ASBESTOS SAFETY MANUAL

ENVIRONMENTAL HEALTH & SAFETY

I. INTRODUCTION

Iowa State University has a responsibility to provide a safe environment for students, employees and visitors. To meet this obligation, the Department of Environmental Health & Safety (EH&S) identifies potential or existing hazards in university facilities and then determines the best course of action to eliminate or minimize the risks. In this role, EH&S has established an asbestos program to assess campus buildings for the presence and condition of asbestos containing materials (ACM) and to oversee operations involving ACM for compliance with regulations issued by the Environmental Protection Agency (EPA) and the Iowa Division of Labor (OSHA).

The Asbestos Safety Manual is the official guide to University policies and procedures that apply to the use, maintenance, and removal of asbestos and asbestos containing materials. This manual was developed to ensure that asbestos is properly maintained and handled and to provide policies and guidelines that promote the safe management of asbestos at ISU.

The information outlined in this manual has intentionally been written in a generalized manner, and while specific references to various asbestos regulations have been made, copies of regulations and guidelines have been omitted due to the rapidly changing regulatory environment.

As is true in most areas of campus safety, the extent to which asbestos safety is practiced depends upon the quality of safety-related information and the willingness of university personnel to put that information into practice. It is the responsibility of university staff who work with asbestos to become familiar with the contents of this manual and to observe the procedures and requirements. In addition, the manual should be reviewed by staff or students who live or work in areas containing asbestos so that they are aware of the hazards.

This manual was prepared specifically for use by all Iowa State University personnel. Any use of this manual by entities outside Iowa State University control is not authorized (except by written permission) and liability is not extended to such use.

II. UNIVERSITY POLICY STATEMENT

It is the policy of Iowa State University to provide employees, students and the public a campus and workplace which is both safe and healthy. ISU intends to comply with all applicable state and federal regulations. This means that no one should be exposed to hazardous levels of asbestos (as defined by applicable regulations). All employees, especially asbestos abatement workers, must be provided with appropriate training, information, and personal protective equipment, which is adequate and relative to the asbestos exposure hazard being encountered. In addition, ISU is committed to providing asbestos assessments and information whenever and wherever asbestos exposure potential exists from University facilities or equipment.

UNIVERSITY RESPONSIBILITIES

The management of ACM at ISU requires the cooperation of many departments and individuals to ensure that asbestos is properly maintained and handled. The specific activities and responsibilities are delegated to various university entities as outlined below:

ISU The president of ISU is ultimately responsible for all health and safety issues. This responsibility is delegated to the provost, vice-presidents, deans, directors, department chairs, principal investigators, supervisors, and ultimately, each employee for ensuring safe work practices and adherence to established policies and guidelines.

EH&S The development and implementation of proper asbestos management practices at ISU is provided by Environmental Health & Safety. It is the responsibility of Enviromental Health and Safety to :

- Develop and implement policies for the proper handling of asbestos at ISU.
- Prepare applications for federal, state and local permits to properly remove and dispose of ACM.
- Ensure that university policies and regulatory guidelines regarding the maintenance, abatement, storage, and disposal of asbestos are followed.
- Prepare, submit and maintain records, notifications and manifests required by regulations.
- Develop project specifications, conduct pre-bid tours, and design, manage and supervise abatement projects.
- Operate a certified asbestos fiber counting and identification laboratory.

- Provide training for employees who work with ACM.
- Respond to emergency situations involving asbestos at university facilities on a 24-hour basis.
- Maintain and update asbestos inventories.

FP&M

The maintenance of university buildings and their systems is the responsibility of Facilities Planning & Management. Custodial and maintenance staff are expected to avoid activities that may result in disturbing ACM. It is the responsibility of these staff to report the location of damaged or deteriorating ACM to their supervisors for repair or removal. **Under no circumstances should custodial or general maintenance staff attempt to repair, clean up, or remove ACM themselves.** In addition, it is the responsibility of Facilities Planning and Management to:

- Ensure that university policies and guidelines regarding the handling of asbestos are followed.
- Ensure that adequate resources are provided to properly maintain ACM.
- Coordinate abatement actions with EH&S.
- Provide proper training and personal protective equipment for employees working with asbestos.

