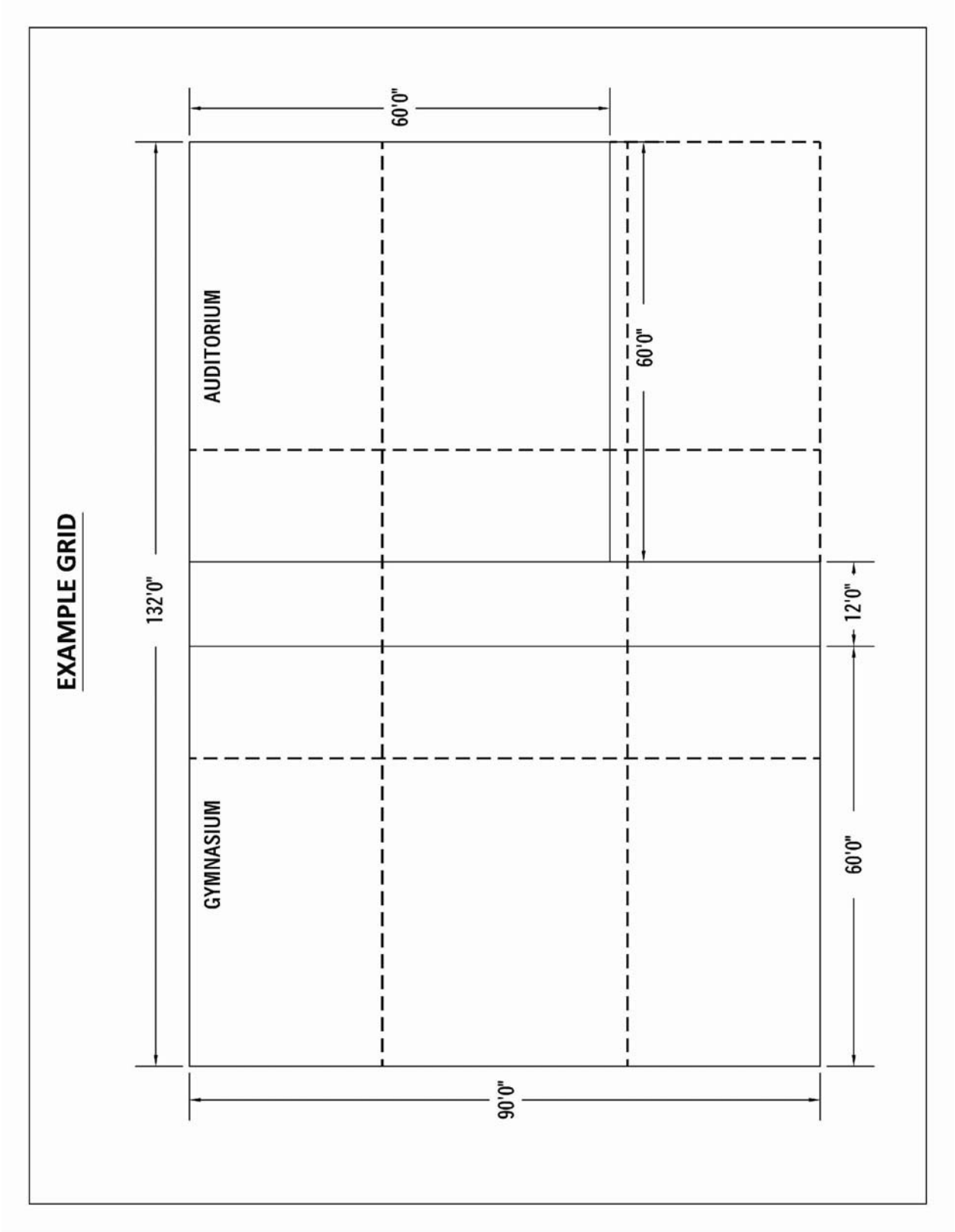


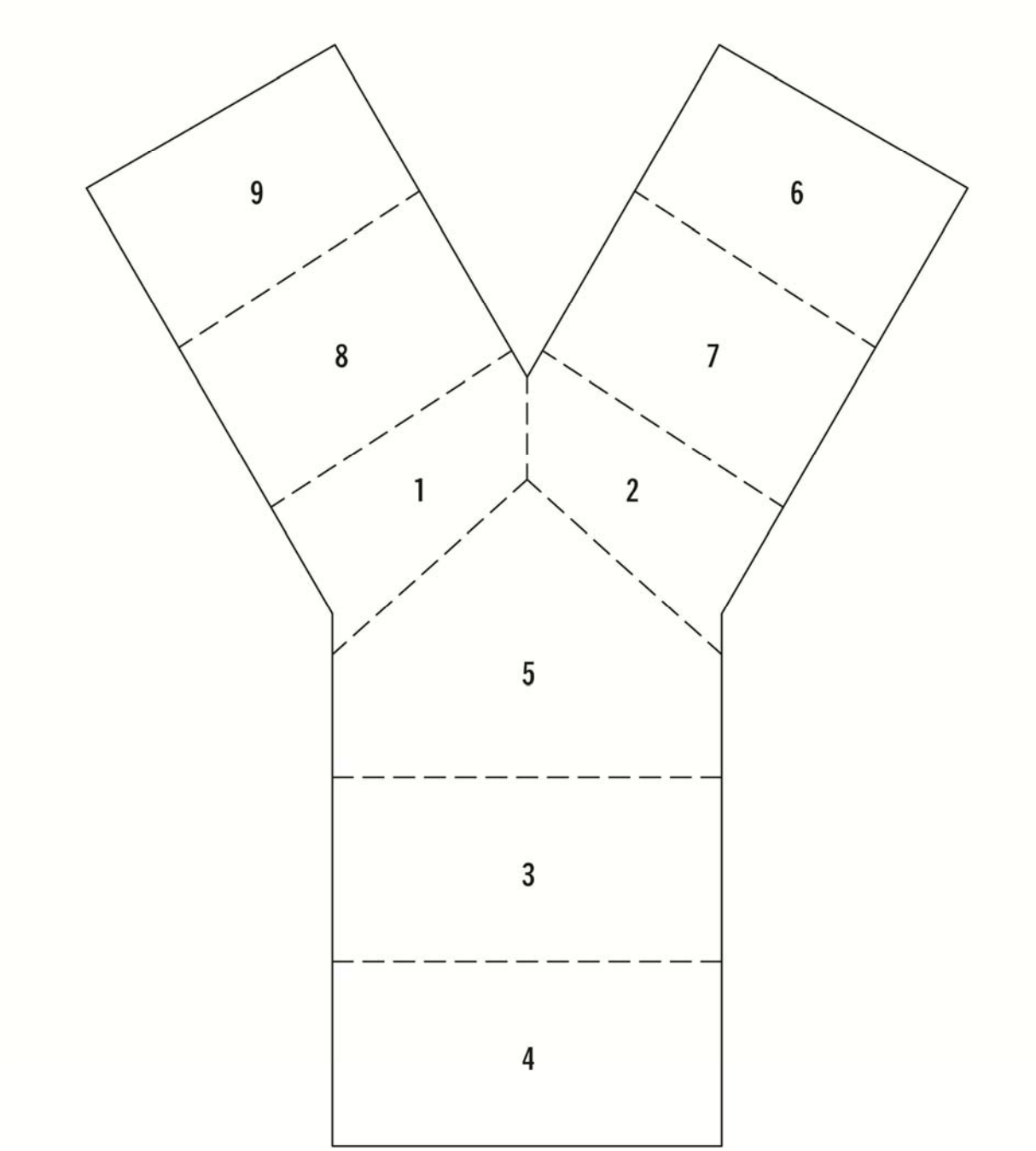
Figure 3

RANDOM NUMBER DIAGRAMS

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

Figure 4

EXAMPLE Y-SHAPED SAMPLING DIAGRAM



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CHAPTER 11

Supervisor Skills

Introduction

Management is the process of accomplishing a goal through effective use of resources. The resources may or may not include people. For the purposes of this chapter, management will be directed to the role of the New York State/City Asbestos Supervisor and resources will include people.

This chapter will focus on basic supervisory skills as they apply to work associated with compliance with Federal, State, and Local asbestos-related regulations. The areas to be presented will include 1) leadership skills, 2) effective communication, 3) good listening practices, 4) problem solving and 5) decision-making.

Leadership Skills

There are a variety of skills to consider when looking at what makes a good supervisor. D. Domeyer an Office Team Executive Director listed the following in *Women in Business, 1999:*

- **Communicate** Clearly
- Set a **Good Example**
- Encourage **Feedback**
- Offer **Recognition**
- Help Employees See the **Big Picture**
- Create an Environment of Constant **Learning**
- Provide Professional **Guidance**

Another set of personality factors was compiled of responses from subordinates. The people were asked what they consider to be good attributes of their supervisors. This survey was conducted by M. A. Smith and J. M. Canger and published in *Journal of Business and Psychology,* 2004. Below are their findings:

- High Level of **Agreeableness**
- High Level of Emotional **Stability**
- High Level of **Extraversion**
- Low Level of **Conscientiousness**
- Affective **Commitment**

The Leadership Academy of The University of Illinois identifies the following four areas for development for leadership skills as they deal with interpersonal development:

Relationship Building
Communication
Ethical Practices
Team Development

Finally, one last list is from L. V. Imundo who identifies in his book *The Effective Supervisor's Handbook,* 1991, the following list of reasons why supervisors fail.

- Too eager to please.
- Promises you can't keep.
- Blaming others.
- Loose cannon.
- Doing employees' work.
- Passing the buck.
- Too tempermental.
- Abuse of privilege.
- Favoritism.
- Making excuses.

From these lists, four areas will be expanded upon. These four areas deal with many underlying themes associated with the items identified on the lists. Communication can be seen in nearly all items listed. Effective communications develop the leadership skills of a supervisor. Good listening practices directly affect communication. An effective supervisor will develop good listening practices, so they will communicate better. Decision-making and problem solving go hand-in-hand with each other. Good decisions and practical problem solving will address many items in the why supervisors fail list.

Communication

As identified earlier communication is an interpersonal skill that should be developed to become a good or better supervisor. Communication is the exchange of thoughts through

speech, actions, expressions, written information, and behavior. When working with asbestos, effective communication is essential to protect the health of workers and the public. Clear communications can prevent asbestos-related disease.

Communications can fail for a variety reasons. Some of the reasons are identified in the next section under listening skills. Imundo uses the following acronym to which many people are familiar. By following this acronym, many failures in communications, particularly on the listening aspect, can be avoided.

The **KISS** Principle

- **K**eep
- **I**t
- **S**hort and
- **S**imple

Imundo goes on to identify the following **barriers to communication**:

- Sentiments
- Language
- Prejudice and Bias
- Position, Role and Importance in the Organization
- Time
- Space

All the aspects identified by subordinates (agreeableness, stability, extraversion, conscientiousness, and commitment) all have an underlying themes relating back to communication. A high level of emotional stability can be perceived by a consistent communication style. Employees should be able to expect the same type of communication style when they approach their supervisor regardless of the situation.

Agreeableness is not necessarily that the supervisor will agree with everything the worker presents, but in this context agreeableness deals with conformity, pleasing, and consistency. The supervisor's communications should be presented in a way that will allow for change to a situation while remaining consistent with past communications. Supervisors working in asbestos abatement have a set of regulations and company policies to follow. Conforming to these regulations is a requirement, but allowing workers to present their view on the abatement process will allow better overall communications. The workers have been trained on the regulatory requirements of the abatement process, and can provide insight from their perspective.

The process to achieve this "big picture" (regulatory compliance) can be achieved in a variety of ways. Asbestos workers may be able to present work practices that can make the abatement process more efficient. The supervisor should be able to determine whether the worker's suggestions conform to regulations and company policy. If so, the supervisor should consider the suggestions and communicate the decision to the worker. If the suggestion does not meet with the requirements, the supervisor should be able to identify and explain the requirements to the worker.

Consistency in communications as it applies to workers' perceptions keeps arising during the various materials presented. The message and the way the message is presented must remain the same through the asbestos project. This does not mean change cannot occur, but the method of change and the way the changes are presented must remain consistent with the initial communication.

Good Listening Practices

Hearing is different from listening. "I hear you" does not mean I understand what you are saying or what you are meaning to communicate. A good listener remains focused on the information being communicated. Imundo identifies some simple rules for good listening.

- Be patient.
- Listen even if you disagree.
- Do not bias on the speakers mannerisms or image.
- Ask for clarification.
- Wait until the message has ended before replying.

M. Brody and D. Alati presented the following information in *Incentive, 2004.*
Improve your attention through S.O.F.T.E.N.

- **Smile**: Facial expressions can be difference between inviting and discouraging communication.
- **Open posture**: Body language can make or break a dialogue. Don't cross your arms. This gesture does not promote conversation.
- **Forward lean**: Body positioning speaks volumes. Again, it can invite or discourage interaction and communication.
- **Tone**: The sound of your voice can promote listening. Show enthusiasm with pitch and inflection.
- **Eye Communication**: Making eye contact is critical. It shows that you are paying attention to the speaker.

Brody and Alati provide the following do's and don'ts for good listening practices.

Do

- Paraphrase for understanding
- Ask appropriate and relevant questions
- Make statements that reflect similar situations

Don't

- Interrupt
- Switch subjects mid-stream
- Tune out and daydream
- Finish sentences for other people

Decision-Making

Decision should be made on solid information. Making decisions on vague or incomplete information may lead to incorrect conclusions and wrong decisions. Wrong decisions will need to be corrected later, and may lead to a perception of inconsistency with communications and attribute instability to the supervisor.

In asbestos abatement, decisions are determined through regulations, policy and contractual agreements. Accurate decisions by the supervisor are derived though the supervisor's knowledge of regulations, policy and the job's contract.

Most times people decide what they want to accomplish before they determine how that will be accomplished. Asbestos abatement is decided then the process of removal is determined. The process must meet applicable asbestos regulations, company policies and any contractual agreements.

Problem Solving

Problems in asbestos abatement like other problems in the workplace are often addressed at the immediate issue rather than finding the source of the problem. Teamwork in problem solving can be very beneficial in finding the source and providing workers' with empowerment. Supervisors may see problems, but not identify the sources. The worker very often can identify the source of problems.

