ASBESTOS CONTROL PROGRAM
OPERATIONS AND MAINTENANCE PLAN

STOCKTON UNIVERSITY

PREPARED BY

Environmental Health and Safety Office
"EHS"

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Table Of Contents

List of Tables

1.0 INTRODUCTION

1.1 *Objective*

Stockton University "Stockton" Asbestos Control Program "ACP", delineates policy for management of asbestos-containing materials "ACM" / presumed asbestos containing materials "PACM" in all of its facilities. The United States Environmental Protection Agency "EPA" Hazard Emergency Response Act "AHERA" provides specific requirements for the ACP. These regulations require that each local educational agency develop and implement an Asbestos Operations & Maintenance (O&M) Plan. The Asbestos O&M Plan is one of the key elements in Stockton's ACP. It provides a responsible alternative to asbestos removal by developing a pro-active, in-place asbestos management program for existing asbestos in and around buildings.

The purpose of Stockton's Asbestos O&M Plan, hereafter referred to as the "Plan" is to provide policies, work practices and procedures that minimize the exposure of all Stockton employees, contractors, and visitors to asbestos fibers at this facility. This will be accomplished by the implementation of asbestos control and management practices designed and used to:

1. Maintain ACM/PACM in good condition.
2. Ensure proper clean up of debris resulting from damaged ACM/PACM.
3. Minimize future release of asbestos fibers and ensure appropriate responses.
4. Monitor the condition of known ACM/PACM.

1.2 *Scope*

This Plan contains policies, work practices and procedures for Stockton employees and contractors performing Occupational Safety and Health Administration (OSHA) Class III and IV asbestos work and routine management of ACM/PACM on this campus.

1.3 *Document Use*

Appendix A to this Plan contains Standard Work Practices, divided into two categories (1) General that should be followed when completing any asbestos O&M activity and (2) Job Specific that should be followed when planning the specific details of any asbestos O&M activity; Appendix B contains General Safety Considerations that should be followed when completing any of the job specific work practices; Appendix C provides applicable forms for the reports referenced in this Plan; Appendix D contains copies of National Institute for Occupational Safety and Health (NIOSH) methods 7400/7402 for analysis of asbestos air samples; Appendix E contains definitions used in this Plan; Appendix F lists references used to develop the Plan and for further information; Appendix G lists the Stockton University's Respirator Program and Appendix H lists the Stockton University's Asbestos Abatement Document.

1.4 *Asbestos O&M Elements*

To achieve its objective, an asbestos O&M program includes the seven elements listed below. Although these elements should appear in all asbestos O&M programs, the extent of each element will vary from program to program depending on the types of buildings, the types of ACM present, and the location and physical condition of the ACM.

1. **Notification:** A program to notify building occupants, maintenance and custodial personnel, visitors, and contractors of the location of ACM and procedures to avoid disturbance.
2. **Training:** Properly trained personnel are critical to achieving successful implementation of the asbestos O&M Plan objectives.

3. **Worker Protection:** Ensuring that workers are protected from exposure to asbestos by providing personal protective equipment, respiratory protection and medical surveillance.
4. **Work Practices:** Work procedures established to avoid or minimize asbestos fiber release during activities affecting ACM/PACM.
5. **Asbestos Work Control System:** A system designed to control the activities, facility personnel, and work practices that may impact ACM/PACM within the facility.
6. **Surveillance:** Periodic observation of ACM/PACM to note, assess and document changes in condition.
7. **Record Keeping:** Documentation of asbestos related O&M activities such as: surveillance data, asbestos O&M abatement actions, employee training, and medical and respiratory program information.

1.5 *Applicable Standards And Guidance Documents*

Federal and all applicable state or local regulations provide the basis for developing a facility asbestos O&M Plan. Table 1 shows the most pertinent regulations applicable to Stockton University. Since rules and regulations affecting asbestos management are often revised, some conflicting information may be found within the listed documents. In such cases, follow the most applicable current and more restrictive guidance. In addition to the requirements of the regulation listed in Table 1, adherence to the provisions contained in current applicable bargaining agreements concerning asbestos is required.

On August 10, 1994, OSHA defined four classes of asbestos work. They include:

- OSHA Class I: Activities involving the removal of thermal system insulation (TSI) and sprayed-on, trowelled-on, or otherwise applied surfacing ACM/PACM.
- OSHA Class II: Activities involving removal of ACM/PACM, which are not TSI or surfacing materials.
- OSHA Class III: Repair and maintenance operations, which are likely to disturb ACM/PACM.
- OSHA Class IV: Custodial and maintenance operations where minimal contact with ACM/PACM may occur.

Larger scale projects (OSHA Classes I and II) involving more complex procedures for the intentional removal of ACM are considered asbestos abatement projects. These projects require asbestos control and abatement procedures that are outside the scope of this asbestos O&M Plan. However, information on the location of the asbestos that was removed, enclosed, or encapsulated should be used to update the building asbestos O&M files. Update inventory records to include change in condition, amount, and accessibility.

Table 1. Applicable Standards And Guidance

REGULATION/ GUIDANCE	TYPE	CITATION	REMARKS
NESHAP[1], Subpart M	Federal Regulation	40 CFR 61	• Regulates asbestos demolition, construction, and removal activities. • Defines friable and non-friable asbestos as greater than 1% as determined by PLM. [2]
N.J.A.C.[6] NJDEP	State/Local Regulation	N.J.A.C. 12:120 N.J.A.C. 5:23-8 N.J.A.C. 7:26	• Enforces NESHAP requirements and defines state and local waste management.
DOT	Federal	49 CFR 171-173	• Hazardous materials rules.
AHERA[3] ASHARA [4]	Federal Regulation	40 CFR 763	• Defines procedures for handling and managing asbestos in schools. • Sets forth training requirements of asbestos workers under the Model Accreditation Plan.
OSHA[5]	Federal Regulation	29 CFR 1926.1101 29 CFR 1910.1001	• Defines exposure and excursion limits, general health and safety.
Green Book	Federal Guidance	EPA 20T-2003	• Guidance on managing asbestos in-place.
Respiratory Protection	Federal Regulation	29 CFR 1910.134 29 CFR 1926.1101	• Regulations for respirator use, fit test, training.

[1]NESHAP: National Emissions Standard For Hazardous Air Pollutants
[2]PLM: Polarized Light Microscopy
[3]AHERA: Asbestos Hazard Emergency Response Act
[4]ASHARA: Asbestos Schools Hazard Abatement Reauthorization Act
[5]OSHA: Occupational Safety and Health Administration
[6]N.J.A.C.: New Jersey Administrative Code

1.6 *Background And Site Description*

This asbestos O&M Plan was prepared by the EHS office, 609-652-4496. The asbestos O&M Plan is based upon materials, assumed and confirmed to contain asbestos, identified in the facility asbestos survey and upon subsequent building inspections. Additional information on the location of asbestos on this campus is located in the EHS office.

Stockton University, situated in Pomona on a 2000-acre pineland reserve, is South Jersey's premier learning center. This O&M plan will serve as the master document for all buildings located at the Stockton University.

2.0 RESPONSIBILITIES

2.1 *The Assistant VP of Facilities Management and Plant Operations "FMPO" shall:*

(a) Provide technical guidance and program oversight for the implementation and management of the ACP.

(b) Serve as the focal point for all facility ACP matters.

(c) Ensure that program and budget requests identify resource requirements to implement the ACP.

(d) Ensure that documentation associated with the ACP meets applicable regulatory requirements.

(e) Ensure routine inspections and program reviews of ACP activities are conducted, and that inspection and surveillance records are maintained and updated.

2.2 *The EHS Office:*

(a) Coordinate with the Assistant VP FMPO to implement the ACP at the necessary locations.

(b) Consider ACP requirements and funding as early as possible in all construction, installation, maintenance, commissioning, modification, and other projects managed by Facility Management and Plant Operations. Prior to any project potentially disturbing asbestos, verify that an asbestos survey has been conducted of the affected area.

(c) Ensure review and coordination on project documents that involve disturbance of ACM/PACM. Ensure the use of the latest revision of Stockton's ACP and O&M plan are used.

(d) Implement an ACP at all facilities occupied and/or maintained where ACM/PACM has been identified or assumed.

(e) Ensure employees receive training as outlined in this program.

(f) Implement a process to ensure that asbestos waste shipment records are prepared and signed by designated and knowledgeable personnel.

(g) Designate a Facility Asbestos Coordinator (FAC) for facility/facilities that contain ACM/PACM.

(h) Review and approve all OSHA Class I Class II asbestos work permits.

(i) Require that future construction projects will use asbestos-free materials and will be documented as such upon completion

(j) Ensure that the FAC is immediately notified of any release of ACM/PACM.

2.3 *Facility Management and Plant Operations "FMPO" shall:*

(a) Adhere to the asbestos control work control system and ensure that anyone performing work in their facility has completed the necessary steps before performing asbestos O&M activities.

(b) Ensure employees receive annual asbestos training and medical surveillance as needed.

(c) Ensure all contractors are informed of existing ACM at their facilities.

(d) Designate sufficient number of FACs and asbestos O&M team members to implement the asbestos O&M Plan.

(e) Ensure that the Assistant VP FMPO and EHS Office are immediately notified of any release of ACM/PACM.

2.4 *Facility Asbestos Coordinator (FAC) shall:

(a) Serve as the designated asbestos contact for managing the ACP at the facility. One person may serve as the FAC for more than one facility.

(b) Review specifications and plans for construction/renovation work in the facility and determine if asbestos will be impacted by the work.

(c) Review all asbestos work permits and forward only those involving OSHA Class I or II asbestos operations to the EHS Office for approval.

(d) Provide notification to supervisors and/or representatives of impending asbestos projects in the facility.

(e) Ensure that ACM is properly stored, transported, and disposed.

(f) Ensure completed asbestos waste shipment records are received from the disposal site and kept on file at the EHS Office indefinitely.

(g) With the assistance of the EHS Office, develop and implement the facility specific asbestos O&M Plan.

(h) Ensure that the ACM/PACM is periodically assessed/updated.

(i) Maintain asbestos accreditation as an AHERA asbestos inspector.

(j) Maintain asbestos inspection survey reports for the facility.

(k) Identify and coordinate posting of work permits, regulated area signs, ACM warning signs and labels.

(l) Notify the FMPO/EHS Office/Assistant VP FMPO of any changes of ACM/PACM condition.

(m) Ensure that all necessary air monitoring is performed, including negative exposure assessments. Coordinate the review of the results with the EHS Office/Assistant VP FMPO.

(n) Assist in the preparation of incident reports.

(o) Ensure that the Facility Manager/EHS Office are immediately notified of any release of ACM/PACM.

DEPENDING ON THE SITUATION, THE FAC MAY BE A DIRECTOR, A MANAGER, AN EHS SAFETY COMPLIANCE COORDINATOR OR AN OUTSIDE CONTRACTOR. MORE THAN LIKELY, THE ROLES AND RESPONSIBILITES OF THE FAC WILL ENCOMPASS SEVERAL DIFFERENT PEOPLE.

3.0 *NOTIFICATION*

The term "notification" is commonly used to cover two areas of concern. In this section, the first area concerns informing building occupants and workers of the hazards associated with disturbing asbestos. The second area concerns notifying regulatory agencies prior to disturbing asbestos during renovation/demolition projects.

Clear lines of communication with all building occupants, custodial workers, contractors, and maintenance staff is an integral part of this asbestos O&M Plan. This approach, along with information regarding the presence, location, and condition of ACM, encourages understanding that the presence of asbestos is not necessarily hazardous and that ACM can be effectively managed in place.

3.1 *Building Occupants & Contractors*

(a) Building occupants shall be notified of the following:

(1) The presence, location, and condition of known ACM/PACM in the facility.

(2) The name and telephone number(s) of the FAC.

(3) Building occupants who may be affected by scheduled asbestos O&M projects shall be notified prior to the commencement of the project. The FAC or EHS Office is responsible for providing such notification to supervisors who then provide notification to building occupants. This notification should be made at least 7 days prior to the start of an asbestos abatement project. If necessary, the notification shall include notice that relocation of personnel to a location outside of the affected project area may be necessary due to potential disturbance of ACM/PACM. This notification shall include at a minimum a brief description of the areas to be impacted, scope of the project, and schedule for completion.

(4) Notification of the presence of ACM/PACM to outside contractors should be made as far in advance of commencement of work in the facility as possible. The FAC, EHS Office, FMPO Office and/or Project Manager is responsible for notifying contractors of the locations, types, and approximate quantities of ACM/PACM present and whether or not it will be disturbed by the contractor's work.

3.2 *Regulatory Agencies*

Some small asbestos O&M projects may be subject to regulatory notification requirements. Notification of unscheduled removal of ACM/PACM is required if the estimated total of Regulated Asbestos Containing Material (RACM) that will be removed as part of unscheduled repair, maintenance, and renovation work during the calendar year exceeds 160 square feet, 260 linear feet, or 35 cubic feet. Notification shall be submitted by the EHS to the EPA Region II office, NJDEP and N.J.A.C. at least 10 working days prior to the start of each calendar year. The EPA Regional Office or NJDEP and N.J.A.C. should be contacted to determine the correct format for this notification and the office to which it should be submitted.

3.3 *Signs And Labels*

(a) Asbestos warning signs shall be posted at all regulated areas at such distance from a regulated area so that an employee can see them and take protective steps to avoid entering the area.

(b) Signs shall be posted at the entrance to mechanical rooms/areas containing ACM/PACM into which employees can reasonably be expected to enter.

(c) Where feasible, warning labels shall be affixed to previously identified TSI or surfacing that is ACM/PACM, e.g., in areas where routine maintenance takes place and/or where there is reasonable likelihood of contact with these materials.

(d) Notification to outside contractors. All contractors performing work at Stockton's facilities covered by the ACP shall be subject to the Asbestos Work Control System (see Appendix C, Applicable Forms).

4.0 TRAINING

Training is one of the keys to a successful asbestos O&M program. In general, training provides a background on asbestos uses and health hazards, asbestos regulations, respiratory and other personal protection equipment, key concepts of asbestos hazard control, and asbestos O&M training presented in this document. Trained personnel reduce the risk faced by both building workers and occupants from the release of asbestos fibers due to improper work practices.

All custodial and maintenance workers, abatement workers and contractors, or other persons involved in asbestos-related activities receive training if they have the potential to disturb ACM, enter an asbestos regulated area, or perform ACM related activities. Table 2 lists the training requirements for each type of personnel involved in asbestos operations.

Table 2. Asbestos Training And Certification Requirements Listed By Type Of Operation

TYPE OF PERSONNEL	INITIAL TRAINING REQUIREMENT	ANNUAL RECERT OR REFRESHER & LENGTH	REGULATORY CITATION
Maintenance And Housekeeping Supervisors, Competent, Qualified Person	16 Hour Operations And Maintenance Course	Yes Not Specified	29 CFR 1926.1101(o)(4)(ii) N.J.A.C. 12:120 N.J.A.C. 5:23-8
Maintenance Workers	16 Hour Operations & Maintenance Course. Requirements Are Relaxed When Only One Generic Category Of Building Material In OSHA Class III Work Is Done.	Yes Not Specified In 1050.20 A	29 CFR 1926.1101(k)(9)
Maintenance & Custodial Workers	2 Hour Asbestos Awareness Course	Yes 2 Hours	29 CFR 1910.1001 (j)(7) 29 CFR 1926.1101(k)(9)
Facility Asbestos Coordinator	40 Hours Asbestos Abatement Contractor/Supervisor Course	Yes 8 Hours	29 CFR 1910.1001 (o)(4)(i) 29 CFR 1926.1101(o)(4)(i) 40 CFR 763.92 40 CFR 61 Subpart M
Environmental Compliance Manager	40 Hours Asbestos Abatement Contractor/Supervisor Course	Yes 8 Hours	29 CFR 1910.1001 (o)(4)(i) 29 CFR 1926.1101(o)(4)(i) 40 CFR 763.92 40 CFR 61 Subpart M
Environmental Compliance Manager	24 Hours Asbestos Abatement Designer Course	Yes 8 Hours	40 CFR 763.92

5.0 WORKER PROTECTION PROGRAM

A worker protection program includes medical surveillance, personal protective equipment, personal exposure monitoring and engineering controls. Engineering controls are the preferred method for worker protection. Contractors conducting maintenance and repair operations will notify the FAC, in writing, that they have an asbestos worker protection program in place. Additionally, OSHA regulations require a written respiratory protection program whenever an asbestos O&M Plan specifies that asbestos workers wear respirators, or where respirators are made available to workers. The FAC, with assistance of the EHS Office, must verify and approve these programs prior to allowing any asbestos work to begin.

5.1 *Medical Surveillance*

Asbestos medical surveillance exams will be coordinated with the EHS Office in accordance with the ACP and this O&M program. Personnel engaged in asbestos O&M activities that meet any of the following conditions shall participate in a Medical Surveillance Program:

(a) Employees engaged in OSHA Class III asbestos work for 30 or more days per year. (Employees engaged in OSHA Class III asbestos work for less than 30 days a year and who are required to wear a negative pressure respirator, will undergo medical surveillance, which will be limited to determining the worker is physically able to perform and wear respirators.)

(b) Employees exposed at or above the OSHA permissible exposure limit (PEL) of 0.1f/cc or excursion limit (EL) of 1.0 f/cc for a combined total of 30 or more days per year.

(c) Employees who are required to wear respiratory protection.

(d) Employees involved in OSHA Class IV asbestos operations requiring the use of a respirator shall at a minimum be required to complete the medical questionnaire, as outlined in 29 CFR 1910.134 (e), Medical Evaluations, and as supervised by a physician or other licensed health care professional.

5.2 *Personal Protective Equipment (PPE)*

Employees performing OSHA Class III asbestos work and OSHA Class IV asbestos work within a regulated area shall be provided with and required to wear disposable full body coveralls with hoods and footwear. The coveralls shall be worn only once and disposed of in bags labeled as asbestos-containing waste. An evaluation of employee exposure to heat stress should be performed whenever employees wear PPE for extended periods or work in hot or high humidity environments. Hard hats, safety glasses, gloves, hearing protection, safety footwear and other types of personal protective equipment may be utilized, as stated in the standard work practice or as needed, depending on specific site conditions and work to be performed, as required by 29 CFR 1910.132.

5.3 *Respiratory Protection*

Respirator use for OSHA Class III and Class IV asbestos operations shall be in accordance with the facility's written Respiratory Protection Program. See Appendix G, Stockton University Facility Specific Respiratory Protection Program. Respirators shall be worn by Stockton employees under the following circumstances:

(a) During all OSHA Class III and IV asbestos work (planned/unplanned) where employee exposure exceeds, or has a reasonable possibility of exceeding the OSHA PEL or EL.

(b) During OSHA Class III asbestos work for which a negative exposure assessment has not been conducted.

(c) During all OSHA Class III jobs where thermal system insulation (TSI) or surfacing ACM/PACM is being disturbed.

(d) During all OSHA Class IV work performed within regulated areas where employees performing other work are required to wear respirators. During any non-asbestos operations that may disturb ACM/PACM whether damaged or in good condition and may cause a potential airborne exposure above the OSHA PEL or EL.

Any employee wearing a respirator shall be given a quantitative or qualitative fit test at the time of initial issue and at least annually thereafter. Positive and negative pressure seal checks must be performed by the employee prior to each use. No employee shall be allowed to wear a respirator unless the employee has received appropriate training and a medical evaluation annually to determine if they are medically able to use a respirator.

5.4 *Air Monitoring*

Air Monitoring will be conducted during routine asbestos O&M activities and asbestos-related incidents. The FAC and/or EHS Office will ensure that qualified personnel conduct the air monitoring. The following minimum requirements will be followed when collecting air samples:

(a) Personal Air Sampling during asbestos O&M activities (OSHA Class III and IV asbestos work): Exposure Limits and 8 hour time weighted average (TWA) personal air samples will be collected in accordance with 29 CFR 1926.1101 and N.J.A.C 5:23-8. The analytical method used for personal air samples will be NIOSH Method 7400 Phase Contrast Microscopy (PCM), or equivalent with optional confirmation of results by NIOSH Method 7402 Transmission Electron Microscopy (TEM). In the absence of a negative exposure assessment (NEA) in accordance with 29 CFR 1926.1101, the FAC, EHS Office and Environmental Monitoring Contractor's Certified Industrial Hygienist (CIH)/Industrial Hygienist (IH) will recommend a sampling strategy that is representative of the worker's exposure during asbestos O&M and emergency response activities. Area and clearance air samples may be collected around the perimeter of the work area, or inside the work area, at the discretion of the FAC, EHS Office and Environmental Monitoring Contractor's CIH/IH, or as designated in the standard work practice.

(b) NEA. For any one specific asbestos job which will be performed by employees who have been trained in compliance with 29 CFR 1926.1101 and N.J.A.C. 5:23-8, the following criteria may be used to demonstrate that employee exposures will be below the OSHA PEL and EL:

(1) Objective data demonstrating that the product or material containing asbestos minerals or the activity involving such product or material cannot release airborne fibers in concentrations exceeding the OSHA PEL and EL under those work conditions having the greatest potential for releasing asbestos.

(2) Monitoring has been conducted during prior asbestos jobs within 12 months of the current or projected job. The monitoring data were obtained during work operations conducted under workplace conditions "closely resembling" the processes, type of material, control methods, work practices, and environmental conditions used and prevailing in the current operations. These data show that under the conditions prevailing and which will prevail in the current workplace there is a high degree of certainty that employee exposures will not exceed the OSHA PEL and EL. In addition, the asbestos jobs must have been conducted by employees whose training and experience are no more extensive than that of employees performing the current job.

(c) Asbestos-related jobs for which a negative exposure assessment is documented may be conducted without the use of respirator and personal protective equipment and monitoring at the discretion of the FAC, EHS Office and/or CIH/IH. For further details regarding Stockton University Respiratory Protection Program, see Appendix G.

(1) Asbestos Incidents. Monitoring during asbestos incidents will be as determined by the FAC and/or EHS Office if the incident occurs as a result of OSHA Class III or IV asbestos work. If the incident occurs as a result of an OSHA Class I or II asbestos work, monitoring shall be in accordance with the Stockton's Contingency Plan.