Supervisors

It is the primary responsibility of the principal investigator, instructor or supervisor to ensure that the information and procedures presented in this manual are strictly followed by all personnel under their jurisdiction.

Individual Employees

As with custodial and maintenance personnel, general university staff are expected to avoid activities that might result in damage or disturbance of ACM. It is imperative that persons who handle materials or occupy areas containing asbestos be prudent in their efforts to follow the guidelines presented in this manual. Individuals have a responsibility to:

- Take no actions which will result in the disturbance of ACM. Use care when moving furniture near asbestos insulated piping and other ACM to avoid contact damage.

- Report evidence of deterioration, water damage, or delamination to EH&S by calling 294-5359 or Facilities Planning & Management at 294-5100.

- Consult with supervisors regarding the handling of ACM. Contact EH&S with questions or other concerns.

Abatement Workers

Individuals designated to remove asbestos are required to take an asbestos training course which meets the standards of the Iowa Administrative Code. This course consists of three days of class and hands-on training for general asbestos workers and four days of class and hands-on training for personnel authorized as supervisors. **Workers who have had this training are the only people authorized to remove, clean up, or repair asbestos insulation.**

III. GENERAL INFORMATION

The term "asbestos" describes several naturally occurring fibrous minerals found in certain types of rock formations. When mined and processed, asbestos mineral is processed into very thin fibers which are commonly mixed with binding materials so that they can be used in many different products (See Appendix A).

Several fibrous minerals are regulated under the heading of asbestiform materials. Asbestos is classified into two categories of materials according to their characteristics:

- **Serpentine Minerals**

  Chrysotile - "white asbestos" has fine, flexible, silky fibers with high tensile strength and accounts for over 90 percent of the asbestos used world-wide. Chrysotile is mined in Canada and the Soviet Union.

- **Amphibole Minerals**

  Amosite - "brown asbestos" is made up of long, brittle, needle-like fibers. Amosite bonds well with plastics and is often used in heat insulating materials. Amosite is primarily mined in Transvaal, South Africa.

  Crocidolite - "blue asbestos" is the strongest asbestos. It is usually found in conjunction with chrysotile in wrapping, sheeting, piping and boiler wrap. As with amosite, crocidolite is mined in South Africa.

  Tremolite, Actinolite, and Anthophyllite - these asbestos forms are seldom seen and rarely found in building or commercial products.

The use of asbestos and asbestos containing materials in our society has developed since around 2500 B.C. when it was used in the manufacture of bricks and pottery. By 1936, asbestos had become one of the most common construction materials because it is strong, doesn't burn, resists corrosion, and insulates well.

Under the Clean Air Act of 1970, the EPA began regulating many asbestos containing materials. By the mid-1970's, several major kinds of asbestos materials such as spray applied insulation, fireproofing, and acoustical surfacing material were banned because of growing concerns about the health effects associated with exposure to such materials.

During surveys conducted at ISU in 1997-99, asbestos was found in certain building materials. EH&S maintains a database of the survey results. This information is available to the University community for the purpose of identifying asbestos locations prior to construction activities. Samples of suspected materials throughout campus have shown that chrysotile asbestos is the most prevalent type of asbestos found. As noted in Figure 1, the largest percentage of ACM was found in ceiling treatments. Ceiling treatments can include acoustical ceilings (sprayed or troweled), ceiling tiles, or ceiling plasters. Thermal insulations such as boiler jackets, pipe coatings, and pipe fittings make up the second largest category of ACM. Other materials such as transite board, floor tile, gaskets, and fireproofing make up the remainder of ACM.

