MODEL EPA CURRICULUM FOR TRAINING MANAGEMENT PLANNERS

(For Accreditation Under TSCA Section 206)

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PREFACE

This model curriculum manual was modified as needed to meet the needs of State Facilities by the Maryland Department of the Environment.

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Section A: COURSE OVERVIEW

QUALIFICATIONS OF THE MANAGEMENT PLANNER

The Asbestos Hazard Emergency Response Act (AHERA) Final Rule suggests certain minimum education prerequisites for Building Inspectors and Management Planners. However, states are free to adopt standards that may be higher or lower than federal suggestions:

Suggested Prerequisites (AHERA)

Inspectors	Planners
High School Diploma	Registered Architect
	Registered Engineer
	Certified Industrial Hygienist
	Related Scientific Professional

To become an accredited Building Inspector, persons are required to participate in an approved 3-day training course and obtain a minimum score of 70 percent on an examination. To become an accredited Management Planner, persons must take the Building Inspector's course plus an additional 2-day approved training course. Management Planners must pass the examination following the Building Inspector's course as well as an examination at the conclusion of the Management Planner's course. To maintain their accreditation, Management Planner's must attend a Building Inspector refresher course of one-half day in length, plus an additional half-day session on Management Planning for annual reaccredidation. Each state has the option of requiring persons to pass reaccredidation examinations at specific intervals. COMAR 26.11.23 requires there to be an examination at the end of each refresher course.

FUNCTIONS OF THE MANAGEMENT PLANNER

The Building Inspector is responsible for (1) determining whether ACM is present in a building and (2) assessing physical characteristics of the ACM and of the building. The Management Planner then uses this information to estimate the degree of current or potential hazard posed by the ACM, and to develop a plan for managing the ACM.

This includes the responsibility for designing an operations and maintenance plan if the existence and location of ACM is confirmed. An O&M plan is to be implemented as soon as ACM is identified. **The O&M program is to remain in effect until all ACM is removed from the facility.**

A building inspection involves (1) an investigation of records for the specification of ACM, (2) an inspection of the building for suspect materials, (3) sampling and analyzing suspect materials to test for asbestos, and (4) assessing the condition and location of the ACM and other characteristics of the building. After reviewing the results of the inspection and physical

assessment report covered in Section B of this notebook, the Management Planner employs a systematic approach to determine: (1) the hazard posed by the ACM, covered in section C: Hazard Assessment; and (2) evaluates and selects control/response options, as discussed in section E. Five major response actions are identified in AHERA. They include:

* Operations and Maintenance (O&M) - sometimes referred to as "preventative measures" in AHERA
* Repair
* Encapsulation
* Enclosure
* Removal

The State Employee' s Asbestos Program adds a sixth oneRestriction (AHERA calls this isolation).

The selection of response actions must be based upon a number of evaluating factors, including (1) hazard assessments, (2) costs - initial and long term, and (3) life of the facility. The Management Planner determines which response action is appropriate for all ACBM identified in the building. **The single most important factor in determining a response action must be the health and safety of the building occupants.** Once this factor has been gauged, all other factors should be incorporated into the final decision. In so doing, the Planner will find it advantageous to consult with other professionals, for example an architect. Section F provides guidance regarding the utilization of other professionals in developing a Management Plan.

If the recommended response action is O&M (any public, commercial, or school building containing or assumed to contain ACBM must implement an O&M program as long as the ACM remains in the building), the Management Planner must develop and document the O&M program in the Management Plan. Developing an O&M program is covered in Section E of this notebook.

Reinspections of school buildings are required every 3 years. These inspections must be conducted by accredited inspectors. Modified inspections on a periodic basis (at least every 6 months), are also part of the Management Planning process. They must be conducted by trained individuals but any required sampling must still be done by an accredited asbestos Building Inspector. All inspection and assessment data compiled at the time of the reinspection are to be appended to the existing Management Plan and acted upon in a timely manner.

Reinspection of State owned buildings are required every 3 years. These inspections must be conducted by accredited inspectors. **Exceptions: areas which are restricted (for these areas documentation that restricted areas are still properly isolated shall be made), and areas that have been documented as "Plausibly Asbestos Free" and confirmed by MDE.** Modified inspections on an annual and periodic basis, are also part of the Management Planning process. They must be conducted by trained individuals but any required sampling must still be done by an accredited asbestos Building Inspector.

All inspection and assessment data compiled at the time of any inspections are to be appended to the existing Management Plan and acted upon in a timely manner.

Recordkeeping to document compliance with EPA, OSHA and State regulations and to update the condition of ACM is covered in section H of this manual. Section I provides a detailed description of the elements of a Management Plan.

The Management Planner is expected to be knowledgeable regarding the costs of and options for financing response actions, including O&M programs. Section J provides financing and cost estimating guidance.

Section F of this manual covers legal issues.

SECTION B: EVALUATION AND INTERPRETATION OF SURVEY RESULTS

INTRODUCTION

As specified in the AHERA Rule, the building inspection and management plans are designed to compliment each other. Information on the presence or absence of ACM, its condition, and its location in the building becomes the input data for the management plan. The Management Planner uses the inspection data to determine (1) the relative degree of hazard posed by the various ACM in the building, (2) recommended response actions together with the timing of those actions, and (3) recommended management practices (the operations and maintenance program) for any ACBM in or on the building.

SUMMARY OF INSPECTION REPORT AND MANAGEMENT PLAN

The AHERA Rule requires that the following key items of information be included in the Inspection Report:

* A list of identified homogeneous areas classified by type of material (surfacing material, thermal system insulation, or miscellaneous material).

* The location (through blueprints, diagram, or written description) of homogeneous sampling areas and individual sampling locations, the location of friable suspect material assumed to be ACBM, and the location of non-friable suspected material assumed to be ACBM. The dates of sampling should also be included.

* Approximate square or linear footage of any homogeneous or sampling area where material was sampled for ACM.

* A copy of the laboratory analyses for each bulk sample and designation of each homogeneous area as ACM or Non-ACM. The dates of sample analyses should also be included.

* The physical assessment of ACBM and suspect ACBM and placement into one of the following categories:

    1. Damaged or significantly damaged thermal system insulation ACBM.

    2. Damaged friable surfacing ACBM.

    3. Significantly damaged friable surfacing ACBM.

4. Damaged or significantly damaged friable miscellaneous ACBM.

5. ACBM with potential for damage.

6. ACBM with potential for significant damage.

7. Any remaining friable ACBM or friable suspect ACBM.

* The name and signature of each accredited inspector collecting samples, the state of accreditation, and, if applicable, his or her accreditation number.

According to AHERA, the following key elements comprise the Management Plan:

- General building description and a summary of the Inspection Report.
- Descriptions of hazard assessments for all ACBM and all suspect material assumed to be ACBM.
- Recommended preventive measures (operations and maintenance program) and/or response actions for any friable ACBM.
- Location where preventive measures and response actions are to be implemented.
- Reasons for selecting the measures or actions.
- Schedule for implementation.
- Identification of ACBM that remains after response actions are taken.
- Plan for periodically reinspecting ACBM.
- Program for informing workers and building occupants.
- Evaluations of resources needed to implement management plan.

The State's Management Plan consists of the following key elements:

* The "Policy Package" which contains:
    - A list of all program personnel
    - An inventory of all buildings and their asbestos content
    - Policies dealing with equipment, notification, etc.
    - A list of records and accessibility information
* The hazard rankings for each type of ACM
* Both short and long term plans to deal with the ACM
* Laboratory results of samples taken

REVIEW OF SURVEY DATA

The building inspection will produce three types of survey data: (1) field data on building characteristics, homogeneous sampling areas, areas where assessments were performed (functional areas), and suspect materials assumed to be ACBM but not sampled, (2) results of laboratory analyses of bulk samples for asbestos, and (3) physical assessment data on suspect ACBM.

Field Data

The Management Planner should first review the Building Inspector's field data to (1) become familiar with the building and suspect, assumed, and confirmed ACBM, and (2) check for obvious errors in the characterization of the building and suspect ACBM. All of the inspector's data sheets (floor plans or sketches, maps or sketches of homogeneous areas, assumed ACBM location forms) should be reviewed during a building walk-through. The Management Planner should also be certain the inspection was performed by an accredited inspector.

Laboratory Analysis

The Building Inspector's bulk sample data forms should be compared with the laboratory reports to verify which samples and which homogeneous areas contain asbestos. The Inspector's summary describing type and location of ACBM, the type of asbestos, and the extent of each homogeneous area should then be checked for accuracy during the building walk-through.

Physical Assessment Data

Finally, the Building Inspector' s reports on the physical assessment of ACBM should be examined. Spot checks of the ACBM (particularly the friable ACBM) should be made during the building walk-through to verify the assessments. Discrepancies between the Building Inspector' s and the Management Planner' s assessments should be noted. Any significant difference (i.e., a change in damage or potential for damage category) should trigger a complete reassessment of all functional areas by the Management Planner.

SUMMARIZING THE INSPECTION DATA

The Damage Control Report and the Building Inspector's Summary Sheet provide a useful starting point for the next step in the development of a management plan --- the hazard assessment. If these forms are not available from the Building Inspector, a summary should be prepared from the Building Inspector' s data forms.

EXHIBIT B-1 INSPECTOR'S SUMMARY FORM SAMPLING AND ASSESSMENT RESULTS

ACBM Location		ACBM Characteristics				Assessment Results		
Homogeneous Area No.	**Functional Space No.**	**Type**	**Friable/ Non-Friable**	**% Asbestos**	**Amount of Material**	**Con-dition**	**Potential Distur-bance**	**Reason for Damage**

EXHIBIT B-2 RECORDING FORM FOR PHYSICAL ASSESSMENT DATA

Building:_____

Room Number:_____ Type:_____

Location:_____

Type of Suspect Material: Surfacing _____,Thermal_____,Misc._____

Description:_____

Approximate Amount of Material (linear or Square ft.):_____

Condition

Percent Damage: _____% Localized, _____%Area

Type of Damage: Deterioration_____,Water_____,Physical _____,

Description:_____

_____

Overall Rating: Good_____, Fair_____, Poor_____

Potential for Disturbance

Frequency of Potential Contact: High_____, Moderate_____,Low_____,

Description:_____

_____

Influence of Vibration: High_____, Moderate_____,Low_____,

Description:_____

_____

Potential of Air Erosion: High_____, Moderate_____,Low_____,

Description:_____

_____

Overall Rating: Potential for_____,Potential_____,Low Potential_____
Sig. Damage for Damage for Damage
Comments:_____

Signed:_____ Date:_____

SECTION C HAZARD ASSESSMENT AND RESPONSE ACTION EVALUATION

INTRODUCTION

Assessing the hazard potential of ACBM is one of the key activities of the Management Planner. Working from the results of the physical assessment of suspect materials (condition and potential for disturbance) conducted by the Building Inspector, the Management Planner interprets and evaluates the data for the purpose of setting abatement priorities and ranking areas for response actions. The interpretation and evaluation process is described in the AHERA Rule as "hazard assessment".

This section builds on the general discussion of approaches to ACM assessment and the detailed description of one approach as it is presented in the Building Inspector' s training course and repeated in this section. New material in this manual focuses on selecting and timing appropriate response actions.

THE MANAGEMENT PLANNER'S HAZARD ASSESSMENT

Although all ACBM will have been evaluated by the Building Inspector in terms of condition and potential for disturbance, **considerable discretion in selecting response actions is allowed.** To assist in selecting among the allowed ACBM control actions for each category, a hazard assessment should be conducted. The hazard assessment combines the level of potential disturbance with the current condition of the ACM to indicate overall hazard potential, as shown on the decision tree.

The rankings of potential hazard range from 7 - the most hazardous to 1 - the least hazardous. The highest rank is reserved for ACBM that is "significantly damaged". A review of the definition of "significant damage" will reveal that the definition is designed to identify ACBM that is so extensively damaged or deteriorated that it requires immediate corrective action. Hazard ranks 4-6 reflect ACBM that is "damaged" as defined in AHERA, with rank 6 indicating a "potential for significant damage" and rank 5 indicating a "potential for damage". Hazard ranks 1-3 are reserved for ACBM currently in good condition, but with a range in the likelihood for future disturbance.

Note that this hazard ranking system combines AHERA categories of condition and potential for disturbance. By combining categories a more complete evaluation of abatement priorities can be obtained.

Note also that the hazard assessment produces seven hazard ranks. These seven ranks are different from and should not be confused with the seven AHERA categories of damage and potential for damage that inspectors use as part of their physical assessment. Review the AHERA categories and hazard ranks to verify their differences.

EVALUATING RESPONSE ACTIONS

Exhibit C-7 outlines the basic response actions specified in the AHERA rule which correspond to the hazard rankings in Exhibit C-5 and C-6. Since the hazard ranks are combinations of AHERA categories, the indicated response actions are likewise combinations. As noted above, hazard rank number 7 indicates that immediate steps should be taken to evacuate people in the functional space or restrict the area with an airtight barrier. **AHERA allows "repair" as an option for thermal system insulation, but only if the repair is "technologically feasible" and "human health and the environment" can be protected.** This ranking receives the highest priority for abatement. Hazard ranks 1-6 are of lower immediate concern, but require specific response actions. The first action should be to institute a comprehensive operations and maintenance program (O&M). A detailed description is found in Section G. Other actions depend on individual circumstances. AHERA encourages Management Planners to broadly evaluate the costs and effectiveness of alternative response actions. A key phrase in the AHERA Rule is that **the most appropriate response action is "the least burdensome method which protects human health and the environment".** Note that removal, enclosure, encapsulation, and repair are all potentially allowable actions for each of the hazard categories. In addition for non-school buildings under the State' s asbestos program, restriction is also an allowable option. **The AHERA rule points out that nothing in the Rule should be interpreted as precluding removal of ACBM at any time.** In the long run, all friable ACBM must be removed from each building prior to renovation or demolition according to the National Emission Standards for Hazardous Air Pollutants (NESHAP). However, the least burdensome strategy may well involve a combination of O&M; repair, enclosure, or encapsulation (if technically appropriate); and eventual removal, perhaps combined with building system renovation. **NEVER THE LESS, THE APPROACH SELECTED MUST PROTECT HUMAN HEALTH AND THE ENVIRONMENT!**

Exhibit C-4 provides information that the Management Planner should use as a staring point in evaluating and selecting response actions. The AHERA requirements provide a framework and establish limits for analysis and decision-making. The abatement priority rank suggests the relative timing for ACBM abatement from a hazard perspective. The final decision will depend - on a detailed analysis of effectiveness and costs as described in Sections D and J.

EXHIBIT: C-1 AND C-2 CLASSIFYING THE CONDITION OF ASBESTOS CONTAINING MATERIALS (ACM)

Asbestos Building Inspectors will use the following criteria to assess the condition of asbestos containing materials.

Significantly Damaged

- The surface is crumbling or blistered over at least ten percent of the surface if the damage is evenly distributed (twenty five percent if the damage is localized).

- Ten percent (twenty five percent if localized) of the material is hanging from the surface, missing, deteriorated, or showing adhesive failure.

- Water stains, gouges, or mars over at least ten percent of the surface (twenty five percent if localized damage)

- Missing jackets on at least ten percent of the piping or equipment.

- Crushed or heavily gouged or punctured insulation on at least ten percent of pipe runs/risers, boiler, tank, duct, etc. if the damage is evenly distributed (twenty five percent if the damage is localized).

- For Thermal System Insulation on pipes, boilers, tanks, ducts, and other thermal system insulation equipment, where the insulation has lost its structural integrity, or its covering, in whole or in part, is crushed water stained, gouged, punctured, missing, or not intact such that it is not able to contain fibers.

- For miscellaneous materials the damage must be extensive and severe.

- Accumulation of powder, dust, or debris similar in appearance to the suspect material or surfaces beneath the material can be used as confirmatory evidence.

Damaged

- The surface is crumbling, blistered, water stained, gouged, marred, or otherwise abraded over less ten percent of the surface but more than one percent if the damage is evenly distributed (less than twenty five percent but more than one percent if the damage is localized).

- A few water stains or less than ten percent of insulation with missing jackets

- Crushed insulation or water stains, gouges, punctures, or mars more than one percent but less than ten percent if the damage is evenly distributed (or more than one percent but less than twenty five percent if the damage is localized)

- For miscellaneous materials there must be damage or deterioration such that the internal structure (cohesion) of the material is inadequate or, if applicable, which has delaminated such that the bond to the substrate (adhesion) is inadequate or which for any other reason lacks fiber cohesion or adhesion qualities. Such damage or deterioration may be illustrated by the separation of the ACM into layers; the separation of ACM from the substrate, flaking, blistering, or crumbling of ACM surface; water damage; significant or repeated water stains, scrapes, gouges, mars, or other signs of physical injury on the ACM. Asbestos debris originating from the ACBM in question may also indicate damage.

- For Thermal System Insulation on pipes, boilers, tanks, ducts, and other thermal system insulation equipment, damage may be illustrated by occasional punctures, gouges, or other signs of physical injury to ACM; occasional water damage on the protective coverings/jackets; or exposed ACM ends or joints. Asbestos debris originating from the ACM in question may also indicate damage.

- Accumulation of powder, dust, or debris similar in appearance to the suspect material or surfaces beneath the material can be used as confirmatory evidence.

Good Condition

- Material with less than or equal to one percent damage or deterioration if the damage is evenly distributed (or less than or equal to one percent damage if localized).

EXHIBIT C -3 CLASSIFYING THE POTENTIAL FOR DISTURBANCE OF ASBESTOS CONTAINING MATERIAL (ACM)

Asbestos Building Inspectors will use the following criteria in assessing the potential for disturbance of asbestos containing materials (ACM)

Potential for Contact with the Material

High:	-	Maintenance workers in the vicinity of the material more than once per week, or
	-	The material is in a public place (e.g. hallway, corridor, auditorium, etc.) and is accessible to building occupants
Moderate	-	Maintenance workers in the vicinity once per month to once per week, or
	-	The material is in room or office and accessible to the occupants
Low	-	Maintenance workers in the vicinity of the material less than once per month, or
	-	The material is visible but not within reach of building occupants

Influence of Vibration

High	-	Loud motors or engines present (e.g. some fan rooms) or
	-	Intrusive noises or easily sensed vibrations (e.g. major airports, major highway etc.)
Moderate	-	Motors or engines present but not obtrusive (e.g. ducts vibrating but no fan in the area etc.) or
	-	Occasional loud sounds (e.g. music room)
Low	-	None of the above

Potential for Air Erosion

High	-	High velocity air (e.g. elevator shaft, fan room etc.)
Moderate	-	Noticeable movement of air (e.g. airshafts, ventilator air stream etc.)
Low	-	None of the above.