(2) Area air sampling and analysis will be performed using NIOSH Method 7400 (PCM) with optional confirmation of results by NIOSH Method 7402 (TEM). Area sampling will be performed for the duration of asbestos O&M and emergency response activities unless otherwise directed by the FAC,

EHS Office and/or CIH/IH. Designated locations for area sampling during asbestos O&M and emergency response work will be determined by the FAC, EHS Office and/or Environmental Monitoring Contractor's CIH/IH.

(3) For asbestos O&M work, the FAC and the EHS Office will determine on a case-by-case basis the need for clearance air sampling and the analytical method to be used. This will depends on the work performed.

In the event that clearance sampling is performed, it must follow the regulations found in N.J.A.C. 5:23 8.21 which states:

"Aggressive air sampling shall be employed using propeller-type fans and leaf blowers as follows: The fans shall be placed in each room to be sampled so as to cause settled fibers to rise and enter the air. Prior to air monitoring, floors, ceilings and walls shall be swept with the exhaust of a one-horsepower leaf blower. The sampling pump and sampling media shall be placed in the abatement area on a random basis to provide unbiased and representative samples. Stationary fans shall be placed in locations which will not interfere with air monitoring equipment. Fan air shall be directed toward the ceiling."

"Post abatement sampling and analysis for an asbestos hazard abatement project utilizing the glove bag technique and encapsulation shall be as follows. Samples collected within the affected work area may be analyzed by PCM to confirm completion of an asbestos abatement project using the methodology specified in NIOSH 7400. For TEM analysis, the project shall be considered complete when the results collected in the affected area comply with 40 CFR 763.90. Maximum turnaround time from sample collection through data reporting shall be 72 hours."

In addition, as per 1910.1101 (f)(5), "The employer must, as soon as possible but no later than 5 working days after the receipt of the results of any monitoring performed under this section, notify each affected employee of these results either individually in writing or by posting the results in an appropriate location that is accessible to employees."

5.5 *Equipment and Supplies*

All personnel assisting with asbestos O&M activities in areas where ACM/PACM may be disturbed, must have the necessary equipment and supplies to contain ACM/PACM and to perform abatement and decontamination in regulated ACM/PACM areas. (See Appendix A, Standard Work Practices, General Work Practice 1)

6.0 WORK PRACTICES

The asbestos O&M Plan focuses on a special set of asbestos work practices for OSHA Class III and Class IV asbestos operations.

In addition, OSHA Standards require the following work practices and engineering controls regardless of the levels of exposure or classes of asbestos work:

- High Efficiency Particulate Air (HEPA) filter equipped vacuums
- Wet methods
- Prompt clean-up and disposal of waste/debris

Additional controls may be necessary to achieve compliance with the OSHA PEL/EL, including:

- Negative pressure system with local exhaust ventilation and HEPA filters
- Enclosure or isolation of processes

The following work practices are prohibited regardless of measured exposure or the results of initial exposure assessments:

- Use of dust generating powered tools (e.g., high-speed abrasive saws) without attached HEPA filter
- Use of compressed air
- Dry sweeping, shoveling or other dry clean-up method
- Employee rotation as means of reducing exposure
- Smoking, drinking, eating, chewing gum, chewing tobacco or applying cosmetics in regulated areas

Proper implementation of the asbestos O&M worker protection plan is very important to ensure worker safety. All asbestos O&M work that involves contact with friable ACM or disturbance of friable or non-friable ACM will be performed and supervised by trained Stockton employees or contractors.

6.1 *OSHA Class I and Class II*

OSHA Class I and II abatement requires more complex controls and procedures that are site specific and outside the scope of this asbestos O&M Plan. Performance with these abatement projects must be in accordance with the Stockton's Asbestos Abatement Specification. If abatement is conducted by an asbestos contractor, then they will be bound by contract to comply with the provisions of the asbestos abatement specification. The FAC and EHS office shall be informed of the extent of the asbestos abatement project. This can be accomplished by reviewing the drawings, contract, and attending the pre-construction meeting.

6.2 *OSHA Class III and IV*

(a) OSHA Class III Asbestos Work is defined as repair and maintenance operations, where ACM/PACM, including TSI and surfacing material, is likely to be disturbed. The maximum amount of disturbed material must not exceed that which will fit into one standard glovebag or standard waste bag. The standard glovebag/waste bag shall not exceed 60 inches in length and width. The minimum requirements for OSHA Class III Asbestos Work are:

- Isolate the work area
- Use wet methods; HEPA vacuums; prompt clean-up
- Use glovebags or mini-enclosures when removing or disturbing TSI or surfacing materials

(b) OSHA Class IV Asbestos Work is defined as maintenance and custodial activities during which employees contact but do not disturb ACM/PACM and activities to clean up dust, waste and debris resulting from OSHA Class I, II, and III activities. OSHA Class IV Asbestos Work requires the following:

- HEPA-vacuum or wet clean all surfaces (especially horizontal)
- Disposal of all debris, filters, mop heads, and cloths in sealed, leak tight containers
- Additional cleaning shall be determined and recommended by the FAC.

(c) Removal of vinyl and asphalt asbestos flooring material for the purpose of renovation or upgrade would typically be classified as OSHA Class II asbestos work. However, removal of a limited amount of material for the purpose of installing new equipment systems or "spot" removal of damaged tiles may be considered OSHA Class III asbestos work. OSHA Class III work would include drilling into flooring material for the purpose of installing equipment.

6.3 *Fiber Release Episodes*

Any Stockton employee or contractor should immediately notify the FAC and/or EHS Office of an ACM disturbance or episode causing the release of asbestos fibers. Prohibit access to the area until the FAC can make an estimate of the extent of contamination.

(a) OSHA Class I and II

Stockton's Contingency Plan shall be prepared prior to OSHA Class I and II abatement projects. The Stockton Contingency Plan details procedures to be used during an asbestos abatement project when either the results of air monitoring reveal that levels exceed the criteria contained in the plan or when a failure in engineering controls is discovered.

(b) OSHA III and IV

In the event of a fiber release episode during OSHA Class III and IV asbestos operations, the FAC will consider the following procedures to address the hazard:

- Keep ACM wetted, if possible;
- Identify scope of the asbestos episode;
- Isolate the affected area;
- Limit entry to the affected area by persons other than those necessary to perform the project;
- Isolate the Heating Ventilating and Air Conditioning (HVAC) system to the affected area, if applicable;
- Post signs to prevent entry by unauthorized persons and make appropriate notifications;
- Institute asbestos O&M work practices and worker protection;
- Institute air monitoring procedures;
- Clean all surfaces (especially horizontal) in the immediate work area, using either wet methods or HEPA vacuum;
- Place asbestos debris and other cleaning material in labeled, double sealed bags or impermeable, leak tight containers.

Special procedures are generally needed to minimize the spread of fibers throughout the building after an asbestos fiber release occurs, such as the partial collapse of an ACM ceiling or wall, or accidental disturbance of ACM. The procedures followed will vary according to the amount of ACM affected, the extent of fiber released from the ACM, the relationship of the release area to the air handling systems, and whether the release site is accessible to building occupants. Depending on the severity of the episode, asbestos consultants and contractors may be needed to develop a strategy for conducting the clean-up

operations. The final steps will include a thorough clean-up and a careful inspection to verify satisfactory cleanup. Final clearance air monitoring may be necessary.

6.4 *Regulated Areas*

The primary method used to control access to activities involving ACM is the establishment of specific regulated areas. Regulated areas are defined in OSHA as those areas where OSHA Class I, II, and III asbestos work is conducted; any area where debris and waste from such work accumulates; and work areas where the fiber concentration may exceed the OSHA PEL/EL. Implementation of restrictive work procedures, with engineering controls, to reduce fiber release is required in regulated areas. Additionally, use health and safety protocols to protect workers in these areas. Limit access to regulated areas or activities that may disturb ACM

7.0 ASBESTOS WORK CONTROL SYSTEM

7.1 *Asbestos Work Controls*

The purpose of the Asbestos Work Control System is to ensure that Stockton employees and contractors who conduct maintenance and repair are aware of the location of ACM/PACM and the restrictions and requirements of the asbestos O&M Plan. The work control system allows review of work plans by the FAC to ensure that all necessary engineering and protective procedures are implemented during the work activity.

Prior to all activities that may contact or disturb ACM/PACM, personnel initiating the work must set-up (write out a scope of work), receive approval for (after bids have been placed), and arrange for a pre-construction meeting prior to the start of work. The following asbestos O&M activities shall require the process mentioned:

- Access to regulated areas or asbestos abatement containments;
- Decontamination of small amounts of asbestos debris resulting from unintentional disturbance of ACM/PACM;
- Building maintenance or repair activities for which ACM may be disturbed.

7.2 *OSHA Class I and Class II Asbestos Operations*

OSHA Class I and Class II asbestos operations in Stockton facilities shall be subject to the same asbestos work control system as asbestos O&M activities.

7.3 *Asbestos Work Control System Schedule*

For all implemented asbestos O&M projects and routine maintenance work, the EHS Office, FAC and Project Manager will be responsible for initiating the asbestos work process and submitting to the EHS Office or FAC prior to the start of work.

8.0 FACILITY ASBESTOS SURVEYS

8.1 *Baseline Surveys*

An initial or baseline building inspection is an asbestos identification survey of the structure to locate ACM/PACM, and assess the condition of the identified materials. The inspection focuses on identifying surfacing materials, TSI, and miscellaneous materials, all of which are likely to contain asbestos. The inspection, conducted by an EPA AHERA accredited inspector, includes the identification of all suspect material, recording the location, quantity, characteristics, the building use and an assessment of the condition of the material.

Buildings and facilities constructed prior to 1981 shall be presumed to contain ACM and shall be treated accordingly unless a definitive determination has been made that there is no ACM/PACM. The EHS/FAC shall assess on a case-by-case basis whether there is ACM/PACM in buildings and facilities constructed in 1981 or later.

The asbestos O&M Plan is based upon materials, presumed or confirmed to contain asbestos, identified in the inspection and upon subsequent building inspections. A copy of the inspection results are located in the EHS Office and in the EHS R: Drive.

8.2 *Periodic Surveillance*

Periodic surveillance is one of the key objectives of an asbestos O&M Plan. Combined with subsequent inspections, work requests, and ongoing reports from maintenance workers of changes in condition; periodic surveillance ensures that damaged or deteriorated materials are detected and that appropriate response actions are initiated. All buildings and facilities identified as containing ACM/PACM shall be visually inspected at least semi-annually by the EHS Office, FAC or another employee or contractor designated by the EHS Office or FAC.

Periodic surveillance may be performed in conjunction with other scheduled inspections or as part of a response action. If necessary, the FAC will schedule more frequent surveillance for specific buildings. Document findings from the surveillance and add the information to the building's asbestos O&M file. (See Appendix C for applicable form.)

Each surveillance includes comments about the following assessment factors:

- Deterioration or delamination from underlying surfaces;
- Water damage;
- Physical damage, including the presence of debris;
- Disturbance of ACM by employees;
- Accessibility; and
- Number of people potentially exposed.

Whenever damaged materials are found, notify the EHS/FAC immediately. The FAC/EHS evaluates the change in condition, implements clean-up procedures, determines and initiates required corrective action, and documents the action for inclusion in the building's asbestos O&M file.

9.0 RECORDKEEPING

The purpose of an asbestos O&M recordkeeping system is to establish and maintain a standardized system which clearly documents the implementation of an ACP. The steps taken to identify asbestos material and associated hazards, and minimize the potential exposure to Stockton employees and building occupants are recorded for future reference. EPA, OSHA, and the Stockton have specific requirements concerning the various records and documentary information that must be maintained. The documents for all Stockton University facilities are maintained at the EHS Office. Stockton's ACP and O&M plan contain asbestos recordkeeping requirements.

The recordkeeping system tracks the following types of data:

- Building information including inspection or survey data, the physical condition of the ACM/PACM, and response actions taken in conjunction with the ACM/PACM;
- Employee training and medical program information;
- Air monitoring data on work practices and procedures; and,
- Additional federal/state/local recordkeeping requirements.

9.1 *BUILDING INFORMATION*

The FAC and EHS Office retains all building asbestos management documents in a permanent file organized by building. These documents can be found at the Stockton University EHS Office - Building 70. The asbestos O&M building files include:

1. **Inspection and Assessment Information.** Record the details on the location, quantity, characteristics, and assessment of the condition of suspect materials. Record bulk sampling locations and results from laboratory analysis. Update the records with data collected during periodic surveillance and maintenance work. Include information on ACM/PACM not identified during the initial inspection/assessment as it is located and sampled.

2. **Asbestos Work Control System.** As asbestos O&M and renovation activities occur, an asbestos work control system is necessary to insure that untrained workers do not inadvertently disturb ACM/PACM and that trained workers use the proper procedures when they are authorized to disturb ACM/PACM. Fully document the review and authorization of work requests. See Section 7.0 for details of the asbestos work control system.

3. **Air Monitoring Work Practices and Procedures.** The EHS/FAC determines the proper asbestos O&M work practices to use whenever asbestos is disturbed during maintenance activities conducted by Stockton personnel. The EHS Office/FAC reviews and approves the work practices of maintenance activities performed by contract personnel. The EHS Office and FAC documents and maintains these work practices in the asbestos O&M building files. The EHS Office and FAC also documents and maintains written standard work practices for asbestos removal operations in the asbestos O&M building files.

   Copies of employee exposure monitoring records shall be maintained indefinitely in the human resources office and at the Stockton University's EHS Office.

4. **Response Action/Renovation Data.** Upon completion of maintenance or renovation work, the FAC documents all changes in the presence or condition of the ACM/PACM. The information is included in the asbestos O&M building files. For asbestos removal projects the information may include certification that work area is asbestos-free, final air sampling results, and the Waste Shipment Record (WSR). For enclosure or encapsulation work, the information may include final air sampling results.

   Additionally, the EHS/FAC retains copies of asbestos abatement contract drawings and specifications, the work plan, final air clearance results, documentation of worker training, and documentation on the type, amount, and location of the materials removed. Include as part of the contract the submission of the above information to the EHS/FAC.

A WSR must accompany all asbestos waste to the landfill. If a copy of this WSR, signed by the operator of the designated disposal site, is not received within 35 days of leaving the facility, contact the waste transporter or designated disposal site to determine the status of the waste shipment. If a copy of the WSR is not returned within 45 days, report in writing to the State or local administrator of the NESHAP regulation. Consult the regulation to determine what information must be reported. All original completed WSRs will be sent to the EHS Office. WSRs shall be maintained indefinitely.

5. **Building Occupant Notification.** Prior to any renovation or removal project, affected building occupants are notified of the following:

- The exact location of the project;
- The methods used to prevent fiber release;
- The methods used to ensure the remaining ACM stays in good condition.

The building occupants are notified by the EHS/FAC, via broadcast email message. Post a copy of the message at the project site and forward a copy to the EHS Office and FAC. All records and notifications associated with the identification, location and quantity of ACM/PACM shall be maintained by the FAC and EHS Office for the duration of facility ownership and shall be transferred to successive owners.

9.2 *Employee Records*

Employee records are typically divided into four areas:

- Medical Surveillance Program
- Personal Air Sampling Exposure Monitoring
- Respiratory Protection Program
- Training

Stockton employee asbestos medical surveillance records, including written evaluations of employees' ability to wear respirators, shall be maintained at the EHS Office for the duration of the employees' employment plus 30 years.

Stockton employee exposure monitoring records shall be maintained for at least 30 years in the human resources office and at the EHS Office.

The EHS Office keeps the Respiratory Protection Program information, including training, medical exam, and fit testing. Respirator fit testing records shall be retained by the EHS Office for respirator users until the next fit test is administered.

The EHS/FAC maintains a copy of the training records for Stockton employees in their facility that perform duties as O&M asbestos workers, building inspectors, project designers, and competent persons. The EHS Office also maintains class attendance records for activity maintenance workers who have attended the asbestos initial O&M awareness course and refresher training, custodial and maintenance workers who have attended the asbestos awareness course and any subsequent refresher courses. Employee training records shall be maintained for at least 1 year beyond the last date of their employment with Stockton.

9.3 *Other Recordkeeping*

Many different records should be maintained for asbestos-related work and depend on the type and extent of the asbestos-related activity being performed. Additional information to support implementation and evaluation of the ACP files includes:

- Copies of current regulatory requirements;

- Agency notifications;
- Inspection reports, updates, and surveillance records;
- Employee training record;
- Chain of custody forms;
- EPA and state notifications and permits;
- Asbestos project logs;
- Equipment maintenance records;
- Regulated area/entry/exit logs;
- Asbestos related incidents; and
- Documentation of response to emergencies.

10.0 ASBESTOS WASTE DISPOSAL

10.1 *Types Of Materials*

Materials disposed of as ACM waste include actual ACM/PACM that are removed and any contaminated materials such as ceiling tiles, lighting fixtures, fiberglass insulation, electrical fittings, and other materials that cannot be decontaminated. Other materials for disposal as ACM include personal protective equipment all filters, including those used in respirators, HEPA-filtered exhaust units, HEPA vacuum cleaners, and water filtration units.

In some situations, certain materials may be cleaned and disposed of as non-asbestos contaminated waste, or the materials may be reused. In all cases, an effort is to be made to minimize the amount of asbestos waste generated.

10.2 *Requirements For Bags, Barrels, Or Drums*

All ACM wastes must be wetted and sealed in two 6-mil polyethylene plastic bags ("double-bagged"), or barrels or drums, double-lined with 6-mil polyethylene. Barrels or drums are used to contain pipe hangers or other sharp objects that could puncture or tear waste disposal bags. All bags, barrels, and drums must be permanently sealed before they are removed from the work site and must be labeled in accordance with OSHA, EPA, and Department of Transportation (DOT) requirements. (See Appendix A, General Work Practice 9, for further details.)

Mini-enclosure materials also need to be bagged for disposal as the area is disassembled following final air clearance testing. Alternatively, portions of the mini-enclosure may be reused in future asbestos O&M projects, providing the materials have been adequately cleaned.

10.3 *Transportation Requirements*

DOT and EPA regulate the transport and disposal of asbestos-containing waste, respectively.

Hand trucks, push carts, or other devices that are used to transport ACM waste to a trash receptacle must be plastic-lined and kept free from ACM/PACM debris. The transport cart must be thoroughly cleaned before being used for another purpose.

A registered waste hauler must be used to transport ACM from the site. A WSR shall be prepared and certified by the hauler and disposal site operator. A copy of the WSR is forwarded to the EHS Office for inclusion in the asbestos O&M files. The waste shall be hauled directly from the site to the pre-approved landfill meeting the requirements of Subtitle D of the Resource Conservation and Recovery Act (RCRA). No intermediate storage or transfer is permitted.

In no case can loose asbestos waste be transported. Asbestos waste must be handled in such a way as to comply with NESHAP regulations. Absolutely no emission to the air is allowed.

10.4 *Landfill And Disposal Requirements*

All asbestos containing waste must be deposited at a waste disposal site that is operated in accordance with NESHAP, 40 CFR 61.154 and N.J.A.C. 7:26. The state environmental agency can provide current information regarding which landfills are allowed to accept ACM.

11.0 AGENCIES AND INFORMATION

- ***EPA TSCA Hotline, Washington, DC,***
  Phone: 202-554-1404
  General information concerning federal requirements in the areas of industrial and commercial notification procedures, school program, analytical methods, abatement projects, and product use restrictions.

- ***Consumer Product Safety Commission, Washington, DC,***
  Phone: 800-638-2772
  Provides information concerning the identification and abatement of asbestos hazards in the home. Information on asbestos in certain consumer products is also available.

- **New Jersey Public Employees Safety and Health**
  Phone: 609-984-1863

- **New Jersey Department of Environmental Protection, Division of Solid and Hazardous Waste**
  Phone: 609-292-8341

  •***Occupational Safety and Health Administration, Washington, DC,***
  Phone: 1-800-321-OSHA (6742)

APPENDIX A: STANDARD WORK PRACTICES, General and Job Specific

Category: General—
General Work Practice 1: Tools, Equipment, and Materials

Scope: Provide general requirements for Personal Protective Equipment, Air Monitoring Equipment and Miscellaneous Equipment for OSHA Class III and IV asbestos work projects.

Work Practice:

(a) Personal Protective Equipment

(1) **Respiratory protection.** The use of engineering controls is the preferred method to control employee exposure to airborne asbestos fibers. However, while engineering controls are being implemented, or if they do not succeed in reducing the airborne concentration of asbestos to levels below OSHA PEL/ELs, or other acceptable limits, employees are required to wear appropriate respiratory protection. The EHS Office is responsible for ensuring an adequate supply of respiratory protective equipment is maintained at each facility. Such equipment shall include, but not be limited to, the following:

- NIOSH approved cartridges
- NIOSH approved [full face] or [half face]negative pressure air purifying respirators/ powered air-purifying respirators (PAPR)
- PAPR flow meter and spare battery
- *[[Qualitative][Quantitative] fit-testing equipment]*
- Alcohol-free towelettes
- Respirator cleaner/sanitizer mix/solution
- "Cleaned equipment" stickers
- Storage bags
- Spectacle kits
- Respirator manufactures instructions

(2) **Protective clothing and other equipment:** Employees who are likely to be exposed to concentrations of asbestos fibers in excess of OSHA PEL/ELs or have their clothing contaminated by asbestos will be required to wear protective clothing. The EHS Office is responsible for prescribing the types of protective clothing and equipment to be worn and maintaining adequate supplies. Such equipment may include, but not be limited to, the following:

- Disposable coveralls with attached hoods *[and footwear coverings]* – Tyvek ™ or equivalent
- Disposable nitrile and rubber gloves.
- Safety glasses/goggles
- Hard-hats
- Rubber/neoprene footwear
- Disposable earplugs or muffs

(b) **Air Monitoring Equipment:** Air monitoring will be conducted in accordance with applicable regulations and Section 5.4 of this Plan. Equipment necessary for conducting air monitoring includes, but is not limited to, the following:

- Low-volume sampling pumps with chargers
- High-volume sampling pumps
- National Institute of Standards and Technology (NIST) traceable calibration standard device

- 25 millimeter (mm) sampling cassettes with 50-mm electrically conductive extension cowl, mixed cellulose ester filter, 0.45 to 0.8 micron pore size
- Tygon ™ or flexible connecting tubing
- Collar clips
- Sample stands

(c) Miscellaneous Equipment: The EHS Office will ensure adequate supplies of the following equipment are maintained:

- Duct tape and low odor spray adhesive
- HEPA vacuum and spare filters (see Job Specific Work Practice 20)
- *[Fire retardant]* 6-mil polyethylene sheeting
- Standard glovebags, glovebags with self supporting frames, gloveboxes (see supplier list)
- Properly labeled disposal bags
- Warning signs and labels
- Barrier tape
- Plastic or fiberboard drums
- Odorless or low-odor encapsulant
- Surfactant
- Airless garden sprayers
- Spray bottle
- Disposable towels
- Shovels (to be used only for asbestos-related work)
- Squeegees (to be used only for asbestos-related work)
- Miscellaneous tools including HEPA filter equipped tools (to be used only for asbestos-related work)
- Electrical cords and Ground Fault Circuit Interrupter (GFCI)
- Utility knives and scrapers

Category: General—
General Work Practice 2: Shut Down and Lockout of HVAC and Electrical Systems

Scope: This work practice applies to any electrical systems that might be worked on or affected by asbestos O&M activities. The systems should be shut down, locked and tagged with electrical lockout tags at the circuit breaker panel or disconnect switch. Affected systems include systems that could create electrical hazards during asbestos O&M activities that involve wetting. Work permits should indicate any NAS equipment that may be affected by a loss of power or HVAC control.