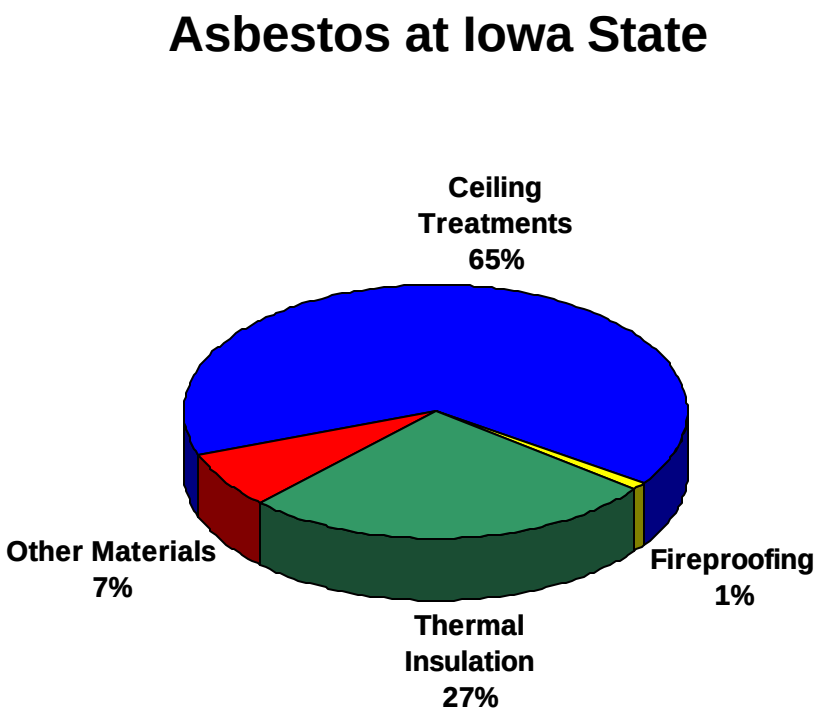


Figure 1. Asbestos Material Footage

ASBESTOS IDENTIFICATION

Definitive analysis for asbestos content is accomplished by an accredited laboratory using polarized light microscopy. EH&S operates an accredited laboratory with asbestos identification ability. Departmental personnel are trained and periodically tested to assure that their skills meet criteria established by the American Industrial Hygiene Association (AIHA) and the Environmental Protection Agency (EPA).