W. W. Hull identified the following process for problem solving in *Supervision,* 2004.

- Define the problem.
- State the facts.
- State the advantages of solving the problem.
- As the employee what are the obstacles that are in the way of solving the problem.
- State possible solutions.
- Decide what to do.

Supervisors who do an appropriate problem solving process that includes workers' input may be perceived as being conscientious and committed. Solid and consistent decisions made through this problem solving process will once again add to the supervisor's aspects on stability and agreeableness.

Conclusion

Supervisors who have effective communications will develop attributes such as agreeableness and stability that are preferred by workers. Supervisors who develop good listening skills will be attributed with being conscientious. Decisions made on accurate and complete information will lead the supervisor to affective commitment. Problem solving that includes worker input leads again to the supervisor's attribute of conscientiousness.

Clear communications, good listening, concise decision-making, and accurate problem solving will establish the supervisor as a good example to the workers. The supervisor through decision-making and problem solving will provide appropriate feedback, recognition and learning for the worker.

The supervisor must always maintain a professional posture. The supervisor's actions and words must always be in keeping with proper ethical practices. The supervisor through actions and practices will be the example for guidance for the worker and the worker/team development.

CHAPTER 12

Legal and Insurance Considerations

Introduction

The owner or manager of a building facing the presence of asbestos has many potential problems. A major area of concern for building owners is the legal implication of asbestos present in buildings. In general, the problems can be divided into three areas. One broad area is the law of torts or legal wrongs. This could include the possibility of an owner or contractor being sued for failure to ensure proper asbestos abatement. It could also include a cost recovery action by an owner who has or will perform an abatement program. The second broad area of concern to owners is the area of contracts as related to asbestos abatement programs.

Finally, the type of law that applies to potential liability in this field is state rather than federal law. This means that one gets different decisions (known as "precedent") in each of the states. This can make for a patchwork quilt of law. You can be facing different legal rules and requirements when you work in different states.

The law is seldom a leader. So it often takes many years after a problem first appears to arrive at a clearly defined legal precedent (decisions of courts). It is also because there is a range of people who might file a legal claim. These include building owners, workers, and visitors to the building, delivery people, and other members of the general public.

Types of Liability

There are four basic types of liability: contractual, tort, regulatory and criminal.

Contractual Liability

The contractor 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 asbestos contractor. 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.

Perhaps the best example comes from the public bidding process where selection on the basis of price is required by procurement regulations. Most asbestos abatement contracts bid on a competitive, fixed-fee basis after the building management has presented the building plans, and the square footage and/or linear feet estimates of material to be abated are identified. In this context, the price of the contract becomes the focus.

Clarity in contract language is the best means of avoiding disputes. It is imperative that the contractor read the specifications prior to bidding. This is especially important if the specifications reflect actions to be performed in the project, which exceeds standards required by law. The timing of the completion of the abatement can be of great concern to the building management and can be the subject of a breach of contract. Liquidated damages are often defined in the contract and are claimed against the contractor for failure to complete on time.

The records turned over to the school or building owner by the contractor 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 waste between the contractor's supervisor and waste hauling company is an example of where the contractor supervisor may be held liable if he/she did not check for proper licensing and permits of the hauler and dump site.

Indemnification Clauses

Many contracts contain provisions requiring that the asbestos contractor indemnify the owner for liability arising out of the performance of abatement services. Indemnification clauses are highly complex and may be subject to differing interpretations in various states. It is important for every contract to be reviewed for such clauses and that the scope of the indemnity be carefully defined to avoid unintended liability for the building owner.

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 the contractor would be negligence. A negligence claim alleges that the contractor 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 contractor 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 contractors practicing in the same or a similar locality. The plaintiff must prove each of the following items:

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

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

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

- **Injury**
  The plaintiff must show that he/she was "injured" by the contractor'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 contractor'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.

The following examples help to illustrate tort liability:

Example A

The design contract requires the development of written specifications to remove sprayed-on surfacing material in a multi-story building. The specifications neglect to address proper isolation of the high-rise elevators; as a result, fiber contamination occurs on floors above and below the work area. The Project Designer could be accused of negligence for a design that did not prevent fiber migration.

Example B:

The Supervisor leaves the lockable door of the decontamination unit open on the ground level at a school over the weekend. Subsequently kids in the schoolyard playing enter the work-area and fall down the stairway over asbestos waste bags. The supervisor, deemed as the ”Competent Person”, a case for negligence could then be argued in a court of law.

Some tort liability considerations are:

- Improper worker protection
- Cutting corners on the abatement project
- Injury due to improper work practices
- Uncertified workers
- Improper recordkeeping

Regulatory Liability

An asbestos contractor can be held liable for non-compliance with federal, state or local regulations. Therefore, regulatory agencies on all levels have adopted diverse and explicit regulations concerning the performance of asbestos abatement.

The failure to comply with regulations can result in both fines and revocation of the contractor’s license. These actions are taken by an administrative agency, such as the Environmental Protection Agency (EPA) or the New York State Department of Labor (NYSDOL). Any arguments made by the contractor 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 the contractor attempt to obtain relief from an administrative action by going to court.

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

For example, if the asbestos supervisor allows non-compliance with regulations on the job, his company, the building owner, and in some cases the Supervisor himself could receive a violation. The Project Monitor, if required other than for the visual inspection after the third cleaning, is responsible for overseeing the scope, timing, phasing, and/or remediation methods used on the asbestos abatement project. If the Project Monitor allows non-compliance with regulations on the job, their company and/or the building owner could receive a violation.

Criminal Liability

With the costs of abatement and the highly regulated field that is asbestos, it is possible for an asbestos abatement contractor 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 contractor must meet two elements. First, the contractor must know his actions are wrong. Second, the contractor must perform a guilty act. An example would be the contractor who consciously illegally removes asbestos from a building without proper notifications and filings, using unlicensed personnel, and illegally dumping of the material, 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.

Federal Statutes

Both tort and contract law are aspects of the common law. That is, they are generally recognized principles that have developed from the evolution of judicial cases over time. In addition, there are specific state and federal statutory requirements regarding the handling of hazardous materials. These are enacted by federal and state legislation to supplement the common law. These provide additional standards and obligations that are binding on all persons. Here we want to outline very briefly several of the federal statutes. In some cases, the state statutes are even stricter.

The key federal statutes responsible for much of the hazardous waste and toxic tort litigation, and resultant insurance coverage disputes, include the Resource Conservation and Recovery Act 1976 (RCRA) and the Comprehensive Environmental Response , Compensation and Liability

Act of 1990 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA).

RCRA

First enacted in 1976, the Resource Conservation and Recovery Act (RCRA) is designed to provide a "cradle to grave" tracking and monitoring system for hazardous wastes. RCRA applies to all sorts of hazardous waste materials that are specifically listed by the federal Environmental Protection Agency (EPA). RCRA sets up a permitting system for all hazardous waste treatment, storage and disposal facilities. In addition, RCRA sets up elaborate procedures to make sure that all wastes are properly labeled, manifested (a type of record keeping), and transported.

Subsection C of RCRA governs hazardous waste. **At the present time, asbestos is not regulated as hazardous waste.** Hazardous wastes include a variety of other gaseous, liquid and solid materials that are disposed, and that you may encounter in a building, when doing asbestos abatement consulting or contracting. Subsection D of RCRA governs solid wastes. Solid wastes are less stringently regulated than hazardous wastes. Asbestos is a solid waste. The RCRA Subpart D regulations apply principally to waste disposal facilities, and thereby to asbestos disposal locations.

CERCLA (Superfund)

A second federal law is the Comprehensive Environmental, Response, Compensation and Liability Act (CERCLA) also known as the "Superfund". The superfund was enacted in 1980 and was reauthorized in 1986. The Superfund basically did two things. First, it created a $9,000,000,000 fund to clean up abandoned contaminated facilities and areas. Second, it very stringently imposed liability on private parties who are in some way responsible for hazardous substance contamination. Unlike RCRA, the superfund does not operate on hazardous wastes. Rather it operates on any hazardous substance, whether or not it is a waste or disposed. Therefore, hazardous materials still in use can count as hazardous substances even before they are disposed as waste.

A critical difference is that the Superfund does cover asbestos. The superfund incorporates by reference lists of pollutants and hazardous substance from four other federal statutes, and via this mechanism (incorporating Clean Air Act substances) asbestos is included. The asbestos can be located at any facility. The word "facility" is defined as any building, structure, vent, pipeline, piece of land, etc. So wherever asbestos is found, it can constitute a legal Superfund concern if the state or federal government determines that a threat is posed to humans or to the environment.

There are four categories of persons or corporations that are potentially responsible to pay the costs of decontamination or clean up. These four categories include:

1. Current owners or operators of a building or site.
2. Past owners or operators of building or site at the time the contamination occurred.
3. Entities that generated or created the waste and arranged for its disposal.
4. Transporters of the hazardous substance who arranged for its disposal

Penalties and Damages

The penalties for violating provisions of the Superfund and RCRA are up to $25,000 per day plus up to one year in prison. Each day the problem continues is treated as a new violation. Under RCRA, the penalties are similar with one exception. Under RCRA, if one creates a knowing endangerment, the penalty can be up to 1,000,000 per violation and up to 15 years in jail. Again, each continuous day is a new violation.

Obviously, corporations do not go to jail. It is corporate employees and officer who serve jail time. The United States Department of Justice alone has had more than fifty corporate employees at one time serving jail for knowing violation of federal environmental standards. The total jail time ordered by court for these individual has exceeded two hundred years collectively, and fines of 12 million dollars. Local and State prosecutors have jailed scores more employees. While typical prison terms are sixty to ninety days, these are still not pleasant prospects.

Jail time is only ordered for an individual if there is a knowing violation. However, any professional working in the field is assumed to "know" the legal requirement and standards applicable under state laws. While it is unlikely that an abatement consultant employee would be prosecuted unless you knowingly and deliberately violate the law, it is not beyond the realm of possibility that the building owner could be prosecuted for a knowing violation of environmental laws for mishandling asbestos abatement.

Legal Considerations of Insurance

A major issue for asbestos abatement contractor is insurance. At present, the insurance "crisis" is over and contractor who have not been able to obtain liability insurance now have it more readily available. From the owner's perspective, it is first important to understand what the insurance requirements may be. The first issue is who must be protected. Generally speaking, the owner will want to require protection for himself, the consultant, the contractor and the workers of the contractor. This will mean that the owner will wish to be an additional insured under the contractor's policy and to be furnished a certificate of insurance. It is important that the certificate of insurance policy specify the types of coverage afforded. 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.

Another very important point is to determine for what length of time the insurance will be in force. Clearly, the insurance should be in force during the contract. However, it is most important that the coverage continue after the contract is completed. This will insure that, if the contractor fails to ensure the complete abatement of the asbestos problem, the owner will nonetheless be protected. Obtaining professional liability insurance is the normal method for a professional to secure protection from possible litigation arising from negligence in performing his or her professional activities. Insurance is a risk-shifting mechanism to provide protection against catastrophic liability.

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. Under certain state and local laws, general liability insurance in specified amounts is often required. 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 risk shifting is the presence of indemnification clauses in the contract, whereby the professional is obligated to indemnify and defend the owner (and vice-versa) against claims brought against the owner arising out of the professional's work. Insurance may not always protect against this type of liability.

Insurance must protect the insured from professional liability claims. While this is standard in liability policies, in professional advice claims, there may be an exclusion of coverage for asbestos-related claims. There may also be an exclusion for the "pollution hazard" which could encompass asbestos fibers released onto the property of another. Therefore, the owner must be sure that he is protected from the real hazards presented by asbestos abatement. Of course, it is necessary to insure against the normal construction hazards as well.

Another very important point is to determine for what length of time the insurance will be in force. Clearly, the insurance should be in force during the contract. However, it is most important that the coverage continue after the contract is completed. This will insure that, if the contractor fails to ensure the complete abatement of the asbestos problem, the owner will nonetheless be protected.
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.

Types of Insurance Coverage

Errors and Omissions

Asbestos consulting companies will normally look for "Errors and Omissions" insurance to protect them against misjudgments made during their services. 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.

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 building owner's project designer 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 "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.

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".

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.

Occurrence-based Insurance with a Sunset Clause

This type of insurance is similar to true occurrence-based insurance except its coverage ends at a specific period of time in as little as 5 years, after which the insured is not covered after the policy expires.

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 contracting firm 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 13

Contracts, Specifications and Drawings

Introduction

Well-designed, detailed contract specifications provide the overall guidance for each asbestos abatement project. These specifications permit the contractor to provide the building owner or designer with an accurate estimate or bid for completing the project. With few exceptions two contracts are required for each project. One contract is established with the contractor performing the actual abatement work, and a second contract between the building owner and air monitoring company.

Poorly designed specifications will result in a poorly performed project. If details omitted in the specifications or procedures are unclear the bids will vary tremendously. Likewise, contractors must spend the necessary time to read the specifications in their entirety before the pre-bid walkthrough of the intended job site. The National Institute of Building Sciences (NIBS)" Guide Specifications for asbestos Abatement Projects" may be a helpful reference for individuals designing projects. With the enactment of the Asbestos Hazard Emergency Response Act (AHERA) in 1987 and the issuance of the Asbestos Hazard Abatement Reauthorization Act (ASHARA) in 1992, an accredited project designer must design asbestos response actions in public and commercial buildings

Contract Documents

Contract documents or construction documents are the legally binding drawings and specifications which are used to construct the building. They consist of:

- Working Drawings
- Specifications
- Other documents including general and supplementary conditions, general requirements, agreement, addenda and change orders.

Specifications

The specifications (specs) for a project are a written set of standards and procedures which inform the contractor of what materials and standards are required for the successful completion of an asbestos abatement project. The specs are generally in book form and accompany the drawings as a portion of the contract documents. Just as various members of the design team are responsible for portions of the drawings, they are responsible for the corresponding portions of the specs.

Typically, the drawings and specs are prepared simultaneously by different personnel in the architect's or engineer's office. It is likely that some conflict between the two may occur. If that is the case, the specs take precedence over the plans.