Work Practice:

HVAC systems in a work area, systems that serve a work area, or systems that will be worked on should be shut down during asbestos O&M activities. Asbestos O&M activities usually do not require HVAC shut down unless work will occur directly on a system or a disturbance of asbestos will occur.

1. Any affected HVAC systems (supply, return, and exhaust) should be shut down, locked, and/or tagged at the circuit breaker panel or disconnect switch.

2. Lock tags should note when and why power is shut down and the personnel performing the lockout.

3. Lock tags should be removed upon completion of the work. Individuals should coordinate with co-workers when locks and/or tags are to remain in place beyond one work shift.

4. There should be only one key for each lock used on lockout tags to prevent accidental reactivation of equipment.

Category: General—
General Work Practice 3: Securing Area

Scope: This work practice applies to any asbestos work area that might be affected by asbestos O&M activities. The area should be vacated and secured using physical barriers and signs. Asbestos work permits should indicate any critical NAS equipment and operations that may be affected by asbestos O&M activities.

Work Practice:

1. When asbestos fibers might be released, work areas should be vacated and secured (where feasible) by scheduling, locking doors (from inside the area if possible) or other means. If this is not feasible, access to the work area should be restricted, such as by asbestos barrier tape around the perimeter of the work area. If barrier tape is used to denote a work area, it should be placed *[5 to 10 feet (1.5 to 3 meters)]* outside of any polyethylene protection used in the work area. Install barrier tape by taping or tying it to fixed objects.

2. Do not block access to any emergency exits, and when asbestos fibers might be released, post OSHA required "Danger" signs at all entrances to the work area. For such projects, it might be desirable to have a visual barrier installed several feet in front of warning signs to avoid having warning signs readily visible to occupants. A "Keep Out of Construction Area" sign should be posted on visual barriers. A visual barrier would be arranged so that a person who goes past the visual barrier would see required warning signs. (See Appendix B – General Safety Considerations. Section IV Emergency Planning)

Category: General—
General Work Practice 4: Critical Barriers

Scope: This work practice applies to any work practice that might involve the migration of airborne asbestos fibers as a result of asbestos O&M activities to be performed or to contain an area from further asbestos fiber migration. Larger and more extensive projects or activities pose a higher risk of generation of asbestos fibers. These projects require more extensive containment and engineering controls.

Work Practice:

1. Individually seal all ventilation openings (supply and exhaust), lighting fixtures, electrical receptacles, clocks, doorways, windows, convectors and speakers, and other openings into the Work Area with at least two layers of polyethylene sheeting at least 6 mil in thickness, taped securely in place with duct tape. Maintain seal until all work including Project Decontamination is completed. Take care in sealing of lighting fixtures to avoid melting or burning of sheeting.

2. Completely separate the Work Area from other portions of the building and the outside by closing all openings with sheet plastic (polyethylene) barriers at least 6 mil in thickness, or by sealing small cracks leading out of Work Area with duct tape.

3. Provide Sheet Plastic barriers at least 6 mil in thickness as required to seal openings completely from the Work Area into adjacent areas. Seal the perimeter of all sheet plastic barriers with duct tape and/or spray adhesive.

4. If critical barriers are used to cover smoke detectors and sprinkler heads, ensure that the fire watch is established until the fire protection systems are returned to service.

Category: General—
General Work Practice 5: Respirators Fit and Pressure (User) Seal Checks

Scope: Applies to any asbestos O&M work practice that might involve the use of air purifying respirators as PPE. The procedures described below are based on the assumption that workers wearing respirators have been trained in the use of respirators and, for negative pressure respirators, fit tested and enrolled in a medical surveillance program as part of a Respiratory Protection Program. NIOSH-approved respirators shall be used. These procedures are not a substitute for a Respiratory Protection Program in accordance with OSHA standard 29 CFR 1910.134, or regulatory requirements regarding respirators. Qualitative and Quantitative Fit test protocols are found as 29 CFR 1910.134, Mandatory Appendix A.

Work Practice:

1. Wearers should inspect their respirators before each use.
2. Respirators must not be damaged, have missing parts or be deformed in any way. The straps must be intact and well attached.
3. Proper filter cartridges for the hazards to be encountered must be installed (N100, P100 or R100 for asbestos). Verify that filters have been replaced in accordance with the Respiratory Protection Program.
4. Batteries for powered respirators should be fully charged.
5. The respirator should also be cleaned if it was not cleaned after the last use.
6. If any problems exist, the respirator should be repaired or replaced in accordance with a Respiratory Protection Program.
7. The straps should be loosened before putting on a respirator.
8. Filter caps (such as those used on some Powered Air Purifying Respirators) should be taped to the filter body or stored where it will not be lost. Powered respirators should be turned on and flow checked before the facepiece is put on.
9. The respirator should be put on and then the straps tightened as recommended in the manufacturer's information provided with the respirator. Pressure (User) Seal Checks should then be performed.
10. Pressure (User) Seal Checks should be performed in accordance with the Respiratory Protection Program by each worker each time they put on a respirator. Both Positive and Negative Pressure (User) Seal Checks should be performed. When feasible, powered respirators should be checked with the motor unit turned off.
11. A Negative Pressure (User) Seal Check is done by donning the respirator and pulling the respirator straps so the unit fits snugly.
12. Inhale gently while placing hands over filters to block off inhalation side. Respirator should pull toward the face and no air should leak in around the face seal.
13. A Positive Pressure (User) Seal Check is done by exhaling gently (without breaking respirator-to-face seal) while blocking off the exhalation valve. The face piece should then expand away from the face while exhaling.
14. Adjust the respirator straps as needed to obtain a good seal of the facepiece to the face.
15. If a good seal cannot be obtained, obtain a new respirator and begin the process of a qualitative or quantitative fit test followed by performing successful Pressure (User) Seal Checks again.

Category: General—
General Work Practice 6: Putting on Personal Protective Clothing

Scope: Asbestos O&M work practices that might involve the use of protective clothing as PPE. Workers protective clothing typically consists of, but is not limited to, disposable coveralls, gloves, and footwear.

Work Practice:

1. Disposable coveralls Tyvek ™ or equivalent with attached hoods *[and footwear coverings]* – Tyvek ™ or equivalent. They should provide complete coverage of the body with the exception of hands and face. Do not modify coveralls.
2. Protective clothing should be put on after respirators. The coverall hood should cover respirator straps.
3. Workers are encouraged to wear protective gloves that are duct taped at the cuffs to the protective coveralls.
4. Eye, hearing, and head protection should also be used where needed.
5. Slip-resistant outer footwear should be worn for all activities. Steel-toed footwear shall be used in areas where foot hazards exist. The opening between the boot and the coverall shall be sealed with duct tape. Do not use coveralls with loose foot coverings for activities that involve climbing ladders or working on a scaffold.

Category: General—
General Work Practice 7: Conducting Air Monitoring During Work Practices

Scope: This work practice applies to any asbestos O&M work practice where initial monitoring or a NEA has not been established or as area or clearance sampling documentation is recommended by the EHS/FAC.

Work Practice:

Note: This section is not intended as a substitute for a complete Air Monitoring Program and specific protocols needed for asbestos O&M work. This section notes air monitoring issues that need to be addressed by the air monitoring person.

Air monitoring during asbestos O&M activities can consist of personal and area air sampling. Air monitoring required for the work practice being performed should be indicated on the Asbestos Work Permit and be conducted in accordance with applicable regulations (such as 29 CFR 1926.1101, Appendix A, the Asbestos O&M Plan, and Air Monitoring Program. All air monitoring work should be conducted by a trained person as assigned by the EHS/FAC.

The air monitoring person should calibrate, adjust, and record the flow rate of all air monitoring pumps to be used before air monitoring is started for an asbestos O&M activity.

Personal Air Sampling

1. Personal Air Sampling (includes initial exposure assessment and negative exposure assessments) shall be conducted by an Industrial Hygienist (IH) under the direct supervision of a CIH.
2. To perform personal monitoring, attach a personal air monitoring pump to a belt worn by the worker.
3. Attach an air sampling cassette to the hose from the pump.
4. Route the hose up the worker's back and tape the hose to the worker's protective coveralls using duct tape.
5. The cassette should be located with the open end facing downwards at approximately a forty-five degree angle in the worker's “breathing zone” at about collar level.
6. Turn the pump on and record start time and flow rate.
7. The air monitoring person will observe and record the activities of the worker. The IH/CIH will retrieve or change the cassette when necessary, or when work is completed.

Area Air Sampling

1. Area Air Sampling includes baseline level sampling, abatement area sampling and clearance sampling and shall be conducted as directed by a Stockton qualified personnel at the discretion of the FAC and/or EHS Office.
2. Area monitoring is usually performed using high volume air sampling pumps.
3. Place pumps inside the work area and outside the work area in occupied areas or areas where occupants could be exposed if fibers are released from the work area.
4. Pumps should be in sufficient number and located where they obtain meaningful measurements of any area contamination.
5. Attach sampling cassettes to the hoses from the pumps and attach the cassettes to the top of tripod stands or other stable structures (do not use the pump as a stand due to its vibrations) to locate the sample at four to five feet (1.2 to 1.5 meters) above the floor.

6. These 25mm cassettes should be located with the open-end facing downwards at approximately a forty-five degree angle. The air monitoring person will retrieve or change cassettes as needed or when the work is completed.

Category: General—
General Work Practice 8: Cleaning Procedures – Wet Wiping and HEPA Vacuuming

Scope: These work practices are used either to pre-clean the work area prior to start of asbestos O&M work, or for cleaning surfaces as part of an asbestos O&M work procedure.

Pre-cleaning of work areas prior to the start of work is done to remove accumulated debris and dust that could be disturbed during the work. Pre-cleaning might include picking up dust and debris with a HEPA vacuum, wet wiping non-porous surfaces, HEPA vacuuming surfaces that cannot be wet wiped. **(Note: EPA has determined in a research study that HEPA vacuuming and steam cleaning of carpets do not completely remove asbestos contamination.)** Pre-cleaning might reduce the extent of cleaning required after the work and for clearances (if required).

Work Practice:

(a) **Wet Wiping -** The procedures to be used for wet wiping are as follows:

(1) Immerse disposable towel in bucket containing amended water.

(2) Wring out towel and fold into quarters.

(3) Wipe surface and refold to have a clean face exposed. Do not place towel back into bucket or water will become contaminated and will need to be replaced.

(4) Repeat step 3 until all faces of towel have been used. Obtain a clean towel if more wiping is needed.

(5) Dispose of used towels in disposal bags.

(6) Dispose of contaminated water as required by applicable regulations.

(b) **HEPA Vacuuming** - The procedures to be used for HEPA vacuuming are as follows:

(1) For floors, use a floor attachment with rubber floor seals and adjustable floor-to-attachment height. For furniture, fabrics, or other surfaces, use an upholstery attachment or brush attachment.

(2) Vacuum hard or smooth surfaces with attachment about 1/16” (2 mm) above the surface.

(3) Vacuum all surfaces in parallel passes with each pass overlapping the previous one to ensure coverage of the area being vacuumed.

(4) Once surfaces are cleaned in one direction, clean a second time at right angles to the first cleaning.

(5) Use nylon crevice brush or other tools to clean irregularly shaped surfaces.

Category: General—
General Work Practice 9: Waste Handling

Scope: These work practices are used to (a) package, decontaminate and label (b) store, transport and dispose of asbestos (c) containing waste resulting from asbestos O&M activities.

Work Practice:

(a) Packaging, Decontaminating and Labeling Waste

(1) Asbestos-containing waste material from asbestos O&M activities should be adequately wet in accordance with the NESHAP requirements, (40 CFR 61.150).

(2) Verify waste packaging and other waste disposal requirements with the landfill that will receive the asbestos waste. Pre-labeled asbestos disposal bags should be used for asbestos waste disposal where possible, appropriate, and permissible.

(3) Disposal bags should be collapsed by evacuating the air from the bag with a HEPA vacuum in the work area or enclosure.

(4) Once collapsed, twist the bag to form a neck and wrap it tightly with duct tape. Fold neck of bag over to form a loop, then again wrap duct tape around neck and loop.

(5) Asbestos waste shall be placed into a second disposal bag and sealed as described in Step 4 above.

(6) Label disposal bags as required by applicable state, local, NESHAP, OSHA, and DOT regulations.

(7) Asbestos waste that does not fit into disposal bags should be wrapped in two layers of 6 mil polyethylene sheets. Each layer should be sealed tightly with duct tape. Label outer layer as required by regulations.

(8) Sharp objects that might puncture polyethylene (such as floor tile) should be placed into cardboard boxes or fiberboard which are lined with [two layers of 6 mil polyethylene] [two asbestos disposal bags].

(9) Packaged waste should be decontaminated by HEPA vacuuming and wet wiping before it is moved out of the work area. Use the wet wiping and HEPA vacuuming procedures in General Work Practice 8: Cleaning Procedures- Wet Wiping, HEPA Vacuuming, and Steam Cleaning. Packaged waste should be placed on a sheet of polyethylene when it is moved outside of the work area. This polyethylene can be the outer portion of a drop cloth, if a drop cloth is being used. Hand trucks, push carts, or other devices that are used to transport waste must be plastic-lined and kept free from ACM debris. The transport cart must be thoroughly cleaned before being used for another purpose.

(10) ACM packaging, with some exceptions, must meet general DOT and EPA requirements and be protective, marked, and labeled. See Table 1. Applicable Standards And Guidance, Section 1.5, for further information. Waste material to be transported off the facility site must also be labeled with the name of the waste generator and the location at which the waste was generated.

(11) Review current labeling requirements with EHS/FAC and disposal site. The OSHA requirements apply regardless of the amount of waste or measured exposure levels (see 29 CFR 1926.1101(k). Three label requirements include:

- OSHA 29 CFR 1926. 1101(k)(8) requirement:

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

- Department of Transportation (DOT), pursuant to changes that were published in the Federal Register (No. 225, November 25, 1986, page 42175) and that became effective on July 1, 1987:

"Asbestos, 9, NA2212, PGIII, RQ"

DOT's shipping paper and marking format, used with some exceptions (See Table 1. Applicable Standards And Guidance, Section 1.5, for further information.)

- NESHAP requirement: NESHAP requires that readily visible and legible warning labels as specified by OSHA be used on waste containers or wrapped materials (this is the same as the OSHA 29 CFR 1926.1101 label listed above).

(b) Storage, Transportation, and Disposal

(1) Storage, Transportation, and Disposal of ACM/PACM. All asbestos waste generated at Stockton facilities will be segregated, stored, transported, and disposed of in accordance with all applicable Federal, State, and local requirements.

(a) Storage. ACM/PACM waste shall be stored inside leak-proof containers in designated areas until properly transported to an approved disposal site. The containers shall be properly labeled and stored in such a manner as to reduce the potential for accidental disturbance.

(b) Transportation. The waste hauling company will be licensed, per applicable State requirements, to transport ACM/PACM waste.

(c) Disposal. All ACM/PACM waste shall be disposed of at a site currently approved to accept asbestos waste materials in accordance with Federal, State, and local requirements. The transporter shall be required to provide a completed waste shipment record to the Stockton within 30 days after removal of the waste from the site. If the EHS Office does not receive the completed waste shipment record back from the disposal site within 35 days, they will contact the disposal site and the waste hauler to determine the status of the shipment. If the completed waste shipment record is not received within 45 days after removal of waste from the site, the EHS Office and/or contractor will contact the appropriate State environmental department and the EPA to report the missing waste shipment record.

Category: General—
General Work Practice 10: Decontamination of Tools, Equipment, and The Work Area

Scope: This work practice applies to the proper procedures for cleaning tools, equipment, and work tools.

Work Practice:

Clean tools and equipment using HEPA vacuuming and/or wet wiping procedures. Special attention should be given to cleaning extension cords, equipment wheels, vacuum hoses and other contaminated items. Tools and equipment should be placed outside of the work area as soon as cleaning is completed. Drop cloths and mini-enclosures can be cleaned or disposed of as ACM.

Any items that cannot be fully cleaned (such as footwear or tools) that might be used in another asbestos O&M activity should be placed into disposal bags, sealed, and labeled as ACM. These bags should be wet wiped and then placed outside of the work area with the other tools and equipment. Do not open bags containing contaminated tools, or open equipment, such as an HEPA vacuum, except during another asbestos O&M activity or in a designated work area. HEPA vacuum hoses can be sealed with tape over both ends if the outside of the hose is clean. Cleaning of the work area, where an asbestos O&M activity is conducted, consists of HEPA vacuuming and/or wet wiping all surfaces.

Category: General—
General Work Practice 11: Worker Decontamination

Scope: This work practice applies to removal of protective clothing and respirators.

Work Practice:

(a) Decontamination and removal of protective clothing following asbestos O&M activities should use the following procedure(s):

(1) Removal of protective clothing when work is performed on a drop cloth.

- HEPA vacuum all parts of protective clothing while standing at the perimeter of the drop cloth, or on a step-off pad immediately adjacent to the drop cloth.
- If two disposable coveralls are used, remove outer coveralls in work area while leaving respirator in place. Fold coveralls inside out as they are removed. Move to the step off pad, HEPA vacuum protective clothing, and remove second set of coveralls in the same manner
- Leaving the respirator in place, remove protective clothing and roll inside out as it is removed.
- Place protective clothing into a disposal bag and label as ACM waste.
- Use procedures in Section b of this work practice for removing the respirator.
- Exit the change room or step-off pad. [Workers should proceed to a shower when available.]

(2) Removal of protective clothing if a mini-enclosure and change room is provided.

- HEPA vacuum all parts of protective clothing while inside work area enclosure.
- If two disposable coveralls are used, remove outer coveralls in work area while leaving respirator in place. Fold coveralls inside out as they are removed. Move to the change room, HEPA vacuum protective clothing, and remove second set of coveralls in the same manner.
- If only one set of disposable coveralls is worn, remove in change room while leaving the respirator in place. Fold coveralls inside out as they are removed.
- Place protective clothing into a disposal bag and label as ACM waste.
- Wash hands, face and surface of respirator with clean water and disposable towels. Use caution to avoid breaking seal between respirator face piece and face. Place disposable towels into a disposal bag.
- Remove the respirator using the procedures in Section 2 of this work practice.
- Exit the change room or step-off pad. [Workers should proceed to a shower when available.]

(3) Street clothes: If street clothes are worn under protective clothing and are contaminated during the work, the street clothes should be HEPA vacuumed, removed during decontamination, and placed into a disposal bag and treated as ACM.

(b) Decontamination and removal of respirators following asbestos O&M activities should use the following procedures:

(1) Before removing the respirator, wash hands, face, and the surface of the respirator with clean water and disposable towels. Avoid getting water into the filter cartridges. Place disposable towels into a disposal bag.

(2) Use caution to avoid breaking the seal between the respirator face piece and face while washing the face, hands, and the respirator.

(3) Remove the respirator after removing protective clothing.

(4) After removing the respirator, either [seal the cartridges with duct tape] or [dispose of the cartridges as ACM waste].

Category: Job Specific—
Job Specific Work Practice 1: Glove Bag Installation and Removal

Scope: Glovebag installation and removal involves the use of pre-fabricated or custom enclosures fabricated on-site to control asbestos fibers during asbestos O&M activities. Some types of pre-fabricated enclosures include standard glovebags, "glovebox" type enclosures, glovebags with self-supporting frames, and glovebags that funnel waste into standard disposal bags.

Pre-Work Activities:

(Information is obtained from the Facility Asbestos Coordinator or designee.)

- Obtain a copy of Asbestos Work Permit and employee notification then post at the job site.
- Work Notification(s) (as applicable).
- Review Schedule for Work.
- Review General Work Practices.
- Follow Work Permit air monitoring requirements (as applicable).
- Demarcate the area with Asbestos Warning signs and other barriers as necessary to prevent unauthorized access.

Job Specific Work Practice:

Remove asbestos-containing material inside a glovebag according to the following procedures. Glovebags shall be used only once and shall not be moved to another location to perform additional removal work, or reused in any way. Use only 60 inches by 60 inches standard glovebags. Do not use glovebags or surfaces on equipment that are over 150°F. If you encounter a situation that requires a special type or size of glovebag, or if hot surfaces are involved, notify FAC and EHS Office.

Glovebags might be used with a framework for asbestos O&M work on flat areas such as surfacing materials. Note that significant asbestos exposures to workers can result from the improper use of glovebags. Workers should obtain information on current regulatory requirements on glovebag use from the FAC and EHS Office.

(a) Procedure A: Glovebag Installation and ACM Removal Procedures

(1) Check area where the work will be performed. If damaged ACM is present (broken lagging, hanging, etc.), wrap in two layers of 6 mil. polyethylene and seal and secure polyethylene with strips of duct tape for reinforcement. Place one layer of duct tape around the ACM removal area where the glovebag will be attached. Also protect any damaged ACM outside the glovebag area that could be disturbed during the work.

(2) Slit top of the glovebag open (if necessary) and cut down the sides to accommodate the ACM removal area.

(3) Place necessary tools into pouch located inside glovebag (or into a sleeve turned inside out). Tools needed typically include: scraper, hand saw, utility knife, disposable towels, nylon brush, abrasive pads, wire cutters, tin snips and pre-wetted lag cloth. Cut lag cloth to sizes needed to cover any ACM that will remain after glovebag work is completed.