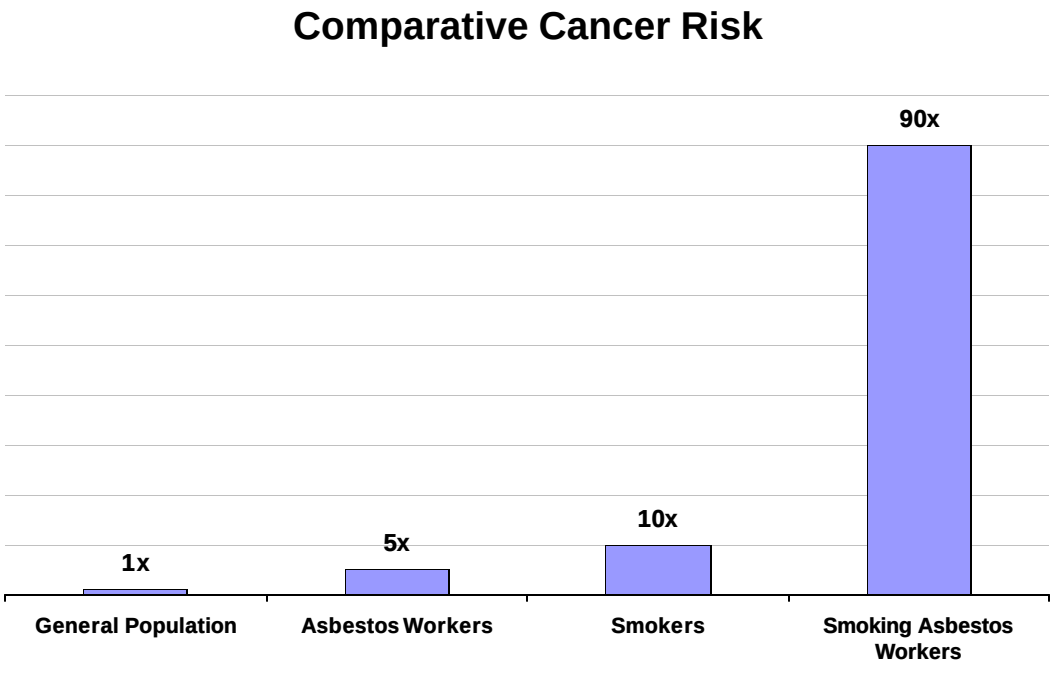
IV. HEALTH HAZARDS OF ASBESTOS

Information concerning the health effects of asbestos primarily comes from studying workers in various asbestos manufacturing industries. The bulk of this health-related information comes from World War II ship building activities and the asbestos industries in the U.S. and England. Elevated airborne asbestos fiber concentrations in these industries have been linked to increased risk of asbestosis, mesothelioma, and various forms of cancer.

Asbestosis is a chronic disease in which the lungs become scarred (fibrotic) as a result of a biological reaction to the inhalation of asbestos fibers. This scarring causes the thickening of the walls of the lungs and a reduction of the capacity to transfer oxygen into the blood. Asbestosis results from exposure to high fiber concentrations over a long period of time. The effects of exposure (the latency period) may show up in the victim as much as 15 to 30 years after the first exposure.

Mesothelioma, a cancer affecting the lining of the lung cavity, is the rarest of the asbestos related diseases. With a latency period of as much as 30 years, the disease is almost always fatal, usually within a year of diagnosis.

Lung cancer is responsible for as many as one-half the deaths occurring from past asbestos exposures. Tumors usually beginning in the lower lobes of the lungs may then invade other tissues. Statistically, the risk of developing lung cancer is five times higher for workers in the asbestos manufacturing and installation industry than those in the general population. Smokers who do not work with asbestos are statistically ten times more likely to develop lung cancer than the general population. It is estimated that a smoker who also works with asbestos is statistically 90 times more likely to develop lung cancer.



V. REGULATORY REQUIREMENTS AND GUIDELINES

Building owners are governed by state and federal regulations in the way they deal with asbestos containing materials in their buildings. An overview of the regulations governing asbestos is presented here to provide background on applicable governmental guidelines.

FEDERAL AGENCIES

The Federal agencies involved with regulations pertaining to asbestos include the following:

- Environmental Protection Agency (EPA)
- Occupational Health and Safety Administration (OSHA)
- Consumer Product Safety Commission (CPSC)
- Mine Safety and Health Administration (MSHA)
- Food and Drug Administration (FDA)

EPA and OSHA are the primary federal agencies which have established regulations to prevent contamination of the environment and to protect asbestos workers and the general public from exposure to asbestos.

ENVIRONMENTAL PROTECTION AGENCY (EPA)

- **National Emissions Standards for Hazardous Air Pollutants (NESHAP)**. The intent of this standard is to prevent visible emissions of asbestos into the environment and applies to the university as a building owner (See Appendix B). Requirements of the NESHAP regulation include:
  - -- Notification in writing to the regional EPA office prior to removal of ACM or prior to demolition of buildings.
  - -- Specified use of removal techniques to minimize fiber release during abatement.
  - -- Adherence to specific guidelines that regulate the final disposal of the removed ACM.
  - -- The prohibition of the application of acoustical or thermal ACM.

- **Asbestos-Containing Materials in Schools Rule** - This regulation was instituted by the EPA under the direction of the Asbestos Hazard Emergency Response Act (AHERA) in October of 1986. This standard only applies to K-12 schools. Parts of the AHERA regulations have become benchmarks for the industry as well as state regulations and have been incorporated into the general thinking in the asbestos industry.

OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA)

OSHA has responsibility for administering regulations that apply to all workplace activities that involve asbestos, including abatement procedures. The two standards that apply to asbestos operations are 29 CFR 1910.1001 for General Industry, and 29 CFR 1926.1101 for Construction Industry. The major requirements of these standards are:

- Personnel exposure limits for abatement activities and monitoring airborne levels.
- Annual medical exams.
- Personal protective equipment, including respirators.
- Special procedures and equipment to reduce personnel exposure during work activities.
- Annual training and on-site supervision.