EXHIBIT C-4 CLASSIFICATIONS FOR THE LEVEL OF POTENTIAL DISTURBANCE

Level of Potential Disturbance	Frequency of Potential Contact	Influence of Vibration	Potential for Air Erosion
HIGH ("Potential for significant damage" as in AHERA	High	Any Value	Any Value
	Any Value	High	Any Value
	Any Value	Any Value	High
MODERATE ("Potential for damage" as defined in AHERA)	Moderate	Moderate or Low	Moderate or Low
	Moderate or Low	Moderate	Moderate or Low
	Moderate or Low	Moderate or Low	Moderate
LOW	Low	Low	Low

EXHIBIT C-5. CLASSIFICATIONS FOR HAZARD POTENTIAL (DECISION TREE DISPLAY)

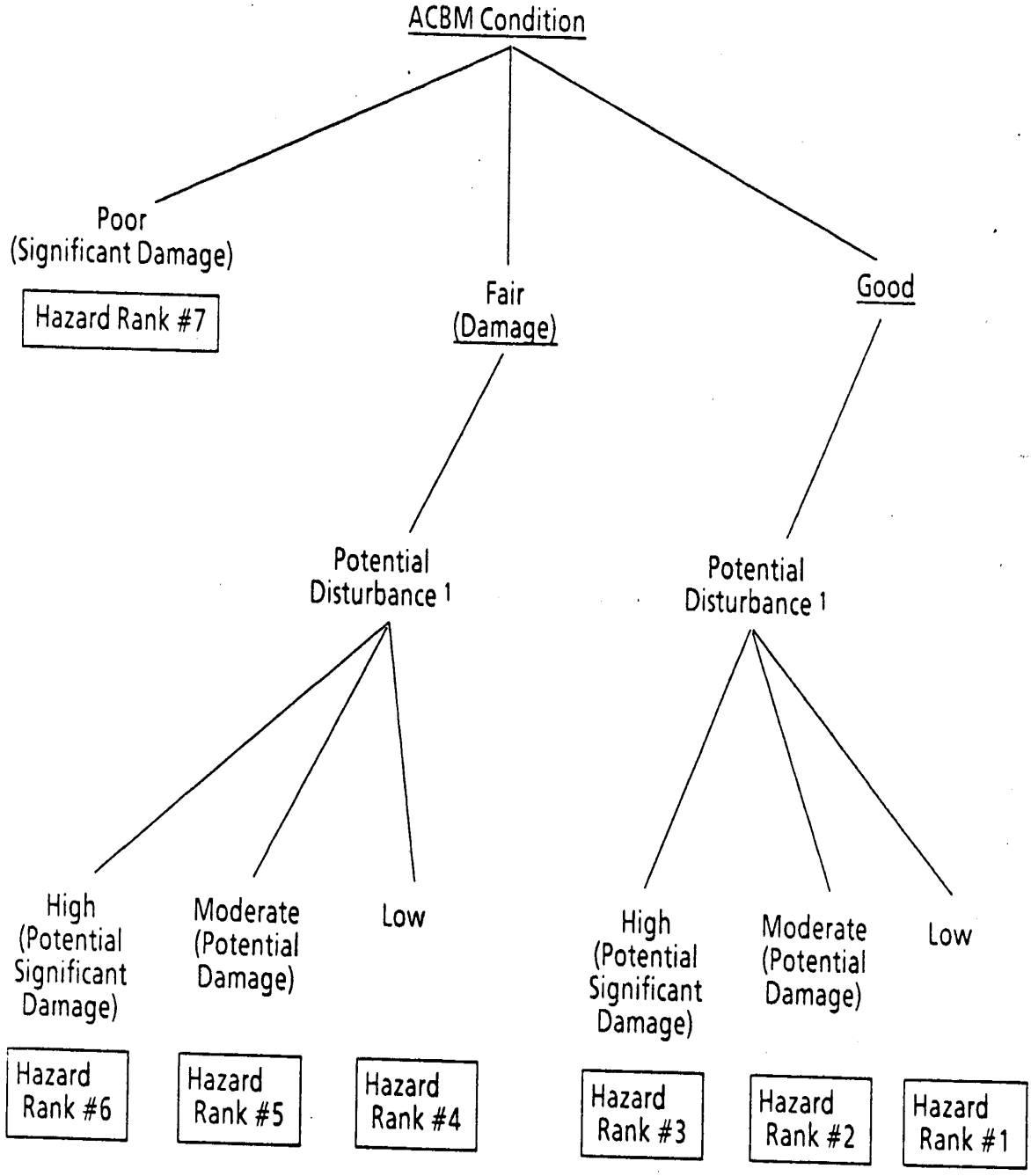


EXHIBIT C-6 CLASSIFICATION FOR HAZARD POTENTIAL (TABULAR DISPLAY)

Hazard Rank	ACBM Condition	ACBM Disturbance Potential
7	**Significantly Damaged**	**Any**
6	**Damaged**	**Potential for Significant Damage**
5	**Damaged**	**Potential for Damage**
4	**Damaged**	**Low Potential for Damage**
3	**Good**	**Significant Potential for Damage**
2	**Good**	**Potential for Damage**
1	**Good**	**Low Potential for Damage**

EXHIBIT C-7 RESPONSE ACTIONS BASED ON HAZARD RANKING

Hazard Rank	Removal Priority	AHERA Categories	Response Actions Required by AHERA
7	1	Significantly Damaged	Evacuate or restrict the area if needed. Remove the ACBM (or enclose or encapsulate it if sufficient to contain fibers). Repair of T.S.I. allowed if feasible and safe. O&M required for all ACBM.
6	2	Damaged with Potential for Significant Damage	Evacuate or restrict the area if needed. Remove, enclose, encapsulate, or repair to correct damage. Take steps to reduce potential for disturbance. O&M required for all ACBM.
5	3	Damaged with Potential for Damage	Remove, enclose, encapsulate, or repair to correct damage. O&M required for all ACBM.
4	4	Damaged with low potential for damage	Same as Hazard Rank 5
3	5	Good with Potential for Significant Damage	Evacuate or restrict the area if needed. Take steps to reduce potential for disturbance. O&M required for all ACBM.
2	6	Good with Potential for Damage	O&M required for all ACBM. Take steps to reduce potential for damage.
1	7	Good with low potential for disturbance	O&M required for all ACBM.

A METHOD FOR CONDUCTING PHYSICAL ASSESSMENTS UNDER AHERA

A Decision Tree Approach to Physical Assessments

The approach described below extends the EPA assessment guidelines in the "Purple Book" to include hazard assessment requirements in the AHERA Rule. It is based on an approach described in the draft EPA document: "Guidance for Assessing and Managing Exposure to Asbestos in Buildings," D. Keyes, et. al., EPA, November 1986.

The fundamental principle of the assessment methodology described here is that the tendency for ACM to release fibers is directly related to the degree that the material has been disturbed or has deteriorated. One of the best measures of past and current disturbance and/or deterioration is the condition of the material. ACM in poor condition reflects past and perhaps ongoing disturbance/deterioration, and probably indicates past and on going release of fibers into the air. The likelihood of future disturbance can be gauged by the location of the material with respect to: (1) workers and other building occupants (the frequency of potential contact), (2) sources of vibration, and (3) sources of air erosion.

Assessing the Condition of the Suspect Material

Suspect material will be placed in one of three categories based on a visual inspection: good, damaged, or significantly damaged. Note that the definition of "significantly damaged" is fairly restrictive. In the spirit of AHERA, it is designed to identify ACBM that needs to be restricted and removed (or repaired, if possible) as soon as is feasible.

To aid in reliable and repeatable application of the definitions, a rough quantitative measure of damage is introduced -- the extent of damage. As indicated, if the damage or deterioration covers roughly one tenth (if evenly distributed) or one quarter (if localized) of the surface, or more, the suspect material is rated as being significantly damaged. The presence or absence of other characteristics would also be sufficient for this classification. Of course, even the quantitative aspects of these assessments remain somewhat subjective. The aim is for the building inspector to gain a "feel" for the appropriate use of the definitions through repeatedly viewing a series of training pictures.

The distinction between localized and distributed damage reflects one of the purposes of assessment -- developing recommendations for abatement. Localized damage or deterioration should be easier to repair.

Assessing the Potential for Disturbance

The likelihood that the suspect material could be disturbed in the future is related to (1) the frequency with which service workers need to work near or building occupants are in the vicinity of the material, (2) its location with respect to sources of vibration, and (3) the potential for air erosion. Note that the factors are evaluated differently depending on whether service workers or other building occupants are the ones likely to contact the material. The results of evaluating the factors in Exhibit C- 3 are then used to classify the material with respect to its potential for disturbance. The categories are: potential for significant damage, potential for damage, and low potential for damage.

The classification scheme is illustrated in Exhibit C-4. As shown, if any one of these three factors (frequency of potential contact, influence of vibration, and potential for air erosion) is determined to be high, then the level of potential disturbance is "potential for significant damage" as defined by AHERA, regardless of ratings for the other two criteria. Similarly, if none of the three criteria is assessed as high but at least one has a rating of "moderate" then the level of potential disturbance is designated "potential for damage" as defined by AHERA. If all three criteria are rated low, then the overall rating is "low potential for damage". Note, that AHERA does not refer specifically to material in good condition or with a low potential for disturbance.

Other Data Important for Estimating Exposure Potential

Once asbestos fibers are released from ACBM, the degree to which they pose a danger to building workers and occupants depends on their concentration in the air at locations where people are present. Understanding the building' s HVAC system is important to understanding the transport of released fibers. Any time fibers are released into the ventilation air stream they will be transported to occupied spaces. Thus, whether or not the ACBM is located in an air plenum should be noted. Location in a supply air plenum is more significant than in a return plenum since the distance of transport to the occupied space is shorter and dilution by make-up air is less significant.

There may also be circumstances where ACBM exist in plenums or other spaces were air movement is present. The air movement may be due to mechanical equipment or through natural forces such as temperature differential or wind forces infiltrating though the building envelope. Never the less, the movement of air around ACBM also constitutes a hazard.

The total amount of suspect material in damaged or deteriorated condition may also affect the level of asbestos in the air. The amount of material can be calculated from the estimated percentage of damage and the estimated amount of material present.

Finally, additional information may be useful for other purposes. For example, the number of people in the building may be needed to put in for AOC funding.

Recording Assessment Data

All of the data discussed above should be collected in a systematic manner. Exhibit C-11 is a data form that could be used for this purpose.

The form should be filled in as follows:

* Fill in the building name, functional space number, and description of the location in the building. Note the type of area as well, including details such as whether it is a supply or return air plenum.

* Identify the type and amount of suspect material being assessed and describe it. Note: Where various types of material are present in a single functional space (e.g., fireproofing, acoustical plaster, and pipe wrap in a classroom), a separate form should be filled out for each material.

* Calculate the approximate amount of material by estimating the square feet of surfacing or miscellaneous material or the linear feet of pipe wrap, the number of pipe elbows, and the square feet of other types of thermal insulation.

* Estimate the extent and type of damage/deterioration and describe it.

* Using the rating scheme summarized in Exhibits C-1 and C-2 rate the overall condition of the material.

* Using the potential for disturbance rating scheme summarized in Exhibit C-3, rate the frequency of potential contact, the influence of vibration and the potential for air erosion. Describe the conditions observed in arriving at your rating.

* Using the classification in Exhibit C-5, rate the overall potential for disturbance.

* Add any additional comments that may be useful to the Management Planner in developing a plan to manage the ACBM.

EXHIBIT C-8
REPRESENTATION OF TEN PERCENT DISTRIBUTED DAMAGE

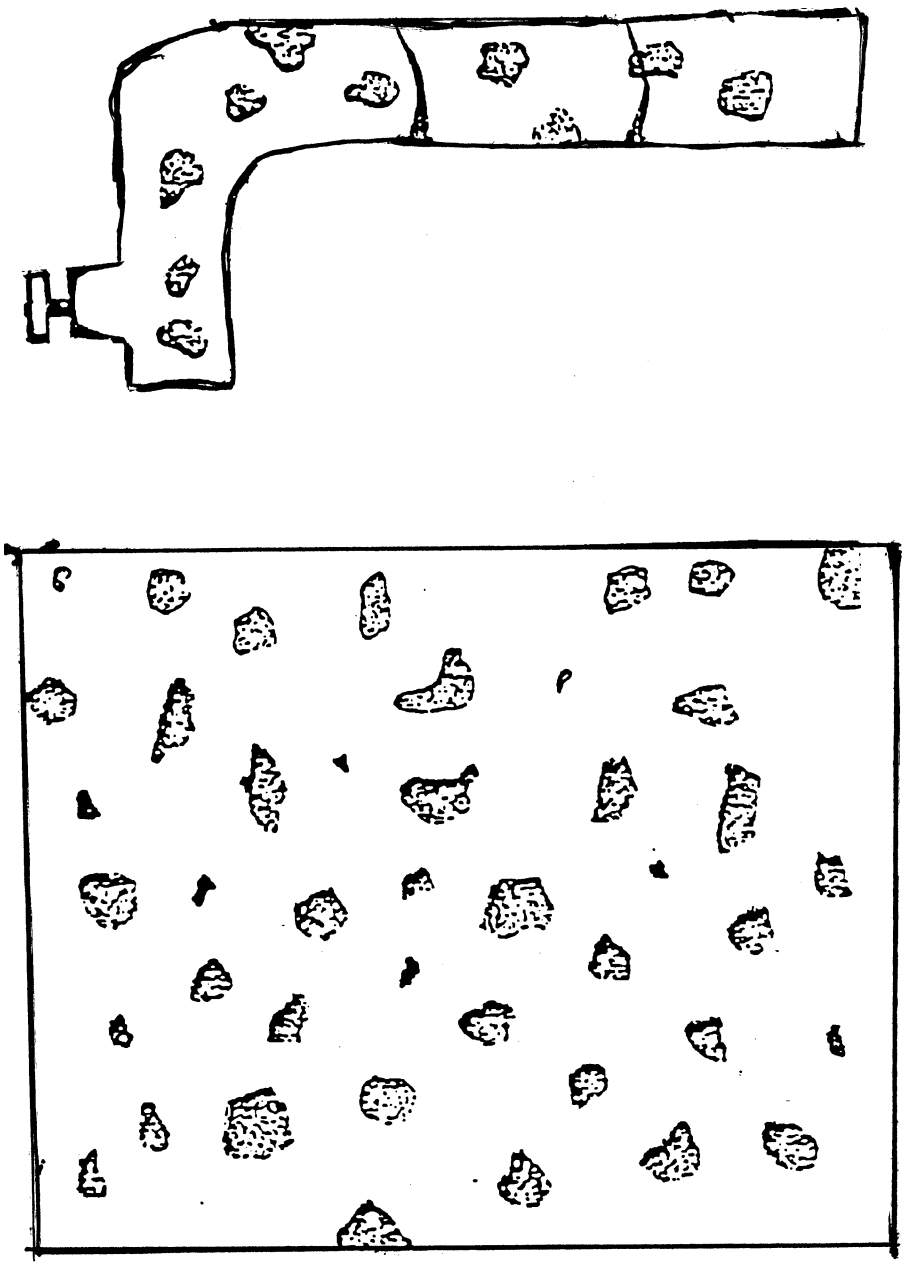
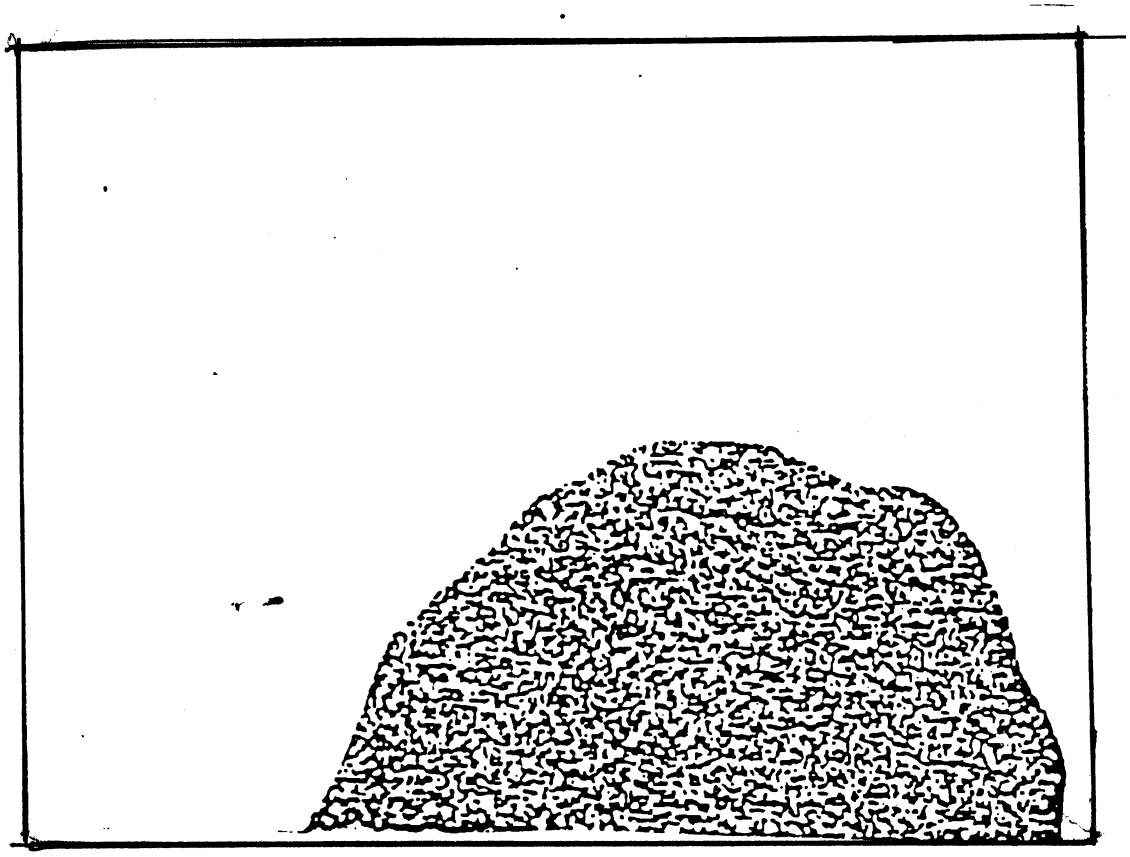


EXHIBIT C-9
REPRESENTATION OF TWENTY FIVE PERCENT LOCALIZED DAMAGE



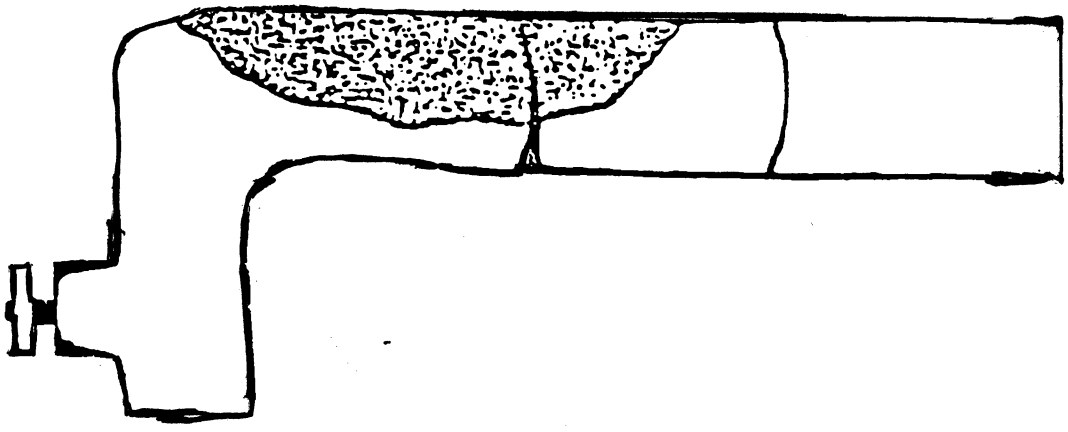


EXHIBIT C-10 CLASSIFICATION OF THE POTENTIAL FOR DISTURBANCE

Potential for Disturbance	Frequency of Potential Contact	Influence of Vibration	Potential for Air Erosion
Potential for Significant Damage	**Any High Value**		
Potential for Damage	**Any Moderate Value**		
Low Potential for Damage	**All Low Values**		

AHERA Definitions

Potential Damage

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

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

Potential for Significant Damage

Same as Potential for Damage, plus:

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

EXHIBIT C-11 RECORDING FORM FOR PHYSICAL ASSESSMENT DATA

Building:_____

Room Number:_____ **Type of Room:**_____

Location:_____

Type of Suspect Material: Surfacing _____, Thermal _____, Miscellaneous _____

Description:_____

_____

Approximate Amount of Material (Linear or Square Ft.)
_____

Condition

Percent Damage: _____% Localized, _____%Area

Type of Damage: Deterioration _____, Water _____,Physical _____,

Description:_____

_____

_____

Overall Rating: Good _____, Fair _____, Poor _____

Potential for Disturbance

Frequency of Potential Contact: High _____, Moderate _____, Low _____,

Description: _____

_____

_____

Influence of Vibration: High _____, Moderate _____, Low _____,

Description:_____

_____

Potential of Air Erosion: High _____, Moderate _____,Low _____,

Description:_____

Overall Rating: Potential for _____, Potential for _____, Low _____
Sig. Damage Damage Potential for Damage

Comments:_____

_____

Signed:_____ **Date:**_____

ALTERNATIVE HAZARD ASSESSMENT METHODS

1. EPA "Purple Book" Table - Guidance for Controlling Asbestos-Containing Materials in Buildings (EPA 560/5-85/024), June 1985, Chapter 4, PP 4-1 to 4-12.