Specifications are either proprietary or non-proprietary. Proprietary specifications require the use of the specific material from a specific manufacturer. Non-proprietary specs do not specify a particular manufacturer, but indicate the materials or performance requirements of the material and/or equipment and allow for the selection of any number of materials or equipment which can perform to those limits. Typically, governmental projects require non-proprietary specifications as a way of ensuring that one manufacturer is not given unfair advantage in pursuing a project.

As a way to organize specifications, many firms use the Construction Specification Institute (CSI) Masterformat, as illustrated later in this document. Another organization that publishes useful documents for the designer is the American Institute of Architects (AIA). They have a MASTERSPEC® for general construction projects. The NIBS Guide Specification sections are arranged to fit the MASTERSPEC® formatting. The most commonly used documents are :

- A-101 Form - Standard Form of Agreement between Owner and Contractor
- A-201 Form - General Conditions of the Contract for Construction

The A-101 Form describes the project, the responsible parties, the contract sum and unit prices (if any), and how payment will be made. This form is signed by the owner and contractor. The A-201 Form describes the rights and duties of the owner and contractor, administration of the contract including resolution of claims and disputes, the role of subcontractors, changes in the work, time, payments and completion, insurance and bonds. Many building owners and construction managers are familiar with the AlA documents and may require their inclusion in the contract. Other AlA Forms that could be used are:

- B-141 Form - Standard Form of Agreement between Owner and Architect
- G-702 Form - Application and Certificate for Payment

Addenda

Upon completion of the plans and specs, and upon authorization by the owner, the bidding period begins. During the period contractors estimate the cost of performing the work in the hope of being awarded the contract. If changes need to be made to the plans and specs each potential bidder is notified of those changes to ensure that they are all operating with the same information. This is done through issuing an addendum to the plans and specs.

An addendum may include both drawings and specifications and is legally incorporated into the contract documents. On a complex project it is very likely that a number of addenda will be issued during the bid period. Addenda should be treated as updates to the plans.

The bid period culminates with each bidding contractor submitting its bid to the owner, followed by a bid opening. The most responsible bidder, with the most responsive bid, is accepted and a contract for the construction of the project is signed. The working drawings, specifications and addenda are all incorporated into the contract. The cost and time of construction are based on these documents.

Change Orders

A change order is a change to the documents after a contract for construction has been signed. A change order may include both drawings and specifications to illustrate the change. It is signed by the owner, architect and contractor as a legal change to the construction contract. These items need to be consulted when investigating the building. A change order can be additive, deductive, or no cost, and can modify the schedule.

Modifications

Sometimes a change is needed to the contract documents that is such a minor change that it will not affect the cost and timing of the project in any manner. This minor change is made by the building owner and is called a modification.

Elements of the Specification

Site Inspection

Contract specifications issued to bidding contractors will usually include general information on bidding requirements. Frequently, in order to become a qualified bidder, a site inspection will be required of the contractor. This is done to ensure all parties that the contractor has become familiar with the condition of the project, including the physical condition of the site, access to

water and electricity, as well as the character and quality of ACM involved in the abatement. Regardless of whether or not a site investigator is specified, a prudent contractor will want to become familiar with the project in order to present a responsible estimate for the work. Associated with the site inspection is a pre-bid walk through and meeting during which details of the project will be discussed, and the competing contractors can ask questions to clarify any misunderstandings. The following sections are typically included in a contract specification.

Scope of Work

This section will include a description of ACM locations and their quantities to the extent they have been determined (usually also provided on the drawings), the type of abatement procedures to be used in a particular area, time frame for project completion, and any restoration requirements which may be necessary.

Description of Work

This section will detail abatement measures for each work areas. Additionally the contractor will be required by this section to supply all labor, materials, services, insurance, equipment, etc necessary to carry out the work in accordance with the specs and all applicable laws. Any special conditions that may be encountered on the project (i.e. high temperature steam lines, operational equipment, etc.) will be detailed. This section may also include the requirement that the contractor restore an abatement area to conditions equal to or better than original. The contractor will be held responsible for any damages caused during the course of his work and will remedy any damages at his own expense.

Submittals and Notices

Submittals and notices are important in getting the abatement project off to a smooth start. The contract specs should spell out who is responsible for properly notifying applicable regulatory agencies, in addition to securing the necessary permits for waste handling and disposal procedures. Documentation that the contractor's supervisors, foremen, and workers are properly trained, licensed where required, and medically certified under applicable regulations will also be submitted to the building owner. It is also important that any existing damage be documented by the contractor and submitted to the owner prior to any work commencing. This will protect both the contractor and owner from punch-list disputes at the close of the project.

Included in the contractor's submittals will be a list of equipment to be used along with any certification documents which the specs call for (For example: HEPA-vacuums conforming to American National Standards Institute (ANSI) standards). This will include respirators as well as other equipment for the project. During the abatement activity itself: the specs may call for weekly progress reports on abatement status, transport manifests, waste disposal receipts,

project monitor logbooks, bulk and air sample results, and documentation of HEPA-filter changes.

In addition to requirements for the contractor, the project specifications will sometimes require the building owner to perform certain functions. This may include notification of building occupants of the work to be performed and making arrangements for temporary relocation. Additionally, the owner will usually have to make available to the contractor the results of any pre-abatement air sampling or bulk sampling tests.

Furniture, Fixtures and Equipment

Another issue that frequently arises is that of furniture, fixtures and equipment. Most asbestos abatement projects require the removal and then reinstallation of furniture, fixtures, and equipment. The owner should make a realistic assessment of whether salvaging of fixtures is feasible and communicate these judgments to the project monitor and the abatement contractor. The age and condition of the equipment must be assessed. It will only promote contractual disputes for the owner to insist that a contractor remove and reinstall fixtures which will be damaged or destroyed by that very process. The owner should not expect to engage in a "backdoor" renovation of his building at the contractor's expense, by placing specification requirements on the contractor which are unattainable.

Site Security

An area of concern for building owners and contractors alike is site security and emergency planning during the abatement project Contract documents will specify that only authorized personnel will be allowed access to the work site (employees of the owner and subcontractor, air monitoring personnel inspectors). This is done to limit the liability of the parties involved and to prevent any worksite problems. Emergency planning will include written notification to police, fire, and emergency medical personnel regarding the proposed abatement activity, and the proper procedures to follow if an emergency situation should arise.

Material Specifications

Material specifications will include documentation of on-site storage regulations, details of material to be used (example: black polyethylene for worker decontamination units), any special materials to be used to protect objects in the work area, and proper containers for asbestos waste. Materials for removal (surfactants), encapsulation, and any replacement materials will be specified here. Proprietary specifications will require the use of a specific material from a specific manufacturer, whereas non-proprietary specifications will indicate materials or performance requirements and will allow the selection of materials which will perform to those limits.

Equipment Specifications

Equipment specifications will detail the performance requirements of units such as negative air filtration units, Type-C respirators and associated compressed air systems, and protective clothing and safety equipment such as footwear, hardhats, and eye protection. Equipment used in the actual removal of ACM will also be specified, such as scaffolds, ladders, sprayers and their capacity ratings, and any other equipment deemed essential for proper completion of the job.

In the event that a substitution of materials or equipment is necessary, specifications will usually call for the submission of complete technical data and information on the substitution from the contractor to the building owner or his/her representative. The building owner will then review the information and have the authority to approve or disapprove such substitution. It is important to keep in mind that the terms "or equal" and "or equal as approved by owner" do not mean automatic owner approval of substitutions. Any material or equipment which the contractor feels is equal to what has been specified should be approved by the owner before being used. There have been many instances where a contractor has had to redo work when unapproved substitutions were found to have been made.

Work Execution

Procedures for preparation of the work area will be specified in the contract documents. The specs will include the shutting down and locking out of electrical power to the area, impossible. Provisions for temporary power and lighting may have to be made, and are usually the responsibility of the contractor. The HVAC system of the building will also need to be shut down or modified to prevent the spread of contamination to other areas of the building. This is an especially important consideration in buildings where adjacent areas will remain occupied.
Considerations will be detailed for furniture, machinery, etc., which will be cleaned, removed from the work area, and stored. Any items not able to be removed will be cleaned and sealed using specified methods.

Specifications will often detail the construction design of the decontamination facilities, including location, size of chambers, and number of airlocks. Additionally, entry and exit procedures will be set forth, with provisions for waste material removal and storage.

The work area will be prepared according to project specs which will usually state polyethylene sheeting thicknesses, layers, and seam overlap. Special considerations for equipment which cannot be shut down and removed from the work area (computers, communications switching equipment), and for work areas with adjacent occupied space will also be specified. It is vital that contractors as well as other abatement professionals become familiar with any special circumstances.

Once the preparation of the work area is complete, specifications will usually detail the methods and order of removal of contaminated materials in the work area. Any encapsulation or enclosure of asbestos-containing material will be specified. As removal, encapsulation, and/or enclosure operations are completed, the waste material will be taken out of the work area, transported by a licensed waste hauler, and disposed of in an approved landfill. Proper documentation and retaining of receipts from disposal practices are specified to be delivered to the building owner.

Respiratory Protection

Specifications for respiratory protection may vary with either the type of abatement activity or with fiber concentrations. HEPA-filter cartridge respirators may be specified for use during work area preparation and/or following complete removal of gross contamination and one or more phases of cleaning. Type-C air supplied respiratory protection is usually specified from the beginning of actual ACM removal until gross contamination has been cleaned-up and removed from the area. Powered air-purifying respirators are sometimes specified in place of cartridge respirators. When considering airborne fiber concentrations and specifications for respirators, a general rule of thumb is to provide a protection factor which would maintain a fiber concentration of 0.01 fibers per cubic centimeter (f/cc) inside the mask. Due to daily fluctuations in fiber concentrations and analytical considerations, it is often difficult to insure that a concentration of 0.01f/cc is maintained. Increasingly, a combination of fiber concentrations in the work area and abatement activity are used in specifications to determine the level of respiratory protection. For example, during the second phase of cleaning, PAPR's may be acceptable if measured fiber concentrations would justify that adequate protection was achieved. Documentation that workers have received proper training in the purpose and use of respirators and that workers have been qualitatively or quantitatively fit-tested should always be specified.

Clearance Air Testing

Specifications should include requirements that a complete and thorough visual examination of the work area be conducted by the owner's representative prior to final air clearance testing. The procedures to, be followed for final air clearance testing should always be thoroughly spelled out in the specs. Sampling locations and the number of samples to be collected will sometimes be specified. Often, however, this is left to the discretion of the air sampling professional. Sampling methods (aggressive or non-aggressive), analytical techniques (PCM or TEM), and sampling times will be specified according to applicable regulations. The specs should also state very clearly what will be considered "clean" in regard to airborne fiber levels.

Waste Disposal

Contract specifications will indicate an EPA authorized landfill which will accept asbestos waste is an acceptable dump site for the abatement project's waste. A recordkeeping format whereby all waste shipment records required by the NESHAP regulations, receipts, and manifests will be retained and delivered to the building owner will usually be included. Specific requirements for the transportation of asbestos waste will include preparation of the waste containers and truck, proper loading and unloading procedures, personal protective equipment which must be worn by waste handlers, and decontamination procedures for the transport vehicle itself.

Material Replacement

Replacement of materials which have been removed, such as fireproofing, insulation, a drop or suspended ceiling, or any renovation work which incorporates new material will be completed following passage of clearance testing. This work may be covered under the original abatement contract and included in the same set of specs, or may be under separate contract and specifications. Following the completion of replacement, or if no additional work is to be done, the contractor will be required to remove all critical barriers, re-secure any objects or fixtures taken from the area, replace furniture and fixtures in their former positions, and re-establish the HVAC, electrical, and any plumbing systems to their proper working order. Finally, any damage resulting from the contractors' abatement activities will be repaired.

Supervision and Training

The heart of any asbestos abatement project is not the equipment, although the equipment is important, or the physical structures, although they are vital, too. The heart of the project is the care and skill exercised by the workers who remove the asbestos-containing materials. If this occurs in a professional manner, the owner can expect a good result. If the work is sloppy, good equipment will not save the job.

From the owner's perspective, it is vital that the contractor's project superintendent be an experienced asbestos abatement worker. He or she must have had experience on various projects and under various conditions. The owner should require documentation of the experience. It will behoove the owner to check on the quality of the preceding projects.

Many jobs are sufficiently extensive to require a project superintendent and foreman. The latter person typically will be in the barrier area actually supervising the workers while the job superintendent may be in and out of the area at various times. If a job foreman is required, he or she too, should be experienced and able to instruct the workers on-site and personally supervise actual preparation, removal, and follow-on clean-up activities. It is desirable to contractually require that both of these positions be filled by qualified individuals. The specific qualifications should be written in the specifications for the project.

If the removal project is being conducted in a school, abatement workers and supervisors, as well as inspectors, management planers and project designers, must be trained in accordance with AHERA regulations. Under regulations promulgated by the Asbestos In Schools Hazard Reauthorization Act (ASHARA), AHERA training requirements have been extended to commercial and public buildings. The NYS Department of Health (NYSDOH) asbestos training certification program meets EPA training requirements.

From a legal standpoint, it is critical that records be kept to document that training was given to each worker. The facility owner, via the project specifications, can reserve the right to inspect these records and retain copies. In fact, the owner may wish to maintain a complete file on all workers who worked on the project. This will avoid the problem of the contractor going out of business later and an asbestos claim arising by an employee against the owner many years thereafter based on an alleged failure to warn.

Adequate Time for Performance

One of the most difficult problems in asbestos abatement work is that of time. Once the owner has decided to conduct an asbestos abatement program, he is virtually always in a hurry. Many programs are specified with very short time limits of two to five days.

To avoid contractual disputes, it is desirable for the owner/project designer to specify enough time to allow the project to be completed. Questions of access, other contractors, and the owners' employees must be considered and detailed in the specifications. Generally speaking, qualified abatement contractors will proceed quickly once they begin a job. Owners are frequently critical of late starts resulting in late finishes. It may therefore be in the owner's interest to provide some penalty for a late start as a means of emphasizing to the contractor that the start date is important, and the project monitor should be aware of this. On the other hand, owners are frequently guilty of not providing the site at the time specified. This may result in difficulties for the contractor with his other work. The resolution is to cooperatively come up with time for the project which will be realistic both in length and in calendar placement for the owner and the contractor. The completion date is an important factor when monitoring a project due to the fact that the contractor will often try to cut comers on a rush project which may result in liability risks, including regulatory, contractual, and legal..