STATE AGENCIES

The state agencies empowered to enforce asbestos regulations in Iowa include the following:

- **Iowa Division of Labor Services** - The Iowa Division of Labor Services enforces OSHA regulations within the State of Iowa. The State of Iowa has adopted all of the provisions of the OSHA Federal Construction and General Industry Standard. The state has also developed additional rules covering worker and contractor licensing and project notification. Specifically, the Iowa Division of Labor Services has issued regulations which require:

  -- All asbestos workers working for commercial abatement firms to complete an asbestos training course and be licensed by the state. In-house workers,, such as those employed by ISU, are exempt from the licensing requirement but still must be given equivalent training.

  -- Notification by contractors must be made to Labor Services of upcoming projects at least 10 days prior to the start of the project. ISU in-house projects are again exempt from this requirement.

- **Iowa Department Of Education And The Iowa Department Of Health** - The Iowa Department of Education and the Iowa Department of Health have been empowered to enforce the provisions of AHERA in the State of Iowa. The AHERA Standard applies to any K-12 Local

Education Agency in the nation. The Department of Education has been granted the power to review inspections and management plans for Local Education Agencies throughout the state.

- **Iowa Department of Natural Resources** - The Iowa Department of Natural Resources has responsibility for enforcement of EPA regulations in the state.

VI. CONTROL MEASURES

NATIONAL OUTLOOK

Possible risk to the public from asbestos exposure has been the subject of much discussion in the news and scientific media. Much of the information concerning the health consequences of asbestos exposure have been derived from studies of groups that had relatively high occupational exposure. In October of 1990, the EPA released a list of five facts intended to put the exposure risk into perspective:

FACT ONE: **Although asbestos is hazardous, the risk of asbestos related disease depends upon the exposure to airborne asbestos fibers.**

An individual must breathe asbestos fibers in order to incur any chance of developing an asbestos related disease. At very low levels, the risk may be negligible or zero.

FACT TWO: **Based on available data, the average airborne asbestos levels in buildings seem to be very low. Accordingly, the health risks to occupants also appears to be very low.**

Ambient fiber sampling conducted in ISU campus buildings show fiber levels to be extremely low or nonexistent. In fact, a 1987 EPA survey of federal buildings showed indoor fiber levels to be approximately the same as levels outside. The average building occupant appears to face a very low or zero health risk.

FACT THREE: **Removal is often not a building owner's best course of action to reduce asbestos exposure. In fact, an improper removal can create a dangerous situation where none previously existed.**

Asbestos removals may tend to elevate airborne asbestos fiber levels due to the disturbance of asbestos containing materials (ACM). Unless properly conducted, a removal operation may actually increase - rather than decrease - the asbestos risk.

FACT FOUR: **The EPA only requires asbestos removal in order to prevent significant public exposure to airborne asbestos fibers during building demolition or renovation activities.**

Asbestos removal prior to renovation or demolition is needed to protect the public health. The EPA believes that an improperly conducted removal project can actually increase health risk.

FACT FIVE: **The EPA does recommend a proactive, in-place management program whenever asbestos-containing material is discovered.**

In the opinion of the EPA, a program to manage the day-to-day operations of a building needs to be in place to prevent accidental or unintentional release of asbestos fibers into the air. An operations and maintenance program may be all that is necessary to control fiber release until the eventual demolition of the building.

Asbestos is still debatably the best functional material in many applications in terms of strength, durability, and insulating capability. In most cases, maintaining ACM that is in good condition is a logical approach to management of the asbestos hazard. However, removal may be necessary in instances when construction or related activities will disturb the ACM or the ACM is deteriorating, resulting in a potential release of asbestos fibers.

At ISU, several measures have been established to deal with asbestos containing materials. The University's fundamental policy is to manage asbestos in place and this method is currently encouraged by the EPA. This process involves locating and assessing the condition of all ACM. Decisions on maintenance, repair, or removal of the material are made based on this assessment, change in occupancy, or construction requirements. Descriptions of each abatement option follow.