2. EPA Draft Assessment Document (Decision Tree) - D. Keyes, B. Price, and J. Chesson, "Guidance for Assessing and Managing Exposure to Asbestos in Buildings," Draft, November 7, 1986. Section 2 (pp. 5-22), Section 3 (pp. 24-40), and Trees, p.26 and 39.

3. British Pink Book (Decision Tree) - Department of the Environment, Asbestos Materials in Buildings, Second Edition, 1986. Chapter 4 (pp. 16-18), Annex 3 (pp. 38-45).

4. Matrix Stratification (Matrix) - Entek Environmental and Technical Services, Inc.

SECTION D EVALUATION AND SELECTION OF CONTROL OPTIONS

INTRODUCTION

This section provides information on technical and operational aspects of alternatives for controlling the release of fibers from ACBM. The information will assist Management Planners in recommending response actions among those allowed by the State Employees Asbestos Program. (See section C for a description of allowable response actions for ACM in various categories.)

OVERVIEW

Both AHERA and ASHARA refer to actions taken in buildings with ACM as "response actions" or "control options". Response action alternatives, as defined by the State Employees Asbestos Program fall into six main categories:

1. Operations & Maintenance Program - a program of training, cleaning, work practices, and periodic surveillance to maintain friable ACM in good condition, ensure clean-up of asbestos fibers previously released, and prevent further release by minimizing and controlling friable ACM disturbance.

2. Repair - returning damaged ACM to an undamaged condition or to an intact state through limited replacement and patching.

3. Encapsulation - treating ACM with a liquid that, after proper application, surrounds or embeds asbestos fibers in an adhesive matrix to prevent fiber release. The material may be a penetrant, which adds cohesion by penetrating the asbestos material, or a bridging encapsulant, which covers the surface of the material using airless spray equipment at low pressure in order to reduce fiber release during applications. The specific language in AHERA is:

   "Encapsulation means the treatment of ACBM with a material that surrounds or embeds asbestos fibers in an adhesive matrix to prevent the release of fibers, as the encapsulant creates a membrane over the surface (bridging encapsulant) or penetrates the material and binds its components together (penetrating encapsulant)."

4. Enclosure - an airtight (or as close to air tight as is possible to construct) barrier installed between the friable asbestos and the building environment. They are typically constructed by mechanical attachment or spray application. For example, materials such as PVC or corrugated metal may be fastened around insulated piping or a barrier may be constructed around asbestos fireproofing on structural members by spraying material that cures into a hard shell. According to AHERA:

"Enclosure means an air tight, impermeable, permanent barrier around ACBM to prevent the release of asbestos fibers into the air."

5. Removal - stripping ACM from its substrate. Asbestos material is separated from the underlying surface, collected, and placed in containers for burial in an approved disposal site.

6. Restriction - restricting access to an area to only properly trained, medically monitored and equipped Level II personnel.

Appropriate applications and advantages/disadvantages of each alternative are described below. Information on the cost of these alternatives and conducting a cost-effectiveness evaluation is provided in section J.

A. ENCLOSURE

(1) Definition:

Enclosure involves building an airtight barrier around the asbestos containing material to separate it from the general environment. Plywood, metal, or sheet rock is often used to construct the barrier. A barrier system must not connect with an air plenum system, and the enclosed space should not communicate in any way with portions of the occupied building.

(2) Application

Enclosure is appropriate when:

- Removal is not feasible
- The enclosure is not likely to be disturbed in any way
- Suitable with all forms and thickness' of ACM
- Suitable where ACM receives impact, abrasion, or other damage.

Enclosure is **NOT** appropriate when:

- Removal is feasible
- The enclosure is likely to be damaged by water or other means
- There is a high exposure potential for building occupants
- Renovation is likely in the very near future.

(3) Advantages and Disadvantages

The advantages of enclosure as an asbestos control option are:

- Exposure outside the barrier is greatly reduced
- It has a lower cost than removal
- It can usually be done by Level II staff

The disadvantages of enclosure as an asbestos control method are:

- The asbestos source remains
- Fiber fallout may continue behind the barrier
- It may be costly if the enclosure disturbs the functions of other systems

- It may require the same preparation as when doing a removal due to fiber release during construction
- An operations and management system is required
- The area cannot be accessed easily

B. ENCAPSULATION

(1) Definition

Encapsulation involves spraying or brush applying a coating or sealant called an encapsulant onto the asbestos containing material. Encapsulants either soak into the material and bind it together (penetrating), or cover it with a plastic or paint like shield (bridging).

(2) Application

Encapsulation is appropriate when:

- Removal is not feasible
- The asbestos containing material is firmly bonded to the underlying surface
- Damage to the asbestos containing material is not probable
- The asbestos containing material is not readily accessible
- Bridging encapsulants are used over cementitious ACM
- Bridging encapsulants are used over painted ACM.
- There are complex surfaces involved

Encapsulation is **NOT** appropriate when:

- Removal is feasible
- The surface to be encapsulated is damaged or deteriorated
- The asbestos containing material is likely to be damaged by water or other means
- The asbestos containing material is poorly adhered to the underlying surface
- The encapsulated material is likely to need removal within a short period of time
- The asbestos is over 1 inch thick
- Penetrating encapsulant over cementitious or painted ACM
- Bridging encapsulant over fluffy, friable ACM
- Not suitable over fireproofing

(3) Advantages and Disadvantages

The advantages of encapsulation as an asbestos control option are:

- Fiber release is reduced and exposures are controlled
- It is an economical method

The disadvantages of encapsulation as an asbestos control method are:

- The asbestos source remains
- The sealant may cause delamination

- An operations and maintenance system is required
- Precautions are necessary during maintenance and renovation
- On-going inspections are required
- Maintenance on damaged or deteriorated encapsulated surfaces is required
- Encapsulated materials are difficult to remove
- There may be fiber release during application
- The encapsulant may not be compatible with the substrate

C. REMOVAL

(1) Definition

Removal is most effectively performed through the use of wet techniques. Usually a wetting agent is added to the water sprayed onto the asbestos containing materials and the materials are removed and disposed of while wet. Dry removal is definitely **not** recommended and it cannot be done by Level II staff. However, it may be necessary in instances of unavoidable damage or electrical hazards associated with the use of wet techniques. In this case the work should be contracted out.

(2) Application

Removal is appropriate when:

- The exposure potential is high
- The asbestos containing material is or is likely to be deteriorated or damaged
- The asbestos containing material is readily accessible
- It is feasible

Removal is **NOT** appropriate when:

- The exposure potential is low
- Removal is not feasible because of cost and location of the material

(3) Advantages and Disadvantages

The advantages of removal as an asbestos abatement control option are:

- The asbestos source is eliminated
- Exposure to that source is ended

- It eliminates the need for periodic surveillance of that asbestos source

The disadvantages of removal as an asbestos control option are:

- It is usually the most costly and complicated control method
- It is usually the most time consuming control method
- Replacement with a substitute material may be necessary
- The exposure potential for workers doing removal is higher
- Elaborate precautions may be necessary during removal
- Improper removal may create a greater exposure problem than that which originally existed through general contamination

D. OPERATIONS AND MAINTENANCE

(1) Definition

An Operations and Maintenance system includes routine and periodic inspections of asbestos containing materials for signs of damage or deterioration that could result in fiber release into the air. It also involves controlling and supervising any maintenance or repair work done on or around asbestos containing materials to ensure that such work is done correctly and in a manner that protects both workers and other building occupants.

(2) Application

An Operations and Maintenance System is appropriate when:

- The asbestos containing materials are not damaged or deteriorating
- The exposure potential is negligible

An Operations and Maintenance System is **NOT** appropriate when:

- The asbestos containing material is damaged or deteriorating
- There is a definite or questionable exposure potential

(3) Advantages and Disadvantages

The advantage of an Operations and Maintenance System as an asbestos control option is that

- The initial cost is lower than that of other options

The disadvantages of an Operations and Maintenance System as an asbestos control option are:

- The asbestos source remains as a potential hazard
- The asbestos exposure may increase if the asbestos containing material becomes damaged or begins to deteriorate
- Precautions are necessary during maintenance and renovation
- Continued reinspection and reevaluation is required
- Maintenance of damaged or deteriorated materials is required

E. REPAIR

(1) Definition

Repair is the returning the asbestos containing material to a "like new condition" so that damage or deterioration is no longer present

(2) Application

Repair is appropriate when:

- The damage or deterioration of the asbestos containing material is not extensive
- Removal is not feasible

Repair is **NOT** appropriate when:

- The damage or deterioration to the asbestos is extensive
- Removal is feasible

(3) Advantages and Disadvantages

The advantages of Repair as an asbestos control option are:

- Can often be done in house with Level II staff
- Is less costly than removal
- Is less disruptive to building operations
- May require fewer or less extensive precautions than removal

The disadvantages of Repair as an asbestos control option are:

- The asbestos source remains
- If done incorrectly, repair can create a greater hazard than the one that originally existed
- Requires an Operations and Maintenance system

F. RESTRICTION

(1) Definition

Restriction is the closing off of an area that contains damaged or deteriorated asbestos containing materials. The area can only be entered by properly trained and equipped Level II personnel. **This method cannot be used in a school (Pre-school through High school).**

(2) Application

Restriction is appropriate when:

- Removal is not immediately feasible
- The loss of the area will not seriously hamper facility operations
- There are a sufficient number of Level II personnel to carry out operations in the restricted area
- The area is not in or adjacent to ventilation systems or other places where asbestos could enter the building air.

Restriction is **NOT** appropriate when:

- Removal is feasible
- The loss of the area will seriously hamper building operations
- There is an insufficient number of Level II staff to carry out necessary operations in the area
- The area is adjacent to ventilation systems or other places where asbestos could enter the building air.

(3) Advantages and Disadvantages

The advantages of Restriction as an asbestos control option are:

- It has a low initial cost
- It can be easy to implement
- Can buy time until another control option becomes feasible

The disadvantages of Restriction as an asbestos control option are:

- The asbestos source remains
- An area is lost to ready access by non-Level II personnel
- It may require a sufficient Level II staff to perform operations in the area
- Fiber release still continues in the area
- Lack of access by non-Level II maintenance staff may mean crucial maintenance doesn' t get done
- Requires an Operations and Maintenance System

G. TEMPORARY CONTROLS

When a suspected asbestos hazard is identified, some interim control measures can be implemented until a hazard evaluation can be done and an appropriate abatement measure taken. These measures should be considered temporary solutions and proper control should be accomplished expeditiously and in a manner that ensures the health and safety of workers and other building occupants. All suspected asbestos hazards should be reported promptly to the Safety & Health Specialist or the Asbestos Program Manager so that immediate action can be taken to evaluate conditions and properly control any hazards that may exist. In the interim, the following guidelines can assist in minimizing any hazard temporarily:

(1) Limit access to the affected area by warning workers and other building occupants via signs, barriers, or locking doors.
(2) Enclose particularly hazardous areas with 6-mil polyethylene plastic.
(3) Seal off air circulation and ventilation systems in the affected area if necessary
(4) Inform maintenance and custodial personnel of the potentially hazardous areas.
(5) Have trained and properly protected Level II personnel clean up any fallen debris using wet cleaning methods or HEPA vacuums.

Should there be any question about the nature or extent of the hazard and/or any of the guidelines for temporary control, the State Employees Asbestos Program of the Maryland Department of the Environment should be contacted for assistance.

The Management Planner must select appropriate actions based on:

1. AHERA requirements for response actions for each category of ACM. (i.e., the seven categories for current condition and potential for disturbance).

2. The hazard ranking system described in Section C

3. The technical suitability of the various alternatives (this section).

4. The costs of the alternatives (see Section J).

The information presented in this section can be used to evaluate the technical suitability of the alternative response actions. It should be used together with information on controlling costs to evaluate the cost-effectiveness of alternatives, as discussed in Section J.

The response actions described here are seldom used alone, but are part of a combination of corrective actions recommended for each area of ACM. For example, even if removal is urgently needed, it normally will take some time to obtain the services of a contractor. During this time, the area must be restricted from the public. This restriction, together with subsequent removal, would constitute a response action. Similarly, enclosure and encapsulation may reduce the potential for ACM disturbance in certain areas and thus be an important part of an O&M program.

STAGING AND PRIORITY OF WORK

* Once the most appropriate response action for each area of ACM has been identified, priorities for abatement and a schedule of projects must be developed. These then become the Management Planner' s recommendations to the facility head and constitutes the major input to the Management Plan.

* See Section C for information on judging areas for removal priority. In addition, occupant' s activity patterns and plans for building maintenance and renovation should be taken into account.

* The proximity of areas needing immediate removal to lower priority areas.

    - For example, if immediate removal of surfacing ACM is required in a wing of a building, and the wing also contains piping with damaged insulation, consideration should be given to removing the ACM from the piping at the same time.

The additional cost of removing pipe insulation may be quite low compared to calling in a contractor next year just to work on the Pipes. Given the fixed costs involved in ACM removal, substantial economies of scale may be realized by combining the work. See Section J for more information on costs.

* The occupancy patterns of the building

No matter how carefully an abatement job is carried out, there is still a potential for exposure of building occupants to airborne asbestos. In the case of schools, the best time of year for removal operations is summer. If removal cannot be postponed until summer vacation, the staging plan may require evacuation and restriction of the areas prior to starting the work. Restriction of the area means not only closing the area to building occupants and non-Level II personnel, but also assuring that the HVAC systems in the area are isolated from the building' s general system.

Abatement projects in occupied buildings are usually more difficult and risky. To reduce the risks of accidental contamination of occupied spaces, additional barriers and protective systems should be engineered. For example, double barriers and additional air samples should be considered. This will raise the cost of the project. **The expertise of an accredited Asbestos Project Designer is required in cases such as this as well as for any abatement project over 3 square or 3 linear feet.**

In staging work, the Management Planner should take into account the disruption of normal building activity caused by restricting the work area. Restricting one or two rooms for a few weeks may have a far different impact than closing down an entire floor for several weeks.

The scheduling of work by wing and floor will aid in minimizing disruption. Scheduling work in areas that can be easily restricted in terms of HVAC systems should also be considered.

* Remaining life of the building

Buildings with relatively short remaining life may not be candidates for large-scale removal before demolition. It may be less expensive to establish a comprehensive O&M and postpone major abatement actions as part of later demolition or a major renovation of the building. **HOWEVER, ALL BUILDING OCCUPANTS MUST BE PROTECTED FROM ASBESTOS EXPOSURE WHILE WAITING FOR AN UPCOMING RENOVATION. IF PROTECTION FROM EXPOSURE CANNOT BE ASSURED, THEN ABATEMENT MUST PROCEED WITHOUT DELAY.**

* Planned renovation and maintenance

Economies may be achieved by combining renovation activities with abatement activities. For example, installation of a sprinkler system or removal of a suspended ceiling during remodeling in an area with fireproofing ACM sprayed on structural beams will disturb the ACM. By combining abatement with renovation, the cost of many common activities can be shared.

SECTION E DEVELOPING AND IMPLEMENTING AN OPERATIONS AND MAINTENANCE PROGRAM

INTRODUCTION

The process of identifying ACM within a facility is the first step in controlling building occupant exposure to asbestos fibers. The next step is to develop a written Operations and Maintenance (O&M) program to minimize the potential hazard posed by the ACM.

The O&M program is a set of specific procedures and practices applied to building cleaning, maintenance, renovation, and general operation to maintain the building as free of asbestos contamination as possible. The O&M program draws heavily on information generated during the building survey and becomes a key component of the management plan. **The O&M program must remain in effect until all ACM is removed from the facility.**

OBJECTIVES OF AN OPERATIONS AND MAINTENANCE PROGRAM

There are **three primary objectives** of the O&M program: **(1)** clean up of existing contamination, **(2)** minimize future fiber release by controlling access to ACM, **(3)** maintain ACM until it is eventually removed. Properly prepared, this plan will document the building owner' s prudence in dealing with asbestos in the building.

Since, by law most ACM must be removed from buildings before demolition, the O&M program is not a permanent solution. It is implemented as part of an overall asbestos management plan that has as its goal the elimination of asbestos exposure within the facility. The O&M program likewise is not a means by which full scale ACM abatement is accomplished. Rather, intentional disruption of ACM should be limited to repair or removal of small areas of significantly damaged ACM or small areas where removal is necessary to facilitate maintenance/renovation activities. Large abatement projects that require extensive planning and technical expertise are beyond the scope of most O&M programs. On the other hand, limited encapsulation and enclosure could be used to enhance and O&M program, e.g., by reducing the likelihood of contact with this ACM.

ELEMENTS OF THE O&M PROGRAM

Specific features of an operations and maintenance program should be individually designed. Each O&M program should include the following elements:

* Notification and labeling;
* Training (on several levels);
* Employee protection (PPE) and medical surveillance programs;
* Specialized cleaning procedures;
* Maintenance/Renovation permit system;

* Special work practices for maintenance activities;
* Special work practices for renovation;
* Emergency response procedures;
* Periodic ACM surveillance; and
* Record keeping.
* Waste disposal procedures

Each of these elements will be discussed in the following sections.

Notification and Labeling

Once the presence of asbestos-containing materials has been established in a facility, a notification and warning program must be initiated. This notification and warning program serves two purposes: (1) it alerts affected parties to a potential hazard in the building; and (2) it provides basic information on avoiding the hazard. Building occupants, employees and others who are aware of the presence of ACM are less likely to disturb the material and cause fiber release.

Notification

Notification of building occupants and other affected individuals can be accomplished several ways. Two common techniques are:

* Distributing notices; and
* Holding awareness or informational seminars.

The distribution of notices is an effective means of alerting building occupants about the presence of asbestos. Memos or letters can be tailored to specific parties, and verification that notification was received is easily accomplished. For example, in a large multi-tenant facility, the building owner can send detailed reports to the management of individual companies, while distributing similar informational memos to building occupants.

Awareness or informational seminars can be designed to follow written notification. They serve to expand on relevant information while allowing attendees to raise questions. These seminars can be developed at the same time as other training programs and typically last no more than a few hours.

Regardless of the method of notification chosen, building occupants should be provided with the following information, at a minimum:

* What asbestos is and how it is typically used;
* Health effects associated with exposure;
* What type(s) of ACM are present in the facility;
* The exact location(s) of these materials;

* How individuals can avoid disturbing ACM;
* How to recognize and report damage;
* How custodial and maintenance personnel are dealing with these materials to prevent fiber release;
* What will be done periodically and over the long run to protect the health and safety of building occupants; and
* Name and telephone number of the person responsible for asbestos-related activities in the facility.

Labeling and Signs

Under AHERA (which applies to school buildings, pre-school through high school), the posting of warning signs is mandatory adjacent to any friable and non-friable ACBM and suspected ACBM in routine maintenance areas (such as boiler rooms) at each school building. Labeling, as opposed to notification, is not intended as general information. It serves as a final line of defense to prevent unprotected individuals from disturbing ACM, or entering areas where repair or renovation activities involving ACM are underway. Labeling is usually in the form of posted signs or notices that are often found either directly attached to ACM or at entrances to areas where ACM is prevalent (e.g., boiler rooms). Warning signs used in conjunction with small renovation or repair that involves the disruption of ACM should be posted at entrances and around the perimeter of the project and in accordance with the OSHA Asbestos Standard for the Construction Industry (29 CFR 1926.1101).

In addition, to regulated areas, OSHA also requires notification under the following conditions:

(1) For areas where the employer has no control over exposure and anyone could have potential exposure to asbestos within the area, or if outside contractors are used in the building, warning signs and locator diagrams shall be posted at the entrances to each area or the entrances to the building as appropriate.

(2) Where the potential exposure is limited to in house staff, warning signs and labels can be posted in common areas frequently traveled by affected personnel, such as at time keeping stations, if the facility also provides verbal and written warnings in their hazard communications training. Any updates must be presented to affected employees every 6 months following periodic surveillance inspections.

(3) In locations where asbestos containing materials and presumed asbestos containing materials are present in relatively small areas, labels could be affixed to the surface of the materials. If the magnitude and complexity of the space is substantial, labels and warning signs, with locator diagrams as appropriate, must be posted at entrances and strategically throughout the area.