As to delay damages, many owners choose to use liquidated damages as a vehicle to make sure that contractors finish the job. If extensive renovation work or other important use of the facility is contemplated, the liquidated damages may not suffice to cover the actual damages. In these instances, the owner may find that he is limited to damages which are less than what he wants. Most courts have limited the owner to liquidated damages if they are specified on the basis that the reason for specifying liquidated damages is the uncertainty of calculation of actual damages.

Cleanliness of the Job-Site

One final note is that of the completion of the job by obtaining "clean air." Actually, the contractual requirements should be a combined requirement of clean air and clean surfaces. It is possible to have acceptable air monitoring tests and still have dangerous levels of asbestos containing materials present within the building. In fact, once an abatement project is undertaken, the disturbing of the surfaces frequently makes the remaining material, if not removed, more friable. Therefore, the project monitor/air monitoring technician must be sure that the contractor has thoroughly removed all material and that the air is clean.

Other Abatement Professionals

Contract documents will specify the qualifications and responsibilities of other abatement professionals associated with the particular project. These other persons will include the Asbestos project Manager - usually the owner or owner's representative. The Project Manager will be responsible for assisting in decision making, developing, implementing, and enforcing the contract specs, inspecting the work areas and critical barriers, and possibly coordinating bulk and air sample collection as well as other duties.

The Air Sampling Professional will be in charge of conducting air sampling in accordance with the project specifications. The types of sampling - pre-abatement, area sampling, personal, ambient - and any air volume requirements or associated sampling strategies will be outlined. The procedures to be followed for final air clearance testing will be detailed in accordance with applicable Federal and State regulations. The laboratory services utilized will be specified as having to be accredited for both bulk and air sample analysis. Turnaround time for samples may also be specified, as well as accreditation requirements for individual analysts.

A well-designed and organized set of contract specifications will provide for a successfully completed abatement project. However, it is important for a contractor to remember that not all regulations and requirements will be included in project specs. For this reason a contractor should become familiar with `any Federal, State, and Local laws which apply to his or her situation.

Working 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 if 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 this 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 real 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 buildings 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, excepting panels, lighting, switches and receptacles, is determined in the field, and as such needs to be verified by a site visit.

Shop Drawings and Submittals

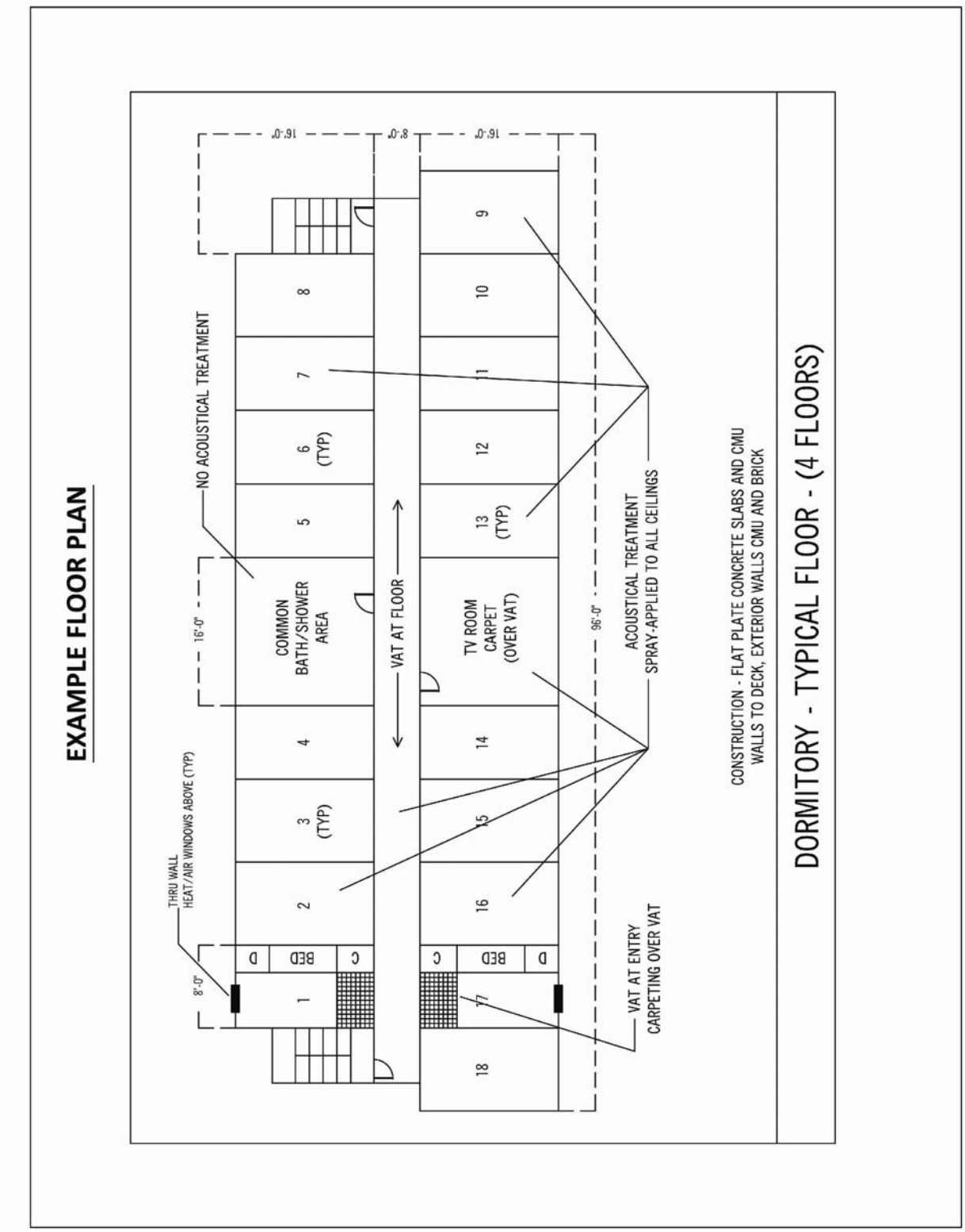
During the course of constructions, detailed drawings or descriptions of certain items are needed before they are installed in the building. These items are called for in the specifications. Shop drawings and/or submittals (drawings or descriptive literature) are prepared by the contractor or his or 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.

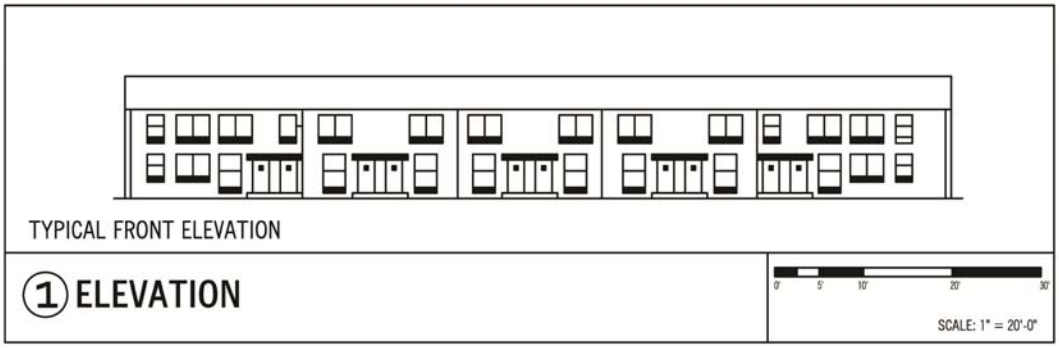
Record Documents

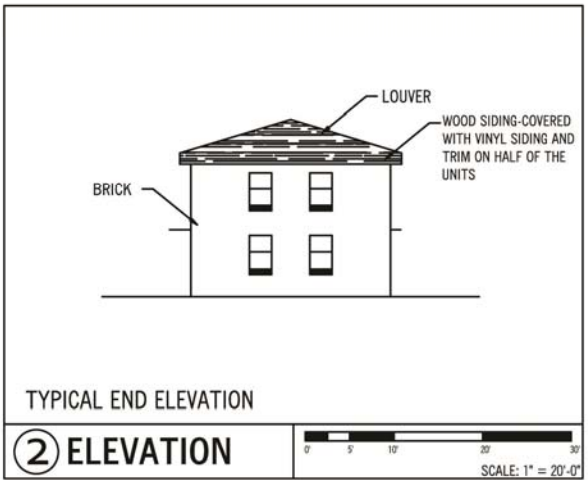
As noted above, numerous changes can be made to a set of construction documents during bidding and construction. Because initial plans and specs are not exact instructions, they may be substantially changed by the time construction is completed. Drawings and specs which reflect the way a building was 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.

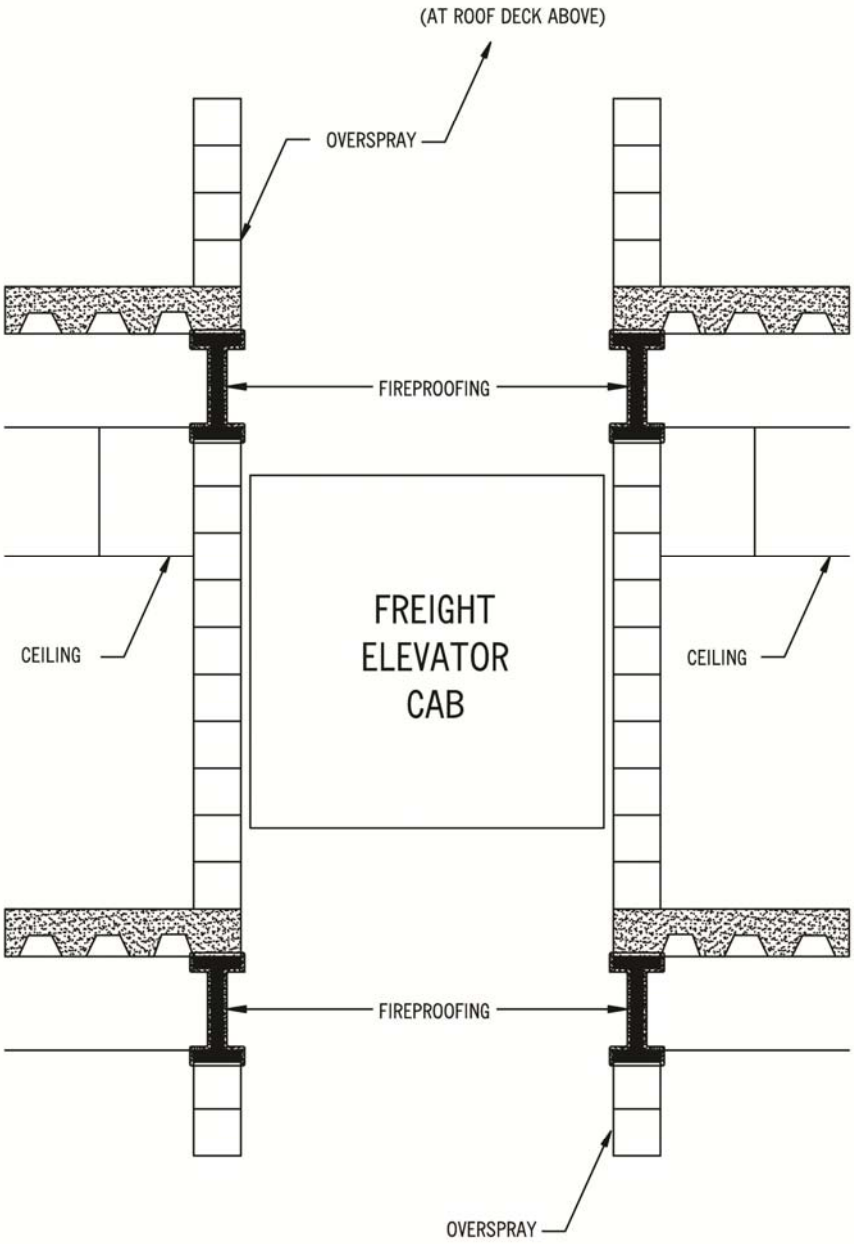

EXAMPLE FLOOR PLAN
DORMITORY - TYPICAL FLOOR - (4 FLOORS)
CONSTRUCTION - FLAT PLATE CONCRETE SLABS AND CMU
WALLS TO DECK, EXTERIOR WALLS CMU AND BRICK
NO ACOUSTICAL TREATMENT
ACOUSTICAL TREATMENT
SPRAY-APPLIED TO ALL CEILINGS
VAT AT FLOOR
VAT AT ENTRY
CARPETING OVER VAT
THRU WALL
HEAT/AIR WINDOWS ABOVE (TYP)
COMMON
BATH/SHOWER
AREA
TV ROOM
CARPET
(OVER VAT)
BED
16'-0"
8'-0"
96'-0"

EXAMPLE OF AN ELEVATION DRAWING



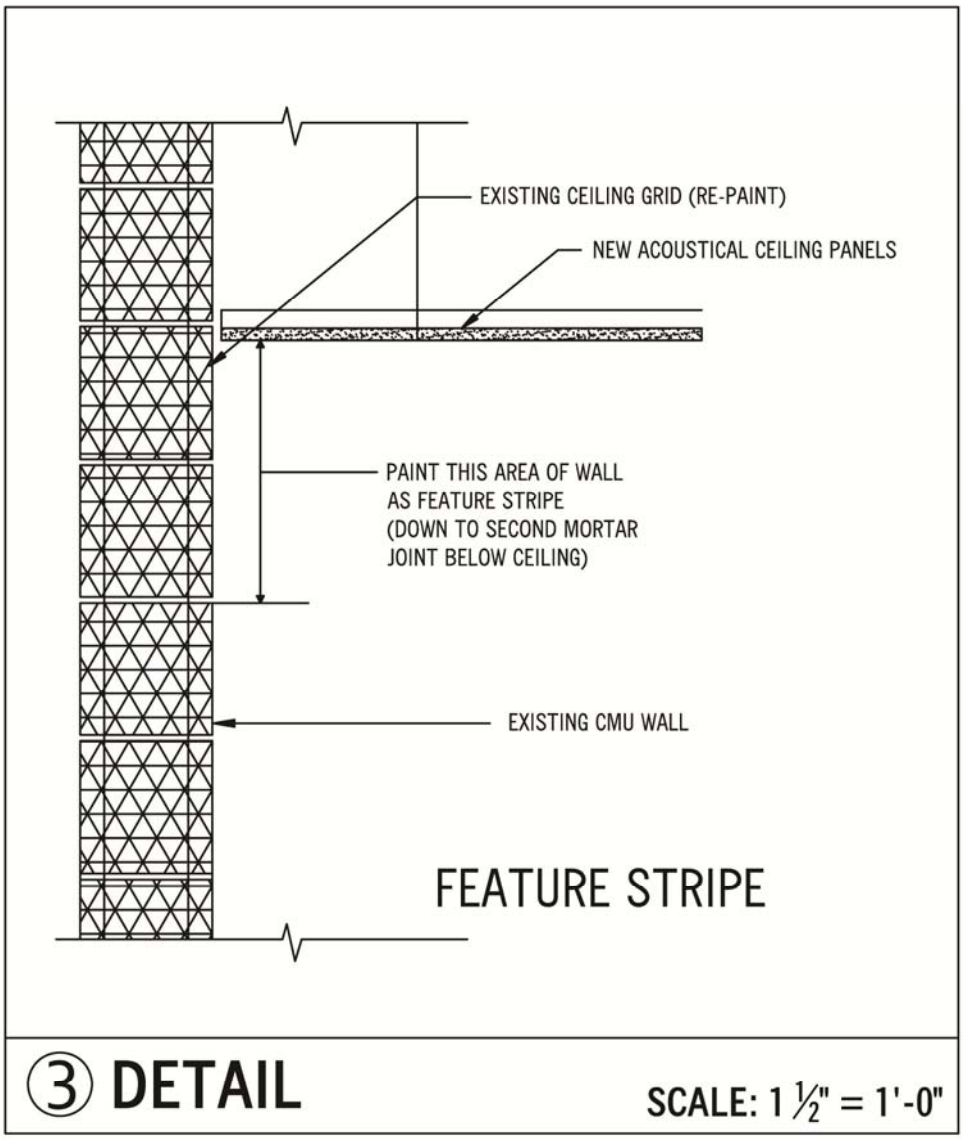


EXAMPLE OF A SECTION DRAWING



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.