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

(5) Place the glovebag around area to be worked on and staple top together through reinforcing duct tape. Provide 8-12 inches (200-300 mm) of space inside glovebag between removal surface and glovebag for working room. Secure glovebag to duct tape previously installed around removal area.

(6) If a supporting framework and HEPA filtered makeup air port is being used, attach hose from an operating HEPA vacuum to glovebag to provide negative pressure in glovebag. Follow equipment manufacturer's instructions on use of negative pressure equipment.

(7) Insert wand from garden sprayer with amended water through water sleeve. Duct tape water sleeve tightly around the wand to prevent leakage.

(8) Use smoke tube and aspirator bulb to test seal. Place tube into water sleeve (two-inch *[50-mm]* opening to glovebag) squeezing bulb and filling bag with visible smoke. Remove smoke tube and twist water sleeve closed. While holding the water sleeve tightly, gently squeeze glovebag and look for smoke leaking out, (especially at the top and ends of the glovebag). If leaks are found, tape closed using duct tape and re-test.

(9) Insert arms into glovebag sleeves.

(10) Remove any metal jacketing or covering over the area where removal is required using tin snips and/or wire cutters. Fold in any sharp edges to avoid cutting the bag. Pierce any painted coverings to permit water to soak into the ACM.

(11) Adequately wet material to be worked on with amended water and allow to soak in. Wet adequately to penetrate and soak material through to substrate.

(12) Cut insulation section to be removed using handsaw or utility knife. Use caution to avoid cutting glovebag. Lift glovebag away from cutting area if necessary.

(13) Throughout this process, spray amended water on the cutting area to keep airborne fibers to a minimum.

(14) Remove insulation using scraper or other tools. Place pieces in bottom of bag without dropping. Rinse all tools with amended water inside the bag and place back into pouch or a sleeve of the glovebag turned inside out.

(15) Using nylon brush, scrub pads, disposable towels and amended water, scrub and wipe down the removal area.

(16) Seal exposed ACM around removal area using pre-wetted lag cloth or encapsulate with a bridging encapsulant. Encapsulate removal area with an appropriate lockdown encapsulant. Use suitable high temperature encapsulants for hot piping.

(17) Wash down inside of glovebag with amended water and wipe as necessary to move all debris and residue to lower part of glovebag (below where bag will be twisted and cut).

(18) Remove water wand from water sleeve, twist water sleeve closed and seal with duct tape.

(19) From outside the bag, pull the tool pouch or sleeve away from the bag and twist pouch to seal it from rest of bag. Place duct tape over twisted portion and then cut the tool bag from the glovebag, cutting through the twisted/taped section.

(20) Evacuate air from glovebag using a HEPA vacuum. With the HEPA vacuum operating, twist the bag several times and tape it with duct tape to keep the material in the bottom during removal of the glovebag from the removal area.

(21) Contaminated tools might then be placed directly into another glovebag without cleaning. Alternatively, tool pouch with the tools can be placed in a bucket of water, opened underwater, and tools cleaned and dried. Discard disposable towels and nylon brush with asbestos waste.

(22) Slip a 6 mil disposal bag over the glovebag (still attached to removal area). With the hose of an operating HEPA vacuum inserted in the upper part of glovebag, remove tape or cut bag and open the top of the glovebag and fold it down into disposal bag. Seal disposal bag.

Post Work Activities:

- Complete visual inspection and air monitoring work.
- Have EHS/FAC or designee complete the Post Work Activities section of the Asbestos Control Work Permit Request Form.
- Remove drop cloth, clean with HEPA/wet methods or properly dispose of as contaminated.
- Properly decontaminate and return tools, equipment, and remaining materials to storage area.
- Remove lockout/tagout devices and restart HVAC/electrical system(s) (as applicable).
- Notify EHS/FAC or supervisor of completed work and return all documents.

Category: Job Specific—
Job Specific Work Practice 2: Mini-Enclosures

Scope: A mini-enclosure is usually a polyethylene enclosure containing a small or limited work area. Mini-enclosures are sealed enclosures used to protect the facility environment by containing fibers or debris generated during the work, as described in 29CFR 1926, 1101, Appendix G.

Pre-Work Activities:
(Information is obtained from the EHS/FAC or designee.)

- Obtain a copy of Asbestos Work Permit and post at the job site.
- Work Notification(s) (as applicable).
- Review Schedule for Work.
- Review General Work Practices.
- Follow Work Permit air monitoring requirements (as applicable).
- Demarcate the area with Asbestos Warning signs and other barriers as necessary to prevent unauthorized access.

Job Specific Work Practice:

A. Mini-enclosures

Mini-enclosures also serve to provide a visual barrier between the workers and any other personnel around the work area. Careful work practices should be the primary means of fiber control during the work in order to prevent gross contamination of the mini-enclosure and minimize worker exposure to airborne asbestos fibers.

It is sometimes appropriate to extend mini-enclosures above ceilings, such as by using polyethylene sheet and framing taped together to provide enclosure around the work area. The mini-enclosure should not contact ACM covered surfaces. The construction will vary depending on whether the enclosure will be attached to pipes, conduit, metal hangers, or some other form of existing construction.

There are a variety of commercially available types of mini-enclosures, including pre-fabricated pop-up boxes and adjustable framework assemblies to permit different sizes of enclosures to be constructed. Disposable liners for mini-enclosures (to facilitate set up and dismantling of the enclosure) are available from some manufacturers. It might be beneficial to construct or purchase a portable mini-enclosure unit that works for the typical conditions found in a given facility.

1. It is recommended that two workers be used to set up and operate mini-enclosures. To construct a mini-enclosure, erect a framework of wood, PVC piping or metal framing that will enclose the work area and be large enough for one person to work inside. The minimum width and depth of the enclosure should be at least 3 feet (1 meter). The height of the enclosure will vary depending upon the work to be performed and the height of the work area. A larger enclosure is preferable where space permits. However, if the enclosure is too large, the final cleaning process will require more time.
2. If a small room (e.g., janitor closet) will be enclosed for performing work, the framework is usually not necessary, unless wall surfaces will be damaged by tape used to support polyethylene. A room can be enclosed for asbestos O&M work by installing one layer of polyethylene sheet on the walls and floor of the room.
3. If the work to be performed is in an elevated location, the enclosure should be erected on a scaffold or personnel lift platform large enough to support the enclosure, and a step off area outside the enclosure. Refer to OSHA Regulations, 29 CFR 1910.28, and 29 CFR 1926.451, concerning scaffold requirements. Any ladders and/or scaffolds used must be built and used in conformance with the OSHA construction standards, and applicable State and local standards.

4. Cover the floor and the framework for the mini-enclosure with two layers of polyethylene attached using duct tape. A second layer of polyethylene laid on the floor might facilitate clean up work, or reduce the possibility of tearing the polyethylene if equipment is used.
5. Mini-enclosures should be constructed with a ceiling of polyethylene if work will not be performed above the enclosure. If work is to be performed above the enclosure and the ceiling is not ACM, the enclosure should extend to and be sealed to the ceiling deck of the floor above [or grid system]. If the enclosure is below an ACM finished surface, the enclosure should be separated from the ceiling by a narrow space.
6. After enclosure is in place, check for, and clean up any debris generated by enclosure installation using wet methods and a HEPA vacuum.
7. Mini-enclosures are shall set up with a negative pressure system as described below to reduce the possibility of fibers being released from the enclosure and to filter the air inside the enclosure. Smoke tubes can be used to confirm negative pressure within the mini-enclosure.

B. HEPA Filtered Local Exhaust Ventilation:

Mini-enclosures should be provided with a negative pressure system to reduce the possibility of fibers being released from the enclosure during the work, and to filter inside air discharged from the enclosure. Negative pressure inside mini-enclosures is commonly provided by a HEPA filtered vacuum or by negative pressure machines, depending upon the size of the enclosure. A HEPA vacuum will usually provide sufficient negative pressure for a mini-enclosure.

A negative pressure system for a mini-enclosure most commonly locates the HEPA vacuum or negative pressure machine outside the enclosure. The intake side of the unit is ducted to the enclosure through the vacuum hose or flexible duct material taped to a hole in the enclosure on the side opposite the entrance to the enclosure or as close as possible to where the work will be performed. The filtered exhaust side of the unit should be ducted to the outside if possible. However, most vacuum units do not provide a connection for an exhaust duct, and are commonly exhausted to the inside. Additional protection might be desirable for an area where air is exhausted inside a building. Follow the manufacturer instructions when changing HEPA vacuum filters.

Post Work Activities:

- Complete visual inspection and air monitoring work.
- Have EHS/FAC or designee complete the Post Work Activities section of the Asbestos Control Work Permit Request Form.
- HEPA vacuum and/or wet wipe inside the mini-enclosure.
- Properly decontaminate and return tools, equipment, and remaining materials to storage area.
- Remove lockout/tagout devices and restart HVAC/electrical system(s) (as applicable).
- Notify EHS/FAC or supervisor of completed work and return all documents.

Category: Job Specific—
Job Specific Work Practice 3: Installing Wiring in a Plenum Space Where Surfacing ACM is Present

Scope: This work practice applies to work where wiring is installed in plenums where surfacing (e.g., spray applied fire proofing) ACM/PACM or debris is present.

Pre-Work Activities:

(Information is obtained from the EHS/FAC or designee.)

- Obtain a copy of Asbestos Work Permit and post at the job site.
- Work Notification(s) (as applicable).
- Review Schedule for Work.
- Review General Work Practices.
- Follow Work Permit air monitoring requirements (as applicable).
- Demarcate the area with Asbestos Warning signs and other barriers as necessary to prevent unauthorized access.

Job Specific Work Practice:

1. Place two layers of 6-mil polyethylene drop cloth under the work area. The drop cloth should be at least one foot square for each foot of ceiling height, but no less than 6 foot by 6 foot. For example, an eight-foot ceiling would require an 8 foot by 8 foot drop cloth. Consider the use of a mini-enclosure to further minimize the generation of dust and debris. Carefully lift the ceiling tile.
2. Place tools, equipment, and materials needed onto the drop cloth.
3. Obtain access through ceiling using ladders or proper work platform.
4. Observe the top of the ceiling in the direction that cables are to be run. If there is any ACM/PACM debris or dust on top of ceiling tiles clean the tops of the tiles using a HEPA vacuum, then locate the next ceiling access so that all parts of the ceiling top can be cleaned.
5. Open enough ceiling tiles that the cables can be passed by hand from opening to opening.
6. Install wiring by [using an electrician's "wire tape" (snake) from the beginning to the end point to minimize the disturbance to the ceiling tiles] passing the leading end of wires from opening to opening. **DO NOT TOSS CABLES OR ANY OTHER OBJECT ABOVE THE CEILING.**
7. Run wiring as required. Avoid contact with surfacing ACM/PACM and minimize disturbance of the ceiling system and other components above in the ceiling space. Clean up any dust or debris generated using a HEPA vacuum.

Post Work Activities:

- Complete visual inspection and air monitoring work.
- Have EHS/FAC or designee complete the Post Work Activities section of the Asbestos Control Work Permit Request Form
- Remove drop cloth, clean with HEPA/wet methods or properly dispose of as contaminated.
- Properly decontaminate and return tools, equipment, and remaining materials to storage area.
- Remove lockout/tagout devices and restart HVAC/electrical system(s) (as applicable).
- Notify EHS/FAC or supervisor of completed work and return all documents.

Category: Job Specific—
Job Specific Work Practice 4: Repair Damaged Surfacing ACM/PACM

Scope: This work practice applies to the repair of damaged or delaminating surfacing ACM/PACM in quantities not exceeding 3 square feet.

Pre-Work Activities:

(Information is obtained from the EHS/FAC or designee.)

- Obtain a copy of Asbestos Work Permit and post at the job site.
- Work Notification(s) (as applicable).
- Review Schedule for Work.
- Review General Work Practices.
- Follow Work Permit air monitoring requirements (as applicable).
- Demarcate the area with Asbestos Warning signs and other barriers as necessary to prevent unauthorized access.

Job Specific Work Practice:

1. Place two layers of 6-mil polyethylene drop cloth under the work area.
2. The drop cloth should be at least one foot square for each foot of ceiling height, but no less than 6 foot by 6 foot. For example, an eight-foot ceiling would require an 8 foot by 8 foot drop cloth.
3. Place tools, equipment, and materials needed onto the drop cloth.
4. Repair damaged area using non-ACM/PACM caulking or patching compound without disturbing ACM/PACM. Do not scrape or sand the existing ceiling.

Post Work Activities:

- Complete visual inspection and air monitoring work.
- Have EHS/FAC or designee complete the Post Work Activities section of the Asbestos Control Work Permit Request Form
- Remove drop cloth, clean with HEPA/wet methods or properly dispose of as contaminated.
- Properly decontaminate and return tools, equipment, and remaining materials to storage area.
- Remove lockout/tagout devices and restart HVAC/electrical system(s) (as applicable).
- Notify EHS/FAC or supervisor of completed work and return all documents.

Category: Job Specific—
Job Specific Work Practice 5: Remove Asbestos-Containing TSI on Piping for Maintenance Work

Scope: This work practice applies to OSHA Class III asbestos work involving removal of ACM/PACM TSI in quantities not exceeding that which will fit into a single 60 inch by 60 inch glovebag or disposal bag.

Pre-Work Activities:

(Information is obtained from the EHS/FAC or designee.)

- Obtain a copy of Asbestos Work Permit and post at the job site.
- Work Notification(s) (as applicable).
- Review Schedule for Work.
- Review General Work Practices and Job Specific Work Practices 1 and 2.
- Follow Work Permit air monitoring requirements (as applicable).
- Demarcate the area with Asbestos Warning signs and other barriers as necessary to prevent unauthorized access. Construct mini-enclosure or install glovebag following general work practices.

  (1) Construct mini-enclosure or install glove bag following general work practices.

  (2) Place tools, equipment, and materials needed inside *[mini-enclosure][glovebag*].

  (3) Adequately wet insulation to be removed.

  (4) Wait until amended water has soaked into insulation. Continue to add amended water until insulation is completely saturated.

  (5) Cut bands holding the insulation in place.

  (6) Slice lagging with a razor knife at vertical joints between sections of insulation and length-wise at joints between halves.

  (7) Remove insulation and place intact into a properly labeled asbestos disposal bag. Do not drop.

  (8) Wet wipe surface of pipe to remove any ACM/PACM residue.

  (9) Apply encapsulant to bare piping and exposed ends of remaining insulation.

Post Work Activities:

- Complete visual inspection and air monitoring work.
- Have EHS/FAC or designee complete the Post Work Activities section of the Asbestos Control Work Permit Request Form
- Remove drop cloth, clean with HEPA/wet methods or properly dispose of as contaminated.
- Properly decontaminate and return tools, equipment, and remaining materials to storage area.
- Remove lockout/tagout devices and restart HVAC/electrical system(s) (as applicable).
- Notify EHS/FAC or supervisor of completed work and return all documents.

Category: Job Specific—
Job Specific Work Practice 6:
Repair Damaged Asbestos-Containing Pipe Insulation

Scope: This work practice applies to the repair of damaged or delaminating ACM/PACM pipe insulation in quantities not exceeding 3 linear feet.

Pre-Work Activities:
(Information is obtained from the EHS/FAC or designee.)

- Obtain a copy of Asbestos Work Permit and post at the job site.
- Work Notification(s) (as applicable).
- Review Schedule for Work.
- Review General Work Practices.
- Follow Work Permit air monitoring requirements (as applicable).
- Demarcate the area with Asbestos Warning signs and other barriers as necessary to prevent unauthorized access.

Job Specific Work Practice:

1. Place two layers of 6-mil polyethylene drop cloth under the work area. The drop cloth should be at least one foot square for each foot of height of the work, but no less than 6 foot by 6 foot.
2. Place tools, equipment and materials needed onto the drop cloth.
3. If access at an elevated level is required, use a ladder or proper work platform.
4. Adequately wet area of insulation to be repaired. HEPA vacuum damaged area to be repaired.
5. Dip lag cloth into water and squeeze out excess water. Apply lag cloth to area of insulation being repaired and smooth it out using a wet sponge. Restore vapor barrier on cold insulation and seal off to adjacent vapor barrier surfaces.

Post Work Activities:

- Complete visual inspection and air monitoring work.
- Have EHS/FAC or designee complete the Post Work Activities section of the Asbestos Control Work Permit Request Form
- Remove drop cloth, clean with HEPA/wet methods or properly dispose of as contaminated.
- Properly decontaminate and return tools, equipment, and remaining materials to storage area.
- Remove lockout/tagout devices and restart HVAC/electrical system(s) (as applicable).
- Notify EHS/FAC or supervisor of completed work and return all documents.

Category: Job Specific—
Job Specific Work Practice 7: Repair Damaged ACM Insulation on a Boiler, Duct, or Flue

Scope: This work practice applies to repair of damaged or delaminating ACM boiler, duct, or flue insulation in quantities not exceeding 3 square feet.

Pre-Work Activities:

(Information is obtained from the EHS/FAC or designee.)

- Obtain a copy of Asbestos Work Permit and post at the job site.
- Work Notification(s) (as applicable).
- Review Schedule for Work.
- Review General Work Practices.
- Follow Work Permit air monitoring requirements (as applicable).
- Demarcate the area with Asbestos Warning signs and other barriers as necessary to prevent unauthorized access.

Job Specific Work Practice:

1. Place two layers of 6-mil polyethylene drop cloth under the work area. The drop cloth should be at least one foot square for each foot of height of the work, but no less than 6 foot by 6 foot.
2. Place tools, equipment and materials needed onto the drop cloth.
3. If access at an elevated level is required, use a ladder or proper work platform.
4. Adequately wet area of insulation to be repaired where appropriate. HEPA vacuum damaged area to be repaired and remove any loose debris.
5. Fill in repair area with non-ACM patching material.
6. Properly re-insulate repaired area. Apply all lagging materials wet and ensure the existing ACM material is not disturbed by lagging installation.

Post Work Activities:

- Complete visual inspection and air monitoring work.
- Have EHS/FAC or designee complete the Post Work Activities section of the Asbestos Control Work Permit Request Form
- Remove drop cloth, clean with HEPA/wet methods or properly dispose of as contaminated.
- Properly decontaminate and return tools, equipment, and remaining materials to storage area.
- Remove lockout/tagout devices and restart HVAC/electrical system(s) (as applicable).
- Notify EHS/FAC or supervisor of completed work and return all documents.

Category: Job Specific—Job Specific Work Practice 8: Remove/Replace Filters from HVAC Units in ARTCC Attics Containing ACM

Scope: This work practice applies to changing filters in HVAC units (other than AHU 290) located in the Control Room attic.

Pre-Work Activities:

(Information is obtained from the EHS/FAC or designee.)

- Obtain a copy of Asbestos Work Permit and post at the job site.
- Work Notification(s) (as applicable).
- Review Schedule for Work.
- Review General Work Practices.
- Follow Work Permit air monitoring requirements (as applicable).
- Demarcate the area with Asbestos Warning signs and other barriers as necessary to prevent unauthorized access.

Job Specific Work Practice:

1. Seal Control Room diffusers. (see Job Specific Work Practice 11)
2. Access the attic area. Bring clean filters into the attic area in a clean plastic bag.
3. Wet the HVAC filters with amended water. Wet sufficiently so that the filter is saturated, but water is not running from the filter.
4. Remove filters from filter frame and place directly into a properly labeled disposal bag. Cut away exposed portions of roll type filters, and place directly into the disposal bag.
5. After all filters are removed, remove gloves and coveralls and dispose of with filters. Follow decontamination procedures. Double bag waste and dispose of as ACM waste.
6. HEPA vacuum and wet wipe the area where filters were installed and all accessible surfaces in the filter chamber.

Post Work Activities:

- Complete visual inspection and air monitoring work.
- Have EHS/FAC or designee complete the Post Work Activities section of the Asbestos Control Work Permit Request Form
- Remove drop cloth, clean with HEPA/wet methods or properly dispose of as contaminated.
- Properly decontaminate and return tools, equipment, and remaining materials to storage area.
- Remove lockout/tagout devices and restart HVAC/electrical system(s) (as applicable).
- Notify EHS/FAC or supervisor of completed work and return all documents.

Category: Job Specific—
Job Specific Work Practice 9: Remove/Replace Filters in HVAC Wall Units and Window Units in Areas Known to Contain Friable ACM

Scope: This work practice applies to the removal/replacement of filters from HVAC wall units and window units in areas where friable ACM is located.

Pre-Work Activities:

(Information is obtained from the EHS/FAC or designee.)

- Obtain a copy of Asbestos Work Permit and post at the job site.
- Work Notification(s) (as applicable).
- Review Schedule for Work.
- Review General Work Practices.
- Follow Work Permit air monitoring requirements (as applicable).
- Demarcate the area with Asbestos Warning signs and other barriers as necessary to prevent unauthorized access.

Job Specific Work Practice:

1. Place two layers of 6-mil polyethylene drop cloth under the work area. The drop cloth should be at least one foot square for each foot of height of the work, but no less than 6 foot by 6 foot.
2. Place tools, equipment, and materials needed onto the drop cloth.
3. Carefully access HVAC filters. Wet filters with amended water. Wet sufficiently so that filter is saturated, but water is not running from the filter.
4. Remove filters from filter frame and place directly into a properly labeled disposal bag. Cut away exposed portions of roll type filters, and place directly into the disposal bag.
5. After all filters are removed, take off gloves and dispose of them with filters. Double bag waste, dispose of as ACM waste.
6. HEPA vacuum and wet wipe the area where filters were installed and all accessible surfaces in filter chamber.

Post Work Activities:

- Complete visual inspection and air monitoring work.
- Have EHS/FAC or designee complete the Post Work Activities section of the Asbestos Control Work Permit Request Form
- Remove drop cloth, clean with HEPA/wet methods or properly dispose of as contaminated.
- Properly decontaminate and return tools, equipment, and remaining materials to storage area.
- Remove lockout/tagout devices and restart HVAC/electrical system(s) (as applicable).
- Notify EHS/FAC or supervisor of completed work and return all documents.

Category: Job Specific—
Job Specific Work Practice 10: Remove a Small Amount of ACM Surfacing Above a Ceiling

Scope: This work practice is used to remove up to one square foot of ACM/PACM fireproofing from structural steel above a non-ACM/PACM ceiling to attach a bracket for mounting equipment.

Pre-Work Activities:

(Information is obtained from the EHS/FAC or designee.)