The language on the label and warning sign shall at least conform to requirements set forth in OSHA's asbestos regulation. Supplementary information should be provided as necessary to adequately alert people of the potential for asbestos exposure. The size and frequency of application associated with labels and warning signs shall be determined by the facility, again, provided people have adequate warning of the potential for asbestos exposure. The facility must also follow the performance requirements for hazard communications.

Training

Training of service (custodial and maintenance) workers is one of the most important aspects of an effective operations and maintenance program. Training serves to establish proper awareness and understanding of work practices that are vital to the success of the program. Training must be offered on several levels depending on which regulation applies. See exhibit E-1 for specific training guidelines.

General Awareness

All service personnel who work in a building that contains ACM must receive awareness training. This training can be part of the more extensive training if that is required.

Custodial and Non Level II Maintenance Workers (State) or Class III /IV OSHA jobs

Service personnel who conduct any activities that will result in the disturbance of ACM must receive more extensive training. Information to be presented in this training session should include proper cleaning techniques, appropriate practices for handling ACM, proper use of respirators and other protective equipment, including hands-on training.

One of the main objectives of the O&M program is to clean the facility of existing asbestos contamination. This training program instructs participants in proper cleaning techniques that involve the use of wet methods, HEPA vacuuming, protective equipment, and proper waste disposal methods. Elements of specialized cleaning and recleaning are discussed later in this chapter.

Level II Maintenance Workers (State) or Class I/II OSHA jobs

Maintenance workers are often required to use specialized asbestos control procedures when working around ACM. Most maintenance work is conducted entirely by in-house staff, entirely by outside contractors, or a combination of the two options.

If routine or even infrequent maintenance involves the possibility of significant disturbance of ACM, workers must be involved in a more extensive training program. Depending on the type of material involved, maintenance workers will need to be trained in local isolation of the HVAC system, isolation of the work area from non-work areas (through the use of barriers and warning signs, etc.), vacuuming, the use of methods to reduce fiber release, HEPA and glovebag techniques for working around pipe insulation, clean-up and decontamination procedures, and ACM disposal procedures. In addition, maintenance workers in this category will need to be involved in respiratory protection and medical surveillance programs.

With respect to outside contractors (e.g., electrical, plumbing, and construction contractors), building owners should require evidence that the contractor is familiar with the O&M program, has experience and/or training in working around ACM, and has adequately trained work crews. It is often preferable to have a member of the in-house staff (an accredited supervisor) to oversee all maintenance performed by outside contractors.

Medical Surveillance and Employee Protection Programs

According to the OSHA Asbestos Standard for the Construction Industry (29 CFR 1926.1101) and the OSHA Asbestos Standard for General Industry (29 CFR 1910.1001), employees must be involved in a medical surveillance program if any of the following conditions apply: (1) they are involved in Class I, II, or III work more than 30 days per year, (2) they are exposed above the permissible exposure limit of 0.1f/cc or the excursion limit of 1f/cc, or (3) they wear a negative pressure respirator. **The State Employees Asbestos Program requires medical surveillance for all active Level II employees whether they meet the OSHA criteria or not**.

The purpose of medical surveillance is to establish an employee's fitness to wear a respirator, and to detect any changes in the gastrointestinal and cardiopulmonary systems as a result of working with asbestos. Such changes may indicate the onset of an asbestos related disease.

The main requirements of the medical surveillance program are initial, periodic, and post employment examinations. The initial exam is required before an employee starts to work with ACM. Periodic examinations are required annually.

Each examination must include, at a minimum:

* Completion of the mandatory questionnaire.

* A physical examination with emphasis on the cardiovascular and gastrointestinal systems;

* A pulmonary function test, which includes the forced vital capacity (FVC) and the forced expiratory volume in one second (FEV); and

* A chest X-ray during the initial examination and thereafter at the discretion of the physician.

Following the examination, the physician must provide the employer with the following:

* A written opinion as to whether the employee has any detected medical condition that would place the employee at increased risk of health impairment from exposure to asbestos.

* Any recommended limits on the employee or on the use of personal protective equipment such as respirators; and

* A statement that the employee has been informed by the physician of the results of the medical examination, and of any medical conditions that may result from asbestos exposure.

The physician is not to reveal in the written opinion given to the employer any specific findings not related to asbestos exposure. Also, the employer must provide a copy of the physician' s written statement as to the employee's fitness for duty to the employee within 30 days of receipt.

The employer must provide the examining physician with the following:

* A copy of the OSHA Asbestos Standard(s);

* A description of the employee' s duties as they relate to asbestos;

* The employee' s actual or anticipated level of exposure;

* A description of any personal protective and respiratory equipment used or to be used and the conditions under which it is used; and

* Information from previous medical examinations of the employee that are not otherwise available to the examining physician.

Finally, the employer must maintain medical records for at least 30 years following termination of employment. If the employer goes out of business without a successor, OSHA must be notified at least 90 days prior to termination of business and provide for transfer of records to the secretary of OSHA, if requested.

With respect to a respiratory protection program, each facility must have a written respiratory program and the elements of such a comprehensive program are included at the end of Section D in the Building Inspector Course Notebook.

Specialized Cleaning Procedures

Cleaning up existing contamination within a facility is one of the primary objectives of the O&M program. Dry brooms, mops, dust cloths and standard vacuum cleaners simply re-suspend asbestos fibers into the air and must not be used. Therefore, it is essential that specialized cleaning procedures be implemented.

Specially trained and properly equipped maintenance or custodial workers should conduct a thorough cleaning in the building as soon as the O&M program is in place and before the initiation of any response actions. These workers should be equipped with high efficiency powered air purifying respirators (PAPR). During the cleaning, the area must be restricted to all occupants other than the level II employees doing the cleaning. A combination of wet mopping /wiping and HEPA vacuuming should be used to clean all surfaces within the building. Irregular surfaces such as curtains, books, furniture, and carpeting can be HEPA vacuumed and in the case of carpet, curtains, or upholstered furniture, steam cleaned. Care should be taken to ensure that liquid waste generated during steam cleaning is properly filtered through a 5-micron filter before being poured down the drain.

Other surfaces, such as walls, non-carpeted floors, light fixtures, equipment housings, the exterior of the air handling ducts, and file cabinets should be cleaned using mops and/or dust cloths wetted with amended water. Amended water is a mixture of water and a non-sudsing surfactant. A dust suppressant could also be used on mops.

Periodic or routine cleaning is less rigorous than the initial cleaning and is implemented when needed, on a regular schedule depending on the extent of the ACM within the facility and the level of contamination. Surfaces should be wet wiped and/or HEPA vacuumed.

The Management Planner should determine whether routine cleaning is needed. This determination should be based on the rate of dust build-up.

Maintenance/Renovation Permit System

Minimizing inadvertent disruption of ACM during maintenance and renovation operations is often one of the most difficult tasks faced by the asbestos program manager. Initiating a permit system, where all work orders or requests are funneled through the asbestos program manager ("designated person" as per AHERA), is a simple yet effective way of controlling disruption of ACM during these activities.

In the permit system, all requests for maintenance/renovation activities are given to the asbestos program manager prior to the issuance of a work order to proceed. (Exhibit E-3 is an example of a permit request form.) The program manager then checks the building' s asbestos records (files, computerized database, etc.) for information about the presence of ACM where work is to be performed. **The manager should also physically inspect the area in question to ensure records reflect actual conditions.**

If no asbestos is present, the work order is issued and the planned actions can proceed. If ACM is found to be present in the area, the program manager will sign the permit application and either equip properly trained maintenance workers to deal with the ACM during the operation or dispatch an "emergency response" team to remove the ACM. In worst-case situations (e.g., large amounts of ACM), non-critical maintenance/renovation work should be deferred until the ACM in the area can be abated by an abatement contractor.

Special Work practices for Maintenance Employees

Normal maintenance activities can disturb ACM and raise levels of airborne asbestos. Maintenance workers should be cautioned against conducting any maintenance work in a manner that may disturb ACM. The O&M program should include provisions for each type of ACM that is present in the facility.

The nature and extent of special work practices should be tailored to reflect the likelihood that the ACM will be disturbed and that fibers will be released. Four kinds of potential disturbance are possible: (1) Contact with ACM is very unlikely; (2) Accidental disturbance is possible; (3) A small amount of ACM (less than three square feet or three linear feet) will be disturbed; and (4) A large amount of ACM (more than three square feet or three linear feet) will be disturbed. The following sections on surfacing materials, thermal system ACM, and miscellaneous materials describe the work practices in detail.

The AHERA and ASHARA rules refer to small scale, short duration projects, but do not use linear or square feet to distinguish small/short from large/long. Instead, the examples cited of small scale, short duration are broadly consistent with accidental disturbance or small amounts of ACM (< 3sq. or lin. ft.) being disturbed.

The OSHA Asbestos Standards for the Construction Industry also breaks down job tasks into the following four categories:

Class	Description
I	Activities involving the removal of surfacing or thermal system insulation ACM
II	Activities involving the removal of miscellaneous ACM
III	Repair and maintenance operations where "ACM" including surfacing, thermal system insulation and miscellaneous ACM is likely to be disturbed (e.g. the matrix of ACM will be disturbed, the ACM will be crumbled or pulverized or visible debris will be generated from the ACM) and the amount of disturbance is no more than would fit in one standard glovebag or waste bag (approx. 60 x 60 inches).
IV	Housekeeping (not clean up) that takes place after a Class I, II, III job has been completed. Does not include picking up and bagging of asbestos debris/dust during Class I, II, and III operations.

Surfacing Materials

Contact with ACM Unlikely

In some buildings with ACM, many routine maintenance activities can be conducted without contacting the ACM. For example, changing light bulbs in a fixture on a ceiling with asbestos containing acoustical plaster can usually be performed without jarring the fixture or otherwise disturbing the ACM. (The top of the fixture should have been wet cleaned previously to remove settled fibers). However, circumstances at each location need to be evaluated before making this assumption. In these situations, few precautions other than normal care are needed. The only precaution is to assure the availability of respirators and a HEPA vacuum if needed. Where maintenance is performed in parts of a building free of ACM, no special precautions are usually necessary. An exception would be work that causes vibrations at a distant location where ACM may be present.

Accidental Disturbance of ACM Possible

Routine maintenance and repair includes work on light fixtures, plumbing fixtures and pipes, air registers, HVAC ducts, and other accessible parts of building utility systems. Where those fixtures or system parts are near ACM, maintenance work may unintentionally disturb the ACM and release asbestos fibers.

For example, maintenance work on ventilation ducts in an air-handling room where asbestos fireproofing is present only on structural beams, could probably be conducted without contacting ACM. However, the fireproofing could be disturbed accidentally during the course of the work.

The following precautions and procedures must be used if accidental disturbance of ACM (or dust and debris containing asbestos fibers) is possible.

* Approval should be obtained from the asbestos program manager or his/her designee before beginning work. The asbestos program manager or accredited supervisor should make an initial visit to the work site.

* The work should be done after normal working hours (nights or weekends), if possible, or access to the work areas should be controlled: doors should be locked from the inside and signs posted to prevent unauthorized persons from entering the work area (e.g., "MAINTENANCE WORK IN PROGRESS, DO NOT ENTER", or, if asbestos levels are, or are anticipated to be high enough to trigger the OSHA rule, "DANGER - ASBESTOS: CANCER AND LUNG DISEASE HAZARD: AUTHORIZED PERSONNEL ONLY: RESPIRATORS AND PROTECTIVE CLOTHING ARE REQUIRED IN THIS AREA"). Note, emergency exits must remain in operation.

* The air handling system should be shut off and locked out or temporarily modified to prevent the distribution of any released fibers to areas outside the work site.

* A 6 mil polyethylene dropcloth should be placed underneath the location of the maintenance work, extending at least 10 feet beyond all sides of the work site. Alternatively a mini-enclosure made of 6-mil poly on a frame can be positioned underneath the maintenance area to inhibit the spread of fibers from fallen ACM. (Mobile enclosures of this type are available commercially).

* Workers must wear at least a PAPR and disposable protective clothing.

* The ACM in the vicinity of the maintenance work must be misted lightly with amended water. Use a mister that produces a fine spray. Be sure the electrical system is locked and tagged out before spraying around any electrical conduits or fixtures.

* After the maintenance work is completed, the fixture, register, or other component, and all tools, ladders, and other equipment must be HEPA vacuumed or wet wiped with a damp cloth.

* If any debris is apparent on the drop cloth, in the enclosure, floor, or elsewhere, it must be HEPA vacuumed up.

* The plastic drop cloth or enclosure must be wiped with a damp cloth, carefully folded, and discarded as asbestos waste. If a metal or PVC frame was used for the enclosure, it can be reused after proper decontamination.

* All clothes, vacuum bags/filters, and other disposable materials must be discarded in sealed and labeled plastic bags as asbestos waste.

* Workers must HEPA vacuum respirators and protective clothing at the work site (on the drop cloth or in the mini-enclosure). The clothing must then be discarded as asbestos waste.

Disturbance of ACM Intended or Likely

Some maintenance and repair activities like installing new sprinkler or piping systems will necessitate hanging pipes from structural members or the ceiling. This will unavoidably disturb the ACM. If the beams or ceilings are insulated with ACM, the ACM will be scraped away to install hangers. Likewise pulling cables or wires through spaces with ACM or ACM debris is likely to dislodge pieces of the ACM or disturb ACM dust or debris. Furthermore, anytime tiles are moved to enter the space above a suspended ceiling, settled dust on top of the tiles will be resuspended. If the beams or decking above the ceiling are covered with ACM, the dust is likely to contain asbestos fibers. All of these examples involve disturbance of ACM or asbestos dust and debris, and will likely result in elevated levels of airborne asbestos fibers.

Small Disturbances

The following procedures are appropriate for maintenance activities which involve removal of less than 3 square feet of surfacing material or when disturbance of ACM dust and debris or unintentional contact with ACM is likely.

* Approval must be obtained from the asbestos program manager or his/her designee before beginning work, and the work must be supervised.

* The work should be done after normal working hours (nights or weekends), if possible, or access to the work areas should be controlled: doors should be locked from the inside and signs posted to prevent unauthorized persons from entering the work area (e.g., "MAINTENANCE WORK IN PROGRESS, DO NOT ENTER", or, if asbestos levels are, or are anticipated to be high enough to trigger the OSHA rule, "DANGER –

ASBESTOS: CANCER AND LUNG DISEASE HAZARD: AUTHORIZED PERSONNEL ONLY: RESPIRATORS AND PROTECTIVE CLOTHING ARE REQUIRED IN THIS AREA"). Note: emergency exits must remain in operation.

* The air handling system should be shut off and locked out or temporarily modified to prevent the distribution of any released fibers to areas outside the work site.

* Workers must wear at least a PAPR and disposable protective clothing.

* A 6 mil polyethylene dropcloth should be placed underneath the location of the maintenance work, extending at least 10 feet beyond all sides of the work site. Alternatively (and recommended for above ceiling work), a mini-enclosure made of 6 mil poly on a frame can be positioned underneath the maintenance area to inhibit the spread of fibers from fallen ACM. (Mobile enclosures of this type are available commercially).

* If entry to the space above a suspended ceiling is necessary, the entry tile(s) must be removed carefully with as little jarring as possible. The air above the opening, the top of the removed tile, all tiles surrounding the opening, and the ACM likely to be disturbed, must be misted with amended water. Use a mister with a fine spray. A thorough misting in the air helps fibers to settle more quickly. Cleaning ceiling tiles with a HEPA vacuum cleaner is also effective as long as care is taken not to vibrate tiles and disturb the ACM.

* During the course of the work, any ACM that is being removed must be collected by the HEPA vacuum. This is best accomplished by placing the vacuum hose just below the ACM being removed.

* After the maintenance work is completed, the fixture, register, or other component, and all tools, ladders, and other equipment must be HEPA vacuumed or wet wiped with a damp cloth.

* If any debris is apparent on the drop cloth, in the enclosure, floor, or elsewhere, it must be HEPA vacuumed up.

* The plastic drop cloth or enclosure must be wiped with a damp cloth, carefully folded, and discarded as asbestos waste. If a metal or PVC frame was used for the enclosure, it can be reused after proper decontamination.

* All clothes, vacuum bags/filters, and other disposable materials must be discarded in sealed and labeled plastic bags as asbestos containing waste.

* Workers must HEPA vacuum respirators and protective clothing at the work site (on the drop cloth or in the mini-enclosure). The clothing must then be discarded as asbestos containing waste.

Large Disturbances

Any maintenance work that involves removal of 3 or more square feet of surfacing material should be considered a large scale disturbance of ACM and requires that the work be designed by an **accredited Asbestos Project Designer**. Moreover, if the maintenance work exceeds 160 square feet (an aggregate total per building per year), it must be contracted out. If the work is within the scope of building maintenance workers, the work must include the following procedures:

* All of the procedures for asbestos removal should be followed:

  - Containment barriers need to be constructed or used
  - Decontamination facilities must be set up (an equipment area for jobs less than 10 square feet or a 3 stage decon for jobs between 10 and 160 square feet)
  - Negative air filtration must be used
  - Protective clothing and respirators must be used
  - Proper disposal of asbestos waste and proper clean up of the worksite must be done
  - Air testing must be done if required

  These procedures are required by OSHA and a more detailed discussion of these steps is provided in the **Asbestos Abatement Worker and Supervisor** course manuals

* Once the work site has been adequately isolated and all precautionary measures have been taken, the maintenance work should begin. If the work involves cutting, drilling, grinding, or sanding the ACM, special tools equipped with HEPA vacuum attachments must be used. Where the ACM is simply scraped off the substrate, the hose from the HEPA vacuum cleaner should be placed just below the removal site to catch the ACM. Any ACM not caught by the vacuum must be immediately shoveled into a disposal bag while it is still wet. Upon completion of the work, the vacuum bags and possibly the filters should be discarded as asbestos waste.

* Where the ACM was disturbed as part of the maintenance activity, it must be repaired with a non- - asbestos plaster or spackling compound or spray/painted with an encapsulant or latex paint. This should be done before the final clean up of the work site.

Thermal System Insulation

Maintenance activities affecting asbestos- containing thermal system insulation generally involve plumbing type repairs to the heating, ventilation, and air conditioning (HVAC) system. Frequently, the ACM must be removed to provide access to a valve, flange, duct, or related system part needing maintenance.

Contact with ACM Unlikely

Maintenance activities or repairs that can be performed without contacting or disturbing the ACM require little more than normal care and good workmanship. (Respirators and a HEPA vacuum cleaner must be available if needed.) For example, valves which are either uncovered or covered with non - asbestos insulation can be repacked or repaired without disturbing asbestos insulation on nearby pipes. As with surfacing ACM, the only precautions necessary are to make sure that a HEPA vacuum cleaner and PAPR respirators are available if needed.

Accidental Disturbance of ACM Possible

Even maintenance tasks that involve no direct contact with ACM may cause accidental disturbance. For example, vibrations created by maintenance activities in one part of the piping network will be transmitted to other parts. Vibrations could then cause fibers to be released from insulation that is exposed (not covered with a protective jacket) or not in good condition. If in doubt about the possibility of fiber release, thoroughly inspect the thermal system insulation before undertaking the maintenance or repair work. Then, either correct the problem before starting the work, or assume that the maintenance work may cause accidental disturbance and fiber release. In this case, the following procedures must be used:

* Approval should be obtained from the asbestos program manager or his/her designee before beginning work. The asbestos program manager or accredited supervisor should make an initial visit to the work site.

* Plastic sheets (6-mil polyethylene) should be cut and taped around any insulation that might accidentally be disturbed. The plastic should be lightly misted with amended water before taping it shut. Workers should wear at least a PAPR and disposable protective clothing.

* After the maintenance work is completed, the fixture, register, or other component, and all tools, ladders, and other equipment must be HEPA vacuumed or wet wiped with a damp cloth.

* If any debris is apparent on the plastic, floor, or elsewhere, it must be HEPA vacuumed up.

* The plastic must be wiped with a damp cloth, carefully folded, and discarded as asbestos waste.

* All clothes, vacuum bags/filters, and other disposable materials must be discarded in sealed and labeled plastic bags as asbestos waste.