REMOVAL

Removal is the most definitive solution to an asbestos problem. Once asbestos containing material is removed from the building, the potential for a hazardous fiber release is eliminated, as is the need for surveillance. However, several problems make this solution much less straightforward than it first appears. As stated above, an improperly conducted removal project may actually increase the health hazard by releasing airborne fibers to the general environment. Once the ACM is removed, often a replacement material is necessary. In the case of thermal insulation, a suitable replacement material (often fiberglass) is needed to insulate piping or boilers. In the case of acoustical treatments, the removed material is usually replaced with other fibrous materials such as mineral wool or fiberglass to function as the original surfacing did. However, replacement materials may have their own inherent health risks. The cost of these replacement materials may double the budget of the overall project.

ENCAPSULATION

Encapsulation can be an effective management option for ACM. An impenetrable barrier is constructed over or around ACM so that the asbestos material and any airborne fibers are effectively sealed within the enclosure. This option may be a cost-effective, short-term approach to the problem since constructing a barrier is often less expensive than removal and replacement. While the encapsulation option may be less expensive, the potential for exposure still exists because the material is still present. In addition, the design of repair and demolition operations must still consider the presence of ACM.

REPAIR & MAINTENANCE

In certain instances, minor areas of damaged ACM may be repaired using various methods to provide a durable, serviceable coating that will allow the material to continue in service. Maintenance of any ACM is essential to prolong the life of the material and is required to maintain its safety and continued integrity.

PROHIBITED ACTIVITIES

Certain activities should never be conducted on materials containing asbestos. In general, **do not**:

- Drill ACM
- Hang plants or pictures from structures covered with ACM
- Sand ACM
- Damage structural ACM (i.e. while moving furniture)
- Install drapes, curtains, or dividers that might damage ACM
- Dry brush, sweep, or dust floors, ceilings, etc. in asbestos contaminated environments
- Use a regular vacuum without HEPA filtration to clean up ACM debris. Instead use a vacuum equipped with a HEPA filter.
- Remove ceiling tiles below ACM without wearing personal protective equipment, clearing the area of occupants, and observing asbestos removal and disposal procedures.

VII. ABATEMENT PROCEDURES AT ISU

All asbestos abatement operations are managed through EH&S. Such supervision for the methods listed below assures that proper operations are performed, occupants are properly notified, and applicable regulations are followed. EH&S will perform air monitoring to assure that no asbestos is released from the containment area. Iowa State University has developed several methods of response to deal with projects and incidents that require asbestos abatement.

IN-HOUSE ABATEMENT PERSONNEL

For projects or abatement that are of limited scope, in-house abatement personnel are available to do the work. Generally, these projects will consist of minor repairs, encapsulations, and glovebag operations (removals conducted in sealed enclosures).

HOURLY CONTRACT ABATEMENT

More extensive removal and/or repair projects are sometimes conducted through the ISU Hourly Asbestos Abatement Contract. Triennially, the purchasing department solicits bids from asbestos abatement contractors to provide abatement services on a per-hour basis inclusive of equipment and material. These services are then provided by the successful bidder on an as-needed basis throughout the three-year period. Contractors are expected to conduct the project to its conclusion and provide for occupant protection.

VIII. EXPOSURE LEVELS

Potential asbestos exposure to members of the university community is primarily dependent upon the type of work performed. Exposure can be grouped into several categories of potential.

BACKGROUND LEVELS

Since asbestos has been used in such a wide variety of materials and products, it has been documented that very small amounts of fiber are present in the atmosphere inside and outside buildings in almost every part of the country. In addition, natural sources of asbestos also contribute a measurable level of fiber to the general environment. At ISU, ambient airborne fiber levels sampled within buildings on campus have always been below the detection limits of the approved method most commonly used to measure airborne asbestos fibers. This has been consistent with measurements reported by the EPA from buildings across the country. Any exposure experienced at these levels is highly unlikely to produce any increased risk of health related problems.