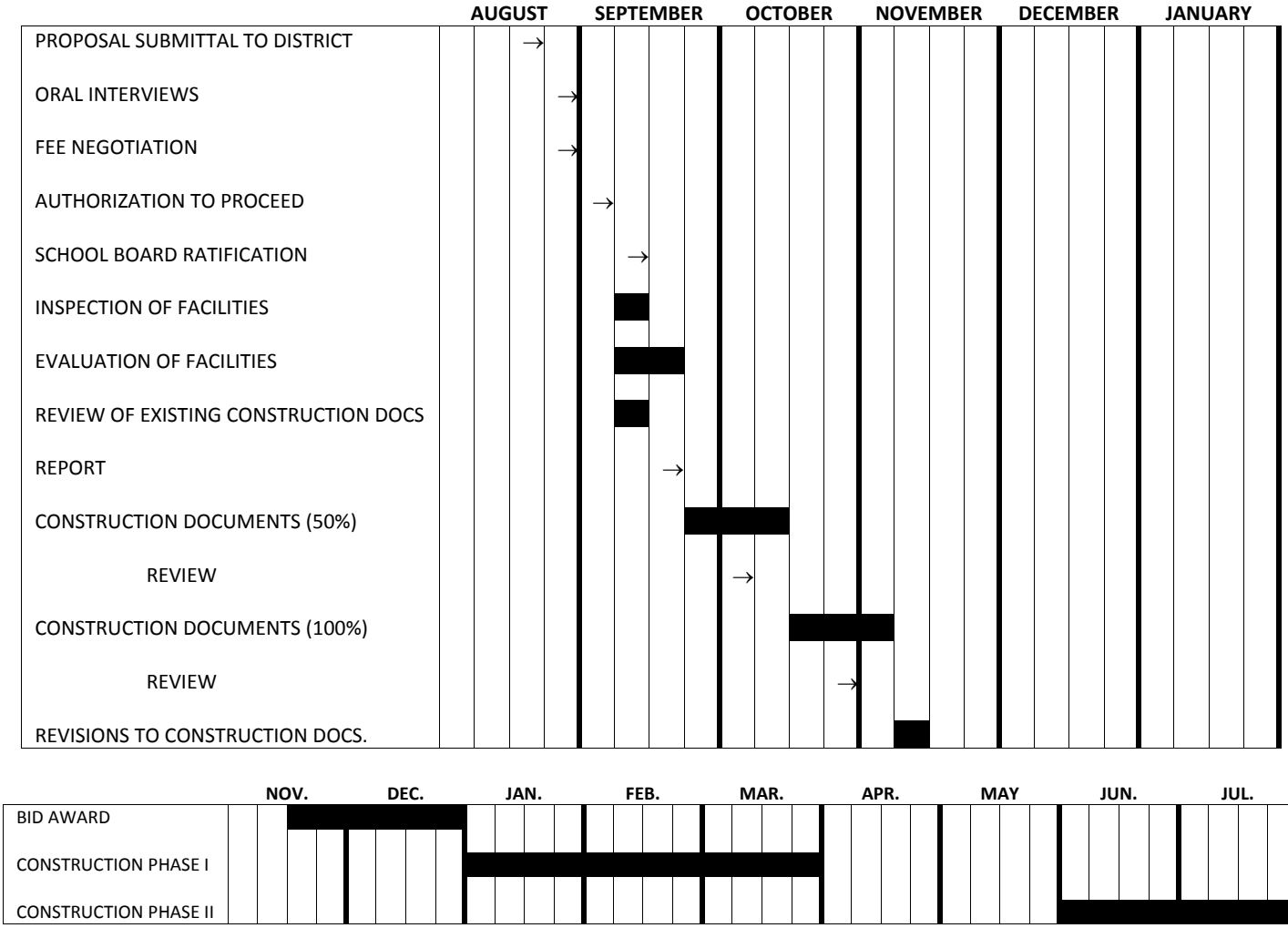
4. Overloads which may result from new fixture reconnections to be checked by contractor. If overload is found, notify architect before proceeding with work.

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

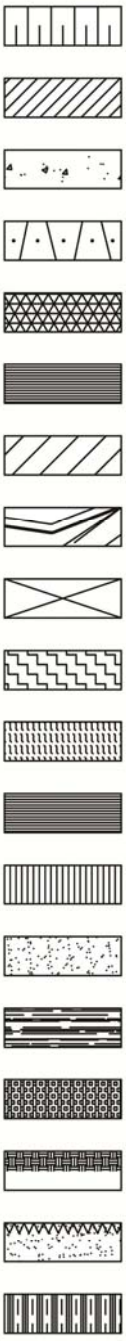
6. All conduit penetrations through firewall to be enclosed with approved fire stops to maintain rated fire separation of existing wall.

EXAMPLE OF MASTER SCHEDULE

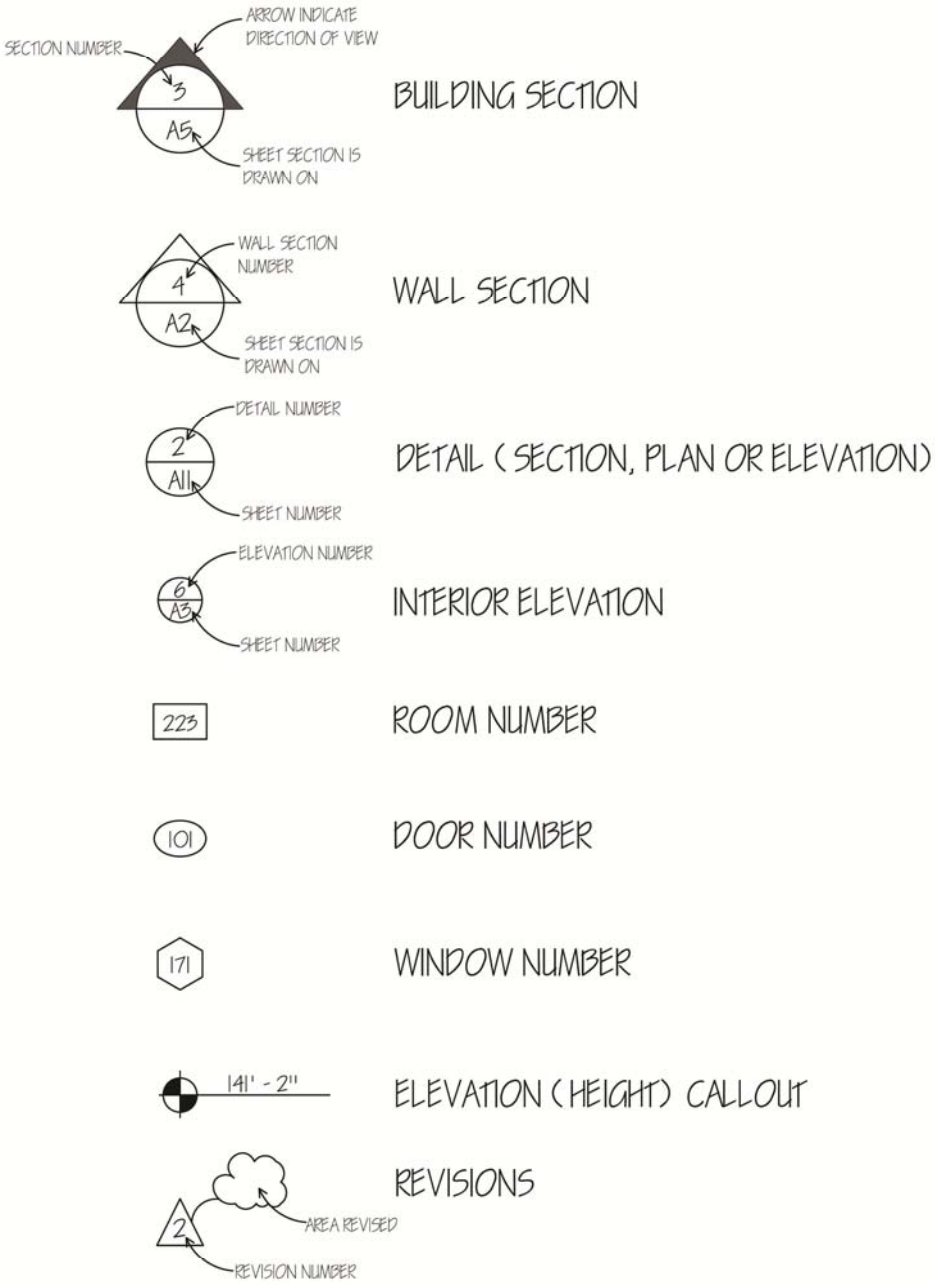
(For Selection/Design/Bid-Award/Construction)



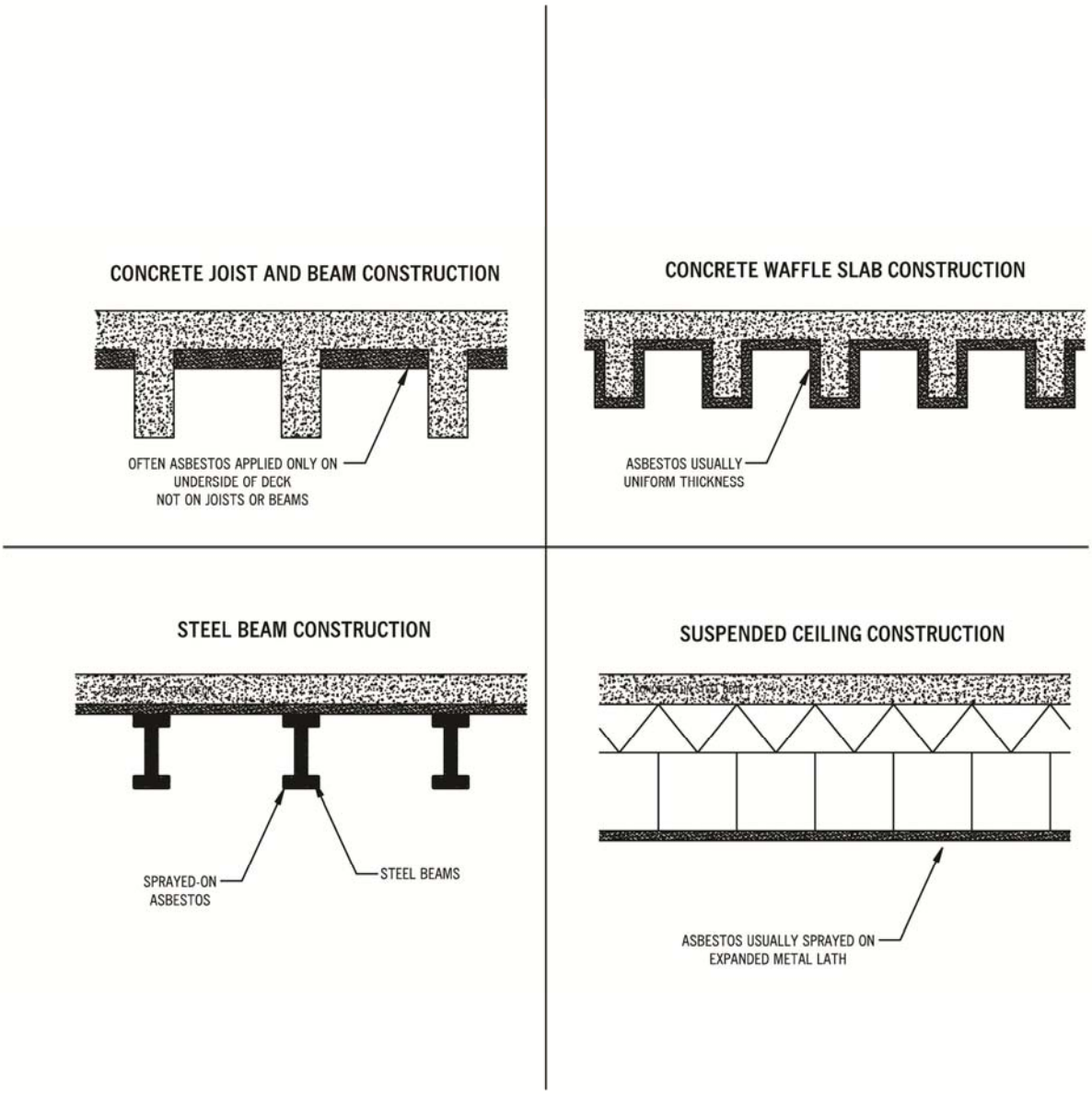
MATERIAL INDICATIONS



REFERENCE SYMBOLS



TYPES OF CEILING CONSTRUCTION



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

SUSPECT MATERIALS	MATERIAL TYPES	PLANS	SPECS
Packing or rope (at penetrations through floors or walls)	M	A	9
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
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
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

Asbeston
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
Careytemp
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
Dualay
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

Flex-Slate
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
LK
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
Portugese Asbestos
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

CONSTRUCTION SPECIFICATIONS INSTITUTE (CSI) MASTER FORMAT

Division 0	Conditions of the contract
Division 1	General requirements
Division 2	Sitework
Division 3	Concrete
Division 4	Masonry
Division 5	Metals
Division 6	Woods and plastics
Division 7	Thermal and moisture protection
Division 8	Doors and windows
Division 9	Finishes
Division 10	Specialties
Division 11	Equipment
Division 12	Furnishings
Division 13	Special Construction
Division 14	Conveying systems
Division 15	Mechanical
Division 16	Electrical

CHAPTER 14

Other Safety and Health Considerations

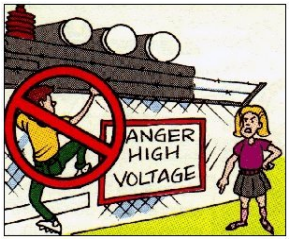
Asbestos abatement projects have become increasingly technically sophisticated as the body of knowledge grows regarding effective control methods. A great deal of attention has been given to protecting workers and confining fibers. The extra burden of dealing with the asbestos hazard can easily create situations where the basic and more immediate safety hazards can be overlooked.