- Obtain a copy of Asbestos Work Permit and post at the job site.
- Work Notification(s) (as applicable).
- Review Schedule for Work.
- Review General Work Practices and Job Specific Work Practices 1 and 2.
- Follow Work Permit air monitoring requirements (as applicable).
- Demarcate the area with Asbestos Warning signs and other barriers as necessary to prevent unauthorized access.

Job Specific Work Practice:

A negative exposure assessment must have been made by a competent person before this work practice is used. If a negative exposure assessment (NEA) has not been made, this work should be performed inside of a mini-enclosure. Refer to the work practice on mini-enclosure.

Note: Do not spray encapsulant on fireproofing or steel to which fireproofing is to be applied without specific authorization from your supervisor. An inappropriate encapsulant could result in the delamination of the material and impact the intended fire rating of the structure.

1. [Place a 6 mil polyethylene drop cloth under the work area. The drop cloth should be at least one foot square for each foot of ceiling height, but no less than 6 foot by 6 foot. For example, an eight-foot ceiling would require an 8 foot by 8 foot drop cloth.][Construct a mini-enclosure and position below the area to be accessed.]
2. Place tools, equipment, and materials needed [onto the drop cloth][inside of the mini-enclosure]. Prepare work area with drop cloth. Include a HEPA vacuum.
3. HEPA vacuum area above ceiling within reach from access hole.
4. Wet fireproofing that is to be removed with amended water. Allow water to soak through fireproofing to substrate. Apply more water as required to saturate fireproofing that is to be removed.
5. Scrape wetted fireproofing from steel. Hold a pan immediately under area being scraped to catch debris. If dry fireproofing is encountered, stop scraping, re-wet and allow water to soak in. Remove all wetted material. Promptly place removed fireproofing in a disposal bag. Spray pan with amended water and wet wipe to remove all fireproofing debris and residue.
6. After fireproofing is removed, wet surface of steel with amended water and wet wipe surface. Wet wipe until all residue is removed. After all residue is removed wet wipe surface with clean water without surfactant. Dispose of materials used to wet wipe surfaces as asbestos waste.
7. HEPA vacuum surface of steel and edge of remaining fireproofing.

8. Perform work as necessary to attach bracket or equipment to steel. Maintain the HEPA vacuum in operation with the nozzle above the ceiling and exhaust at the floor for the entire time that the ceiling is open and work is being done above the ceiling.
9. Replace removed fireproofing with new fireproofing patching material. Install fireproofing patch material in accordance with facility's fireproofing repair work practices, and manufacturer's instructions.
10. Carefully install item on bracket without disturbing fireproofing material.
11. While standing on the drop cloth, thoroughly wet wipe and HEPA vacuum the ladder and properly decontaminate all tools using the work practices in General Work Practice 10. Pass the ladder and tools [to a person standing off of the drop cloth.][through the airlock to a person standing on the other side.]

Post Work Activities:

- Complete visual inspection and air monitoring work.
- Have EHS/FAC or designee complete the Post Work Activities section of the Asbestos Control Work Permit Request Form
- Remove drop cloth, clean with HEPA/wet methods or properly dispose of as contaminated.
- Properly decontaminate and return tools, equipment, and remaining materials to storage area.
- Remove lockout/tagout devices and restart HVAC/electrical system(s) (as applicable).
- Notify EHS/FAC or supervisor of completed work and return all documents.

Category: Job Specific—
Job Specific Work Practice 11: Sealing ARTCC M1 Control Room Diffusers Using a Mechanical Personnel Lift

Scope: This work practice applies to sealing control room diffusers to prevent HVAC system contamination with asbestos fibers and migration of asbestos fibers during asbestos related work.

Pre-Work Activities:
(Information is obtained from the EHS/FAC or designee.)

- Obtain a copy of Asbestos Work Permit and post at the job site.
- Work Notification(s) (as applicable).
- Review Schedule for Work.
- Review General Work Practices and Job Specific Work Practice 2.
- Follow Work Permit air monitoring requirements (as applicable).
- Demarcate the area with Asbestos Warning signs and other barriers as necessary to prevent unauthorized access.

Job Specific Work Practice:

1. [Wet-wipe and HEPA vacuum][Power wash] the personnel lift prior to entering the control room.
2. Follow manufacturer's instructions for safe operation of the personnel lift including the use of appropriate PPE.
3. Prepare two layers of 6-mil polyethylene sheeting cut slightly (approximately 1-inch) larger than the diffuser. Attach the sheets to form one layer of 12-mil polyethylene.
4. Using 6-mil polyethylene sheeting, construct a mini-enclosure in side the personnel lift platform. The floor of the personnel lift platform must be covered with two layers of 6-mil polyethylene. Equip the mini-enclosure with a HEPA vacuum hose and a device to illuminate the work area.
5. Turn on the HEPA vacuum. The vacuum will operate for the duration of the operation.
6. Carefully position the personnel lift platform under the diffuser, taking care not to disturb the diffuser or nearby ceiling tiles.
7. Once the personnel lift is positioned correctly, carefully HEPA vacuum the outer edges of the diffuser. Do not contact the ceiling or diffuser.
8. After HEPA vacuuming is complete, spray the outer edges of the polyethylene sheeting with a spray adhesive and carefully apply over the diffuser opening. Gently run a finger over the edges of the diffuser to ensure a good seal.
9. Carefully apply duct tape over the edges of the polyethylene. The duct tape seal shall be made to the flat, horizontal edge of the diffuser.
10. After the necessary work is performed, carefully remove polyethylene sheeting and duct tape and dispose as asbestos-contaminated waste. Waste materials shall be placed in properly labeled disposal bags while inside the personnel lift platform mini-enclosure.

Post Work Activities:

- Complete visual inspection and air monitoring work.
- Have EHS/FAC or designee complete the Post Work Activities section of the Asbestos Control Work Permit Request Form
- Remove drop cloth, clean with HEPA/wet methods or properly dispose of as contaminated.
- Properly decontaminate and return tools, equipment, and remaining materials to storage area.
- Remove lockout/tagout devices and restart HVAC/electrical system(s) (as applicable).
- Notify EHS/FAC or supervisor of completed work and return all documents.

Category: Job Specific—
Job Specific Work Practice 12: Repair or Replace an Item in or on a Surface Finished with ACM/PACM

Scope: This work practice is used for asbestos O&M activities to repair or replace an item located in or on a surface finished with ACM/PACM.

Pre-Work Activities:

(Information is obtained from the EHS/FAC or designee.)

- Obtain a copy of Asbestos Work Permit and post at the job site.
- Work Notification(s) (as applicable).
- Review Schedule for Work.
- Review General Work Practices and Job Specific Work Practice 2.
- Follow Work Permit air monitoring requirements (as applicable).
- Demarcate the area with Asbestos Warning signs and other barriers as necessary to prevent unauthorized access.

Job Specific Work Practice:

An example item is a light fixture that is recessed in a ceiling finished with ACM/PACM acoustical plaster, where the light fixture has an escutcheon so that it can be unfastened and dropped out.

A negative exposure assessment (NEA) must have been made by a competent person before this work practice is used. If a NEA has not been made, this work should be performed inside of a mini-enclosure. Refer to job specific work practice 2 on how to construct and use a mini-enclosure.

1. [Place 6 mil polyethylene drop cloth under the work area. The drop cloth should be at least one foot square for each foot of ceiling height, but no less than 6 foot by 6 foot. For example, an eight-foot ceiling would require an 8 foot by 8 foot drop cloth.][Construct a mini-enclosure and position below the area to be accessed.]
2. Place tools, equipment, and materials needed [onto the drop cloth][inside of the mini-enclosure] Prepare work area with drop cloth. Include a HEPA vacuum.
3. Lightly mist area of ACM acoustical plaster around frame of light fixture using garden sprayer containing amended water and allow water to soak in for several minutes.
4. Completely remove screws holding light fixture in place, while holding fixture so that it does not move.
5. Gradually lower one side of fixture while removing any loose ceiling material with a HEPA vacuum. Lower other side while continuing with HEPA vacuum. Use HEPA vacuum to remove any ceiling material as fixture is lowered from the ceiling. Disconnect wire from fixture and coil above ceiling so that it does not contact the acoustical plaster.
6. HEPA vacuum and then wet wipe all surfaces of the light fixture.
7. Collect any surfacing debris from repair/replacement work using HEPA vacuum.
8. While standing on the drop cloth, thoroughly wet wipe and HEPA vacuum the ladder and properly decontaminate all tools using proper work practice. Pass the ladder and tools [to a person standing off the drop cloth.][through the airlock to a person standing on the other side.]

Post Work Activities:

- Complete visual inspection and air monitoring work.
- Have EHS/FAC or designee complete the Post Work Activities section of the Asbestos Control Work Permit Request Form
- Remove drop cloth, clean with HEPA/wet methods or properly dispose of as contaminated.
- Properly decontaminate and return tools, equipment, and remaining materials to storage area.
- Remove lockout/tagout devices and restart HVAC/electrical system(s) (as applicable).
- Notify EHS/FAC or supervisor of completed work and return all documents.

Category: General—
Job Specific Work Practice 13: Working From a Ladder Above Ceilings Where Surfacing ACM/PACM is Present

Scope: This work practice applies to all OSHA Class III and IV asbestos work involving access above non-ACM ceiling panels into plenum spaces containing surfacing ACM/PACM. For access above ceiling panels, this work should be performed inside a mini-enclosure.

Pre-Work Activities:

(Information is obtained from the EHS/FAC or designee.)

- Obtain a copy of Asbestos Work Permit and post at the job site.
- Work Notification(s) (as applicable).
- Review Schedule for Work.
- Review General Work Practices and Job Specific Work Practice 2.
- Follow Work Permit air monitoring requirements (as applicable).
- Demarcate the area with Asbestos Warning signs and other barriers as necessary to prevent unauthorized access.

Job Specific Work Practice:

1. [Place a 6 mil polyethylene drop cloth under the work area. The drop cloth should be at least one foot square for each foot of ceiling height, but no less than 6 foot by 6 foot. For example, an eight-foot ceiling would require an 8 foot by 8 foot drop cloth.][Construct a mini-enclosure and position below the area to be accessed.]
2. Place tools, equipment, and materials needed [onto the drop cloth][inside the mini-enclosure].
3. HEPA vacuum around edges of all panels to be removed.
4. While holding the nozzle of the HEPA vacuum near the edge of the panel, slowly lift one edge of the ceiling panel. Immediately HEPA vacuum the space at the lifted edge. Lift the entire panel straight up and HEPA vacuum all four sides.
5. Place panel on top of adjacent ceiling.
6. Note that the operation of the HEPA vacuum is intended to clean the air in the location of the work. As such, the nozzle should be kept above the ceiling as much as possible and the canister on the floor.
7. Climb to a position that permits access to the top of the ceiling adjacent to the removed panel.
8. Working in the space above the ceiling, HEPA vacuum both sides of the ceiling panel first removed and hand it down into a 6 mil polyethylene bag for storage.
9. Remove loose material hanging from the friable ACM with the suction from the HEPA vacuum.
10. Pass the nozzle of the operating HEPA vacuum through the air between ACM and top of ceiling.
11. HEPA vacuum the tops of all ceiling panels that are within reach.
12. Carefully HEPA vacuum the crack between the suspension system and ceiling panels from the top for all ceiling panels within reach.
13. Remove ceiling panels as required while constantly HEPA vacuuming all four edges of the panel and the suspension system.

14. Working in the space above the ceiling, HEPA vacuum both sides of each panel removed and hand each down into a 12-mil polyethylene bag.
15. Maintain the HEPA vacuum in operation with the nozzle above the ceiling and exhaust at the floor for the entire time that the ceiling is open and work is being done above the ceiling.
16. When the work is complete, replace ceiling panels.
17. HEPA vacuum the worker's head, arms, and shoulders before climbing down from the ceiling.
18. HEPA vacuum the ladder while climbing down.
19. While standing on the drop cloth, thoroughly wet wipe and HEPA vacuum the ladder and properly decontaminate all tools using proper work practice. Pass the ladder and tools [to a person standing off the drop cloth.][through the airlock to a person standing on the other side.]

Post Work Activities:

- Complete visual inspection and air monitoring work.
- Have EHS/FAC or designee complete the Post Work Activities section of the Asbestos Control Work Permit Request Form
- Remove drop cloth, clean with HEPA/wet methods or properly dispose of as contaminated.
- Properly decontaminate and return tools, equipment, and remaining materials to storage area.
- Remove lockout/tagout devices and restart HVAC/electrical system(s) (as applicable).
- Notify EHS/FAC or supervisor of completed work and return all documents.

Category: Job Specific—
Job Specific Work Practice 14: Working From a Mechanical Personnel Lift Above Ceilings Where Surfacing ACM is Present in ARTCC (Control Room)

Scope: This work practice applies to all OSHA Class III and IV asbestos work involving access above suspended ceilings into plenum spaces containing surfacing ACM in ARTCC Control Rooms.

Pre-Work Activities:

(Information is obtained from the EHS/FAC or designee.)

- Obtain a copy of Asbestos Work Permit and post at the job site.
- Work Notification(s) (as applicable).
- Review Schedule for Work.
- Review General Work Practices and Job Specific Work Practice 2.
- Follow Work Permit air monitoring requirements (as applicable).
- Demarcate the area with Asbestos Warning signs and other barriers as necessary to prevent unauthorized access.

Job Specific Work Practice:

1. Obtain an approved Work Permit and post at the work site, prior to the start of work.
2. Work will be conducted, whenever possible, during the operational times with the least amount of employee presence.
3. Follow instructions in the Work Permit regarding air monitoring and required personal protective equipment.
4. Demarcate the area with Asbestos Warning signs and other barriers as necessary to prevent unauthorized access.
5. Personnel lift may be used to perform this work. Following set-up of the personnel lift or mini-enclosure, proceed as follows:
   a. Construct a personnel lift platform mini-enclosure as described in Job Specific Work Practice 11.
   b. HEPA vacuum around edges of all panels to be removed.
   c. While holding the nozzle of the HEPA vacuum near the edge of the panel, slowly lift one edge of the ceiling panel. Immediately HEPA vacuum the space at the lifted edge. Lift the entire panel straight up and HEPA vacuum all four sides.
   d. Place panel on top of adjacent ceiling.
   e. Note that the operation of the HEPA vacuum is intended to provide negative air pressure in the enclosure. The nozzle should be kept above the ceiling as much as possible and the canister on the floor or personnel lift platform.
   f. Climb to a position that permits access to the top of the ceiling adjacent to the removed panel.
   g. Working in the space above the ceiling, HEPA vacuum both sides of the ceiling panel first removed and place into a 6 mil polyethylene bag for storage [hand it down] [store bagged panels above ceiling].
   h. Remove loose material hanging from the friable ACM with the suction from the HEPA vacuum.
   i. Pass the nozzle of the operating HEPA vacuum through the air between ACM and top of ceiling.
   j. HEPA vacuum the tops of all ceiling panels that are in reach.
   k. Carefully HEPA vacuum the crack between the suspension system and ceiling panels from the top for all ceiling panels within reach.

l. Remove ceiling panels as required while constantly HEPA vacuuming all four edges of panel and the suspension system.

m. Working in the space above the ceiling, HEPA vacuum both sides of each panel removed and hand each down into a 6-mil polyethylene bag.

n. Maintain the HEPA vacuum in operation with the nozzle above the ceiling and exhaust at the floor for the entire time that the ceiling is open and work is being done above the ceiling.

o. When the work is complete, replace ceiling panels.

p. Properly decontaminate all tools using the work practices.

q. HEPA vacuum the worker's head, arms, and shoulders before climbing down from the ceiling.

r. HEPA vacuum the personnel lift platform.

Post Work Activities:

- Complete visual inspection and air monitoring work.
- Have EHS/FAC or designee complete the Post Work Activities section of the Asbestos Control Work Permit Request Form
- Remove drop cloth, clean with HEPA/wet methods or properly dispose of as contaminated.
- Properly decontaminate and return tools, equipment, and remaining materials to storage area.
- Remove lockout/tagout devices and restart HVAC/electrical system(s) (as applicable).
- Notify EHS/FAC or supervisor of completed work and return all documents.

Category: Job Specific
Job Specific Work Practice 15: Replace Bulbs in Light Fixtures Attached to Surfacing ACM

Scope: This work practice applies to activities where light bulbs will be changed in fixtures attached to, or in close proximity to, surfacing ACM.

Pre-Work Activities:

(Information is obtained from the EHS/FAC or designee.)

- Obtain a copy of Asbestos Work Permit and post at the job site.
- Work Notification(s) (as applicable).
- Review Schedule for Work.
- Review General Work Practices (special emphasis on General Work Practice 2).
- Follow Work Permit air monitoring requirements (as applicable).
- Demarcate the area with Asbestos Warning signs and other barriers as necessary to prevent unauthorized access.

Job Specific Work Practice:

1. Place two-layers of 6-mil polyethylene drop cloth under the work area.
2. The drop cloth should be at least one foot square for each foot of ceiling height, but no less than 6 foot by 6 foot. For example, an eight-foot ceiling would require an 8ft x 8ft drop cloth.
3. Carefully replace light bulbs without jarring the fixture or releasing debris. Clean up any dust or debris generated using a HEPA vacuum. Clean up any dust or debris.
4. Properly dispose of wastes generated by the work.

Post Work Activities:

- Complete visual inspection and air monitoring work.
- Have EHS/FAC or designee complete the Post Work Activities section of the Asbestos Control Work Permit Request Form
- Remove drop cloth, clean with HEPA/wet methods or properly dispose of as contaminated.
- Properly decontaminate and return tools, equipment, and remaining materials to storage area.
- Remove lockout/tagout devices and restart HVAC/electrical system(s) (as applicable).
- Notify EHS/FAC or supervisor of completed work and return all documents.

Category: Job Specific—
Job Specific Work Practice 16: Drilling Asbestos Containing Floor Coverings and Mastics

Scope: This work practice applies to activities that involve drilling through asbestos containing floor coverings and mastics.

Pre-Work Activities:

(Information is obtained from the EHS/FAC or designee.)

- Obtain a copy of Asbestos Work Permit and post at the job site.
- Work Notification(s) (as applicable).
- Review Schedule for Work.
- Review General Work Practices.
- Follow Work Permit air monitoring requirements (as applicable).
- Demarcate the area with Asbestos Warning signs and other barriers as necessary to prevent unauthorized access.

Job Specific Work Practice:

1. Clean the area to be drilled using wet methods or a HEPA vacuum.
2. Mark the drilling location and position drill.
3. Use a HEPA-equipped drill or attach/hold the nozzle of a HEPA vacuum near the drilling location while drilling. Keep the HEPA vacuum running throughout the work.
4. Use one of the following wetting/control methods to prevent generation of airborne asbestos fibers:
    - Adequately wet the area to be drilled throughout the work. Keep water away from electrical cords and equipment.
    - For small holes (less than ¼ inch), place wet sponges on either side of the drilling location and drill the hole through the sponges.
    - Shaving cream can be sprayed on the area to be drilled. Shaving cream must be disposed of as ACM.
5. Operate the drill at low speed.
6. Wet wipe the floor and drill bit and properly decontaminate all tools.
7. Properly dispose of all towels and drilling debris.

Post Work Activities:

- Complete visual inspection and air monitoring work.
- Have EHS/FAC or designee complete the Post Work Activities section of the Asbestos Control Work Permit Request Form
- Remove drop cloth, clean with HEPA/wet methods or properly dispose of as contaminated.
- Properly decontaminate and return tools, equipment, and remaining materials to storage area.
- Remove lockout/tagout devices and restart HVAC/electrical system(s) (as applicable).

- Notify EHS/FAC or supervisor of completed work and return all documents.

Category: Job Specific—
Job Specific Work Practice 17: Removal of Asbestos-Containing Floor Tiles and Mastic

Scope: This work practice applies to all OSHA Class III asbestos work involving removal of floor tiles and mastics in quantities not exceeding that which will fit into a single 60 inch by 60 inch disposal bag.

Pre-Work Activities:

(Information is obtained from the EHS/FAC or designee.)

- Obtain a copy of Asbestos Work Permit and post at the job site.
- Work Notification(s) (as applicable).
- Review Schedule for Work.
- Review General Work Practices.
- Follow Work Permit air monitoring requirements (as applicable).
- Demarcate the area with Asbestos Warning signs and other barriers as necessary to prevent unauthorized access.

Job Specific Work Practice:

1. Pre-clean the work area using wet methods and a HEPA vacuum before starting work. Keep the HEPA vacuum running throughout the work, vacuuming any dust and debris generated. Place duct tape over the nozzle when the work is complete.
2. Use the following procedures to remove floor tiles:
3. Floor tiles must be wetted (misted with a garden sprayer) before actual removal begins, unless heat will be used to remove tiles.
4. Start removal by carefully wedging a wall scraper in the seam of two adjoining tiles and gradually forcing the edge of one of the tiles up and away from the floor. Continue to force the balance of the tile up by working the scraper beneath the tile. Exert both a forward pressure and a twisting action on the blade to promote release of the tile from the adhesive and the floor.
5. When the tile is removed, place it into a properly labeled disposal bag or container.
6. Force the scraper through tightly-adhered areas by striking the scraper handle with a hammer using blows of moderate force while maintaining the scraper at a 25 to 30 degree angle to the floor. The Resilient Floor Covering institute manufacturers' work practices recommend the use of safety goggles during this work.
7. Continue to wet (mist) the tiles throughout the procedure.
8. All efforts should be made to remove tiles intact, although some breakage of tiles is unavoidable.
9. If the procedure above is inadequate to loosen tiles, use a hot air gun or radiant heat source to soften the adhesive. Remove tiles by hand or by using a scraper. The Resilient Floor Covering institute manufacturers work practices recommend that the hot air gun or radiant heat source, tiles and adhesive be carefully handled to avoid burns, and that heated tiles and adhesive be handled only with suitable glove protection for hands. Caution: Over-heating resilient tile might produce harmful vapors, and a respirator with organic vapor cartridges might be needed.
10. Properly decontaminate all tools.
11. Properly dispose of tiles and debris.
12. Wet scrape residual adhesive from floor.