ACCIDENTAL SHORT-TERM ELEVATED EXPOSURE

Occasionally, incidents occur that may cause a short period of elevated levels of asbestos fibers in public areas due to inadvertent damage caused to ACM. These incidents occur despite the best intentions of all involved. They are most likely associated with repair and maintenance activities; however, they may accidentally be caused by building occupants moving furniture, etc. In general, maintenance staff are aware of the potential hazards of asbestos, and projects that may impact ACM are brought to the attention of trained personnel. EH&S provides training to university employees who have jobs that will potentially put them into contact with asbestos. The ISU asbestos policy stipulates that no work should proceed which may result in damage to ACM. If accidental damage to ACM occurs, EH&S should be notified immediately.

LEVELS ASSOCIATED WITH ASBESTOS ACTIVITIES

Activities that involve the repair and/or removal of ACM involve increased potential exposure to asbestos fibers. It is the policy of ISU that individuals who work with asbestos have training as specified in the regulations, be physically able to wear a respirator, and be experienced in the methods of abatement. The university will provide the necessary equipment to complete the required work in the safest possible manner and provide proper management and monitoring to assure that a safe environment is maintained.

IX. PERSONNEL PROTECTION

Routine monitoring for asbestos levels in occupied areas of ISU (i.e. classrooms, offices, laboratories) has revealed no fiber levels above detection limits. However, because asbestos fibers can be released during inspection, maintenance and removal activities, personal protective equipment is necessary for maintenance activities involving work with asbestos.

PERSONAL PROTECTIVE EQUIPMENT

The proper use of personal protective equipment will result in reduced exposure to asbestos fibers during abatement and other activities that involve asbestos. Work practices and engineering controls should be the primary methods for reduction of the hazard. OSHA, EPA and the Iowa Division of Labor mandate the use of PPE when performing asbestos related activities. There are a number of types of protective equipment available. EH&S can help ensure that the proper personal protective equipment is selected.

Respiratory protection provides a safeguard against the inhalation of asbestos fibers. Airborne asbestos fiber monitoring indicates that negative pressure mechanical respirators are generally sufficient to provide adequate respiratory protection (See Appendix C). ISU will provide respirators for personnel performing asbestos related activities, and these employees must be enrolled in the ISU Respiratory Protection Program in order to wear respirators.

PERSONNEL EXPOSURE

Environmental Health & Safety has been assigned the responsibility of monitoring asbestos projects to determine employee exposure to airborne asbestos fibers. Employees are then notified of these monitoring results in accordance with regulatory requirements.

MEDICAL SURVEILLANCE

Annual medical examinations are provided to ISU personnel occupationally exposed to asbestos. These annual examinations are conducted through the Iowa State University Occupational Medicine Program and comply with regulatory requirements.

X. EMERGENCY PROCEDURES

GENERAL

Responses to emergency situations are taken into consideration during asbestos abatement projects. Emergency situations that may occur should be covered by the contractor and EH&S prior to the project. Specific references are listed in the University Asbestos Abatement Specifications.

MINOR FIBER RELEASE EPISODES

In the event that small amounts of ACM (less than 3 linear or 3 square feet) are inadvertently dislodged or damaged, the following procedures should be followed:

- Restrict entry into the area and post signs to restrict entry into the area.
- Notify EH&S at 4-5359.
- Maintain the contaminated area in an unoccupied state.
- Thoroughly saturate the debris using wet methods.
- Clean the area using HEPA filtered vacuums and wet methods.
- Place any asbestos debris in a leak tight sealed container.
- Repair the area of damage using non-asbestos containing materials.

MAJOR FIBER RELEASE EPISODES

In the event that larger amounts of ACM (more than 3 linear or 3 square feet) are inadvertently dislodged or damaged, the following procedures should be followed:

- Restrict entry into the area and post signs to restrict entry into the area.
- Notify EH&S at 4-5359.
- Shut off or modify air handling systems to prevent migration of fibers to other areas.
- EH&S will design a response action in accordance with the severity of the situation.

XI. WASTE DISPOSAL

Disposal of asbestos waste generated by removal activities at the university must comply with federal and state regulations. Asbestos waste is disposed of in sealed double thickness 6 mil bags or leak proof drums. The containers are then labeled with warning labels as specified by OSHA, and generator identification labels as specified by EPA. Manifests describing and listing the waste are created and the containers are then transported by approved means to an authorized landfill for burial.