* Workers must HEPA vacuum respirators and protective clothing at the work site (on the drop cloth or in the mini-enclosure). The clothing must then be discarded as asbestos waste.

Disturbance of ACM Intended or Likely

Where asbestos-containing insulation must be removed to maintain or repair the thermal system, the ACM will obviously be disturbed. As with surfacing ACM, the amount to be removed or manipulated will determine the procedures to be used.

Small Disturbances

* Approval must be obtained from the asbestos program manager or his/her designee before beginning work, and the work must be supervised.

* The work should be done after normal working hours (nights or weekends), if possible, or access to the work areas should be controlled: doors should be locked from the inside and signs posted to prevent unauthorized persons from entering the work area (e.g., "MAINTENANCE WORK IN PROGRESS, DO NOT ENTER", or, if asbestos levels are, or are anticipated to be high enough to trigger the OSHA rule, "DANGER - ASBESTOS: CANCER AND LUNG DISEASE HAZARD: AUTHORIZED PERSONNEL ONLY: RESPIRATORS AND PROTECTIVE CLOTHING ARE REQUIRED IN THIS AREA"). Note, emergency exits must remain in operation.

* The air handling system should be shut off and locked out or temporarily modified to prevent the distribution of any released fibers to areas outside the work site.

* Workers must wear at least a PAPR and disposable protective clothing.

* A 6 mil polyethylene dropcloth should be placed underneath the location of the maintenance work, extending at least 10 feet beyond all sides of the work site.

* The asbestos containing insulation should be removed as necessary for the repairs, using standard glove bag techniques. (See the OSHA Asbestos Standard for the Construction Industry 29 CFR 1926.1101).

Detailed discussions of Glove bag technique can also be found in Section of the **Asbestos Abatement Worker** or **Supervisor** course manuals. Glove bags are fastened around the part to be repaired, the insulation is removed with knives, and saws to make the part accessible, and the repairs are made using tools that were placed in the glove bag tool pouch. The open faces of the remaining asbestos-containing insulation are then sealed with an encapsulant or latex paint, all surfaces are wet wiped or HEPA vacuumed, and all debris is sealed in the glove bag and removed together with the bag.

* If a bag is ruptured during the course of repairs, work should stop, the area should be sealed off. Sealing tape applied quickly to a small puncture could prevent significant release of fibers to the room provided the ACM inside the bag was thoroughly wet. In this case, sealing off the area followed by cleaning and air testing is probably not necessary.* Workers must HEPA vacuum respirators and protective clothing at the work site (on the drop cloth). The clothing must then be discarded as asbestos waste.

* All glove bags and any used materials (including disposable clothing) must be discarded as asbestos waste.

* Non-asbestos insulating material can be installed, as necessary, to replace insulation that was removed.

Large Disturbances

Maintenance activities which involve removal of 3 linear feet or more of asbestos thermal system insulation (e.g., several valves need attention in a utility room or block insulation needs to be removed for boiler repair) should be considered large-scale disturbances and will require that the job be designed by an accredited **Asbestos Project Designer.** If the work involves over 260 linear feet in a building (this is an aggregate over a calendar year) then the work must be contracted out. In some situations, glove-bag techniques may be appropriate. In other situations the use of glove bags will not be feasible. More detailed information on large scale removal can be found in the **OSHA Asbestos Standard for the Construction Industry 29 CFR 1926.1101 and in the Asbestos Abatement Worker or Supervisor course manuals. Also remember that any job exceeding 25 linear feet requires a 3 stage decon.**

The choice between conducting multiple glove bag operations and isolating the entire work site is largely one of convenience and cost. However, if the maintenance activities are likely to cause disturbance of ACM on pipes, boilers, or ducts at sites other than those just undergoing repair (due to vibration for example), then the entire room or area must be isolated and large - scale asbestos removal procedures employed. **COMAR 26.11.21 requires that glovebag jobs be isolated unless a variance is granted.**

Other ACM

Other types of ACM should also be addressed in the special O & M program. They include vinyl asbestos floor tiles, asbestos ceiling tiles, Transite wallboard and counter tops, asbestos roof tiles, various textile products (i.e., stage curtains), fire doors, asbestos siding, asbestos roofing materials, and asbestos containing concrete pipe. Disturbance of these materials should be avoided. Where this is not possible, procedures should be used as described for large - scale removal of ACM. Cutting, drilling, sanding, or grinding of ACM must be performed in an enclosed area with tools equipped with a HEPA filtered vacuum system.

Other Measures

Whenever friable ACM is present in a building, special procedures must be followed when changing filters in the HVAC system. The filters should be misted with amended water as they are removed, placed in plastic bags, sealed, and discarded as asbestos waste. Workers should wear PAPR' s and protective clothing.

Special Work Practices for Renovation and Remodeling

Renovation

Building renovation or building replacement can cause major disturbance of ACM. Moving walls, adding wings, and replacing heating and air conditioning systems involve breaking, cutting, or otherwise disturbing ACM that may be present. Prior removal of ACM is highly recommended in these situations particularly if it will be impacted by the renovation work and is sometimes required by regulation. If prior removal is not undertaken, the renovation project should be considered equivalent to an asbestos removal project. All the procedures and precautions for asbestos removal required by the State Employees Asbestos Program must be followed. A key step in considering a renovation project is checking on the location and type of ACM that may be affected. Clearance must be obtained from the asbestos program manager or his/her designee before serious project planning is begun.

Remodeling

Remodeling or redecorating implies less dramatic structural alteration. However, disturbance of ACM or materials contaminated with asbestos fibers is still possible. Where the remodeling involves direct contact with ACM (e.g., painting or wallpapering over ACM), all of the procedures and precautions required by the State Employees Asbestos Program must be followed.

If "other" types of ACM have to be removed as part of the renovation project, the removal must be done with care to avoid breaking the material. For example, **small sections** of asbestos containing floor tiles can be removed by applying heat to the tops of the tiles and then prying them up. Glued carpet may require a mechanical chipper to separate the carpet from the floor.

Before a chipper is employed, test the carpet adhesive for asbestos. If it contains asbestos, all workers must wear respirators and protective clothing and treat the project as an asbestos removal project.

Emergency Response Procedures

As long as ACM remains in the building, a fiber release episode could occur. Custodial and maintenance workers must report to the asbestos program manager or his/her designee the presence of debris on the floor, water or other physical damage to the ACM, or any other evidence of possible fiber release. Fiber release episodes can also occur during maintenance or renovation projects. The asbestos program manager may call a contractor or assigned properly trained, equipped and medically monitored Level II Personnel to clean up the debris and make repairs as soon as possible. The area must be restricted until such work is completed. If an outside contractor is to be used, a company should be selected and retained by contract for quick response action as needed.

Minor Episodes

Minor episodes, such as a small section of insulation (less than 3 linear feet) falling from a pipe or a careless worker bumping into a beam and dislodging a small amount of fireproofing ACM (less then 3 square feet) are defined as minor fiber release episodes in the AHERA rule. They can be treated with the following techniques:

* Workers must wear PAPR' s and disposable protective clothing

* Workers should thoroughly saturate the debris with amended water using a mister with a very fine spray. The debris must then be placed in a labeled 6 mil disposal bag and the floor must be cleaned with a damp rag or mop. Alternatively, the debris can be collected with a HEPA vacuum cleaner.

* All debris and materials in the cleanup must be discarded as asbestos waste.

* Workers must vacuum their disposable suits and wet wipe their respirators before leaving the work area. The suits must be disposed of as asbestos containing waste.

* The damaged ACM must be repaired with asbestos free materials or sealed with latex paint or an encapsulant.

Major Episodes

Major Episodes are very serious events. Large amounts of ACM falling from heights of several feet may contaminate an entire building with asbestos fibers. **If 3 square feet or more of surfacing or friable miscellaneous or 3 or more linear feet of thermal system insulation delaminates or becomes dislodged from its substrate, the episode would be considered**

major. A large breach in a containment barrier for a maintenance or abatement project should also be considered a major episode. Both AHERA and ASHARA require that the response action for any major fiber release episode be designed by an **accredited Asbestos Project Designer** and conducted by **accredited Workers and Supervisors**. However the following response procedures should form the basis for response actions.

* The area must be restricted immediately after the ACM debris is discovered. Where the area can be sealed by doors, they should be locked from the inside (escape corridors must remain in operation) and signs posted to prevent unauthorized personnel from entering the work area ("DANGER - ASBESTOS; CANCER AND LUNG DISEASE HAZARD; AUTHORIZED PERSONNEL ONLY; RESPIRATORS AND PROTECTIVE CLOTHING ARE REQUIRED IN THIS AREA").

* The air handling system must be shut off and locked out or temporarily modified to prevent the distribution of fibers from the work site to other areas of the building. If possible, doors, windows, and air registers should be sealed with 6 - mil plastic sheets and duct tape.

* All the procedures required by OSHA and the State Employees Asbestos Program for removal of ACM must then be followed. These include containment, negative pressure ventilation, personal respiratory protection, and protective clothing, decontamination facilities, and air testing.

* Workers wear either a "Type C" Pressure Demand Airline Respirator or a Powered Air Purifying Respirator depending on the anticipated or actual level of asbestos exposure, and disposable protective clothing (body suit, hood, boots, and possibly gloves). Personal air monitoring of workers will need to be conducted.

* Fallen debris must be sprayed with amended water and placed in 6 mil plastic bags for disposal. Shovels are useful for collecting the debris. The floor should be thoroughly cleaned with a HEPA vacuum cleaner.

* Walls, ceilings, pipes, boilers, or other surfaces where ACM was damaged or delaminated must be repaired temporarily. This might involve replastering with asbestos-free material, spraying with an encapsulant, or wrapping /covering the area in 6 mil poly. In some cases, ACM beyond the immediate area of damage may need to be removed to prevent additional episodes.

* The air should be tested for asbestos fibers before the plastic barriers are removed. Testing should follow EPA, OSHA, and COMAR guidelines.

* After the barriers have been taken down, a decontamination of the entire building or a portion of it should be considered.

The need for this will depend on how rapidly the response team reacted to the episode and, in particular, how quickly the HVAC system was turned off. A thorough decontamination includes HEPA-vacuuming and/or wet wiping all carpets, furniture, and other surfaces. Decontamination of the HVAC system would involve disassembling and cleaning (HEPA-vacuuming or wet wiping) ducts, ventilators, registers, and other system parts. System filters should also be removed and replaced.

* All equipment used in the cleanup operation must be washed or wiped with damp cloths. All disposable materials, (e.g., cloths, mop heads, filters, suits) must be discarded as asbestos waste.

Fiber release episodes must be documented. A report format is suggested in Exhibit H-4. These procedures must be employed whether the building owner uses in-house staff or an outside asbestos abatement contractor. If an outside contractor is used, the procedures should be thoroughly discussed and proper training of the contractor' s crew assured before signing the contract.

Under the AHERA Rule and the ASHARA Rule for major fiber release episodes, this part of the O & M program must be developed by an accredited **Asbestos Project Designer**. At a minimum, the Management Planner should have a Project Designer review and sign off on this part of the O & M plan.

Periodic ACM Surveillance

Periodic surveillance is essential to ensure that the asbestos stays in good condition. Periodic surveillance will ensure that any damage or deterioration of the ACM will be detected and corrected. Periodic surveillance must be done every at least six months by a trained individual.

The assessment factors described in section C should be used to evaluate each homogeneous area of surfacing ACM, thermal system ACM, and miscellaneous ACM. The assessment factors are: ACM condition (deterioration, physical damage, and water damage), and potential for disturbance (frequency of contact, sources of vibration, and air erosion). A trained individual must conduct the inspections**. Any sampling that needs to be done must be done by an accredited asbestos building inspector**. The results must be documented and placed in the permanent asbestos file.

Although air monitoring could supplement the physical inspection, the EPA does not recommend it for the initial assessment of exposure potential. Air monitoring provides a "snap shot" or one time view of conditions that can be very misleading because airborne asbestos levels vary from day to day and from room to room. Low readings are therefore possible even when the ACM is in poor condition.

Record keeping

All written records discussed in this section must be maintained as part of a thorough Record keeping process. To review, these include:

* The written O&M plan itself, including work practices;
* Building plans and drawings;
* Survey date;
* Copies of notification and warning programs;
* Descriptions, times, dates, and attendants of training programs;
* Written respiratory protection program;
* Medical surveillance records;
* Copies of all permits and documentation of custodial, maintenance, renovation, and emergency response actions performed;
* Periodic ACM surveillance records.

OSHA requires that each employee' s record of exposure and medical surveillance be made available to that employee. EPA recommends that all written elements of the O&M program similarly be made available for inspection.

A detailed description of Record keeping requirements under AHERA and the State Employee' s Program is found in Section H of this manual.

Waste Disposal

All waste from an asbestos project must be double bagged in specially labeled 6 mil poly bags. These bags must be sealed using a "goosenecking" procedure. The label must include the OSHA labeling information (29CFR1926.1101), generator's name (license # if applicable), address, location of waste generation, and the date the bag was sealed. All waste must be disposed of at a landfill that is licensed and follows EPA requirements. Manifests must be generated and kept for all waste. Up to 20 cubic yards of waste can be stored at the facility but it must be in rigid leak tight containers in a locked and secured area. Only properly equipped and trained employees may enter this area.

EXHIBIT E-1 TRAINING REQUIREMENTS

	AHERA	**ASHARA**	**OSHA**	**STATE OF MD.**
2 Hr.	Yes - for all service workers	No	Yes - for all Class IV jobs **[Class IV work NOT allowed in MD as OSHA defines it]**	Yes - for all Level I employees
16 Hr.	Yes - for all service personnel who will disturb asbestos in amounts < 3 sq. ft. or 3 lin. ft.	No	Yes - for all Class III jobs.	No
4 Day	Yes - for all workers performing response actions	Yes - for all workers performing response actions	Yes - for all Class I and some Class II jobs	Yes - for all Level II employees
5 Day	Yes - for all supervisors of response actions	Yes - for all supervisors of response actions	Yes - for all supervisors of Class I and some Class II jobs	Yes - for all supervisors of Level II employees

EXHIBIT E-2

PERMIT APPLICATION FOR PERFORMING MAINTENANCE/RENOVATION WORK

1. Exact location of area involved (including building number, room number, location within room etc.)_____
_____
_____
_____

2. Description of work involved
_____
_____
_____
_____

3. Starting Date _____ Anticipated Completion Date _____

4. Approximate amount of asbestos present (linear feet, square feet, size of tank, etc.)
_____
_____
_____

5. Asbestos control methods to be used (i.e., glove bag, HEPA vacuum, mini-enclosure, etc.)
_____
_____
_____
_____

6. Protective equipment to be used_____
_____
_____

7. Name and telephone number of supervisor_____
_____

TO BE FILLED OUT BY ASBESTOS PROGRAM MANAGER:

Permit _____ Accepted _____ Rejected _____

Signed_____ Print _____

Permit Number _____

Emergency Contact _____

Please Return this Form to:
_____
_____

EXHIIT E-3

FIBER RELEASE EPISODE REPORT

1. Building and room number(s) (or description of area) where episode occurred:_____
_____
_____
_____
_____
_____
_____
_____
_____

2. The release episode was reported by _____
_____ on _____(date)

3. Describe episode:_____ _
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

4. The asbestos containing material was _____/was not_____
cleaned up according to approved procedures. Describe the cleanup:_____
_____
_____
_____
_____
_____
_____

Signed:_____ Date: _____
(Asbestos Program Manager)

EXHIBIT E-4

PERIOD SURVEILLANCE SURVEY SHEET

BUILDING:
DATE OF SURVEY: / / **SUPERSEDES SURVEY DATED: / /**
PAGE ____ OF

LOCATION	CONDITION (GOOD or NEEDS REPAIR)	TYPE OF ACM (SURFACE; TSI; MISC)	COMMENTS: Cause/Suggested Correction; Exposure Risk; Potential For Damage/Significant Damage; Recommendations For Follow-up, e.g., collection of bulk samples, restriction of area, increased surveillance schedule, etc.

SURVEYOR: **ACCREDITED BLDG.. INSP..:**

AGENCY SAFETY & HEALTH SPECIALIST:
RECEIPT BY ACCREDITED MGMT PLANNER: / / MGMT PLANNER

SECTION F LEGAL RESPONSIBILITIES OF MANAGEMENT PLANNERS

INTRODUCTION

This section discusses the liability that the Management Planner may shoulder as a result of conducting a hazard assessment and developing a management plan. It begins with a discussion of broader issues, namely, the legal responsibilities of the Management Planner's employer the Building Owner (State of Maryland).

THE OWNER'S RESPONSIBILITY

Legally, a building owner has responsibility for any hazards within a structure, of which the owner knows or of which the owner should know. Under general principles, a building owner who knows or should know that asbestos is present in a building; or who knows or should know that asbestos is likely to be hazardous to those exposed to it, may be liable to occupants of the building. This theory is based on the fact that the building owner has a common law (and sometimes statutory) responsibility to "invitees" and "licensees", which are persons who have a right to use or be in the building. Further, once the owner suspects or has reason to suspect that asbestos hazards may be present on the property, any extended delay in confirming whether a hazard exists or in instituting a safe and effective asbestos management or abatement program increases the owner's chances of being found negligent in a personal injury suit. In summary, an owner can be held liable if the owner knew or should have known, that asbestos was present, and failed to take appropriate action or took improper or incomplete actions. Persons who may claim to be injured parties due to the building owner's negligence can include: employees of the owner, tenants (and their employees), outside maintenance personnel, outside contractors, persons who enter the property (business visitors, delivery persons), and the public.

Persons understand the principle of owner responsibility in connection with wet floors, snow removal, leaking roofs, etc. Just as these situations cause potentially dangerous conditions, so can the presence of asbestos-containing materials. And just as owners have their maintenance staff be vigilant regarding wet floors, so too must appropriate precautions and action be applied to the presence of asbestos-containing materials.

The building owner is generally held negligent for the actions of any employee performing his employment duties. Furthermore, because responsibility for an activity that is inherently dangerous cannot generally be delegated, a building owner retains responsibility for asbestos management or abatement programs if they are performed by the owner's employees and, in some cases, by outside contractors. An owner will not necessarily be liable for the negligence of an independent contractor, although the owner would be liable for the same acts of negligence if committed by an employee.

Finally, a building owner is generally under an obligation to exercise reasonable care inspecting and maintaining a building. Therefore, in addition to developing and instituting an asbestos management or abatement program if hazards are found, the building owner may have a duty to warn persons who may be affected by the danger, and to take adequate measures to control the hazard. The extent of responsibility and liability will be determined by the state, county, or municipal laws applicable in various jurisdictions.

In summary, the responsibility for potential asbestos exposure in a building rests with the building owner. An owner cannot discharge this responsibility by ignoring, delaying, or delegating it. The Asbestos Hazard Emergency Response Act (AHERA) addresses asbestos related actions in public and private schools (Pre-school thru twelfth grade). The Asbestos School Hazard Abatement Reauthorization Act (ASHARA) addresses asbestos related actions in schools, public, and commercial buildings. The OSHA Asbestos Standard for the Construction Industry also addresses some building owner responsibilities. The State Employees Asbestos Program requires that management plans be developed and submitted, response actions be implemented, maintenance and custodial personnel be protected, and buildings be reinspected.

LIABILITY OF THE MANAGEMENT PLANNER

While primary legal responsibility for damages suffered arising out of exposure to asbestos-containing materials rests with the building owner, consultants and contractors who become involved with inspecting and developing management plans may also incur liability. The responsibilities of persons acting in the capacity of a Management Planner fall into three areas: contractual liability, tort liability, and regulatory liability.

Contractual Liability

A Management Planner who provides services under contract is liable for breach of contract if the contract is not properly performed. Consequently the terms of contracts between building owners and consultants are of extreme importance.

While all contracts are important legal documents, over the years there have evolved "form" contracts which consultants may find convenient to use or adopt. Inherent in the use of any form are the dangers of contract terms that are incomplete, inadequately understood or ambiguous. These potential dangers have often led to contractual disputes. In connection with asbestos-related work, contract documents should be designed for each project, to take account of particularities of project size, scheduling, professional interdisciplinary interaction, safety, liability insurance, and the like. It is advised that if form agreements are used, they be modified with the advice of legal counsel.