- **Wet Scrape Residual Adhesive:** After removing tile, always wet scrape the residual adhesive to remove any loose material. Use the following procedure so that no ridges or puddles are evident on the floor and that at the most a thin, smooth, film residue remains on the floor or use the following procedure so that no ridges or puddles are evident on the floor:
    - Moisten the adhesive with amended water. Wet scrape with a stiff-bladed wall or floor scraper removing ridges and any loose adhesive.
    - Wet vacuum standing water with wet/dry HEPA vacuum.
    - Continue the above steps until a thin, smooth film remains.
    - Properly decontaminate all tools.
    - Properly dispose of all waste generated during the work.
- **Wet remove residue of adhesive from concrete with wet sand and rubbing stones:** If work that could disturb the adhesive residue, such as drilling through the floor is going to occur, completely remove residue of adhesive at the point of drilling or use an alternative procedure. If residue cannot be completely removed, use an alternative procedure.
    - Place a small amount of cutting sand (enough to cover area of removed tile) into a container, add amended water mixed to dampen the sand (approximately 20 pounds (9.07 kg) of sand to ½ gallon (1.89 liters) amended water).
    - Place sand over the area of removed tile and wet remove the existing adhesive residue with a hand held rubbing stone. The sand and subfloor must be kept continuously wet.
    - Occasionally push away cutting sand from the subfloor with a wall or floor scraper to check for complete removal.
    - Wet-scrape sand into a pile using a stiff-bladed floor or wall scraper and place sand and adhesive residue in a properly labeled disposal bag.
    - Rinse area with water using a hand sprayer. Avoid getting sand on footwear. Worker's footwear should also be rinsed and cleaned if necessary.
    - Wet-vacuum standing water with a wet/dry HEPA vacuum.
    - Continue with the above steps until adhesive is completely removed.
    - Allow the subfloor to dry and vacuum any remaining dirt or sand using a HEPA vacuum. Do not brush or dry sweep the area.
    - Properly decontaminate all tools.
- **Wet remove residue of adhesive from concrete with a commercially available removal solution:** Prior to using a commercially available removal solution ensure the compatibility of the product with any replacement material. Also, as general rule, an odorless or low-odor, low hazard solvent should be used is possible. If work that could disturb the adhesive residue, such as drilling through the floor, is going to occur, completely remove residue of adhesive left after removal of resilient floor tile using either the procedure in the previous section or the following procedure:
    - Apply the removal solution onto the residual adhesive with a hand sprayer or rag over the area of removed tile. Use enough removal solution to ensure that the area is thoroughly wet. Allow the area to soak for 5 to 10 minutes. Remove the adhesive by hand scrubbing with a piece of a black floor pad (or equivalent). The subfloor must be kept continuously wet. Periodically check the area below the work area to prevent the slurry from leaking through any cracks in the floor.
    - Occasionally push away the adhesive slurry from the subfloor with a wall or floor scraper to check for complete removal. Continue to scrub the floor with the black pad, in the same area until the concrete subfloor is cleaned to the desired degree.
    - Wet HEPA vacuum the adhesive slurry. When the HEPA vacuum is full, place a commercially suitable water absorbent into the HEPA container until the adhesive slurry is absorbed.

- Rinse area with water using a hand sprayer or mop. Avoid getting remover on footwear. Worker's footwear should also be rinsed and cleaned if necessary.
- Wet-vacuum standing water using a HEPA vacuum.
- Continue with the above steps until adhesive is completely removed.
- Allow subfloor to dry and vacuum using a HEPA vacuum. Do not brush or dry sweep.
- Properly dispose of all waste.

Post Work Activities:

- Complete visual inspection and air monitoring work.
- Have EHS/FAC or designee complete the Post Work Activities section of the Asbestos Control Work Permit Request Form
- Remove drop cloth, clean with HEPA/wet methods or properly dispose of as contaminated.
- Properly decontaminate and return tools, equipment, and remaining materials to storage area.
- Remove lockout/tagout devices and restart HVAC/electrical system(s) (as applicable).
- Notify EHS/FAC or supervisor of completed work and return all documents.

Category: Job Specific—
Job Specific Work Practice 18: Remove Carpet Over Resilient Asbestos Flooring

Scope: This work practice describes the procedures to be used for removing a small area of carpet installed over a resilient asbestos floor.

Pre-Work Activities:

(Information is obtained from the EHS/FAC or designee.)

- Obtain a copy of Asbestos Work Permit and post at the job site.
- Work Notification(s) (as applicable).
- Review Schedule for Work.
- Review General Work Practices.
- Follow Work Permit air monitoring requirements (as applicable).
- Demarcate the area with Asbestos Warning signs and other barriers as necessary to prevent unauthorized access.

Job Specific Work Practice:

1. Find a seam or corner wherever carpet removal can begin. If no seams or corners exist, a cut will need to be made around the piece to be removed. Wet the areas that need to be cut using amended water. Cut carpet using utility knife with a new blade.
2. Pry up corner or seam of carpet using scraper. Pull back a section large enough (approximately one square foot [0.1 square meters]) to hang onto while removing carpet. Adequately wet flooring and adhesive exposed.
3. Pull carpeting back slowly and spray amended water on flooring and adhesive as they are exposed. Remove carpet in pieces no larger than approximately 200 square feet (18.6 square meters).
4. If carpet and adhesive are non-ACM, roll up carpet and dispose of as non-ACM waste. If portions of asbestos-containing flooring remain attached to carpet backing, dispose of the affected section of carpet as ACM ensure not to exceed [160 square feet of effected carpet as ACM.] [insert local or state requirement.] Loose vinyl asbestos flooring shall be disposed of in disposal bags or containers.
5. HEPA vacuum surface of flooring after carpet is removed. If residual asbestos containing adhesive or residual felt backing needs to be removed, follow wet-scraping procedures. Allow substrate to dry before installing new flooring.
6. Perform clean up and tear down steps.

Post Work Activities:

- Complete visual inspection and air monitoring work.
- Have EHS/FAC or designee complete the Post Work Activities section of the Asbestos Control Work Permit Request Form
- Remove drop cloth, clean with HEPA/wet methods or properly dispose of as contaminated.
- Properly decontaminate and return tools, equipment, and remaining materials to storage area.
- Remove lockout/tagout devices and restart HVAC/electrical system(s) (as applicable).
- Notify EHS/FAC or supervisor of completed work and return all documents.

Category: Job Specific—
Job Specific Work Practice 19: Cleaning, Stripping, Buffing of Resilient Asbestos Flooring

Scope: This work practice covers the cleaning, stripping, buffing of resilient asbestos flooring. Any loose or damaged flooring should be repaired or replaced prior to beginning work.

Pre-Work Activities:

(Information is obtained from the EHS/FAC or designee.)

- Obtain a copy of Asbestos Work Permit and post at the job site.
- Work Notification(s) (as applicable).
- Review Schedule for Work.
- Review General Work Practices.
- Follow Work Permit air monitoring requirements (as applicable).
- Demarcate the area with Asbestos Warning signs and other barriers as necessary to prevent unauthorized access.

Cleaning

1. Place tools, equipment and materials needed in work area. Place walk-off mats to prevent tracking of scrubbing solution to other areas. Position "Caution - Wet Floor" signs.
2. Install polyethylene sheet on adjoining floors for protection from any spilled cleaning solution.
3. Mix scrubbing chemical with water as recommended by manufacturer and apply liberal amount (do not flood) using mop. Allow to soak for amount of time recommended by manufacturer. Keep floor adequately wet by reapplying cleaning solution if drying occurs. Work small areas at a time.
4. Using the floor scrubbing speed, clean floor to remove embedded dirt and surface marks; use manufacturer's recommended pads and operating requirements.
5. Remove spent scrubbing solution with wet vacuum or mop.
6. Rinse area using clean mop and clean rinse water. Remove water with wet vacuum or mop. Damp mop area to clean up any remaining water or streaks.
7. Perform applicable steps to complete work.
8. After wax or finish has softened, strip flooring using least abrasive pad and low speed setting (300 RPM maximum). Keep floor adequately wet during machine operation. Do not overstrip. Stop stripping when the old wax or finish is removed. Work small areas at a time.
9. Remove dirty stripping solution with wet vacuum or "strip" mop.
10. With "rinse" mop, apply liberal amount of clean water to area stripped and remove water with wet vacuum or mop. Repeat rinse procedures.
11. If some spots of wax or finish remain, restrip those areas.
12. If new flooring will be installed over the stripped floor, do not apply wax or finish. When applying new wax or finish, do so according to manufacturer's recommendations.
13. Perform clean up and tear down steps to complete work.

Stripping

1. Place tools, equipment and materials needed in work area. Place walk-off mats where required to prevent tracking of stripping solution to other areas. Position "Caution - Wet Floor" signs.
2. After proper mixing of stripping chemical, adequately wet floor by mop applying liberal amounts of the solution. Allow chemical to soak for amount of time recommended by manufacturer. If areas become dry, reapply solution to keep floor adequately wet.

Wet Buffing

1. Spray buffing compound, appropriately diluted, compatible polish and restorer chemical solution.
2. Place tools, equipment and materials needed in work area. Position “Caution-Wet Floor” signs.
3. Pick up any large loose debris and place into disposal bags. Using scraper and water, remove all foreign matter from the finished surface (gum, tar, stickers, etc.).
4. Spot or damp mop to remove stains and spills. Mix chemical cleaner or restorer with water and apply according to manufacturers recommendations. Spot or damp mop to remove stains and spills. If dry buffing will be performed, apply restorer chemical as required.
5. Allow floor to dry thoroughly.
6. Spray or dry buff as appropriate:
    - To spray-buff, spray small area with spray-buff solution and buff using manufacturer's recommended pad or brush at recommended speed as revolutions per minute (RPM). Repeat procedure until entire area is spray-buffed.
    - To dry buff, buff or dry burnish with manufacturer's recommended pad or brush at recommended RPM.

Post Work Activities:

- Complete visual inspection and air monitoring work.
- Have EHS/FAC or designee complete the Post Work Activities section of the Asbestos Control Work Permit Request Form
- Remove drop cloth, clean with HEPA/wet methods or properly dispose of as contaminated.
- Properly decontaminate and return tools, equipment, and remaining materials to storage area.
- Remove lockout/tagout devices and restart HVAC/electrical system(s) (as applicable).
- Notify EHS/FAC or supervisor of completed work and return all documents.

Category: Job Specific—
Job Specific Work Practice 20: Emptying and Changing Filter in HEPA Vacuum or HEPA Fan Unit

Scope: This work practice applies to the procedures for changing the bag/filter in a HEPA vacuum or fan unit. The manufacturer of this equipment also provides instructions on filter changing. These instructions should be consulted and used in conjunction with this work practice.

Pre-Work Activities:

(Information is obtained from the EHS/FAC or designee.)

- Obtain a copy of Asbestos Work Permit and post at the job site.
- Work Notification(s) (as applicable).
- Review Schedule for Work.
- Review General Work Practices and Job Specific Work Practice 2.
- Follow Work Permit air monitoring requirements (as applicable).
- Demarcate the area with Asbestos Warning signs and other barriers as necessary to prevent unauthorized access.

Job Specific Work Practice:

1. Erect mini-enclosure and place the HEPA vacuum or fan unit inside the mini-enclosure. Use HEPA filtration with the mini-enclosure system where possible.
2. Place tools, equipment and materials inside enclosure.
3. Enter the mini-enclosure and access the filter/bag.
4. Wet the filter to be removed and place in disposal bag.
5. HEPA vacuum or wet wipe the filter/bag cavity.
6. Install new filter/bag and reassemble the unit
7. Tear down the mini-enclosure.

Post Work Activities:

- Complete visual inspection and air monitoring work.
- Have EHS/FAC or designee complete the Post Work Activities section of the Asbestos Control Work Permit Request Form
- Remove drop cloth, clean with HEPA/wet methods or properly dispose of as contaminated.
- Properly decontaminate and return tools, equipment, and remaining materials to storage area.
- Remove lockout/tagout devices and restart HVAC/electrical system(s) (as applicable).
- Notify EHS/FAC or supervisor of completed work and return all documents.

Category: Job Specific—
Job Specific Work Practice 21: Cut/Drill Asbestos Cement Panels or Wallboard

Scope: This work practice applies to activities involving cutting or drilling of asbestos cement panels or wallboard. If greater than 3 square feet of asbestos debris will be created by the work, a licensed asbestos abatement contractor must remove the material prior to work being performed.

Pre-Work Activities:

(Information is obtained from the EHS/FAC or designee.)

- Obtain a copy of Asbestos Work Permit and post at the job site.
- Work Notification(s) (as applicable).
- Review Schedule for Work.
- Review General Work Practices.
- Follow Work Permit air monitoring requirements (as applicable).
- Demarcate the area with Asbestos Warning signs and other barriers as necessary to prevent unauthorized access.

Job Specific Work Practice:

1. Place a two-layer 12-mil polyethylene drop cloth under the work area. The drop cloth should be at least one foot square for each foot of height of the work, but no less than 6 foot by 6 foot.
2. Place tools, equipment and materials needed onto the drop cloth.
3. If accessible, install a drop cloth on the back side of the panel below where hole will penetrate through panel.
4. Place tools, equipment, and materials needed onto the drop cloth.
5. If possible, adequately wet both sides of area to be drilled using garden sprayer with amended water. Keep water away from any electrical cords or equipment.
6. [Cut][Drill] hole using [hand drill or power drill][hand saw or circular saw] with operating HEPA vacuum attached. Wet the area using amended water.
7. As options, the following control methods may be used:
   - For small holes, a wet sponge can be placed on both sides of the surface and the hole cut or drilled through the sponges.
   - A HEPA vacuum hose may be used near the bit/blade of a non-HEPA equipped drill/saw, and on the back side if accessible.
   - Shaving cream can be sprayed on both sides of the cutting/drilling area to control dust and debris. Shaving cream must be wiped up and disposed of as ACM.
8. If the reverse side was enclosed, insert the wand of the garden sprayer into the reverse side of the enclosure and wet debris with amended water. Remove the reverse side of the enclosure and place into a properly labeled disposal bag. Wet wipe surfaces that were exposed inside the reverse side of the enclosure.
9. Properly dispose of wastes generated during the work.

Post Work Activities:

- Complete visual inspection and air monitoring work.
- Have EHS/FAC or designee complete the Post Work Activities section of the Asbestos Control Work Permit Request Form
- Remove drop cloth, clean with HEPA/wet methods or properly dispose of as contaminated.
- Properly decontaminate and return tools, equipment, and remaining materials to storage area.
- Remove lockout/tagout devices and restart HVAC/electrical system(s) (as applicable).
- Notify EHS/FAC or supervisor of completed work and return all documents.

Category: Job Specific—
Job Specific Work Practice 22: Cut or Drill Asbestos-Containing Drywall, Plaster or Drywall Compound.

Scope: This work practice involves the cutting or drilling into asbestos drywall or plaster. It also covers joint compounds and tape, which can be impacted during these operations.

Pre-Work Activities:

(Information is obtained from the EHS/FAC or designee.)

- Obtain a copy of Asbestos Work Permit and post at the job site.
- Work Notification(s) (as applicable).
- Review Schedule for Work.
- Review General Work Practices.
- Follow Work Permit air monitoring requirements (as applicable).
- Demarcate the area with Asbestos Warning signs and other barriers as necessary to prevent unauthorized access.

Job Specific Work Practice:

1. Place a 6 mil polyethylene drop cloth under the work area, on both sides if possible.
2. Place tools, materials and equipment on the drop cloth.
3. Mark area to be cut or drilled.
4. Adequately wet the area impacted with amended water.
5. Cut the substrate using a utility knife, other hand tools or power tools that are equipped with a HEPA filtered dust collector. Keep the area wet during the cutting/drilling process.
6. Remove the cut ACM material and place in bag for disposal.
7. HEPA vacuum the hole cut area and any visible dust or debris generated by the operation.

Post Work Activities:

- Complete visual inspection and air monitoring work.
- Have EHS/FAC or designee complete the Post Work Activities section of the Asbestos Control Work Permit Request Form
- Remove drop cloth, clean with HEPA/wet methods or properly dispose of as contaminated.
- Properly decontaminate and return tools, equipment, and remaining materials to storage area.
- Remove lockout/tagout devices and restart HVAC/electrical system(s) (as applicable).
- Notify EHS/FAC or supervisor of completed work and return all documents.

Category: Job Specific—
Job Specific Work Practice 23: Clean Up Debris

Scope: This work practice applies to activities involving clean up of ACM debris. This work practice should be used in conjunction with related work practices for debris clean up.

Pre-Work Activities:

(Information is obtained from the EHS/FAC or designee.)

- Obtain a copy of Asbestos Work Permit and post at the job site.
- Work Notification(s) (as applicable).
- Review Schedule for Work.
- Review General Work Practices.
- Follow Work Permit air monitoring requirements (as applicable).
- Demarcate the area with Asbestos Warning signs and other barriers as necessary to prevent unauthorized access.

Job Specific Work Practice:

1. Remove asbestos-containing debris using the following sequence:
   - Shut down all ventilation into the room.
   - Start the HEPA vacuum before entering the area.
   - Use the HEPA vacuum to clean a path at least 6 feet (1.83 m) wide from the entry point of the work area to the site of the fallen material.
   - Remove all small debris with the HEPA vacuum.
   - Remove any loose debris from the surface of larger pieces of ACM with a HEPA vacuum. Mist surface of pieces with amended water.
   - Pick up such pieces and place in a properly labeled 6 mil polyethylene disposal bag. Place pieces in the bag without dropping to avoid unnecessary disturbance and release of material. Thoroughly wet debris in bag with amended water as it is collected.
   - Remove all remaining visible debris with HEPA vacuum.
   - HEPA vacuum an area 3 feet (0.91 m) beyond the location in which any visible debris was found.
   - Workers must vacuum beginning at the point farthest away from the [entrance][decon][stepoff pad].
   - Wet wipe any hard surfaces or objects in the area.
   - Clean and decontaminate objects in the vicinity of debris.
   - Repair any damaged ACM from which the debris was generated following appropriate work practices.
2. Properly dispose of wastes generated during the work.

Post Work Activities:

- Complete visual inspection and air monitoring work.
- Have EHS/FAC or designee complete the Post Work Activities section of the Asbestos Control Work Permit Request Form
- Remove drop cloth, clean with HEPA/wet methods or properly dispose of as contaminated.
- Properly decontaminate and return tools, equipment, and remaining materials to storage area.

- Remove lockout/tagout devices and restart HVAC/electrical system(s) (as applicable).
- Notify EHS/FAC or supervisor of completed work and return all documents.

Category: Job Specific—
Job Specific Work Practice 24: Decontamination of Furnishings

Scope: This work practice applies to decontamination of furnishing and other objects that may be contaminated with asbestos. EPA studies have shown that porous fabrics such as curtains and carpets normally cannot be adequately decontaminated. Industry standard practice is to dispose of these contaminated fabrics as asbestos wastes. The [FAC/EHS Office] should be consulted to evaluate the severity and extent of contamination on a case-by-case basis.

Pre-Work Activities:

(Information is obtained from the EHS/FAC or designee.)

- Obtain a copy of Asbestos Work Permit and post at the job site.
- Work Notification(s) (as applicable).
- Review Schedule for Work.
- Review General Work Practices.
- Follow Work Permit air monitoring requirements (as applicable).
- Demarcate the area with Asbestos Warning signs and other barriers as necessary to prevent unauthorized access.

Job Specific Work Practice:

1. Clean and decontaminate objects in the vicinity of debris using the following procedure:
   - Perform all work of decontaminating objects wherever possible on a 6 mil polyethylene drop cloth.
   - HEPA vacuum all surfaces of the object and immediate area before moving the object.
   - If possible, pick-up the object and HEPA vacuum all surfaces.
   - Wet wipe the object using amended water.
   - Decontaminate the area where the object was located by HEPA vacuuming twice, in two perpendicular directions. Wet clean if necessary to remove any debris.
2. Return the object to its original location.

Post Work Activities:

- Complete visual inspection and air monitoring work.
- Have EHS/FAC or designee complete the Post Work Activities section of the Asbestos Control Work Permit Request Form
- Remove drop cloth, clean with HEPA/wet methods or properly dispose of as contaminated.
- Properly decontaminate and return tools, equipment, and remaining materials to storage area.
- Remove lockout/tagout devices and restart HVAC/electrical system(s) (as applicable).
- Notify EHS/FAC or supervisor of completed work and return all documents.

Category: Job Specific—
Job Specific Work Practice 25: Remove Asbestos-Containing Fire Door and/or Door Hardware

Scope: This work practice applies to the removal of fire doors in which the ACM/PACM is internal to the door structure. This procedure also applies to removal and/or replacement of door hardware including locks. No drilling or cutting of the door is allowed.

Pre-Work Activities:

(Information is obtained from the EHS/FAC or designee.)

- Obtain a copy of Asbestos Work Permit and post at the job site.
- Work Notification(s) (as applicable).
- Review Schedule for Work.
- Review General Work Practices.
- Follow Work Permit air monitoring requirements (as applicable).
- Demarcate the area with Asbestos Warning signs and other barriers as necessary to prevent unauthorized access.

Job Specific Work Practice:

1. Place a 6 mil polyethylene drop cloth under the work area.
2. Place tools, materials and equipment on the drop cloth.
3. If door is equipped with a closer, detach closer arm from door frame. Remove screws attaching closer to door. HEPA vacuum or wet clean screws, closer, and area where closer was attached to door. Thoroughly clean closer and parts. Reuse the closer and parts or dispose of as non-ACM waste.
4. Remove lockset from door using the same procedures as for the closer. Thoroughly clean the lockset and reuse or dispose of as non-ACM waste.
5. Lay two layers of 6 mil polyethylene sheet on floor.
6. Remove hinge pins or screws attaching hinges to door frame. Lay door on polyethylene sheets.
7. If hinges are to be re-used, remove from door following procedures for door closer. If hinges are to be disposed of, leave hinges attached to door. **Note: Doorjambs may contain asbestos. Verify through bulk sampling and take necessary precautions**.
8. Wrap door in polyethylene sheets and secure with duct tape.
9. HEPA vacuum the floor area.

Post Work Activities:

- Complete visual inspection and air monitoring work.
- Have EHS/FAC or designee complete the Post Work Activities section of the Asbestos Control Work Permit Request Form
- Remove drop cloth, clean with HEPA/wet methods or properly dispose of as contaminated.
- Properly decontaminate and return tools, equipment, and remaining materials to storage area.
- Remove lockout/tagout devices and restart HVAC/electrical system(s) (as applicable).

- Notify EHS/FAC or supervisor of completed work and return all documents.