For large contracted and hourly abatement projects, it is the written obligation of the contractor to legally dispose of the asbestos waste generated during that project.

Waste generated during in-house projects is accumulated in secure storage supervised by EH&S until a sufficient amount is accumulated to warrant transport to a local authorized landfill. Disposal fees are the responsibility of the department generating the ACM waste.

APPENDIX A

Asbestos-Containing Materials Found in Buildings*

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

Asbestos-Containing Materials Found in Buildings*

(Continued)

Subdivision	Generic Name	Asbestos (%)	Dates of Use	Binder/Sizing
Roofing felts	smooth surface	10-15	1910-present	asphalt
	mineral surface	10-15	1910-present	asphalt
	shingles	1	1971-1974	asphalt
	pipeline	10	1920-present	asphalt
Asbestos-containing compounds	caulking putties	30	1930-present	linseed oil
	adhesive (cold applied)	5-25	1945-present	asphalt
	joint compound		1945-1975	asphalt
	roofing asphalt	5	unk-present	asphalt
	mastics	5-25	1920-present	asphalt
	asphalt tile cement	13-25	1959-present	asphalt
	roof putty	10-25	unk-present	asphalt
	plaster/stucco	2-10	unk-present	Portland cement
	spackles	3-5	1930-1975	starch, casein, synthetic resin
	sealants/fire water	50-55	1935-present	caster oil or polyisobutylene
	cement, insulation	20-100	1900-1973	clay
	cement, finishing	55	1920-1973	clay
	cement, magnesia	15	1926-1950	magnesium carbonate
Asbestos ebony products				
Flooring tile and sheet goods	vinyl/asbestos tile	21	1950-present	poly (vinyl) chloride
	asphalt/asbestos tile	26-33	1920-present	asphalt
	sheet goods/ resilient	30	1950-present	dry oils
Wallcovering	vinyl wallpaper	6-8	unk-present	---
Paints and coatings	roof coating	4-7	1900-present	asphalt
	air tight	15	1940-present	asphalt

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* The information in this table is taken, with modification, from: Lory EE, Coin DC. February 1981. *Management Procedure for Assessment of Friable Asbestos Insulating Material*. Port Hueneme, CA: Civil Engineering Laboratory naval Instruction Battalion Center. The U.S. Navy prohibits the use of asbestos-containing materials when acceptable nonasbestos substitutes have been identified.

⊕ Laboratory aprons, gloves, cord, rope, fire blankets, and curtains may be common in schools.

APPENDIX B

NESHAP NOTIFICATION REQUIREMENTS

	DEMOLITION	RENOVATION	
Amount of asbestos involved	All cases	> 260 lin. ft. or > 160 sq. ft.	< 260 lin. ft. < 160 sq. ft.
Notification required?	Yes	Yes	Not required
Advance notice required	10 working days	10 working days	Not required

APPENDIX C

RESPIRATORY PROTECTION FOR ASBESTOS, TREMOLITE, ANTHOPHYLLITE, AND ACTINOLITE FIBERS*

Airborne concentration of asbestos, tremolite, anthophyllite, actinolite, or a combination of these materials	Required Respirator
Not in excess of 1.0 f/cc (10 X PEL)	Half mask air-purifying respirator equipped with high efficiency filters
Not in excess of 1.0 f/cc (10 X PEL)	Full facepiece air-purifying respirator equipped with high efficiency filters (qualitatively fit-tested)
Not in excess of 10.0 f/cc (100 X PEL)	Tight-fitting air-purifying repirator equipped with high efficiency filters
Not in excess of 100 f/cc (1000 X PEL)	Full facepiece supplied air respirator operated in pressure demand mode
Greater than 100 f/cc (>1000 X PEL) or unknown concentration	Full facepiece supplied air respirator operated in pressure demand mode equipped with an auxilliary positive pressure self-contained breathing apparatus

*As appearing in the OSHA Construction Standard 29 CFR 1926.1101(h) (2) (iii)