The following items should be considered when drafting a contract document.

* The scope of work should be carefully defined so that all parties understand what services and products are being contracted for. All parties ultimately benefit from a detailed description of the scope of work.

* Specification of cost and the manner and schedule of payment for services.

* Schedule of delivery of services.

A professional consultant is liable for a breach of contract if the contract is not properly performed. Thus, all contracts must be reviewed to determine the obligations being undertaken and whether they can be performed.

Tort (Negligence) Liability

In the event that Management Planners fail to perform their work in accordance with the standards of their business, they may be sued in "tort". A tort is a legal wrong, and breach of a legal duty is often termed "negligence". Negligence can arise from improper design or performance of:

* Building surveys
* Hazard assessments
* Development, implementation or oversight of response actions
* Development or implementation of operations and maintenance plans

It is therefore important that persons involved in these activities keep current in these matters.

Regulatory Liability

Failure to adhere to requirements imposed by law or regulation can also lead to liability imposed by governmental agencies. Various federal, state, and local laws and regulations apply to the performance of activities involved in asbestos-related work. Violation of these requirements can lead to civil penalties (such as fines) and criminal penalties (which can include fines and/or imprisonment). It is thus extremely important that all legal requirements be adhered to in order to avoid serious penalties.

Indemnification Clauses

In the event that the building owner hires a consultant, the consultant should be concerned about protection from his own and other's negligence. The building owner or third parties may file suit if negligence is suspected. In addition, a plan that is not executed, or improperly executed, may result in a lawsuit against the building owner. Even if the management plan is well designed and implemented, a frivolous lawsuit may be filed.

Any suit against the building owner is likely to name the Management Planner. A hold harmless clause in the Planner' s contract may protect him or her from the building owner.

In addition an indemnification clause obligates the building owner to indemnify the Management Planner for legal fees and judgments, in case of a third party suit, and would offer protection against negligence on the part of those responsible for implementing the management plan and against nuisance suits.

LEGAL CONSIDERATIONS OF ABATEMENT MEASURES

If asbestos discovered in a building is incompletely or improperly abated, the legal theories of liability are numerous, and the number of parties who may be liable is equally large. Owners and building managers must take action to determine the presence of any dangerous conditions. Plans must be developed to determine the hazards presented and appropriate response actions. Anyone who is or becomes involved from that point on may be liable for any resulting consequences.

Many owners, both public and private, are concerned about recovering the expense of abatement or removal efforts from asbestos mining and product manufacturing firms, suppliers, and distributors, and contractors involved in the original installation of the asbestos. The term "cost recovery" has become an important concept for owners, consultants and contractors.

Similarly, insurers are concerned over the liability of their insured (whether owners, professionals, or contractors) for prior acts, as well as for the potential liability of those involved currently in asbestos-related activities. Developing and implementing a management plan may be essential to the success of cost recovery litigation as well as the defense of insurers.

If ACM control measures are undertaken in a hurried, emotional atmosphere, the resulting situation may be even more hazardous than the situation that is supposedly being remedied. Each step in the planning process requires careful technical and legal consideration and coordination, as well as proper execution. Simply developing a well-conceived management plan is not sufficient. If it is improperly executed, the legal perils may be equal to or greater than having no plan at all. Failure to implement the plan through a coordinated team of competent technical and professional consultants can lead to the loss of the health protections that are sought, as well as loss of legal protection. All abatement work must conform to the existing state-of -the -art practices.

LEGAL CONSIDERATIONS OF MANAGEMENT PLANS

Design and Implementation

Both the design and implementation of the Management Plan carry legal implications. Generally speaking, a Management Plan has two major goals:

* The minimization of exposure of employees, tenants, and the public to asbestos; and

* The assurance that abatement activities are appropriate and conducted competently.

Each Plan must be tailored to the unique characteristics of the individual buildings: the structure itself, the use of the structure, the occupancy of various areas and the persons responsible for executing the plan. Off-the-shelf Plans cannot adequately address the peculiarities of each building.

Owners and Management Planners must make certain that all affected parties involved in the Management Plan fully understand the severity of the risks involved in non-compliance with the plan and the need for strict adherence to all elements of the plan.

Use of In-House Staff vs. Contracted Labor

In connection with establishing the Operations and Maintenance (O&M) program (and the Management Plan, of which the O&M program is a part), a building owner must consider whether the planning and response efforts will be done by in-house staff. The O&M plan development and permanent corrective measures may entail a high degree of risk to workers and to persons occupying the building. All persons involved in planning response actions should be specially trained in this area, and, in the case of schools, public and commercial buildings they must be accredited.

The determination of whether to engage independent contractors involves legal issues, as well as economic ones. While a building owner can be held liable, under certain circumstances, for work conducted by consultants and independent contractors, the building owner will definitely be held liable for all work done by the owner's employees. A building owner can be held liable for retaining someone to do work whom the owner knew, or should have known, was not competent or qualified to perform the task. Under current regulations, a building owner may be held responsible for failure to notify EPA prior to undertaking asbestos work or for improper disposal of asbestos waste removed from the owner's building.

Therefore, it is extremely important that a building owner make certain that any contractors and consultants who are hired are trained, qualified, experienced, and observe all regulations. This implies that the building owner, or the owner's representative be knowledgeable and competent as well.

USE OF PREVIOUS INSPECTIONS

Past inspections could have been performed in an inadequate manner, either because of a lack of knowledge or inattentiveness to requirements or detail. Thus, before a Management Planner can safely rely on a previous inspection, the following considerations must be addressed:

* The time at which the inspection was performed and the state of then-current knowledge;

* The person(s) performing the inspection, their training and expertise at the time;

* The information provided at that time to the Inspector by the owner;

* The procedure used to perform the inspection

* The scope of the inspection

* Restrictions placed on the inspector at that time; and

* Events that have transpired since the original inspection (such as renovation, remodeling, etc.)

A Management Planner may be liable if he or she relies on a prior inspection if the reliance was not reasonable and was not performed properly.

THE IMPORTANCE OF RECORD KEEPING

It is imperative that owners and Management Planners document all of their efforts and investigations regarding management planning and response actions for ACM. In addition to legal requirements regarding the compiling and maintenance of certain medical information on workers exposed to asbestos, it is important that they set up RECORD KEEPING systems as part of the entire asbestos management program.

From a legal perspective all efforts to abate or manage ACM must be fully documented and the records retained. Even if the hazard assessment shows that no hazard exists, it may be necessary years later to show that the assessment was done properly and by competent professionals. If hazards are discovered and abated, it may be necessary to prove that the abatement was done competently and in conformity with the then "State-of-the-Art" work practices. Similarly, records should be kept to show that the O&M programs were properly designed, implemented, and periodically reassessed. Every aspect of the asbestos management program must be reviewed from a legal perspective to determine the types of records that are either required to be kept, or desirable to keep. Successful tort defense plans and cost recovery plans are heavily dependent on proper RECORD KEEPING.

INSURANCE

The Role of Insurance

Insurance is intended to protect the insured against catastrophic financial loss. This "risk shifting" has been and continues to be sound business practice.

However, in order to accomplish risk shifting successfully, an insured must be confident that (1) the anticipated risks will be covered by the policy; (2) the insurance carrier will respond to and adjust claims in a satisfactory manner and not deny coverage unjustifiably; (3) the insurance carrier has the financial ability to respond to claims; (4) the insurer will continue its activity in the industry being insured, particularly where the type of policy written requires that the insured remain with the same carrier.

It is obvious that insurance adds to the consultant's cost of performance and thus is eventually paid by the owner, either on a pro-rata basis or dollar-for-dollar.

Types of Insurance

Management Planners will normally look for "errors and omissions" insurance to protect them against "mistakes" in the management plan. They should also purchase comprehensive general liability insurance for events that may occur during building reinspection. For more discussion on these two insurance items see the Building Inspector Notebook, Legal Liability Section.

In the past, errors and omissions and liability insurance has been written on an "occurrence" basis. 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 the writing of this type of coverage, insurance carriers must defend claims brought years after companies are no longer insured by the carrier. Occurrence policies can result in great losses to carriers who have not received premiums over a period of time, especially given the long latency periods for asbestos-related diseases.

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 ("tail") reporting period. The tail 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 caused by a planned response action may not be obvious and injury may not be detected for 20 to 40 years afterward. Claims made coverage may not be of value in such cases if (1) the insured changes insurance carriers before a claim is made, or (2) the carrier withdraws from the market before a claim is filed.

There is no single definition of what "claims made" or "occurrence" means, thus it is mandatory that the insured read and understand the coverage afforded under the policy. All exclusions, conditions, endorsements and definitions should be carefully analyzed.

There are several important considerations in making an analysis of available insurance coverage or in specifying same:

* 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 that arose in prior years, similar to "occurrence" policies.

* The insurance certificate itself provides little or no information regarding the specifics of coverage. The policy itself must be reviewed.

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

Problems that have arisen in this area can be illustrated by the following examples:

* A general liability insurance policy issued for asbestos work that excludes coverage for personal injury attributable to airborne mineral fibers. Of course, asbestosis a mineral fiber and is generally only dangerous when it is airborne and thereafter inhaled.

* An errors and omissions policy written for a consultant that includes a "pollution exclusion" excluding coverage for any personal injury or property damage caused by a broad list of substances, including asbestos. This policy provides no coverage for asbestos risks.

* A general liability "occurrence" policy which excludes "anticipatory damages" which is defined as damages that are claimed to have been caused by asbestos, but which cannot be proved due to the fact that the asbestos-related disease has not yet manifested itself. This situation is perhaps the type of claim that can most often be expected, but no coverage is provided in these circumstances.

Evaluating an Insurance Company

Assuming that the management planner or building owner, realizes the pitfalls of making assumptions regarding insurance coverage, and decides to make a knowledgeable choice regarding the type and quality of coverage to obtain, the next choice is the company from which to obtain coverage. There are several factors that must be considered in making this choice:

* The quality of the coverage being written (as discussed above);
* The financial stability of the company (reserves)
* The management of the company
* The commitment of the company to the asbestos abatement industry; and
* Other features of the insurance company' s program (such as work guidelines, loss control procedures, etc.)

Considerations for evaluating the type of coverage being written have been discussed above. Evaluating the financial stability of the insurance company can be difficult. For example, is an insurance company with $10 million of assets and having 100 insured (each of whom is covered by a policy providing $1 million of coverage) more financially stable than an insurance company with $5 million in assets that has 20 insured under the same circumstances? Also, what are the criteria that the insurance company uses to evaluate whether it will provide insurance? If the insurance company has an inspection procedure that is designed to assure the competence of its insured, the financial stability of the insurance company in the long run may be enhanced.

With respect to the carrier' s commitment to the asbestos industry, this consideration is important in connection with obtaining claims made coverage. If the claims made policy provides that coverage is no longer afforded after the termination of the policy, several events which may cause termination of coverage must be considered:

* The insured goes out of business or ceases doing business in asbestos-related work;

* The insurance company decides to stop writing coverage for asbestos-related work; and

* The insurance company goes out of business.

Unfortunately, you will not be able to obtain written guarantees from the insurance carrier that it will continue writing insurance for asbestos-related work. Similarly, the insurance company cannot obtain guarantees that the consultant will continue buying coverage from the same company. Even if such written assurances were obtained, either the consultant or the insurance company could go bankrupt and thereby legally avoid its obligations. However, a consultant or owner can investigate the insurance company to determine as best as reasonably possible, whether the insurance company has a commitment to writing insurance for asbestos work in the future. This can only be done by talking directly to the company or its representatives; while this may appear troublesome, it would appear to be a prudent investment of time in view of the significant premiums that are being charged for asbestos coverage.

In addition, various types of coverage that may provide longer-term protection should be investigated, including "extended reporting coverage" or "tail coverage". While these might involve additional premiums, the investment may again be worthwhile to consider depending on how long the tail is. For owners and consultants who are contemplating or are involved in significant amounts of work, the specific design of appropriate insurance coverage may be a worthwhile investment. Such requests should be broached to the insurance carriers in advance in order to determine whether specialty coverage can be written and, if so, at what cost. In this regard, coverage offered by specialty insurance carriers and insurance companies formed as risk retention should not be ignored. Many owners, upon analyzing such carriers, the coverage offered, and the loss control policies, have determined that the insurance programs are equal to or more desirable than those offered by traditional carriers.

With respect to the review of other elements of an insurance program, the adoption of work procedures and loss control procedures should not be overlooked. The first line of defense with respect to claims is that the work is performed properly. If persons are not injured and property is not damaged in the first place, no claims should arise. Thus, the use of proper specifications for the performance of the work can help reduce claims, as can the monitoring of the work by professionals. Loss prevention programs established by an asbestos insurance carrier can be a significant additional service to an owner or consultant. Also, inspections of work being performed by the insured party by the insurance companies can help assure that proper work procedures are being observed.

For these reasons, the importance of considering all aspects of an insurance carrier' s programs cannot be overemphasized. The mere choice of a company based on any one criterion may not be in the best interest of the management planner or building owner. Choices made on the basis of typical insurance industry evaluation standards (for example, whether the carrier is rated, or licensed in a particular state) may exclude carriers whose programs are specifically designed for the asbestos industry and whose coverage may be superior.

CONCLUSION

The legal considerations involved in management planning are many and complex. Each step in the asbestos control process must be properly planned and executed, not only to minimize the risk of exposure, but also to protect the persons and companies involved from significant legal exposure.

SECTION G ROLE OF OTHER PROFESSIONALS IN THE MANAGEMENT PLANNING PROCESS

INTRODUCTION

The Management Planner must confer with and obtain assistance from a number of other professionals during the course of the development of a report. The Management Planner has to consider health, economic, engineering, and administrative factors in developing recommendations for asbestos management and control. In order to accomplish this task, the Planner may need to confer with at least four types of other professionals while preparing a report: industrial hygienists, architects, maintenance engineers, and facility budget officials.

RELEVANT PROFESSIONALS

Industrial Hygienist

The Industrial Hygienist plays a critical role in many phases of asbestos assessment and control activities. With respect to the Management Planners, consulting hygienists could provide assistance with regard to the hazard assessment and the prioritization of response actions. The hazard assessment requires the Planner to make judgments regarding fiber release potential under a variety of use, accessibility and ventilation situations. The assessment of future fiber release may consequently involve technical questions regarding re-entrainment of fibers, dispersion of fibers under specific air flow conditions, damage potential of asbestos covering under heat, or water related stress. In addition, if the building owner wishes to undertake air monitoring (not recommended by EPA for assessment, but might be used as a surveillance tool for an O&M program), an industrial hygienist could conduct the air sampling. Hygienists can provide valuable technical assistance on these issues.

A second area in which the industrial hygienist can aid the Planner is in prioritizing response options. From the hazard assessment the hygienist can offer guidance in ranking areas and drawing up a suggested time frame for implementing response actions.

A third form of interaction between the Management Planner and industrial hygienist might involve the hygienist as the building owner's representative. In such a role, the hygienist will be interested in teaming with the Planner to ensure that he performs competently and in the best interests of the building owner.

Architect

The development of response action options may require the Management Planner to consult with architects. The management report is not meant to contain detailed specifications for proposed response actions.

However feasibility of the responses, the sequencing of response actions, or the approximate costs of some proposed actions may require the services of a consulting architect. Certain planned actions may require unique architectural solutions for purposes of removal or access, the design of special containment structures, or more funding than for a response under conventional conditions.

Depending on local building codes, an architectural review may be needed on aspects of a management plan. This review may be required under the following circumstances:

1. Prior to submission of renovation or demolition plans to the local review and permitting agency.

2. By an architect doing subsequent renovation work at the building.

3. By the staff architect/facilities manager representing the building owner.

Building Engineer

The building engineer can provide the Management Planner with valuable information concerning building use (and abuse) patterns, history of damage and repair, and frequency of activities that may potentially result in fiber release episodes. These types of information will aid the Management Planner with the hazard assessment. In addition, it will be useful in the determination of response action priorities.

The Management Planner will develop an O&M program to optimize protection of building occupants from future fiber release from asbestos remaining in the building. In order to develop a feasible program, the Management Planner needs to know how operations and maintenance activities are presently carried out. Such items as the processing of work orders for repair jobs, work practices, and the use of contract services should be explored. In order to understand the present system and develop feasible approaches to changing the system, the Planner will need information and advice from custodial personnel.

Facility Administration

In developing a realistic response plan, the financial situation at the facility and the facility' s preference or ability for use of in-house maintenance staff/or contract workers should be taken into consideration. Creation of a plan without information on these factors may lead to confrontations and submission of a plan that cannot be implemented. It is essential that the Management Planner confer with the relevant facility officials to assess these factors and adapt the plan to suit conditions at the facility.

SECTION H: RECORD KEEPING FOR THE MANAGEMENT PLANNER

INTRODUCTION

An effective management plan is keyed to a comprehensive RECORD KEEPING system. The Management Planner develops a report that is submitted to the Facility Asbestos Program Manager and Facility Head for approval. The report presents the results of the building inspection, the assessment of asbestos in and on the building, a discussion of recommended response actions the facility should implement to manage the asbestos, and guidance concerning the cost of various options.

The Planner' s report essentially becomes the facility' s management plan and is submitted to both the facility' s parent department and the Department of the Environment for approval.

BENEFITS

The purpose of the RECORD KEEPING process is to establish and maintain a standardized system that clearly documents implementation of an asbestos control program. The steps taken by the facility to identify asbestos material and associated hazards, and to minimize potential exposure to employees and building occupants must be recorded for future reference. AHERA is specific concerning the various records and documentary information to be maintained. It is the facility' s responsibility to establish a RECORD KEEPING system and maintain the required records as part of its management plan.

ELEMENTS OF RECORD KEEPING

In general, the RECORD KEEPING system must track three types of data: (1) data on the physical condition of the ACBM, (2) actions taken on the ACBM, and (3) the data associated with personnel involved with the asbestos management program.

The tracking of the ACBM' s may be thought of as tracking of a business' s physical inventory. It requires the recording of: the condition of the material at intervals (record of the surveillance), substantive changes in material status (removal, enclosure, encapsulation, or repair), various required reports to governing bodies (notices of abatement and disposal actions to EPA, MDE), and an up-to-date inventory on a periodic basis (reinspection).

Required RECORD KEEPING for personnel includes the identity of personnel working with asbestos, their training, medical monitoring, respirator fit testing, and environmental exposure levels. This information should be recorded in a form that will be available for a period of 30 years or more.

Despite the fact that the Management Planner does not set up, or maintain facility records (except when assigned these duties by the facility head), the Planner should be certain that the facility is aware of the RECORD KEEPING requirements.

The various types of records and documents to be included in the RECORD KEEPING system are outlined below.

1. For each preventive measure or response action taken:

    - Detailed description of the measure or action
    - Methods used
    - Location
    - Justification for why a specific measure or action was selected
    - Start and completion dates of all work
    - Names and addresses of all outside contractors or facility personnel involved and accreditation information
    - If ACM was removed, name and location of storage or disposal sites

2. For any air sampling conducted

    - Name and signature of person collecting samples
    - Date and location where samples were collected
    - Name and address of laboratory analyzing samples
    - Date and method of analysis
    - Results of analysis
    - Name and signature of analyst

3. For persons required to be trained for maintenance and repair operations involving asbestos, training records must be maintained:

    - Employee' s name and job title
    - Dates initial and annual training completed
    - Location of training and training organization or provider' s name
    - Number of hours of training
    - Accreditation number

4. For each time periodic surveillance is performed:

    - Inspector' s name
    - Date of the surveillance
    - Notification of changes (or lack of) in the condition of the ACBM

5. For each time cleaning is performed to remove asbestos dust and debris:

   - Name of the person(s) doing the cleaning
   - Date of cleaning
   - Locations cleaned
   - Methods used in cleaning

6. For each time operations and maintenance activities are performed:

   - Name of person(s) performing activities
   - Start and completion dates of action
   - Location(s)
   - Description of activity, including preventive measures taken
   - If ACBM was removed, location of storage/disposal site

7. For each time maintenance activities other than Class III or Class IV activities (as defined by OSHA 29 1926.1101) are undertaken:

   - Name, signature, and accreditation number for each person involved in activity
   - Start and completion dates of project
   - Location(s)
   - Description of project, including preventive measures taken
   - If ACBM was removed, name and location of storage/disposal site

8. For each fiber release episode:

   - Date of episode
   - Location
   - Method of repair
   - Preventive measures or response action taken
   - Name(s) of person(s) performing work
   - If ACBM was removed, location and name of storage/disposal site

9. Other documentation:

   - Complete historical blueprint of facility, if available
   - Documentation on materials/products used in construction or renovation of the facility that may contain asbestos (include any correspondence with manufacturers)
   - Location and photographs (optional) of warning signs and barriers placed to prevent unauthorized access to areas of ACBM
   - Required State and Federal forms dealing with notification and compliance
   - All correspondence pertaining to asbestos in the facility

- Inventory of respirators and other equipment used to protect workers and the environment from asbestos as well as maintenance records for this equipment.
- Copies of annual notification statements, press releases, meeting agendas, (with attendance rosters)

The reason for maintaining complete and detailed records of asbestos management are many. Documentation can expedite response actions and make future renovation in any facility easier. The legal liabilities involved with asbestos are another reason to maintain thorough records. The more thorough the documentation, the more defensible the actions taken. Further, poor or sloppy RECORD KEEPING could imply callousness toward employees, building occupants, and the public. EPA, OSHA, and the State, also require that facilities keep records related to asbestos activities.