Category: Job Specific—
Job Specific Work Practice 26: Remove Asbestos-Containing Flexible Duct Connector

Scope: This work practice applies to the removal of asbestos-containing flexible (fabric type) duct connector. This procedure may be used if the material is in good to poor condition and may be damaged during removal.

Pre-Work Activities:

(Information is obtained from the EHS/FAC or designee.)

- Obtain a copy of Asbestos Work Permit and post at the job site.
- Work Notification(s) (as applicable).
- Review Schedule for Work.
- Review General Work Practices.
- Follow Work Permit air monitoring requirements (as applicable).
- Demarcate the area with Asbestos Warning signs and other barriers as necessary to prevent unauthorized access.

Job Specific Work Practice:

1. Shut down HVAC system in which duct connector is located.
2. Place a 6 mil polyethylene drop cloth under the work area. Also, where possible, install critical barriers in the ductwork adjacent to both sides of the connector.
3. Wet the connector adequately with amended water.
4. Remove all screws holding flexible connector in place.
5. While spraying with amended water, slide the connector away from the ductwork.
6. Place connector and screws in bag for disposal.
7. HEPA vacuum and wet wipe the flanges where the connector was removed
8. HEPA vacuum adjacent surfaces. Install a new non-ACM duct connector if applicable.
8. Remove critical barriers in the HVAC unit.

Post Work Activities:

- Complete visual inspection and air monitoring work.
- Have EHS/FAC or designee complete the Post Work Activities section of the Asbestos Control Work Permit Request Form
- Remove drop cloth, clean with HEPA/wet methods or properly dispose of as contaminated.
- Properly decontaminate and return tools, equipment, and remaining materials to storage area.
- Remove lockout/tagout devices and restart HVAC/electrical system(s) (as applicable).
- Notify EHS/FAC or supervisor of completed work and return all documents.

Category: Job Specific—
Job Specific Work Practice 27:
Remove Asbestos Containing Gaskets/Packing, Caulking/Glazing Materials

Scope: This work practice applies to the removal of asbestos containing gaskets/packing or caulking/glazing materials for asbestos O&M work. This could include materials such as asbestos felt, rope, cement, rubber, graphite, metal or other products.

Pre-Work Activities:

(Information is obtained from the EHS/FAC or designee.)

- Obtain a copy of Asbestos Work Permit and post at the job site.
- Work Notification(s) (as applicable).
- Review Schedule for Work.
- Review General Work Practices.
- Follow Work Permit air monitoring requirements (as applicable).
- Demarcate the area with Asbestos Warning signs and other barriers as necessary to prevent unauthorized access.

Job Specific Work Practice:

1. Place a 6 mil polyethylene drop cloth under the work area.
2. Determine the temperature of the surface and do not use glovebags above 150 degrees Fahrenheit. Ensure that proper PPE and engineering controls are used to prevent burns. Shut down heat generating source when feasible.
3. Remove Thermal System Insulation (TSI) (if ACM follow approved work practices and other equipment to expose the gasket/packing.
4. Wet gasket with amended water. Stop work if wetting of surfaces generate hazardous conditions.
5. With the HEPA vacuum nozzle near the gasket, use careful handling procedures to remove the gasket or packing. Try to remove the gasket or packing in as few pieces as possible. Ensure that all the material has been removed. If power tools are needed to remove the material, ensure that the tool is equipped with a HEPA filtered exhaust.
6. HEPA vacuum and wet wipe the area.
7. Install the new non-ACM gasket/packing and reassemble the equipment

Post Work Activities:

- Complete visual inspection and air monitoring work.
- Have EHS/FAC or designee complete the Post Work Activities section of the Asbestos Control Work Permit Request Form
- Remove drop cloth, clean with HEPA/wet methods or properly dispose of as contaminated.
- Properly decontaminate and return tools, equipment, and remaining materials to storage area.
- Remove lockout/tagout devices and restart HVAC/electrical system(s) (as applicable).
- Notify EHS/FAC or supervisor of completed work and return all documents.

APPENDIX B: GENERAL SAFETY CONSIDERATIONS

General Safety Considerations

Note: (This section is reprinted from Appendix D of the EPA's White Book for use by personnel performing O & M activities.)

This guide was primarily developed to provide recommendations concerning worker respiratory protection within the asbestos abatement industry. However, employers must not lose sight of the safety hazards their employees are exposed to in performance of their work. Asbestos abatement operations can take place in a variety of industrial, commercial and public settings. Each has unique potential safety hazards that the employer must control. However, nearly all abatement operations have some common safety hazards. With proper job planning and supervision, the employer can control both the health hazards and the safety hazards faced by their workers. The more common safety hazards associated with abatement operations and general recommendations to control them are discussed below. Sources for more specific safety information are listed to supplement and support the applicable OSHA regulatory standards.

I. Elevated Work Surfaces

The nature of asbestos abatement tasks usually requires workers to work from ladders, scaffolds, personnel lifts, or other elevated surfaces, which creates the potential for fall injuries. Slips and falls from ladders, scaffolds, and other elevated surfaces result in a major portion of the construction industry injuries. Many of these can be prevented by implementing a few control measures, such as:

A. General

1. Avoid use of makeshift work platforms by providing portable ladders and scaffolds.

2. Ensure that job-built elevated work surfaces are inspected by a competent person other than the individual who erects it.

3. Avoid working from elevated surfaces where possible. Consider use of wands for spraying amended water or scrapers with extended handles.

B. Ladders

1. Eighty percent of ladder-related accidents result from improper use or application.

2. Workers should face the ladder when climbing up, down, or working from it.

3. Workers should not carry objects in their hands while ascending or descending ladders. While working from a ladder they should hold on with at least one hand.

4. Ladders should not be used as a substitute for planks, runways, or walkboards.

5. Ladders shall be maintained in good condition. Defective ladders must be destroyed so that no one uses them by mistake.

6. Ladders shall have safety feet in good condition to keep the ladder from slipping and cutting through polyethylene floor covers.

7. Ladder rungs/steps should be kept free of contaminants such as amended water and buildup of asbestos waste.

8. Employees should work no higher than the fourth step/rung from the top of the ladder.

9. Employees shall not attempt to “reach” distant objects from a ladder; other platforms shall be used.

10. Wood or fiberglass ladders should be provided to help control exposure to electrical hazards.

11. Employees are not to straddle the space between a ladder and another object.

12. Employees are to make a visual inspection of ladders before each shift.

13. Employees should ensure that the base of portable ladders is spaced 1 foot away for every 4 feet they reach up.

Additional information sources:

Safety Requirements for Portable Wood Ladders" -- ANSI A14.1 -- 1982
Safety Requirements for Job-Made Ladders -- ANSI A14.4 -- 1979
Safety Requirements for Portable Reinforced Plastic Ladders -- ANSI A14.5 -- 1982

American National Standards Institute, Inc.
1430 Broadway
New York, NY 10018

C. Scaffolds

Falls from scaffolds result in about 2,000 injuries per month in the United States. The number of falls can be reduced by:

- Providing guardrails around the perimeter of the work surface where required
- Securing scaffold decks and planks against slippage
- Keeping scaffold uprights vertical and pinned together when stacked
- Ensuring vertical members are braced to keep the scaffold plumb and level
- Decking the entire top portion of the work surface in lieu of using minimum planking dimensions
- Extending planks at least 6" (150 mm) over their support and cleating or restraining them from movement
- Ensuring that manufacturer is built-in ladders are in good condition
- Maintaining mobile scaffold casters in good condition with position locking devices secured when employees are working from the scaffold
- Keeping mobile scaffolding height less than four times the minimum base dimension and with an adequate cross-bracing
- Only interchange scaffolding parts from different units when compatible and allowed by the OSHA regulations
- Never use defective scaffolding
- Designating only "Competent" persons to perform scaffolding repairs.

D.Mechanical Personnel Lifts

- Follow manufacture's instructions for safe operation of the personnel lift including the use of appropriate PPE.

Additional information sources:

Manually Propelled Mobile Ladder Stands and Scaffolds" -- ANSI A92.1 -- 1977
Manually Propelled Elevating Work Platforms -- ANSI A92.3 -- 1980
Self-Propelled Elevating Work Platforms -- ANSI A92.6 -- 1999

American National Standards Institute, Inc.
1430 Broadway
New York, NY 10018

II. Electrical Hazards

Asbestos abatement is often related to renovation or remodeling activities. Normally the equipment, machinery, overhead lighting fixtures, and auxiliary furnishings are removed to facilitate the abatement work. However, it is becoming more common that industrial and commercial buildings remain partially occupied while abatement operations are performed. In either situation, the abatement operator must take positive actions to protect employees from accidentally coming into contact with energized electrical circuits.

A. General

(1) Perform a pre-work walk-through of the abatement area to look for pre-existing electrical hazards involved with the work.

(2) De-energize circuits in the affected area to safely perform the work.

(3) Verify that the circuits have been de-energized with a "Field Current Sensing Device" circuit tester. Lock out/tag out all de-energized circuits to prevent them from accidentally being energized.

(4) Use non-conductive tools such as scrapers and vacuum attachments made of wood, plastic, or rubber.

(5) Use non-conductive rubber footwear and/or gloves, when work must be done around energized wiring or equipment.

(6) Prohibit accumulation of puddles of water on the floor. No water can be used around energized circuits if the water has the potential to contact the energized circuits.

B. Permanent Building Circuitry

(1) Ensure that all permanent circuits are provided with a grounding system. Grounding can be determined with a portable ground tester.

(2) Ensure that electrical outlets are tightly sealed and taped to avoid water spray.

(3) Determine what equipment must remain energized during the abatement process.

(4) Insulate or guard energized equipment and wiring from employee contact and other conductive objects.

(5) Avoid damaging permanent building wiring during the work.

(6) Consider dry removal methods in the vicinity of electrical equipment, which must remain energized.

C. Temporary Power

(l) All temporary circuits provided by the abatement operator must be provided with a grounding system and protected by ground fault circuit interrupters.

(2) Avoid stringing temporary wiring across floors.

(3) Elevated wiring should not be fastened with staples, nails, or wire.

(4) Use care not to damage the insulation on wiring during installation or abatement work.

D. Electrical Cords and Tools

(1) Provide extension cords, which have a ground conductor.

(2) Ensure that cords are not damaged, contain no splice, and that the grounding lug on the male plug is intact.

(3) Position extension cords to eliminate stumbling/tripping hazards and to protect them from damage by moving scaffolds.

(4) Provide electrical tools which are either grounded or of the double-insulated type

(5) Use shatterproof, guarded bulbs and heavy duty wiring for temporary lighting.

(6) Where plugs enter receptacles, ensure that the connection is protected by use of duct tape or by other means.

Additional information sources:

National Electrical Safety Code -- ANSI C2-1997
National Electrical Code -- ANSI/NFPA 70-1999

American National Standards Institute, Inc.
1430 Broadway
New York, NY 10018

III.Housekeeping

Asbestos abatement operations present continuous housekeeping problems. The accumulation of asbestos and other debris on polyethylene-covered floors create employee slipping and tripping hazards. It is essential that accumulation of such debris be bagged and removed from the floor as soon as possible. Even though this activity may initially require more effort it will make final cleanup easier and the work area safer.

Additional information source:

Supervisors Safety Manual
National Safety Council
444 North Michigan Avenue
Chicago, Illinois 60611

IV.Emergency Planning

The abatement operator should develop emergency procedures for fires or severely injured employees. Since abatement work areas must be sealed off thereby blocking normal exits, the operator must familiarize the workers with procedures for safe exit in case of fire. Furthermore, the operator should develop plans for obtaining emergency aid in case of severe employee injury. The plans should be compatible with decontamination procedures yet provide for quick medical aid.

APPENDIX C: APPLICABLE FORMS, PRECONSTRUCTION CHECKLIST, ASBESTOS TRAINING QUALIFICATION PROFILE, PERIODIC SURVEILLANCE SUMMARY SHEET

PERIODIC SURVEILLANCE SUMMARY SHEET

Date Surveillance Performed:Date Submitted to FAC:

Facility Location:

Type of Surveillance: semiannual annual _other

FACILITY FAC Name:

Surveillance Results

Instructions: If a change in ACM condition is noted on the Periodic Surveillance Data Sheet, the following information must be filled out for each ACM type where a change in condition was noted for each facility. Note: Include specific location (e.g. room number, room description, floor etc.).

ACM Type: Location:

Physical Damage (Y/N);Water damage (Y/N); Deterioration (Y/N).

Comments:

Accessible (Y/N);Activity Level near ACM (H/M/L); Location in Airstream (Y/N).

Comments:

ACM Type: Location:

Physical Damage (Y/N);Water damage (Y/N); Deterioration (Y/N).

Comments:

Accessible (Y/N);Activity Level near ACM (H/M/L); Location in Airstream (Y/N).

Comments:

ACM Type: Location:

Physical Damage (Y/N);Water damage (Y/N); Deterioration (Y/N).

Comments:

Accessible (Y/N);Activity Level near ACM (H/M/L); Location in Airstream (Y/N).

Comments:

ACM Type: Location:

Physical Damage (Y/N);Water damage (Y/N); Deterioration (Y/N).

Comments:

Accessible (Y/N);Activity Level near ACM (H/M/L); Location in Airstream (Y/N).

Comments:

Asbestos Training
Qualification Profile

Location: _____Year: _____

Name	Type of Training	Date Completed

Asbestos Training Key

G-I General Awareness Training – Initial
G-R General Awareness Training – Refresher
O&M-I Operations and Maintenance Training – Initial
O&M-R Operations and Maintenance Training – Refresher
C/S-I Contractor/Supervisor Training – Initial
C/S-R Contractor/Supervisor Training – Refresher
I-I Inspector Initial
I-R Inspector Refresher
PD-I Project Designer Initial
PD-R Project Designer Refresher

APPENDIX D: METHOD 7400 /7402

METHOD 7400

ASBESTOS and OTHER FIBERS by PCM 7400

Various MW: Various CAS: Various RTECS: Various

METHOD: 7400, Issue 2 **EVALUATION: FULL** **Issue 1: Rev. 3 on 15 May 1989**
Issue 2: 15 August 1994

OSHA : 0.1 asbestos fiber (> 5 µm long)/cc; 1 f/cc/30 min excursion; carcinogen
MSHA: 2 asbestos fibers/cc
NIOSH: 0.1 f/cc (fibers > 5 µm long)/400 L; carcinogen
ACGIH: 0.2 crocidolite; 0.5 amosite; 2 chrysotile and other asbestos, fibers/cc; carcinogen

PROPERTIES: solid, fibrous, crystalline, anisotropic

SYNONYMS [CAS #]: actinolite **[77536-66-4]** or ferroactinolite **[15669-07-5]**; amosite **[12172-73-5]**; anthophyllite **[77536-67-5]**; chrysotile **[12001-29-5]**; serpentine **[18786-24-8]**; crocidolite **[12001-28-4]**; tremolite **[77536-68-6]**; amphibole asbestos **[1332-21-4]**; refractory ceramic fibers **[142844-00-6]**; fibrous glass.

SAMPLING

SAMPLER: FILTER (0.45- to 1.2-µm cellulose ester membrane, 25-mm; conductive cowl on cassette)

FLOW RATE*: 0.5 to 16 L/min

VOL-MIN*: 400 L @ 0.1 fiber/cc
-MAX*: (step 4, sampling)
*Adjust to give 100 to 1300 fiber/mm^2

SHIPMENT: routine (pack to reduce shock)

SAMPLE STABILITY: stable

BLANKS: 2 to 10 field blanks per set

ACCURACY

RANGE STUDIED: 80 to 100 fibers counted

BIAS: See EVALUATION OF METHOD

OVERALL PRECISION ($\hat{S}_{rT}$): 0.115 to 0.13 [1]

ACCURACY: See EVALUATION OF METHOD

MEASUREMENT

TECHNIQUE: LIGHT MICROSCOPY, PHASE CONTRAST

ANALYTE: fibers (manual count)

SAMPLE PREPARATION: acetone - collapse/triacetin - immersion

COUNTING RULES: described in previous version of this method as "A" rules [1,3]

EQUIPMENT:
1. positive phase-contrast microscope
2. Walton-Beckett graticule (100-µm field of view) Type G-22
3. phase-shift test slide (HSE/NPL)

CALIBRATION: HSE/NPL test slide

RANGE: 100 to 1300 fibers/mm^2 filter area

ESTIMATED LOD: 7 fibers/mm^2 filter area

PRECISION ($\hat{S}_r$): 0.10 to 0.12 [1]; see EVALUATION OF METHOD

APPLICABILITY: The quantitative working range is 0.04 to 0.5 fiber/cc for a 1000-L air sample. The LOD depends on sample volume and quantity of interfering dust, and is <0.01 fiber/cc for atmospheres free of interferences. The method gives an index of airborne fibers. It is primarily used for estimating asbestos concentrations, though PCM does not differentiate between asbestos and other fibers. Use this method in conjunction with electron microscopy (e.g., Method 7402) for assistance in identification of fibers. Fibers < ca. 0.25 µm diameter will not be detected by this method [4]. This method may be used for other materials such as fibrous glass by using alternate counting rules (see Appendix C).

INTERFERENCES: If the method is used to detect a specific type of fiber, any other airborne fiber may interfere since all particles meeting the counting criteria are counted. Chain-like particles may appear fibrous. High levels of non-fibrous dust particles may obscure fibers in the field of view and increase the detection limit.

OTHER METHODS: This revision replaces Method 7400, Revision #3 (date 5/15/89).

REAGENTS:

1. Acetone,* reagent grade.
2. Triacetin (glycerol triacetate), reagent grade.

* See SPECIAL PRECAUTIONS.

EQUIPMENT:

1. Sampler: field monitor, 25-mm, three-piece cassette with ca. 50-mm electrically conductive extension cowl and cellulose ester filter, 0.45- to 1.2-µm pore size, and backup pad.
   NOTE 1: Analyze representative filters for fiber background before use to check for clarity and background. Discard the filter lot if mean is ≥5 fibers per 100 graticule fields. These are defined as laboratory blanks. Manufacturer-provided quality assurance checks on filter blanks are normally adequate as long as field blanks are analyzed as described below.
   NOTE 2: The electrically conductive extension cowl reduces electrostatic effects. Ground the cowl when possible during sampling.
   NOTE 3: Use 0.8-µm pore size filters for personal sampling. The 0.45-µm filters are recommended for sampling when performing TEM analysis on the same samples. However, their higher pressure drop precludes their use with personal sampling pumps.
   NOTE 4: Other cassettes have been proposed that exhibit improved uniformity of fiber deposit on the filter surface, e.g., bellmouthed sampler (Envirometrics, Charleston, SC). These may be used if shown to give measured concentrations equivalent to sampler indicated above for the application.
2. Personal sampling pump, battery or line-powered vacuum, of sufficient capacity to meet flow-rate requirements (see step 4 for flow rate), with flexible connecting tubing.
3. Wire, multi-stranded, 22-gauge; 1", hose clamp to attach wire to cassette.
4. Tape, shrink- or adhesive-.
5. Slides, glass, frosted-end, pre-cleaned, 25 x 75-mm.
6. Cover slips, 22- x 22-mm, No. 1-1/2, unless otherwise specified by microscope manufacturer.
7. Lacquer or nail polish.
8. Knife, #10 surgical steel, curved blade.
9. Tweezers.

EQUIPMENT:

10. Acetone flash vaporization system for clearing filters on glass slides (see ref. [5] for specifications or see manufacturer's instructions for equivalent devices).
11. Micropipets or syringes, 5-µL and 100- to 500-µL.
12. Microscope, positive phase (dark) contrast, with green or blue filter, adjustable field iris, 8 to 10X eyepiece, and 40 to 45X phase objective (total magnification ca. 400X); numerical aperture = 0.65 to 0.75.
13. Graticule, Walton-Beckett type with 100-µm diameter circular field (area = 0.00785 mm2) at the specimen plane (Type G-22). Available from Optometrics USA, P.O. Box 699, Ayer, MA 01432 [phone (508)-772-1700], and McCrone Accessories and Components, 850 Pasquinelli Drive, Westmont, IL 60559 [phone (312) 887-7100].
    NOTE: The graticule is custom-made for each microscope. (see APPENDIX A for the custom-ordering procedure).
14. HSE/NPL phase contrast test slide, Mark II. Available from Optometrics USA (address above).
15. Telescope, ocular phase-ring centering.
16. Stage micrometer (0.01-mm divisions).

SPECIAL PRECAUTIONS: Acetone is extremely flammable. Take precautions not to ignite it. Heating of acetone in volumes greater than 1 mL must be done in a ventilated laboratory fume hood using a flameless, spark- free heat source.

SAMPLING:

1. Calibrate each personal sampling pump with a representative sampler in line.
2. To reduce contamination and to hold the cassette tightly together, seal the crease between the cassette base and the cowl with a shrink band or light colored adhesive tape. For personal sampling, fasten the (uncapped) open-face cassette to the worker's lapel. The open face should be oriented downward.
    NOTE: The cowl should be electrically grounded during area sampling, especially under conditions of low relative humidity. Use a hose clamp to secure one end of the wire (Equipment, Item 3) to the monitor's cowl. Connect the other end to an earth ground (i.e., cold water pipe).
3. Submit at least two field blanks (or 10% of the total samples, whichever is greater) for each set of samples. Handle field blanks in a manner representative of actual handling of associated samples in the set. Open field blank cassettes at the same time as other cassettes just prior to sampling. Store top covers and cassettes in a clean area (e.g., a closed bag or box) with the top covers from the sampling cassettes during the sampling period.
4. Sample at 0.5 L/min or greater [6]. Adjust sampling flow rate, Q (L/min), and time, t (min), to produce a fiber density, E, of 100 to 1300 fibers/mm^2 ($3.85 \cdot 10^4$ to $5 \cdot 10^5$ fibers per 25-mm filter with effective collection area A_c= 385 mm^2) for optimum accuracy. These variables are related to the action level (one-half the current standard), L (fibers/cc), of the fibrous aerosol being sampled by:

$$t = \frac{A_c \cdot E}{Q \cdot L \cdot 10^3}, \text{ min.}$$

NOTE 1: The purpose of adjusting sampling times is to obtain optimum fiber loading on the filter. The collection efficiency does not appear to be a function of flow rate in the range of 0.5 to 16 L/min for asbestos fibers [7]. Relatively large diameter fibers (>3 µm) may exhibit significant aspiration loss and inlet deposition. A sampling rate of 1 to 4 L/min for 8 h is appropriate in atmospheres containing ca. 0.1 fiber/cc in the absence of significant amounts of non-asbestos dust. Dusty atmospheres require smaller sample volumes (≤400 L) to obtain countable samples. In such cases take short, consecutive samples and average the results over the total collection time. For documenting episodic exposures, use high flow rates (7 to 16 L/min) over shorter sampling times. In relatively clean atmospheres, where targeted fiber concentrations are much less than 0.1 fiber/cc, use larger sample volumes (3000 to 10000 L) to achieve quantifiable loadings. Take care, however, not to overload the filter with background dust. If ≥ 50% of the filter surface is covered with particles, the filter may be too overloaded to count and will bias the measured fiber concentration.