Safety hazards can manifest if good work practices are not followed. Potential hazards include: electrical considerations, ladders and scaffolding, working surfaces, fire considerations, heat related disorders, and body protection, The methods used in a typical abatement project (sealing the work area, using wet methods, working at heights on ladders and scaffolding, and shutting down normal building systems) add new dimensions to the task of providing a safe working environment.

Electrical Safety Considerations

The Hazard

One of the most common safety hazards, and one that gives the least warning, is electrical current. Incorrect wiring, improper grounding, and lack of proper shielding results in approximately 1,000 people per year being electrocuted nationwide. Many of these fatalities result from contact with only 120 volts ac.



Three factors determine the severity of electrical shock. They are:

- The amount of current flowing through the body;
- The path of the current flowing through the body;
- The time the current is allowed to follow this path.

These factors vary greatly. The path of the current depends upon the points of contact. Most often the path is from the hands, through the body, and out the feet. The amount of electrical resistance determines in part the amount of current flow. Moist skin or damp conditions greatly

reduce electrical resistance and significantly increase a person's risk of serious injury if he comes in contact with a current source. In addition to the obvious shock potential, many deaths result from falls after a non-fatal electrical shock.

Pre-Work Considerations / Identifying the Hazards

During the pre-bid inspection, preparation of the work site, and during asbestos removal, there are potential electrical hazards that can be identified and eliminated, Examples include:

Identification of wiring faults in the building

These include open ground paths, reverse wiring polarity, and hot-neutral or hot-ground wires reversed. These common faults can easily be identified with a volt-ohm meter or with plug-in type circuit testers and should be corrected prior to the start up. This is particularly important if these circuits will be used to provide power inside the removal area.

Un-insulated or exposed and energized wiring or equipment

Asbestos removal jobs are often part of renovation or remodeling projects. Overhead lighting is often removed for cleaning. Equipment or machinery may have been moved out of the area during the removal job and wiring left in place. Damaged equipment or electrical fixtures may not have been repaired by the building owner. All of these things may be combined to create sources of contact with energized electrical circuits. When possible, circuits that will not be used during removal efforts should be turned off and locked out. Wiring and electrical connections should always be considered energized until tested and proven otherwise. Unenclosed wiring junctions in overhead areas are a particularly likely point of contact for removal workers.

Asbestos Abatement Projects where the Building remains Occupied

This is becoming more common as industrial and commercial projects are increasing. This can present problems where electrical circuits or control panels, that are located inside the removal area and that control other parts of the building, must remain energized. Where this situation is encountered, all breakers and switches should be clearly labeled in case power must be secured to other areas of the building during the removal project. Sealing transformers or control boxes may not be possible due to heat build-up. If this situation is encountered, polyethylene will have to be kept away from the surface of the equipment to allow for air circulation. Dry removal may be necessary around energized equipment to avoid a serious shock exposure.

Providing Power Inside the Removal Area

This can create hazards not associated with the building systems. Since OSHA considers abatement projects to fall under the requirements of the 29 CFR 1926 Construction Industry Safety and Health Standards, there are special requirements for supplying temporary power. This may be done by supplying power through Ground Fault Circuit Interrupters (GFCI) or having an Assured Equipment Grounding Program in effect. Use of GFCis to protect all circuits provides the safest power source since any significant current leakage will trip the circuit. These devices prove most effective when kept outside the work area away from the high humidity. An assured equipment grounding program requires regular inspection of all tools, cords, and electrical devices along with written documentation.

Commonly found electrical devices on abatement projects are: Lights, HEPA vacuum cleaners, negative air systems, drills, saws, heaters, sump pumps, and often, radios. All of these should be inspected regularly for damage, proper grounding, and integrity of insulation.

With the above mentioned items in place, there are still several basic items that should not be overlooked. When possible, scrapers with non-metallic handles should be used for scraping to prevent a possible shock if wiring is cut or contact is made with energized equipment. Insulating the handles of metal scrapers is another option. Hard rubber or plastic scrapers, while more difficult to find, may be used. Wooden or fiberglass ladders reduce or eliminate a ground path if a worker contacts an energized circuit.

ELECTRICAL SAFETY REVIEW

- The use of wet methods increases the potential for electrical shock when working around electrical panels, conduit, light fixtures, alarm systems, junction boxes, computers, transformers, etc.

- De-energize as much equipment as possible. Use portable floodlight systems for lighting and regularly check the system and wiring for damage. Twelve volt lighting systems are available that work very well.

- Consider using dry removal in areas immediately adjacent to energized electrical equipment if de-energizing is not feasible. Consultation with local NESHAP authorities is necessary to prevent citation for failure to use wet methods. Use non-conductive scrapers and vacuum attachments (wood, plastic, rubber).

- Ensure that all electrical equipment in use is properly grounded before the job starts. This means checking outlets, wiring, extension cords and power pickups. Check for the ground-pin on plugs. These checks should also be made while setting up and regularly during the job.

- Use care not to violate Insulated coverings with scrapers, scaffolding wheels, etc. Rolling a heavy cart or scaffold over a flex-cord can easily cause internal damage.

- Avoid stringing electrical wiring across floors. Elevate Wiring if possible to keep It away from water on the floor and damage from foot traffic and rolling scaffolds. Duct tape is effective for this.
- Do not allow water to accumulate in puddles on work area floors. NESHAP regulations require adequately wet material, not standing water!

- Ensure that electrical outlets are tightly sealed and taped to avoid water spray.

- Always perform a pre-work walkthrough to identify potential sources of electrical hazards to abatement workers, or equipment that may be damaged by wet removal methods. Any miswired or damaged receptacles should be rewired or replaced by a qualified electrician prior to the abatement project start-up.

- Use stable wooden or fiberglass ladders - not metal.

- Determine operating voltages of equipment and lines before working on or near energized parts. De-energize and lock-out when possible.

- Electrical equipment and lines should be considered energized unless tested and determined otherwise.

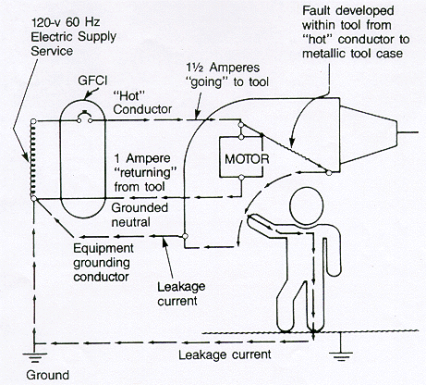
- Energized parts must be insulated or guarded from employee contact and any other conductive objects

- Extension cords used with portable electric tools and appliances must be the three-wire grounded type, designed for hard or extra hard use (Types S, ST, SO, STO, SJ, SJO, SJT, SJTO), and connected to a GFI (Ground Fault Interrupter) circuit.

- Extension cords:
  - Should be protected from accidental damage.
  - Should not be fastened with staples, hung from nails, or suspended by wire (tape is an acceptable alternative).

- Portable electric hand tools should meet the following requirements:
  - Should be equipped with a 3-wire cord having a ground wire permanently fixed to the tool frame; or
  - Should be of double-insulated type and labeled as such.

- For circuits over 600 volts, If electrical disconnects are not visible and open or locked out, the following requirements should be met:
  - Circuits to be de-energized are clearly identified and isolated from all energy sources.
  - Notification received from a designated employee that all switches and disconnectors that could supply energy have been de-energized, locked out, and plainly tagged to show men at work.
  - Visual inspections and tests made to assure de-energizing of lines and equipment.
  - Protective grounds applied to disconnected lines or equipment.
  - Separate tag and lockout attached for each crew requiring de-energizing of same line or equipment.
  - Tags and lockouts should not be removed from completed work until designated employees report that all crew members are clear and protective grounds they installed have been removed.



GFCI monitors the difference in current flowing into the "hot" and out to the grounded neutral conductors. The difference [1/2 ampere in this case] will flow back through any available path, such as the equipment grounding conductor, and through a person holding the tool, if the person is in contact with a grounded object.

Ladders/Scaffolding/Walking – Working Surfaces (Inspections and Proper Use)

Ladders and Scaffolds

Asbestos abatement projects always present risks to workers from falls, slips, or trips. The nature of the tasks necessitates the use of scaffolding and ladders.

Ladders

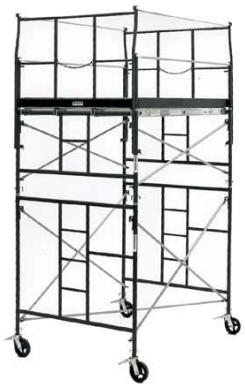
The following items should be checked on a regular basis:

- Ladders are always maintained in good condition.
- Complete inspections are done periodically.
- No improvised repairs are made.
- Defective ladders are not used.
- Safety feet spreaders and other components of ladders are in good condition. (Missing safety feet create sharp edges that will cut polyethylene floor covers.)
- Movable parts operate freely without binding or undue play.
- Rungs are kept free of grease or oil.
- Ladders are not used for other than their intended purpose. (Ladders should not be used as a platform or walkboard.)
- Extension type ladders should be used with a 1-4 lean ratio (1foot out for every 4 feet of elevation).
- Step ladders should only be used when fully opened.
- The user faces the ladder while going up and down.
- Tops are not used as steps. If needed, get a longer ladder.
- Bracing on the back legs is not used for climbing.
- Portable ladders are used by one person at a time.
- Ladders are secured to prevent displacement during use. All ladders have well-designed safety shoes.
- Hook or other type ladders used in structures are positively secured.
- Wood or fiberglass ladders should be selected to avoid electrical hazards of metal ladders.

Extension Ladder

Step Ladder

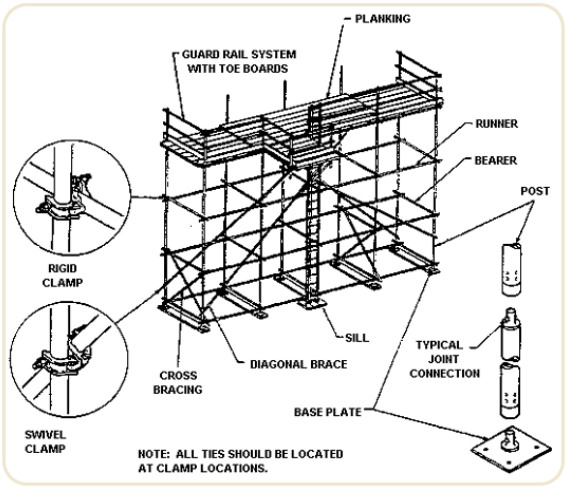
Scaffolding



Most asbestos abatement projects will involve the use of scaffolding. Proper setup, regular inspection, and basic maintenance should not be overlooked. In many removal projects, manually propelled mobile scaffolding provides a convenient and efficient work platform. OSHA standards require that when free-standing mobile scaffolding is used, the height shall not exceed four times the minimum base dimension. This requirement is based on the fact that scaffolding is easily turned over. Your instructor will illustrate a simple method to estimate a reasonable amount of force necessary to tip a mobile scaffold if workers try to move it while standing on it.

Since relatively little force is required to tip a scaffold, it becomes important to make sure that wheels on mobile scaffolds move freely and are in good repair. If rented scaffolding is used, all components should be inspected prior to accepting it. Wheels should turn freely and be lubricated. All components such as cross bracing, railings, pin connectors, planking or scaffold grade lumber should be available before the units are assembled. When workers will be riding mobile scaffolding the base dimension should be at least one half of the height. Workers should be careful to keep debris bagged and obstacles off the floor where mobile scaffolds will be used. If a wheel catches debris on the floor when the unit is moved, additional force will be required to move it. This additional force may be all that is needed to turn the unit over.

Guardrails should always be installed on scaffolding used for abatement projects.
Workers are usually looking up while working and can easily step off the edge of an unprotected scaffold. OSHA requires that guardrails be used when scaffolding is from 4 to 10 feet tall and less than 45 inches wide. Scaffolding 10 feet or higher must have guardrails Planking used on a scaffold should not extend farther than 12" over the edges and should always be secured to the frame with cleats on both ends.



Slips, Trips, and Falls

Areas sealed with polyethylene and kept damp to reduce airborne fibers become very slick. Disposable booties are a potential trip hazard; air and electrical lines also create trip hazards. All of these conditions create potential worker hazards even before removal begins. When asbestos and other debris are removed, the accumulations should be bagged and removed from the floor as soon as possible. This simple step, which may require more initial effort, will make cleanup easier and the overall job far safer. The National Safety Council estimates that there are 200,000 to 300,000 disabling injuries in work-related falls each year and was the number one occurring injury in 2001. Over 40 percent of the workers are employed in the construction industry.