Forms which may assist the facility in its RECORD KEEPING task are discussed in Section E (Operations and Maintenance) of this notebook.

SECTION I: ASSEMBLING AND SUBMITTING A MANAGEMENT PLAN

INTRODUCTION

Each facility must develop an asbestos management plan for buildings under its authority. The original plans were to be submitted to the Maryland Department of the Environment by September 30, 1989, with yearly updates thereafter. Under AHERA, schools had to submit their management plans by May 9, 1989 and begin implementing them by July 9,1989.

A management plan should be used as a guidance document for asbestos control. A brief description of the elements of the plan required by AHERA, followed by a discussion of the forms and instructions for submitting the State required management plan are covered in this section. Other sections of the notebook provide detailed information on the various components of the plan.

Management plans should be considered working documents. They set forth a framework for short and long term actions to be taken by the facility to protect building occupants. They must be kept up to date (e.g., response actions, dates, and results of surveillance) on a regular basis.

AHERA REQUIRED COMPONENTS OF A MANAGEMENT PLAN

The management plan is to be developed by an accredited management planner. It must include a list of schools covered by the plan and state whether the building contains friable ACBM, non-friable ACBM, and friable and non-friable suspected ACBM that has been assumed to contain ACM.

The plan must provide the name and qualifications of the person named by the Local Education Agency to carry out the schools responsibility under AHERA.

Inspection Statement

An Inspection statement is to be included which describes all inspection and response action activities that were carried out before the new regulations became effective on October 17, 1987.

Inspection Results

A copy of the inspection report filed by an accredited Building Inspector accompanies the management plan. The material to be covered in this report was detailed in Section K of the Building Inspector' s course.

Response Actions

All recommended response actions for friable ACM need to be addressed. Information that should be included is: the type of action planned, the location where the action is to take place, and the timetable for completion of specific response actions.

Remaining Asbestos

If any asbestos will remain in the school or facility after response actions are taken, it needs to be documented. Detailed information on what type is present, its location, the measures taken to ensure its integrity, and the potential for exposures are all to be covered in the management plan.

Reinspection and Other Activities

A plan and timetable for reinspection and long-term surveillance activities needs to be specified. This may be in the form of statements, such as the building will be checked semi-annually. Or, the actions may be presented in the form of a chart with specific dates for particular activities. Whichever form, it must include the following:

* Plans for surveillance and periodic reinspections of friable and non-friable asbestos in a school building under the authority of the LEA.

* Plans for informing and educating school employees (school service and maintenance personnel), building occupants, or their guardians, about the location, response actions, safety procedures that are to be observed with respect to friable and non-friable asbestos.

Financial Resources

An evaluation of the resources needed to fully implement the plan is to be included in the management plan. This includes the expenses associated with response actions and the expenses to carry out reinspection, surveillance and operations and maintenance activities.

Operations and Maintenance (O&M)

An operations/maintenance and repair program needs to be addressed. Details regarding O&M plans can be found in Section E of this course notebook.

STATE EMPLOYEES ASBESTOS PROGRAM REQUIREMENTS FOR MANAGEMENT PLANS

The components of the State Asbestos Management Plan along with instructions for filling out the necessary forms are available on the Maryland Department of the Environment's website: www.mde.state.md.us.

CONCLUSION

The management plan should provide elaboration on all aspects of the facility' s efforts to manage asbestos containing materials. For example, in selecting a response action, justification is necessary for the particular choice, rationale for its prioritization, and explanation of the resources required to implement the response should appear in the plan.

The management plan is viewed as a planning, or working document. It not only sets out a course of action for the Facility, but it becomes documentary evidence of progress in implementing asbestos control options. Given the cost and financing information contained in the plan, it provides guidance on matters such as annual and long term facility budgeting. In addition, the management plan will help facility administrators identify potential funding sources to implement their asbestos control program. It is also a key document to help the facility establish that human health is being protected from asbestos containing materials within its buildings.

SECTION J: COST ESTIMATION AND FINANCING ABATEMENT OPTIONS

INTRODUCTION

At a minimum, the Management Planner is charged with recommending the "least burdensome" response actions consistent with "protecting human health and the environment". AHERA also specifies that long and short-range costs should be considered in evaluating ACBM control options.

This section addresses the various factors that affect the costs of conducting various response actions: removal, encapsulation, enclosure, repair, and O&M (including reinspection). Combining cost with technical information of effectiveness (see Section E), as is illustrated, should be useful in evaluating and comparing the costs and effectiveness of alternative actions. This section also discusses financing options for response actions.

Because costs vary significantly between jobs and over time, figures used in this manual are to illustrate the methodology only and may not represent actual cost figures to estimate specific projects

COST ESTIMATING

There are several approaches that can be taken in estimating the cost of an abatement project. Abatement and O&M costs are highly variable. Costs vary by region of the State, type of building, occupancy status of building, type of ACM, amount and location of the ACM area, and the hazard rating of the ACM. In order to effectively estimate the cost of a specific project it is necessary to become very familiar with the scope of work and the work area. The cost of a specific job can vary tremendously depending on the different factors affecting the project. Until the work area is visited and the necessary time invested to calculate the cost of the project, any estimation is nothing more than a random guess.

Knowledge and experience are the keystones of good job estimating. Knowledge of building systems, building code requirements, public relations, workers ability and morale; all of these affect the actual cost of a job. A person who has taken the time to acquire this knowledge will have a more effective edge on those who have not. Experience is not easily gained, however it is probably the most important tool a project estimator can have.

A final component in cost estimation can be one of the most obscure and decisive - fate. In every cost estimate there is a similarity to rolling dice. A good estimate is based on reducing that element of fate as much as possible. One approach to doing that is to factor in the different project considerations and site conditions that can affect successful completion of the project. Some of these are as follows:

General Factors Affecting Costs

Size and Type of Project

Since both abatement and O&M are labor intensive, the larger the job, the greater the cost. In addition, Class I work (TSI and surfacing material) has greater requirements than Class III work.

Complexity of the Project

Regardless of the size of the job (with the exception of very small projects), more complex projects imply greater costs. Most abatement jobs will involve relatively high fixed set-up costs for construction of containment structures. If the area is irregular, has high ceilings, special floors to be protected, etc., or the building is occupied, the fixed initial costs will be higher. Scheduling other building improvement operations together with abatement- renovation, replacement, redecoration, or demolition - may reduce set-up costs. Similarly, costs to develop and implement O&M plans will depend on the number of O&M areas, their location, and the range of activities affecting them.

Occupied Buildings

Abatement in occupied buildings poses a greater risk to the public. The building owner has the responsibility of informing other occupants. Interference from poorly informed or uninformed people can cause delays. There is a greater need for securing of the regulated area. There is also a greater investment of labor, time, and material than in vacant spaces.

Renovation vs. Demolition

Renovation involves a greater cost in protecting an area from contamination than does demolition. Removal of ACM may dictate the installation of replacement materials. For example, asbestos free materials will be needed to replace the fire retardancy or acoustical function of ACM. Repairs from incidental damage (spray glue damaging walls, etc.) Need to be considered. There is often a tighter schedule for renovation projects vs. demolition.

Amount and Application of ACM

Costs depend on whether ACM was used on walls, floors, ceilings, structural members, etc., as well as how thick it was applied, and the type of asbestos used.

Quality of Contract Specifications

Generally speaking, the more precise the contract specifications (i.e., for service contractors as part of an O&M program or for abatement contractors), the more competitive the bids from qualified contractors will be. In addition, selection of a qualified service or abatement contractor reduces the likelihood of cost overruns or subsequent liability costs due to inadequate work.

Elements of Cost Estimation

ACM Abatement

Cost estimates are generally expressed in terms that correspond closely to both the site conditions and the unit activities needed to be carried out. Exhibit J- 1 lists some of the site considerations and Exhibit J-2 lists some typical unit operations involved in the various types of abatement. The specific tasks shown all involve the following categories of expenditures.

Labor - Asbestos abatement is a labor-intensive operation, and labor costs tend to be the largest component of total cost. Typically, labor will constitute from 40% to 50% of the total cost of ACM removal. Labor costs include professional fees, wages, retirement funds, unemployment, health, and general liability insurance and special allowances for increased work hazard and potential asbestos disease liability. Union scale wage rates tend to run high. A typical removal "team" may consist of a foreman and four laborers. Such a team may be expected to remove 50-100 linear feet or 100-200 square feet of ACM per day, depending most significantly on whether or not work is being performed at floor level. Various factors may affect labor costs such as:

- the size of the work crew
- the experience of the work crew
- physical ability and energy of the work crew
- leadership ability of the supervisor
- morale
- shift work

Equipment and Material Costs - Specialized and often expensive equipment is essential when working with ACM. Much of the protective equipment must be disposed of after a job rather than reused. For reusable equipment, amortized purchase cost, depreciation and maintenance costs contribute to equipment charges. Such equipment includes supplied air compressors, showers, negative air units, HEPA vacuum cleaners, spray equipment, and scaffolding. Abatement jobs normally require a considerable quantity and variety of consumables. Personal protective clothing, plastic containment materials, duct tape, glove bags, surfactants, encapsulants, etc., will be required on most jobs.

Costs for supplies and materials normally run approximately 5% of the total bid price. Material cost estimates also depend upon:

- what is needed for the job
- cost of material and equipment
- age and condition of equipment
- potential costs for repairing aged equipment and probability of equipment breakdown
- equipment storage considerations

This only a summary of different factors to consider when making a cost estimate.

There are several general concepts that can be used in cost estimating asbestos abatement projects. On an abatement project the number one cost is usually labor, after that comes materials and equipment. The third highest cost is usually disposal. A general breakdown of abatement costs would look like this:

Labor	60 - 65%
Materials and Equipment	20 - 30%
Disposal	5 - 15%

Once again, these percentages can vary depending on the different factors involved. Other incidental costs need to be taken into account as well. These include insurance, bonding, overhead, and of course, profit. These costs can vary greatly.

Potential Liability Costs - Costs to indemnify the contractor for potential losses involving property damage and long term disease manifestation, may be included as overhead cost factors. If liability insurance is required and available, these costs will be the insurance policy premium.

Profit - Contractor's profit margin must reflect a desirable rate of return after taxes on available working capital. A higher degree of risk or retention of liability in asbestos removal projects relative to other construction business may justify a higher rate of return.

Other Costs - Air monitoring must be conducted at the conclusion of each abatement project done in a school and for projects over 160 sq. ft./260 lin. ft. in other types of buildings to ensure that fiber levels are sufficiently low. Air sampling may cost $400 per day, and laboratory analysis of samples may range from $10 to $300 per sample, depending on the number of samples and the method of analysis (PCM or TEM).

The most commonly used yardstick for comparing costs is the cost per square (or linear) foot for ACM removed and replaced, or encapsulated. A similar yardstick is used for spray-applied enclosures (encasement). Although actual costs vary widely by region, building, and individual project (based on factors described above), ranges of typical costs are:

*	Removal and Replacement	
	Surfacing Material	$5-25/sq.ft.
	Thermal System Insulation	$5-20/linear ft.
*	Encapsulation	$3-10/sq.ft.
*	Encasement	$5-10/sq.ft.

Costs for enclosures other then spray applied encasements are even more variable. They depend entirely on the type of enclosure and the means of attaching the enclosure material around the ACM.

Another technique involves the use of mandays (one worker/eight hours).

Plaster Wall Demolition	500 sq. Ft./32 mandays

The following is an example of job cost estimating using a standard method of assessing the work:

A boiler room which measures 30 ft. Long, 20 ft. Wide and 10 ft. high has a corrugated ceiling deck which has fireproofing sprayed on it. The spray-on is about 30 - 35% chrysotile asbestos and 2" thick. It would take a crew of 4 workers and 1 supervisor for a job this size.

Labor is the number one cost on an abatement job. A job can be set up into various stages of work. The following can be useful in determining the cost of labor.

	Men		Days		Mandays
Pre-clean/Set-up	5	x	1	=	5
Gross Removal	5	x	2	=	10
Fine Cleaning	5	x	4	=	20
Final Clearance	5	x	3	=	15
Demobilization	3	x	2	=	6
TOTAL				=	56

The average hourly wage for a worker on a non-scale job is between $8 and $10. A supervisor can usually make between $12 and $16 an hour. The hourly wage for this job is:

Worker	$10 x 4 workers = $40
Supervisor	$15 x 1 supervisor = $15
Total	$55Average wage

$55 (Total hourly wage) /5 (people) = $11(average hourly wage)

Direct cost of labor = (56 mandays) x (8 hours/manday) x ($11.00) = $4, 928.

Material costs can be made from a general estimate as well. The type of removal will influence the amount of material used. A glovebag operation will use more material per manday then a negative pressure enclosure. In general, cost of material is somewhere between $25 and $40 per manday.

For this exercise $30 per manday will be used.

Material Costs = (56 mandays) x ($30/manday) = $1,680

Disposal costs can be determined by how much material would fit into one bag. Approximately 10 sq. Ft. of spray-on material will fit into a disposal bag. Cost per bag is $3.60. Using this information we can calculate the average cost of disposal.

$$\frac{\text{Amount of material to be removed}}{\text{Material that will fit in a disposal bag}} = \frac{600 \text{ sq. ft.}}{10 \text{ sq. ft./bag}} = 60 \text{ bags}$$

Disposal Cost = (60 bags) x ($3.60/bag) = $216

Total direct cost is the sum of labor, materials, and disposal.

Total Direct Cost = Labor cost + Material cost + Disposal cost

$4,928 + $1,680 + $216 = $6, 824

A percentage figure is usually developed to figure indirect costs such as insurance, overhead, and bonding if the job will be carried out by an outside contractor. This percentage can vary depending on the project and the company involved. For this project we will take a generic percentage of 10%.

Indirect Cost (overhead, insurance, bonding) = Total Direct Cost x 10%
$6,284 x 10% = $628.24

TOTAL COST Without Profit = INDIRECT COST + DIRECT COST

$628.40 + $6,284 = $6, 912.40

Profit is also a percentage based upon the project, the overall market and other considerations. For this exercise we will adopt a 10% profit margin.

% Profit	x	Total Cost		Profit
10	x	$6,912.40	=	$691.24

TOTAL PROJECT COST = TOTAL COST + PROFIT
$6,912.40 + $691.24 = $7,603.64

There are several advantages to using these techniques. They appear to be very efficient and it takes a minimum of time to come up with an estimate. The above estimates of ACM abatement costs are approximate. They are generalized from many jobs and may not be useful for estimating the cost of a particular job. Better estimates can be obtained by contacting a few local contractors, describing the amount, type, and general characteristics of the ACM to be abated, and asking for a "best guess" cost range. Environmental consultants and other industry sources such as the Bureau of National Affairs, Environmental Information Association, et. al., can also be contacted. Other methods for estimating costs can be found in Exhibit J-4.

O & M Programs

Operations and maintenance programs typically have low initial costs but continuing annual costs. Cost elements of an O & M program include:

* Equipment - respirators, HEPA vacuum cleaners, portable enclosures, and showers.

* Labor - time for worker training, medical monitoring, and additional time for maintenance tasks (including asbestos differential pay)

* Supplies - cleaning material, labels, bags, drop cloths, disposable clothing, HEPA filters, glove bags, duct tape, and other consumables

* Other - training for Level I workers and informational meetings for other building occupants, higher costs for service and construction work by outside contractors, record keeping requirements, and higher insurance costs.

The cost of an O & M program will be specific to the characteristics of each facility. However, a rough estimate of initial and annual costs can be calculated by consulting an equipment supply company, as well as obtaining salary schedules for the affected workers. Training programs may run 4 - 5 days and costs for outside contractors may be 10 - 25% higher than the same work conducted in asbestos free environments.

Other Costs

Two types of costs - direct and indirect - need to be analyzed. Direct costs include all expenses incurred to assure that the work, whether O&M or removal is conducted properly. Direct costs have a "hidden" component - temporary relocation of equipment and workers, temporary phone lines, rental expenses, and other associated costs may be significant. Indirect costs reflect productivity and perhaps revenue losses due to disruption of work routines and other types of business interruption. Indirect costs may be substantial.

For schools and State facilities, the most obvious direct costs other than for abatement itself are for equipment and personnel relocation. Even if the abatement work can be scheduled while the building is unoccupied, equipment and furniture may still have to be moved. if abatement while the areas are occupied is unavoidable, costs of temporary relocating occupants and staff should be estimated. The resulting disruption in facility administration will likely make facility operations less efficient, but the "costs" are likely to be measured in guardian, occupant, and staff discomfort rather than in dollar outlays. Indirect costs for owners of buildings may be more tangible in money terms.

COMPARING COSTS AND EFFECTIVENESS OF ALTERNATIVES

Response Action Alternatives

Costs and effectiveness of alternative response actions should be compared only after a schedule of actions has been developed. **HOWEVER, COST MUST NOT BE CONSIDERED WHEN IT COMES TO PROTECTION OF HUMAN HEALTH.** For example, alternatives for a facility may include the following:

1. Immediate removal of all ACBM

2. Immediate removal of ACBM in the highest hazard ranks 4 - 7 and removal of ACBM in all other ranks when combined with renovation/remodeling /demolition as planned; O & M until all ACBM is removed.

3. Immediate removal of ACBM in hazard rank 7 only and removal in all other ranks combined with renovation/remodeling/demolition as planned; O & M until all ACBM is removed.

Present Value Calculation (For estimating the costs of future projects)

The costs of the above alternatives should be estimated taking into account the time value of money. This means calculating all future costs in net present value terms. "Present value" is the amount of money a building owner would have to invest now in order to pay for future response actions, considering expected rates of return and rates of inflation. "Present value" can be calculated as follows:

$$PV = \frac{C_1 (I)}{(d)} + \frac{C_2(I)^2}{(d)^2} + \frac{C_3(I)^3}{(d)^3} + \frac{C_n(n)^n}{(d)^n}$$

Where:

* PV is the present value of future abatement costs
* I is the expected annual rate of inflation (expressed as a fraction, i.e., 1% = 0.01).
* d is the expected annual "discount rate"; the expected rate of return on investments or the costs of borrowing money.
* n is the number of years in the future that the costs will have to be paid
* C is the estimated cost of a response action.

The above equation discounts future payments by what is called the nominal discount rate, that is the expected rate of return on investments in future years taking into account the expected rates of inflation. As indicated, the further out in time the cost is borne, the lower value of the cost in today's terms. This is true even though inflation raises the actual cost of response actions. For example, a three percent annual inflation rate will raise the cost of a $1 million abatement project about $1.8 million in 20 years. If the discount rate averages six percent per year for the next 20 years, the $1.8 million is only worth roughly $560,000 in today's dollars.

Some building owners will want to do their own present value calculations. Others may be totally unfamiliar with the concept of present value but may want the Management Planner to make the calculations. Whoever makes the calculations will have to assume a value for "I", the inflation rate and "d" the discount rate. A value of 1 - 5% has been used by economists for these types of calculations in the recent past.

An Example

The three alternative schedules for response actions sketched out above will be used to illustrate how costs can be estimated in present value terms.

The Facility Profile

* Steel frame construction, 4 story central structure, 2 - 1 story wings
* 80,000 square feet of space
* 30 years of remaining useful life

ACBM Profile

Type	Location	Hazard Rank	Amount
Fireproofing	On beams above dropped ceiling in central structure	6	100,000 sq. ft.
Thermal System Insulation	On boilers and piping in boiler room	6	500 sq. ft. 1,000 lin. ft.
Thermal System Insulation	On pipes in locker rooms	7	100 lin.ft.
Acoustical Plaster	Throughout 2 wings	3	40,000 sq. ft.

Abatement Costs

Removal and replacement of fireproofing - 100,000 sq. ft. @ $18 = $1,800,000

Encasement of fireproofing - 100,000 sq.ft.@$8 = $800,000

Removal and Replacement of TSI in boiler room - 500 sq.ft.@$12 = $6,000
1,000 lin.ft.@$15 = $15,000
$21,000

Removal and Replacement of TSI in locker rooms 100ln.ft.@$20 = $2,000

Enclosure of TSI in locker rooms 100ln.ft.@$5 = $500

Removal and Replacement of acoustical plaster 40,000 sq.ft.@$15 = $600,000

Encapsulation of acoustical plaster 40,000sq.ft.@$8 = $320,000

O & M - All ACBM $5,000 per year
- TSI or acoustical plaster only $3,000 per year

Alternative 1: Immediate removal of all ACBM

Costs: $1,800,000 + $21,000 + $2,000 + $600,00 = $2,423,000

Effectiveness: Conducted properly, potential exposure is eliminated. Conducted improperly, fiber levels and potential exposure could increase, at least until the building was decontaminated.

Alternative 2: 1. Immediate removal of ACBM in categories 5 -7, and

2. Removal of other ACBM combined with renovation.

Costs: a. $1,800,000 + $21,000 + $2,000 = $1,823,000

b. Assume (1) the wings will be renovated in 10 years, (2) a cost savings of 20% for combined abatement/renovation, and (3) an inflation rate of 3% per year and (4) a discount rate of 6% per year.

Removal of acoustical plaster

$PV = (0.3)^{10} (600,000)/(.060)^{10} = \$300,000$

O & M for 10 years @$3,000 per year:

$PV = \$3,000 + \$3,000 (.03)/(.06) +$

$\$3,000 (.03)^{10}/ (.06)^{10} = \$6,000$

Total = $306,000

Effectiveness: Removal considerations are the same as Alternative 1. The effectiveness of O & M for the acoustical plaster is high since the ceiling is above the reach of most people. The ceiling could be encapsulated for 10 years, but the cost would outweigh the O & M savings. Encapsulation might also make any water leak problem more difficult to repair.

Alternative 3:

1. Immediate removal of ACBM in hazard rank 7,
2. Removal of other ACBM combined with renovation or use of other abatement techniques.

Costs: Without going into details on the cost of each abatement and O & M option, the key tradeoffs can be illustrated by the options for fireproofing:

a. Removal in 30 years:

$$PV = \$1{,}800{,}000\ (.03)^{30}/(.06)^{30} = \$900{,}000$$

O & M for 30 years @$5,000/year = $150,000

$1,050,000

b. Encasement: $800,000 + $50,000 for cleaning ceiling tiles + ? for removal of fireproofing after 30 years.

Effectiveness: An O & M program for the fireproofing will be difficult to enforce since building occupants have been known to jump up and knock the ceiling tiles out of place.

Encasement combined with cleaning the ceiling tiles would essentially eliminate the need for O & M.

What alternative does the Management Planner recommend that the Facility Administration choose? The first concern is for the thermal system insulation in the locker room. It has the highest hazard rank (7) due to its current poor (significantly damaged) condition. Repair is determined not to be a lasting solution due to the likelihood of future damage. The next concern is for the fireproofing in the central structure. Despite the fact it has the same hazard rank (6) as the thermal insulation in the boiler room, an O & M program will be much less effective for the fireproofing - occupants are much more difficult to control than the maintenance staff. Thus, removal (or encasement) of the fireproofing receives the second highest abatement priority. The choice between removal or encasement will be based on cost estimates and judgments regarding the costs of eventually removing the encased fireproofing. Removal of the acoustical plaster in conjunction with future renovation is chosen by the Facility Administration as the most cost effective approach.

FINANCING RESPONSE ACTIONS

Political Considerations

Expressing costs in net present value terms allows for fair comparisons among all alternatives. However, the State may also be concerned about when the expenses will occur and how they will be met. Thus one response action may be preferable to another from a political perspective even though it does not have the lowest net present value. Whether the Management Planner should include political considerations in his or her report to the Facility Administration should be arranged with the Administration.

Financing Options

There are several sources of funding for both in-house and contracted out asbestos projects that State facilities can choose from. They include the following:

1. The Asbestos Oversight Committee - this committee is tasked with the distribution of funds designated for asbestos abatement projects in State buildings.

2. Capital Funds - these funds are for renovations, demolitions and other building improvements (i.e., new boilers etc.). They cannot be used specifically for asbestos, but can pay for, for example, the asbestos removal in connection with replacing a boiler.

3. Auxiliary Funds - these funds are from independent revenue generators like dormitories, student unions, toll facilities etc.. If your facility has such funds they can be used for asbestos removal for those buildings covered by these funds.

4. Facility Operating Budget - these funds are used for the day-to-day operations at the facility. Their primary use for asbestos projects, would be for those projects done by facility staff.

The Management Planner should check with the Facility Asbestos program Manager or the Departmental Coordinator to determine how to access these funds. This will assist the Management Planner in developing a timetable on when various response actions will be carried out.

EXHIBIT J-1
FACTORS AFFECTING COSTS

1. The amount of material to be disturbed

2. The degree of difficulty in disturbing/removing material
   a. Irregular surfaces (corrugated deck is difficult to fine clean and will require additional time and labor)
   b. Embedded utilities (e.g., electrical/water lines, etc.)
   c. Height above floor (8 feet is a benchmark, the higher the ceiling, the higher the cost of material and labor)
   d. Poor Accessibility
      I. Obstructions
      ii. Close quarters (e.g., attics, crawl spaces, etc.)
      iii Need to remove ducts or other structures to get to ACM
   e. Condition of material
      I. Previously encapsulated
      ii. Non-friable/slightly friable (e.g., pipe elbows, etc.)
      iii. Material difficult to detach from substrate
   f. Pipe systems and boilers
      i. Most pipe fittings are cementitious and commonly contain amosite asbestos making wetting difficult
      ii. Removal from copper pipe is easier, from iron pipe it is more difficult
      iii. Many boilers contain asbestos firebrick

3. The degree of difficulty with containment
   a. Plenum extending beyond work site (e.g., walls in project extending just up to suspended ceiling, open plenum area above suspended ceiling)
   b. Multi -service area for HVAC system
   c. Excessive penetrations through critical barriers (e.g., large numbers of pipes, ducts, and/or conduits penetrating walls, floor, and/or ceiling which could serve as pathways for contamination.)
   d. Substantial changes in pressure between the work site and adjacent areas (consider presence of elevator shafts, infiltration/exfiltration through the building envelope, unbalanced air handling systems in the building, etc.)
   e. Pipe systems and boilers
      i. Hot pipes can lead to heat exhaustion, glovebags may not be used on pipes over 120 F
      ii. Ribbed boilers must be dismantled and cleaned
      iii. Pipe systems may be close together making access and fine cleaning difficult

4. Protection of Special Finishes
    a. Carpets
    b. Hardwood floors
    c. Wood panels
    d. Other easily damaged materials

5. Special Environmental Problems
    a. Elevated heat
    b. Confined spaces
    c. Toxic materials (in tank or other containers and/or applied within the space such as pesticides)
    d. Pressurized vessels, pipes, etc.
    e. Electrically energized equipment and/or utilities

6. Special decontamination problems
    a. High probability that the interior of the duct is contaminated
    b. Contaminated dirt floor
    c. Contaminated ceiling tiles
    d. Debris and contamination beyond the site of damage
    e. Mechanical equipment with contamination between flanges, or other components that will require it to be disassembled to abate contamination

7. Tight time frame for completion of the work
    a. Double or triple shifts per day
    b. Work six or seven days a week

8. Entrance/exits
    a. For workers
        I. Insufficient entrance and exit for worker decontamination chamber and waste transfer chamber
        ii. Excessive difficulty in moving waste in multi story building (e.g., more than 3 stories) necessitates outside elevator or other waste transfer system
    b. For occupants
        I. Abatement activities will take a fire exit out of service, restricting occupancy per Life Safety Code
        ii. Alternative fire exits not feasible if one or more building exits taken out of service.
9. Disposal problems
    a. No landfills willing to accept ACM in jurisdiction
    b. Special handling

10. Requirement for scale labor (e.g., projects greater than $500,000)

EXHIBIT J-2
TYPICAL OPERATIONS IN AN ABATEMENT PROJECT

Removal	**Encapsulation**	**Enclosure**
Develop work plan	Develop work plan	Develop work plan
Isolate work area	Isolate work area	Isolate work area
Erect scaffold	Spray encapsulant	Construct mechanical enclosure or
Remove insulation - areas (wall, ceiling) - boiler - pipe - fittings	Clean work area	Spray encasement
	Conduct air sampling	Clean work area
Dispose of asbestos in landfill	Remove barriers	Conduct air sampling
Spray surfaces with encapsulant		Remove barriers
Seal exposed surfaces		
Clean dirt and debris		
Conduct air sampling		
Remove plastic barriers		
Install insulation - areas (wall, ceilings) - boiler - pipe - fittings		

EXHIBIT J-3
ESTIMATING PITFALLS

1. Misinterpretation of the scope of work

2. Omission or improperly defined scope of work

3. Poorly defined or overly optimistic schedule

4. Inaccurate work breakdown

5. Applying improper skill levels to tasks

6. Failure to account for risks

7. Failure to understand or account for cost escalation and inflation

8. Failure to use the correct estimating technique

9. Failure to consider costs associated with overhead, general and administrative, and indirect costs.

EXHIBIT J-4
COST ESTIMATING

There are several approaches to cost estimating with varying levels of precision and accuracy. They include, for example:

The "Shot-In-The-Dark" Method

The "Similar Nature and Scope Comparison" Method

The "Contractor Quote" Method

The "Means Cost Guide" Method

The "Time and Materials" Method

The Shot-In-The-Dark Method

Basically a number is "pulled out of the hat" for an estimate. This estimate should be within the upper and lower bounds of gullibility.

Advantages	Disadvantages
Quick	Not based on reality
Often works	Frequently does not work
Generalized cost based on what is easily visible	Hidden complication often not considered
Uses a jury of peers to decide acceptability of the estimate	If jury of peers are unfamiliar with asbestos abatement and construction work or is too gullible, unreasonably low or high estimates can be accepted
	Very likely that estimate will be different, and often substantially different from actual price. Clients get highly upset when the project price exceeds the estimate and the whole thing flops. They are also not very amused if they have to justify a large budget based on your estimate, then have the project price come in very low.

Similar Nature and Scope Comparison Method

Basically the estimate is approximated from the actual cost of a another project believe to be similar in nature and scope.

Advantage	Disadvantage
More reliable than the Shot-In-The-Dark Method	The two projects have to be recent. Market conditions have to be similar Codes and regulations have to be the same Seasonal variations have to be considered
Could work well as a short-term estimation approach if all things are considered	No two projects are exactly alike. The quantities may be the same, but prices may vary due to the layout of the work area may vary between jobs. the time frame and other work constraints may vary between jobs. the skill of the labor force or the availability of technological equipment may vary between jobs.

Contractor Quote Method

Estimate based on one or more quotes from contractors who are provided details about the project.

Advantage	Disadvantage
Estimate should be realistic provided: Contractor given all the appropriate details Contractor has knowledge and experience in the field Contractor is representative of market in area	For a public agency this approach could be conflict of interest, particularly if the Contractor contacted to give quote is also allowed to bid on project. (i.e., allegation of favoritism, if one or a few contractors have advance and detailed knowledge of project.) May be illegal on State projects.
	Often contractor has a limited time to spend in working up quote and may be inaccurate because Did not take time to account for all the details associated with the work. May be inflated to deal with uncertainties May be inflated due to perceived desperation
	Scope of Work often changes between time initial estimate given and specifications finalized

Means Cost Guide Method

The R. S. Means Company publishes an annual Building Construction Cost Data and related guides. Information from Means can be used to generate an estimate.

Advantage	Disadvantage
Costs are consensus for various types of work from contractors across the country	Means prices are focused for the very large construction projects. They are not that applicable to small and mid-size projects.
Book presents information following the Construction Specification Institute' s	Labor cost in Means often reflect skilled labor and/or unionized labor and are reflective of salaries in various metropolitan areas. There are tables to some regional differences, but this is complicated.
	Figures for asbestos work are given, but are not as extensive as other construction work.
	Many of the assumptions used by Means may not be applicable to work on our projects
Procedure requires a detailed investigation of conditions on the job, both in terms of quantity of material and work tasks	Not a quick and simple procedure

Time and Material Method

Estimate based on the sum of the time (labor costs) and material (equipment, supplies, and services) used to perform the various tasks associated with the project.

Advantages	Disadvantages
More precise if done properly	Not quick and easy
By using detailed outline of tasks to be performed, method is better to ensure nothing gets overlooked	Still may not be totally accurate because overhead and profit need to be taken into consideration
	Asbestos abatement work, particularly with performance specifications, can vary between contractors. Some may have labor saving equipment or work practices which may precise estimating hard. Also the skill of the crew may vary between contractors.

GLOSSARY

Asbestos Program Manager - a person appointed by the facility head in a State facility in consultation with the Departmental Asbestos Coordinator to be in charge of the asbestos control program at the facility.

Agency Safety & Health Specialist – a person appointed by the Asbestos Program Manager in consultation with the Departmental Asbestos Coordinator to be in charge of the safety and health provisions of the asbestos control program at the facility.

Amended Water - water to which a surfactant has been added.

Claims - Made Insurance - a form of insurance in which a claim is allowed only if the insurance is in effect when the claim is made, that is, when the injury or effect is observed.

Competent Person - a person capable of identifying asbestos hazards and who has authority to eliminate hazards (OSHA definition).

Damaged Friable Surfacing/Miscellaneous Material - friable surfacing/miscellaneous ACM which has deteriorated or sustained physical injury such that the internal structure (cohesion) of the material is inadequate or, if applicable, which has delaminated such that the bond to the substrate (adhesion) is inadequate or which for any other reason lacks fiber cohesion or adhesion qualities. Deterioration may be illustrated by the separation of ACM into layers; separation of ACM from substrate; flaking, blistering, or crumbling of ACM surface; water damage; significant or repeated water stains, scrapes, gouges, mars or other signs of physical injury on the ACM. Asbestos debris originating from the ACBM in question may also indicate damage (AHERA definition). Generally the damage is >1% but <10% area wide or >1% but <25% localized.

Damaged or Significantly Damaged Thermal System Insulation - thermal system insulation on pipes, boilers, tanks, ducts, or other thermal system insulation equipment in which the insulation has lost its structural integrity, or its covering, in whole or in part, is crushed, water-stained, gouged, punctured, missing, or not intact such that it is not able to contain fibers. Damage may be further illustrated by occasional punctures, gouges, or other signs of physical injury to ACM; occasional water damage on the protective covering/jackets; or exposed ACM ends or joints. Asbestos debris, originating from the ACBM in question may also indicate damage (AHERA definition). Generally this damage is >1% whether area wide or localized.

Decontamination - cleaning contaminated areas or persons. Decontamination chambers are used in ACM abatement projects.

Departmental Asbestos Coordinator - a person selected by the departmental secretary to develop and oversee the department' s (i.e., DHMH, DPSCS, etc.) asbestos control program.

Direct Costs - the costs of an ACM response action reflected by the action itself, temporary relocation of people and equipment, and related needs.

Encapsulation - the use of an agent to seal the surface (bridging encapsulant) or penetrate the bulk (penetrating encapsulant) of ACM.

Enclosure – an air tight structure, built around ACM designed to prevent disturbance and contain released fibers.

Errors and Omissions Insurance - a type of liability insurance which protects professionals for mistakes they may make in contracted plans and recommendations.

Friable - material that can be crumbled to a powder by hand pressure when dry.

Functional Spaces - spatially distinct units within a building that contain similar identifiable populations of building occupants.

General Liability Insurance - a broad type of property and liability insurance that covers the insured for damage to property and persons caused by his or her own negligence.

Glovebag - a device used to remove a section of pipe insulation without isolating the entire space or room.

Hazard Assessment - the interpretation and evaluation of physical assessment data in order to set abatement priorities and rank areas for response actions.

Heating, Ventilation, and Air Conditioning (HVAC) system - the system of pipes, ducts, and equipment (air conditioners, chillers, heaters, boilers, pumps, and fans) used to heat, cool, move, and filter air in a building. HVAC systems are also part of the mechanical system.

High Efficiency Particulate Air (HEPA) - a type of filter that is 99.97% efficient at filtering particles of 0.3 micrometers in diameter or larger.

"Hold Harmless" – a clause in a contract that is intended to abdicate or waive the cost of judgments and legal expenses in the event of litigation.

Homogeneous Area - an area that appears similar throughout in terms of color, texture, and appearance of the material.

Indemnify - to pay for or pay back. Indemnification clauses in contracts are intended to cover the cost of judgements and/or legal defenses in the event of litigation.

Indirect Costs - the costs of an ACM response action reflected by the productivity losses due to disruption and business interruption.

Liability - being subject to legal action for one' s behavior.

Management Plan - a written plan specific to each facility to identify, evaluate, control and manage ACM.

Mechanical Systems – include both plumbing and HVAC systems.

Medical Surveillance – a medical evaluation of all employees who perform asbestos work. Also includes those who used to perform asbestos work while in State service.

Occurrence Insurance - a form of insurance which covers an insurable “occurrence” regardless of when the claim is filed or if the policy is still in force. For asbestos insurance, the "occurrence" could be the time of first exposure.

Operations & Maintenance Program - a program that is designed to clean up asbestos contamination, minimize future fiber release, and maintain ACM in good condition.

Permissible Exposure Limit (PEL) - a level of airborne asbestos fibers specified by OSHA as an occupational exposure standard. There are two limits: 0.1fibers/cubic centimeter for an 8 hour workday (Time Weighted Average or TWA) or 1 fiber/cubic centimeter for one 30 minute period per day (Excursion Limit or EL).

Phase Contrast Microscopy (PCM) - a method of analyzing air samples for fibers using a light microscope.

Physical Assessment - assessing suspect material to determine the current condition of the material and the potential for future disturbance.

Present Value - the value of future expenditures in terms of today' s dollars.

Polarized Light Microscopy (PLM) - a method of analyzing bulk samples for the presence of asbestos using a light microscope and optical filters.

Pulmonary FunctionTest (PFT) - a test of breathing capacity (lung function) given as part of a medical surveillance program.

Removal - scraping, cutting, vacuuming, or otherwise taking ACM out of a building and discarding it.

Repair - restoration of damaged or deteriorated ACM to an intact condition.

Respiratory Protection Program - a set of written procedures and equipment required by OSHA if employees wear respirators.

Response Actions - actions specified in the management plan to control ACM; includes repair, removal, restriction, enclosure, encapsulation, and operations & maintenance.

Significantly Damaged Friable Surfacing/Miscellaneous Material - friable surfacing/miscellaneous ACM in a functional space where damage is extensive and severe (AHERA definition). Usually > 10% over an entire area or > 25% of a localized area.

Surfactant - an agent added to water to decrease surface tension and thus increase water' s ability to "wet" or penetrate bulk material.

Tort - a legal wrong, sometimes referred to as negligence.

Transmission Electron Microscopy (TEM) - a method of analyzing bulk or air samples for asbestos fibers using an electron microscope and possibly associated instruments for further identifying asbestos.

"Type C" Supplied Air Respirator - an airline respirator in which outside air is compressed, purified, and delivered to the wearer.