To Summarize

- Consider the height of the work, equipment in use, and numerous trip hazards. Take a look at your "walking surfaces".
- The use of disposable booties may be impractical in many removal situations. They may come apart and create a serious trip hazard. Seamless rubber boots, slip-on shoes, or safety shoes with non-skid soles may be an alternative depending on the job.
- Inspect ladders and scaffolding for condition. Ensure that railings are adequate on scaffolds.
- Minimize water on floors. Wet polyethylene is very slick and water increases the risk of electrical shock.
- Use care around air lines and electrical cords.
- Suspend electrical lines and cords, when possible, using tape.
- No running, jumping, or horseplay in work areas should ever be allowed.
- Minimize debris on floors.
- Pick up tools, scrapers, etc.

Fire Considerations

Fires can create immediate life threatening conditions. Fire prevention/control should be given a high priority both during planning and removal stages of asbestos projects. A few of the fire safety features to be concerned with are exits, travel distances, emergency lighting, and alarm systems.

Sealing off an area and blocking entrance/exit openings conflict with OSHA, National Fire Protection Association (NFPA), and local fire code requirements. The contract specifications may state "one means of egress through a properly designed decontamination system"; however, emergency plans should be developed to include alternative exits in emergency situations and these must be familiar to all personnel entering the work area.

Perform a pre-work survey to determine potential fire hazards, sources of ignition, hot spots, and location of exits. Coordinate this with the number of workers to be in the area, the square footage, and the types and amount of combustible/flammable materials that will remain on site.

Some protective clothing will burn and melt quickly. It can shrink, adhere to skin and drip as it burns. Heavy black smoke is a combustion by-product.

Polyethylene being combustible will start to burn slowly and pick up speed as more heat is generated. It gives off heavy smoke as the fire progresses. Flame spread is slow and steady. Poly also produces toxic gases during thermal decomposition. Workers would not be adequately protected from smoke with respirators used for asbestos work. Sheeting should be kept away from heat sources such as transformers, steam pipes, boilers, etc., that will be heated during removal. (Polyethylene should not be allowed to contact surfaces above 150"F.) NOTE: "Fire Resistant" and "Fire Retardant" polyethylene are not "Fire Proof'!

To avoid fire problems in asbestos control areas

- Ensure that all sources of ignition are removed. Be sure that gas and other fuel sources are cut off and that pilot lights in boilers, heaters, hot water tanks, compressors, etc., are extinguished.
- Locate "hot spots." Quite often you will have to drape equipment instead of sealing off to prevent overheating (i.e., computers, terminal boards, switch panels, transformers).
- Cut off supply to steam lines, electric and steam heaters, and radiators. Do not permit the polyethylene to lay against hot surfaces.
- Do not allow lighters, matches, etc., into the work area. Strictly enforce no smoking, eating, or drinking inside the work area.

- When using an oxygen/acetylene torch to cut pipe, etc., post a fire watch with an appropriate fire extinguisher such as pressurized water. The fire watch should remain at the site for at least one half hour after work is completed. Do not use CO2 extinguishers in confined or enclosed spaces. Dry chemical extinguishers are effective, but the powder is a respiratory irritant.
- When using a cutting torch, know what is on the other side of the wall and below the floor. Use sheet metal or a treated tarp to catch sparks.
- Reduce the amount of flammable/combustible materials inside a space to a minimum prior to hanging plastic. This includes removal of any chemicals, flammable liquids, heat sensitive materials, etc.
- Mark exits from work area and post directional arrows when exits are not visible from remote work areas. This can easily be done using duct tape on the polyethylene walls and barriers. It is recommended that these directional arrows be placed close to the ground to assist workers who may be crawling in smoky conditions to escape a fire.
- Keep trash and debris to a minimum (i.e., tape, poly, bags, lumber, etc).
- If the work area is large and many workers are present, several emergency exits may be needed. Choose exits that are locked from outside but can be opened from the inside. A daily inspection should be conducted to ensure that secondary exits are not blocked.
- Lighting of exits and exit routes should be provided.
- In case of fire, the fire hazard becomes more immediate than the asbestos hazard and workers may need to violate the plastic barriers. This should be covered with workers in the emergency action plan for the job site.
- Be alert for flammable vapors in industrial areas (solvents such as naphtha, toluene, xylol, etc.). This is especially critical in industrial vacuuming operations where vacuum motors are not explosion proof. Compressed air vacuums may be required.
- A telephone should be available on the job site at all times for notification of authorities in an emergency.
- Post local Fire Department and Rescue Squad phone numbers as a backup to localities with 911 service. Advise them of the operations in progress.
- Ensure that you have a monitor outside at all times trained in emergency procedures. Someone should be trained in first aid, and in the treatment of heat stress.

Emergency Procedures

OSHA requires a written emergency action plan and fire prevention plan. These requirements are detailed in 29 CFR 1910.38. Briefly, the essential items of the plans should include:

- The manner in which emergencies are announced.
- Emergency escape procedures and emergency escape routes.
- Procedures for employees who must remain to operate critical plant operations which may take time to shut down.
- Procedures to account for all employees after evacuation
- Rescue and medical duties.
- Names and/or job titles of people to be contacted for additional information.
- A list of the major workplace fire hazards.
- Names and/or job titles of people responsible for maintenance of fire prevention equipment.
- Names and/or job titles of people responsible for the control of fuel source hazards.

Establish a system for alerting workers of an emergency or other problems that may require evacuation of the work area. A compressed air boat horn provides an effective alarm that can be heard and does not rely on a power source. All persons entering the work area should be familiar with the evacuation alarm signal and primary and secondary exits. A simple floor plan drawing of the work area should be posted to familiarize persons entering the work area with the site and location of exits.

Written emergency procedures should cover procedures to be used in case of the following: fire, which may include heavy smoke conditions; power failure; compressor failure with the use of air-supplied respirators; accident; or employee injury.

EVACUATION PLAN
PROJECT ADDRESS: 5555 North Industrial Blvd.
New York City, NY 12321
Phone: 555-303-1212

EMERGENCY PHONE NUMBERS:
Ambulance
FIRE
POLICE
555-211-8569 Suburb General Hospital
555-303-6140 Suburb Fire Department
555-303-6666 Suburb Police Department

Medical Services and First Aid

The OSHA Asbestos Standard for the construction industry requires that all employees who are exposed to asbestos at or above the PEL for 30 or more days per year or who are required to wear a negative pressure respirator be given a complete physical examination. The main objective of the examination is to determine that the employee is medically qualified to wear a respirator before performing abatement activities. The examining physician or clinic should be aware that respirators may be worn under hot, adverse conditions. During warm months, heat exhaustion and heat stroke are serious hazards faced by workers, particularly those not acclimated to the heat.

Heat-Related Disorders

It is important for the employer to provide training in recognition and awareness of the symptoms and effects of heat stress and heat stroke. It is also important to stress the importance of drinking water and maintaining proper electrolyte levels.

Heat Stress

Causes:

- High air temperature
- High humidity
- Low air movement
- Hard work
- Not enough breaks away from the heat
- Insufficient fluid intake
- Full body clothing
- Workers not acclimated to heat

Symptoms:

- Fatigue, weakness, profuse sweating, normal temperature, pale clammy skin, headache, cramps, vomiting, fainting.

Treatment:

- MEDICAL ALERT
- Remove worker from hot area.
- Have worker lie down and raise feet
- Apply cool wet cloths
- Loosen or remove clothing
- Allow small sips of water or Gatorade'" if victim is not vomiting

Prevention:

- Frequent breaks away from the heat
- Increase fluid intake
- Allow workers to become acclimatized to heat.
- External cooling (vortex cooling, ice vests)

Heat Stroke

Causes:

- High air temperature
- High humidity
- Low air movement
- Hard work
- Not enough breaks away from the heat
- Not drinking enough water
- Full body clothing
- Workers not acclimated to heat

Symptoms:

- Dizziness, nausea, severe headache, hot dry skin, confusion, collapse, delirium, coma, and death

Treatment:

- MEDICAL EMERGENCY
- Remove worker from hot area
- Remove clothing
- Have them lie down
- COOL THE BODY (SHOWER, COOL WET CLOTHS)
- Do Not give stimulants

Telephone numbers of the physicians, hospitals, and ambulances should be conspicuously posted for emergency use.

Means should be available for prompt transport of an injured person to a physician or hospital, and there should be a telephone with emergency numbers available.

Before beginning the project, provisions should be made for prompt medical attention in case of serious injury or other medical emergency.

Note: Someone trained in basic first aid should always be on the abatement project.

Carbon Monoxide Poisoning

When airline respiratory protection is used, it is important that the outside monitor be familiar with the system and any problems associated with breathing air. Carbon monoxide poisoning is perhaps the most important of these problems. It is important to note that these symptoms are similar and may be confused with those from heat stress.

Description of CO: Colorless Odorless, and Tasteless
Sources:

- Oil-lubricated compressor
- Internal combustion engine
- Open flame and fire
- Unvented gas kerosene heaters

Symptoms:

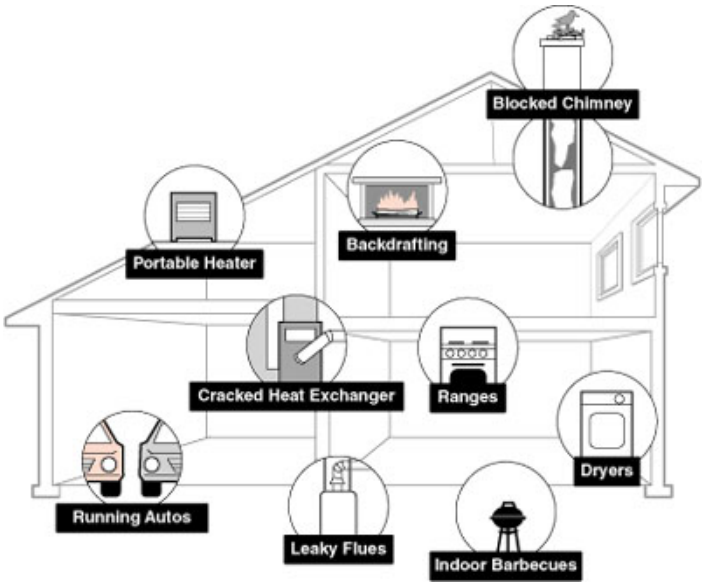
- Dizziness, nausea, headache, drowsiness, vomiting, collapse, coma, and death (note similarity of symptoms to heat stroke)

Limits:

- 35 PPM (Time weighted average over 8 hours) OSHA
- 200 PPM ceiling limit- OSHA
- 10 PPM CO - Grade D breathing air for airline respirators (OSHA 1910.134 (i)(1)(ii)(C)

If these symptoms are observed, those persons should immediately be brought into fresh air and medical attention should be provided

Monitor any prescription or over the counter medicines being used by employees. These may cause an adverse reaction when used by persons under strenuous conditions common to removal work.



Body Protection

The following guidance should be used when addressing whole body protection for abatement area personnel:

- Provide and require use of special whole body clothing, including shoes, for any employee exposed to airborne concentrations of asbestos.
- Provide work gloves as part of whole body protection to employees exposed to asbestos. This is particularly important when metal lath, suspended ceiling grids, and other materials are being removed.
- Scrapers, retractable knives, wire cutters, chisels, and other sorts of bladed tools are frequently used. Always cut away from the body. Provide tools with insulated handles.
- Many puncture and cut wounds occur when removing metal lath or cutting duct work. Use care and have a good first aid kit available.
- Protective hardhats must be worn on a jobsite where there is exposure to falling objects, electric shock, or burn.
- Provide, require the use of, and maintain in sanitary and reliable condition protective equipment necessary to protect any employee from any hazard that could cause injury or illness.
- Wear face shields or goggles for operations involving potential eye injury. Full face respirators are most effective.
- Check with your surfactant supplier on irritant properties of your wetting agent. (Always have a material safety data sheet on all of your materials and familiarize workers with any cautions or special considerations for their safe use.)
- Arrange work so workers do not have to reach extensively overhead. Get them up to the job!
- Instruct your workers on proper lifting methods. Nothing will take the profit out of a job faster than a serious back injury.
- Use the "buddy system" for lifting and moving heavy objects.
- Use hand carts or rolling pallets when possible. Keep manual material handling to a minimum.

Miscellaneous

OSHA requires that a poster be permanently posted on the job site notifying workers of their rights under the act. This poster, commonly known as the "Job Safety and Health Poster," is available from OSHA offices.

When an employer has more than 10 employees at any time during the calendar year, he is required to maintain a record of injuries and illnesses that occur. Part of this requirement may be met by filling out accident reports required by Worker's Compensation insurance carriers.

The other requirement is maintenance of the "Log and Summary of Occupational Illnesses and Injuries - OSHA Log 300." These forms and a booklet titled "What Every Employer Needs to Know about OSHA Record keeping," are available from OSHA

OSHA Log 300

To provide guidelines for the accurate recordkeeping of workplace injuries as defined by OSHA. All locations are required to maintain an OSHA 300 log.

Procedures

Step 1: Is the injury or illness work-related?

Work-relatedness is presumed for injuries and illnesses resulting from events or exposures occurring in the work environment, unless one of the 9 exceptions applies (see 29 CFR Part 1904.5 (b)(2)(i – ix)

Step 2: Is the injury or illness OSHA Recordable?

A work-related injury or illness is OSHA recordable if it meets one or more of the 6 general recording criteria:

- death; days away from work; restricted work or job transfer; medical treatment beyond first aid; loss of consciousness; or, diagnosis by a physician or other licensed health care professional as a significant injury or illness

Step 3: Record on OSHA 300 Log

If the injury or illness is work-related and recordable as defined above, then it must be recorded on the new OSHA 300 log. Instructions for completing the log is provided on the form.

All OSHA recordable injuries or illnesses *must* be logged on the OSHA 300 Log WITHIN 7 CALENDAR DAYS of receipt of the information that an OSHA recordable case has occurred.

For sensitive cases, sites must enter the "Privacy *Case*" rather than the employee's name, and keep a separate list of the case number and corresponding names. The following cases would be considered privacy cases:

Other illnesses, if the employee independently and voluntarily requests that his or her name not be entered on the log. Musculoskeletal disorders (MSDs) are not considered privacy concern cases. (Note: The first sentence is effective January 1, 2002. The second sentence is effective January 1, 2003)

OSHA's Form 300 (Rev. 01/2004)

Log of Work-Related Injuries and Illnesses

Attention: This form contains information relating to employee health and must be used in a manner that protects the confidentiality of employees to the extent possible while the information is being used for occupational safety and health purposes.

Year 20__ __

U.S. Department of Labor
Occupational Safety and Health Administration

Form approved OMB no. 1218-0176

You must record information about every work-related death and about every work-related injury or illness that involves loss of consciousness, restricted work activity or job transfer, days away from work, or medical treatment beyond first aid. You must also record significant work-related injuries and illnesses that are diagnosed by a physician or licensed health care professional. You must also record work-related injuries and illnesses that meet any of the specific recording criteria listed in 29 CFR Part 1904.8 through 1904.12. Feel free to use two lines for a single case if you need to. You must complete an Injury and Illness Incident Report (OSHA Form 301) or equivalent form for each injury or illness recorded on this form. If you're not sure whether a case is recordable, call your local OSHA office for help.

Establishment name ______________________

City ______________ State ______________

Identify the person			Describe the case			Classify the case — CHECK ONLY ONE box for each case based on the most serious outcome for that case:				Enter the number of days the injured or ill worker was:		Check the "Injury" column or choose one type of illness: (M)					
								Remained at Work									
(A) Case no.	(B) Employee's name	(C) Job title (*e.g., Welder*)	(D) Date of injury or onset of illness	(E) Where the event occurred (*e.g., Loading dock north end*)	(F) Describe injury or illness, parts of body affected, and object/substance that directly injured or made person ill (*e.g., Second degree burns on right forearm from acetylene torch*)	Death (G)	Days away from work (H)	Job transfer or restriction (I)	Other record-able cases (J)	Away from work (K)	On job transfer or restriction (L)	Injury (1)	Skin disorder (2)	Respiratory condition (3)	Poisoning (4)	Hearing loss (5)	All other illnesses (6)
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					Page totals ➤	___	___	___	___	___	___	___ Injury (1)	___ Skin disorder (2)	___ Respiratory condition (3)	___ Poisoning (4)	___ Hearing loss (5)	___ All other illnesses (6)

Be sure to transfer these totals to the Summary page (Form 300A) before you post it.

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Public reporting burden for this collection of information is estimated to average 14 minutes per response, including time to review the instructions, search and gather the data needed, and complete and review the collection of information. Persons are not required to respond to the collection of information unless it displays a currently valid OMB control number. If you have any comments about these estimates or any other aspects of this data collection, contact: US Department of Labor, OSHA Office of Statistical Analysis, Room N-3644, 200 Constitution Avenue, NW, Washington, DC 20210. Do not send the completed forms to this office.

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CHAPTER 15

Recordkeeping

Introduction

In the environmental business, recordkeeping is extremely important. Why are these ink scribbled pieces of paper so important? The answer to this question is simple. Paperwork provides the backbone of every asbestos abatement project by documenting all relevant activities and conditions.

NIOSH method 7400 only specifically requires that with each microscope, a logbook must be kept of the dates of calibrations and major servicing. Certainly, the intent of the method calls for more adequate documentation. Listed below are some recommended documentation that should be kept on an asbestos abatement project.

Project Air Monitoring:

1. Log Book, which the Project Monitor uses to record his/her observations during the abatement project. It is very important that the contractor's work practices and activities are accurately recorded because the Log Book may be used as evidence in a future legal case.

2. Pump/rotameter calibration forms and calibration curves, which ensures validity of air sampling pump flow.

3. Equipment list, which provides record of equipment taken, for both field and office personnel.

4. Air sample data sheets, which provide a record of all relevant sampling data.

5. Laboratory analysis sheets, which provide a record of all analytical data.

6. Maps/diagrams of work area; pictures are worth a thousand words.

7. MSDS sheets for any chemicals used on the job, such as mastic remover. Chain of custody sheets, which provide a record for shipping samples to/from Laboratory.

Project Supervision:

Industrial Code Rule 56 Record-Keeping Requirements:

1) Detail

Every asbestos contractor shall maintain for at least thirty (30) years, a record of each asbestos project in which the asbestos contractor engages. Such record shall include the following information:

Exception: Non-abatement asbestos contractors shall maintain for at least thirty (30) years, a record of the following applicable project information for each asbestos project, if it relates to their portion of the asbestos project:

a) The name, address, social security number and asbestos certificate number of the person who supervised the asbestos project;
b) The location and description of the asbestos project;
c) The amount of asbestos or asbestos material that was removed, enclosed, encapsulated, repaired, disturbed or handled;
d) The commencement and completion date of the asbestos project;
e) The name, asbestos handling license number, and address of the air sampling asbestos contractor that was used on the project;
f) The name, address and current NYS ELAP registration number, of the laboratory that was used for air sample analysis on the project;
g) The name, asbestos handling license number, and address of the project monitoring asbestos contractor that was used on the project;
h) The name and address of the deposit or waste disposal site or sites where the asbestos waste material was deposited or disposed;
i) The name and address of any sites that were used for the interim storage of asbestos or asbestos waste materials prior to final deposit or disposal;
j) The name and address of any transporters that were used to transport asbestos or asbestos material;
k) The name, address, social security number and asbestos license or certificate number of all persons who were engaged on that portion of the asbestos project for which the asbestos contractor has responsibility;
l) A copy of the asbestos abatement supervisor's daily project log;
m) Any other information that the Commissioner may require, on a form and according to instructions provided by the Commissioner.

2) Project Record

a) At all sites where there is an active project, a project record shall be required. The project record shall be available on-site with the building/structure owner or his designated representative, and shall include the following:

(i) Copies of licenses of all entities involved with the project;
(ii) Copies of all supervisors and handler certificates;
(iii) Copies of notifications and amendments;
(iv) Copies of all variances, amendments and re-openings being used for the project;
(v) A copy of the air sample log if the air sampling technician is on site. If the air sampling technician is not on site, a copy of the air sample log shall be supplied within 24 hours of the request to produce a copy there of;
(vi) A copy of all air sampling results, including method of analysis, by date for the entire asbestos project, organized by regulated abatement work area;
(vii) A copy of the project monitor's daily logs during abatement (if a project monitor is used on the project);
(viii) The supervisor's daily log with entry/exit logs organized by date;
(ix) All bulk sample data including all asbestos inspections and surveys completed for affected portions of the building, structure and work site;

b) This record shall be kept on site at all times with the building/structure owner or his designated representative, and produced upon verbal request of the Commissioner or his or her duly authorized representative.

3) Surrender of Records

Within ten (10) working days of the expiration, revocation, or non-renewal of an asbestos contractor's asbestos handling license, or upon the receipt of the written request of the NYSDOL, any records kept required by ICR 56 shall be delivered to NYSDOL.

4) Copies of any records kept pursuant to this Part shall be surrendered to the Commissioner or his or her duly authorized representative upon written request.

Permanent Record-Keeping

1. Medical Surveillance

According to OSHA, it is the employer's responsibility to ensure that all employees working on an asbestos abatement project are placed under a medical surveillance program. The

surveillance program includes annual physical examinations, pulmonary function tests, and the OSHA questionnaire. A key element of the program is a statement from the doctor that the employee is capable of wearing a respirator. These records must be updated annually as long as the employee remains employed. Once the employee leaves the company, the company must maintain the records for thirty years. Due to the transient nature of the asbestos-abatement industry, maintaining records on every employee on every abatement project may seem next to impossible. However, it is not impossible, just difficult and time consuming, neither of which is an excuse under the OSHA regulations for not maintaining these records.

2. Respiratory Protection Program

Where respiratory protection is used, the employer shall institute a written respiratory protection program in accordance with OSHA, 29 CFR 1910.134. The written document outlines the type of respirators used, the individual in charge of the program, how the airborne hazards are assessed, worker training, and all the steps necessary to maintaining proper respiratory protection. The written program must be updated annually to reflect any changes in respirators, assessment methods, etc.

3. Fit-Testing

In accordance with the previously mentioned written respiratory protection program, an employer must fit-test all workers annually to ensure that the respirator they are using is adequate. Fit-test records must include the following and be retained until the next fit test is administered:

- Name of employee tested
- Type of fit test performed
- Specific make, model, style, and size of respirator tested
- Date of test
- Pass/Fail results for qualitative fit test (QLFT) or fit factor results for quantitative fit test (QNFT)

4. OSHA 300 Form

The OSHA 300 form documents all injuries and illnesses on an abatement project.

5. Waste Shipment Record (Waste Manifest)

A chain of custody document which indicates the name of the waste generator, the supervisor on site at the time of pick-up, the driver of the vehicle, and the location of the dump where the asbestos material was deposited. A representative of each of the parties listed *above* should

sign the waste manifest, and the disposal site should send a copy of the signed manifest back to the waste generator for their records.

On-Site Documentation and Postings

Documents, which should be posted on or near the decontamination units or near the entrance to the work area, include, but are not limited to, the following:

1. Notification Form

   Copies of all notifications that were sent to the following agencies:

   - EPA: Required for all large projects; submitted at least 10 working days before project.
   - New York State Department of Labor: Required for all large projects; submitted at least 10 calendar days before project begins.
   - New York City Department of Environmental Protection: Required for all large and small projects; submitted at least 7 days before project begins.

2. Notice of Asbestos Abatement: To be posted at least 10 days prior to the project, one floor above and below the floor where the abatement will take place, to notify building occupants of the abatement.

3. OSHA Warning Signs: NYC requires the OSHA warning signs to be posted in both English and Spanish. The signs should be posted at the entrance(s) to the work area.

4. Copy of Regulations - Post all regulations applicable to your project, which includes, but is not limited to

   - EPA NESHAP 40 CFR Part 61 Subparts A and M
   - OSHA Asbestos Construction Standard 29 CFR 1926.11 01
   - NYS Industrial Code Rule 56
   - NYC Title 15, Chapter 1 (if the project is in New York City)
   - Local: Any other regulations that apply to your project. For example, in a school, AHERA would be posted

5. Worker Certificates

   Workers must have the appropriate asbestos handling certificate(s) in his/her possession at all times during work on the project, or in a location proximate to the work site. This means the original NYC card and either the original or a copy of their NYS

Asbestos Handlers Certificate. In addition, Industrial Code Rule 56 specifies that no contractor shall compel the holder of any certificate to surrender the original thereof for safekeeping, display, or any other purpose.

Consultants are also required to have their certificate in their possession.

6. Contractor Licenses

   A copy of a valid asbestos handling license shall be conspicuously displayed proximate to, but outside of, the work area. This includes the handling license of all contractors on the project (i.e., abatement contractor, consultant, air monitoring firm, etc.)

   This license is issued to contractors by the New York State Department of Labor and is renewed annually

7. Emergency Phone Numbers

   The phone numbers should include the following: Fire department, ambulance, police, nearest hospital, building owner, contractor, consulting firm, Department of Labor, and Department of Environmental Protection (NYC only).

8. Variances

   Issued by 'each of the regulatory agencies, they must be posted conspicuously outside the decontamination unit(s). In NYC, a variance is known as an ACP-9 form. A variance is permission from the regulating agencies to not follow the regulations as they are written. In order to be granted a variance, you must demonstrate why you cannot follow the regulation as it is written, and give them your alternate procedure explaining how it will ensure worker and public safety. New York City and New York State also require a non-refundable fee for requesting a variance. There is no guarantee that a variance will be granted.

9. Diagram (Floor Plan) of the Work Area

   Posted outside the decontamination unit(s). However, it is also recommended that diagrams be posted inside the work area wherever they may be necessary.

10. No Smoking Area

    OSHA requires the contractor to provide a no smoking area at the job site.

11. Worker Entry/Exit Log

    Everyone who enters and exits the work area must sign the entry/exit log. This log shall indicate, and the signatures shall be used to acknowledge, that the person signing has reviewed and understood all posted regulations, procedures, and personal protection requirements, including work area entry and exit procedures.

12. Material Safety Data Sheets (MSDS)

    Material Safety Data Sheets are documents that provide the user of a chemical substance information on the physical properties, health effects, first aid procedures, chemical properties, emergency spill procedures, and other relevant data for dealing with that specific chemical product. MSDS's must be available, on the job site, for all hazardous materials at that site.

13. Emergency Procedures

    This must be posted and familiar to all employees.

14. OSHA Personal Air Sampling Laboratory Analysis Results

    These air samples are not specifically required by the regulations to be posted at the job site. However, it is in the best interest of the contractor to have a copy of these results at the work site.

15. Copies of the laboratory analysis results of the area air samples collected by the Air Sampling Technician

16. NVLAP and ELAP Certificates of the Lab Performing Sample Analysis, as well as the NYS Asbestos Handling License

17. Medical Records and Respirator Fit Test Records

Other Documentation:

Other records to maintain on site include any project asbestos abatement specifications and drawings; consultant/technician/laboratory certifications, relevant analytical methods, regulations and guidance documents, and equipment "owner's manuals".

Design and Use of the Contractor's Project Logbook

Prior to the start of any asbestos abatement project, a logbook should be established. This logbook will serve as a vehicle for maintaining all the records associated with a project. At a minimum, included in the book should be copies of the employees' medical reports, copies of any accident, injury, or accident reports, unusual events or occurrences (such as failure of negative air system or containment barriers), air sampling results, notes concerning any deviation from standard work procedures, sign-in sheets, employee training/certification documentation, And all other pertinent documents, permits, correspondence, photographs, or records. Many of these records will be duplicated elsewhere, such as medical records in the employee's personal file, etc.

The logbook should be well organized, but in a style decided by the contractor. There are two common methods of organization. First, there is the day-by-day method such as a captain's log. If this method is chosen, a loose leaf or bound notebook with dividers labeled with each day should be maintained for each job. Be sure to make entries on days that no work is done, including how the integrity of the jobsite was maintained. Another more common method of organizing a logbook is by activity. Using this method, a loose leaf notebook is divided into each activity and all documentation, notes, and receipts concerning that activity are maintained in the appropriate section.