NOTE 2: OSHA regulations specify a minimum sampling volume of 48 L for an excursion measurement, and a maximum sampling rate of 2.5 L/min [3].

5. At the end of sampling, replace top cover and end plugs.
6. Ship samples with conductive cowl attached in a rigid container with packing material to prevent jostling or damage.
   NOTE: Do not use untreated polystyrene foam in shipping container because electrostatic forces may cause fiber loss from sample filter.

SAMPLE PREPARATION:

NOTE 1: The object is to produce samples with a smooth (non-grainy) background in a medium with refractive index ≤1.46. This method collapses the filter for easier focusing and produces permanent (1 - 10 years) mounts which are useful for quality control and interlaboratory comparison. The aluminum "hot block" or similar flash vaporization techniques may be used outside the laboratory [2]. Other mounting techniques meeting the above criteria may also be used (e.g., the laboratory fume hood procedure for generating acetone vapor as described in Method 7400 - revision of 5/15/85, or the non-permanent field mounting technique used in P&CAM 239 [3,7,8,9]). Unless the effective filtration area is known, determine the area and record the information referenced against the sample ID number [1,9,10,11].

NOTE 2: Excessive water in the acetone may slow the clearing of the filter, causing material to be washed off the surface of the filter. Also, filters that have been exposed to high humidities prior to clearing may have a grainy background.

7. Ensure that the glass slides and cover slips are free of dust and fibers.
8. Adjust the rheostat to heat the "hot block" to ca. 70 °C [2].
   NOTE: If the "hot block" is not used in a fume hood, it must rest on a ceramic plate and be isolated from any surface susceptible to heat damage.
9. Mount a wedge cut from the sample filter on a clean glass slide.
   a. Cut wedges of ca. 25% of the filter area with a curved-blade surgical steel knife using a rocking motion to prevent tearing. Place wedge, dust side up, on slide.
      NOTE: Static electricity will usually keep the wedge on the slide.

b. Insert slide with wedge into the receiving slot at base of "hot block". Immediately place tip of a micropipet containing ca. 250 µL acetone (use the minimum volume needed to consistently clear the filter sections) into the inlet port of the PTFE cap on top of the "hot block" and inject the acetone into the vaporization chamber with a slow, steady pressure on the plunger button while holding pipet firmly in place. After waiting 3 to 5 sec for the filter to clear, remove pipet and slide from their ports.
   CAUTION: Although the volume of acetone used is small, use safety precautions. Work in a well-ventilated area (e.g., laboratory fume hood). Take care not to ignite the acetone. Continuous use of this device in an unventilated space may produce explosive acetone vapor concentrations.
c. Using the 5-µL micropipet, immediately place 3.0 to 3.5 µL triacetin on the wedge. Gently lower a clean cover slip onto the wedge at a slight angle to reduce bubble formation. Avoid excess pressure and movement of the cover glass.
   NOTE: If too many bubbles form or the amount of triacetin is insufficient, the cover slip may become detached within a few hours. If excessive triacetin remains at the edge of the filter under the cover slip, fiber migration may occur.
d. Mark the outline of the filter segment with a glass marking pen to aid in microscopic evaluation.
e. Glue the edges of the cover slip to the slide using lacquer or nail polish [12]. Counting may proceed immediately after clearing and mounting are completed.
   NOTE: If clearing is slow, warm the slide on a hotplate (surface temperature 50 °C) for up to 15 min to hasten clearing. Heat carefully to prevent gas bubble formation.

CALIBRATION AND QUALITY CONTROL:

10. Microscope adjustments. Follow the manufacturers instructions. At least once daily use the telescope ocular (or Bertrand lens, for some microscopes) supplied by the manufacturer to ensure that the phase rings (annular diaphragm and phase-shifting elements) are concentric. With each microscope, keep a logbook in which to record the dates of microscope cleanings and major servicing.
    a. Each time a sample is examined, do the following:
       (1) Adjust the light source for even illumination across the field of view at the condenser iris. Use Kohler illumination, if available. With some microscopes, the illumination may have to be set up with bright field optics rather than phase contract optics.
       (2) Focus on the particulate material to be examined.
       (3) Make sure that the field iris is in focus, centered on the sample, and open only enough to fully illuminate the field of view.
    b. Check the phase-shift detection limit of the microscope periodically for each analyst/microscope combination:
       (1) Center the HSE/NPL phase-contrast test slide under the phase objective.
       (2) Bring the blocks of grooved lines into focus in the graticule area.
           NOTE: The slide contains seven blocks of grooves (ca. 20 grooves per block) in descending order of visibility. For asbestos counting the microscope optics must completely resolve the grooved lines in block 3 although they may appear somewhat faint, and the grooved lines in blocks 6 and 7 must be invisible when centered in the graticule area. Blocks 4 and 5 must be at least partially visible but may vary slightly in visibility between microscopes. A microscope which fails to meet these requirements has resolution either too low or too high for fiber counting.
       (3) If image quality deteriorates, clean the microscope optics. If the problem persists, consult the microscope manufacturer.
11. Document the laboratory's precision for each counter for replicate fiber counts.
    a. Maintain as part of the laboratory quality assurance program a set of reference slides to be used on a daily basis [13]. These slides should consist of filter preparations including a range of loadings and background dust levels from a variety of sources including both field and reference samples (e.g., PAT, AAR, commercial samples). The Quality Assurance Officer

should maintain custody of the reference slides and should supply each counter with a minimum of one reference slide per workday. Change the labels on the reference slides periodically so that the counter does not become familiar with the samples.

b. From blind repeat counts on reference slides, estimate the laboratory intra- and intercounter precision. Obtain separate values of relative standard deviation (S_r) for each sample matrix analyzed in each of the following ranges: 5 to 20 fibers in 100 graticule fields, >20 to 50 fibers in 100 graticule fields, and >50 to 100 fibers in 100 graticule fields. Maintain control charts for each of these data files.

NOTE: Certain sample matrices (e.g., asbestos cement) have been shown to give poor precision [9]

12. Prepare and count field blanks along with the field samples. Report counts on each field blank.

NOTE 1: The identity of blank filters should be unknown to the counter until all counts have been completed.

NOTE 2: If a field blank yields greater than 7 fibers per 100 graticule fields, report possible contamination of the samples.

13. Perform blind recounts by the same counter on 10% of filters counted (slides relabeled by a person other than the counter). Use the following test to determine whether a pair of counts by the same counter on the same filter should be rejected because of possible bias: Discard the sample if the absolute value of the difference between the square roots of the two counts (in fiber/mm^2) exceeds 2.77 (X)S_r', where X = average of the square roots of the two fiber counts (in fiber/mm^2) and $S_r' = \frac{S_r}{2}$, where S_r is the intracounter relative standard deviation for the appropriate count range (in fibers) determined in step 11. For more complete discussions see reference [13].

NOTE 1: Since fiber counting is the measurement of randomly placed fibers which may be described by a Poisson distribution, a square root transformation of the fiber count data will result in approximately normally distributed data [13].

NOTE 2: If a pair of counts is rejected by this test, recount the remaining samples in the set and test the new counts against the first counts. Discard all rejected paired counts. It is not necessary to use this statistic on blank counts.

14. The analyst is a critical part of this analytical procedure. Care must be taken to provide a non-stressful and comfortable environment for fiber counting. An ergonomically designed chair should be used, with the microscope eyepiece situated at a comfortable height for viewing. External lighting should be set at a level similar to the illumination level in the microscope to reduce eye fatigue. In addition, counters should take 10-to-20 minute breaks from the microscope every one or two hours to limit fatigue [14]. During these breaks, both eye and upper back/neck exercises should be performed to relieve strain.
15. All laboratories engaged in asbestos counting should participate in a proficiency testing program such as the AIHA-NIOSH Proficiency Analytical Testing (PAT) Program for asbestos and routinely exchange field samples with other laboratories to compare performance of counters.

MEASUREMENT:

16. Center the slide on the stage of the calibrated microscope under the objective lens. Focus the microscope on the plane of the filter.
17. Adjust the microscope (Step 10).

NOTE: Calibration with the HSE/NPL test slide determines the minimum detectable fiber diameter (ca. 0.25 µm) [4].

18. Counting rules: (same as P&CAM 239 rules [1,10,11]: see examples in APPENDIX B).
    a. Count any fiber longer than 5 µm which lies entirely within the graticule area.
       (1) Count only fibers longer than 5 µm. Measure length of curved fibers along the curve.
       (2) Count only fibers with a length-to-width ratio equal to or greater than 3:1.
    b. For fibers which cross the boundary of the graticule field:
       (1) Count as 1/2 fiber any fiber with only one end lying within the graticule area, provided that the fiber meets the criteria of rule a above.

(2) Do not count any fiber which crosses the graticule boundary more than once.
(3) Reject and do not count all other fibers.

c. Count bundles of fibers as one fiber unless individual fibers can be identified by observing both ends of a fiber.
d. Count enough graticule fields to yield 100 fibers. Count a minimum of 20 fields. Stop at 100 graticule fields regardless of count.

19. Start counting from the tip of the filter wedge and progress along a radial line to the outer edge. Shift up or down on the filter, and continue in the reverse direction. Select graticule fields randomly by looking away from the eyepiece briefly while advancing the mechanical stage. Ensure that, as a minimum, each analysis covers one radial line from the filter center to the outer edge of the filter. When an agglomerate or bubble covers ca. 1/6 or more of the graticule field, reject the graticule field and select another. Do not report rejected graticule fields in the total number counted.

NOTE 1: When counting a graticule field, continuously scan a range of focal planes by moving the fine focus knob to detect very fine fibers which have become embedded in the filter. The small-diameter fibers will be very faint but are an important contribution to the total count. A minimum counting time of 15 seconds per field is appropriate for accurate counting.

NOTE 2: This method does not allow for differentiation of fibers based on morphology. Although some experienced counters are capable of selectively counting only fibers which appear to be asbestiform, there is presently no accepted method for ensuring uniformity of judgment between laboratories. It is, therefore, incumbent upon all laboratories using this method to report total fiber counts. If serious contamination from non-asbestos fibers occurs in samples, other techniques such as transmission electron microscopy must be used to identify the asbestos fiber fraction present in the sample (see NIOSH Method 7402). In some cases (i.e., for fibers with diameters >1 µm), polarized light microscopy (as in NIOSH Method 7403) may be used to identify and eliminate interfering non-crystalline fibers [15].

NOTE 3: Do not count at edges where filter was cut. Move in at least 1 mm from the edge.

NOTE 4: Under certain conditions, electrostatic charge may affect the sampling of fibers. These electrostatic effects are most likely to occur when the relative humidity is low (below 20%), and when sampling is performed near the source of aerosol. The result is that deposition of fibers on the filter is reduced, especially near the edge of the filter. If such a pattern is noted during fiber counting, choose fields as close to the center of the filter as possible [5].

NOTE 5: Counts are to be recorded on a data sheet that provides, as a minimum, spaces on which to record the counts for each field, filter identification number, analyst's name, date, total fibers counted, total fields counted, average count, fiber density, and commentary. Average count is calculated by dividing the total fiber count by the number of fields observed. Fiber density (fibers/mm^2) is defined as the average count (fibers/field) divided by the field (graticule) area (mm^2/field).

CALCULATIONS AND REPORTING OF RESULTS

20. Calculate and report fiber density on the filter, E (fibers/mm^2), by dividing the average fiber count per graticule field, F/n_f, minus the mean field blank count per graticule field, B/n_b, by the graticule field area, A_f (approx. 0.00785 mm^2):

$$E = \frac{\left(\frac{F}{n_f} - \frac{B}{n_b}\right)}{A_f}, \text{ fibers/mm}^2.$$

NOTE: Fiber counts above 1300 fibers/mm^2 and fiber counts from samples with >50% of filter area covered with particulate should be reported as "uncountable" or "probably biased." Other fiber counts outside the 100-1300 fiber/mm^2 range should be reported as having "greater than optimal variability" and as being "probably biased."

21. Calculate and report the concentration, C (fibers/cc), of fibers in the air volume sampled, V (L), using the effective collection area of the filter, A_c (approx. 385 mm^2 for a 25-mm filter):

$$C = \frac{(E)(A_c)}{V \cdot 10^3}.$$

NOTE: Periodically check and adjust the value of A_c, if necessary.

22. Report intralaboratory and interlaboratory relative standard deviations (from Step 11) with each set of results.

NOTE: Precision depends on the total number of fibers counted [1,16]. Relative standard deviation is documented in references [1,15-17] for fiber counts up to 100 fibers in 100 graticule fields. Comparability of interlaboratory results is discussed below. As a first approximation, use 213% above and 49% below the count as the upper and lower confidence limits for fiber counts greater than 20 (Fig. 1).

EVALUATION OF METHOD:

A. This method is a revision of P&CAM 239 [10]. A summary of the revisions is as follows:

1. Sampling:
   The change from a 37-mm to a 25-mm filter improves sensitivity for similar air volumes. The change in flow rates allows for 2-m^3 full-shift samples to be taken, providing that the filter is not overloaded with non-fibrous particulates. The collection efficiency of the sampler is not a function of flow rate in the range 0.5 to 16 L/min [10].
2. Sample Preparation Technique:
   The acetone vapor-triacetin preparation technique is a faster, more permanent mounting technique than the dimethyl phthalate/diethyl oxalate method of P&CAM 239 [2,4,10]. The aluminum "hot block" technique minimizes the amount of acetone needed to prepare each sample.
3. Measurement:
   a. The Walton-Beckett graticule standardizes the area observed [14,18,19].
   b. The HSE/NPL test slide standardizes microscope optics for sensitivity to fiber diameter [4,14].
   c. Because of past inaccuracies associated with low fiber counts, the minimum recommended loading has been increased to 100 fibers/mm^2 filter area (a total of 78.5 fibers counted in 100 fields, each with field area = .00785 mm^2.) Lower levels generally result in an overestimate of the fiber count when compared to results in the recommended analytical range [20]. The recommended loadings should yield intracounter S_r in the range of 0.10 to 0.17 [21,22,23].

B. Interlaboratory comparability:
   An international collaborative study involved 16 laboratories using prepared slides from the asbestos cement, milling, mining, textile, and friction material industries [9]. The relative standard deviations (S_r) varied with sample type and laboratory. The ranges were:

	Intralaboratory S_r	Interlaboratory S_r	Overall S_r
AIA (NIOSH A Rules)*	0.12 to 0.40	0.27 to 0.85	0.46
Modified CRS (NIOSH B Rules)**	0.11 to 0.29	0.20 to 0.35	0.25

* Under AIA rules, only fibers having a diameter less than 3 µm are counted and fibers attached to particles larger than 3 µm are not counted. NIOSH A Rules are otherwise similar to the AIA rules.
** See Appendix C.

A NIOSH study conducted using field samples of asbestos gave intralaboratory S_r in the range 0.17 to 0.25 and an interlaboratory S_r of 0.45 [21]. This agrees well with other recent studies [9,14,16].

At this time, there is no independent means for assessing the overall accuracy of this method. One measure of reliability is to estimate how well the count for a single sample agrees with the mean count from a large number of laboratories. The following discussion indicates how this estimation can be carried out based on measurements of the interlaboratory variability, as well as showing how the results of this method relate to the theoretically attainable counting precision and to measured intra- and interlaboratory S_r. (NOTE: The following discussion does not include bias estimates and should not be taken to indicated that lightly loaded samples are as accurate as properly loaded ones).

Theoretically, the process of counting randomly (Poisson) distributed fibers on a filter surface will give an S_r that depends on the number, N, of fibers counted:

$$S_r = 1/(N)^{1/2} \quad (1)$$

Thus S_r is 0.1 for 100 fibers and 0.32 for 10 fibers counted. The actual S_r found in a number of studies is greater than these theoretical numbers [17,19,20,21].

An additional component of variability comes primarily from subjective interlaboratory differences. In a study of ten counters in a continuing sample exchange program, Ogden [15] found this subjective component of intralaboratory S_r to be approximately 0.2 and estimated the overall S_r by the term:

$$\frac{[N + (0.2 \cdot N)^2]^{1/2}}{N} \quad (2)$$

Ogden found that the 90% confidence interval of the individual intralaboratory counts in relation to the means were +2 S_r and - 1.5 S_r. In this program, one sample out of ten was a quality control sample. For laboratories not engaged in an intensive quality assurance program, the subjective component of variability can be higher.

In a study of field sample results in 46 laboratories, the Asbestos Information Association also found that the variability had both a constant component and one that depended on the fiber count [14]. These results gave a subjective interlaboratory component of S_r (on the same basis as Ogden's) for field samples of ca. 0.45. A similar value was obtained for 12 laboratories analyzing a set of 24 field samples [21]. This value falls slightly above the range of S_r (0.25 to 0.42 for 1984-85) found for 80 reference laboratories in the NIOSH PAT program for laboratory-generated samples [17].

A number of factors influence S_r for a given laboratory, such as that laboratory's actual counting performance and the type of samples being analyzed. In the absence of other information, such as from an interlaboratory quality assurance program using field samples, the value for the subjective component of variability is chosen as 0.45. It is hoped that the laboratories will carry out the recommended interlaboratory quality assurance programs to improve their performance and thus reduce the S_r.

The above relative standard deviations apply when the population mean has been determined. It is more useful, however, for laboratories to estimate the 90% confidence interval on the mean count from a single sample fiber count (Figure 1). These curves assume similar shapes of the count distribution for interlaboratory and intralaboratory results [16].

For example, if a sample yields a count of 24 fibers, Figure 1 indicates that the mean interlaboratory count will fall within the range of 227% above and 52% below that value 90% of the time. We can apply these percentages directly to the air concentrations as well. If, for instance, this sample (24 fibers counted) represented a 500-L volume, then the measured concentration is 0.02 fibers/mL (assuming 100 fields counted, 25-mm filter, 0.00785 mm^2 counting field area). If this same sample were counted by a group of laboratories, there is a 90% probability that the mean would fall between 0.01 and 0.08 fiber/mL. These limits should be reported in any comparison of results between laboratories.

Note that the S_r of 0.45 used to derive Figure 1 is used as an estimate for a random group of laboratories. If several laboratories belonging to a quality assurance group can show that their interlaboratory S_r is smaller, then it is more correct to use that smaller S_r. However, the estimated S_r of 0.45 is to be used in the absence of such information. Note also that it has been found that S_r can be higher for certain types of samples, such as asbestos cement [9].

Quite often the estimated airborne concentration from an asbestos analysis is used to compare to a regulatory standard. For instance, if one is trying to show compliance with an 0.5 fiber/mL standard using a single sample on which 100 fibers have been counted, then Figure 1 indicates that the 0.5 fiber/mL standard must be 213% higher than the measured air concentration. This indicates that if one measures a fiber concentration of 0.16 fiber/mL (100 fibers counted), then the mean fiber count by a group of laboratories (of which the compliance laboratory might be one) has a 95% chance of being less than 0.5 fibers/mL; i.e., 0.16 + 2.13 x 0.16 = 0.5.

It can be seen from Figure 1 that the Poisson component of the variability is not very important unless the number of fibers counted is small. Therefore, a further approximation is to simply use +213% and −49% as the upper and lower confidence values of the mean for a 100-fiber count.

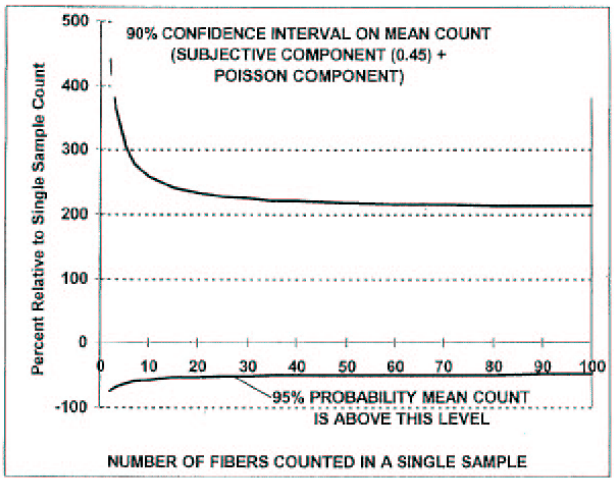

Figure 1. Interlaboratory Precision of Fiber Counts

The curves in Figures 1 are defined by the following equations:

$$UCL = \frac{2X + 2.25 + [(2.25 + 2X)^2 - 4(1 - 2.25 S_r^2) X^2]^{1/2}}{2(1 - 2.25 S_r^2)} \quad (3)$$

$$LCL = \frac{2X + 4 - [(4 + 2X)^2 - 4(1 - 4 S_r^2) X^2]^{1/2}}{2(1 - 4 S_r^2)} \quad (4)$$

where S_r = subjective interlaboratory relative standard deviation, which is close to the total interlaboratory S_r when approximately 100 fibers are counted.
X = total fibers counted on sample
LCL = lower 95% confidence limit.
UCL = upper 95% confidence limit.
Note that the range between these two limits represents 90% of the total range.

REFERENCES:

[1] Leidel, N. A., S. G. Bayer, R. D. Zumwalde, and K. A. Busch. USPHS/NIOSH Membrane Filter Method for Evaluating Airborne Asbestos Fibers, U.S. Department of Health, Education, and Welfare, Publ. (NIOSH) 79-127 (1979).
[2] Baron, P. A. and G. C. Pickford. "An Asbestos Sample Filter Clearing Procedure," Appl. Ind. Hyg., 1:169-171, 199 (1986).
[3] Occupational Safety and Health Administration, U.S. Department of Labor, Occupational Exposure to Asbestos, Tremolite, Anthophyllite, and Actinolite Asbestos; Final Rules, 29 CFR Part 1910.1001 Amended June 20, 1986.
[4] Rooker, S. J., N. P. Vaughn, and J. M. LeGuen. "On the Visibility of Fibers by Phase Contrast Microscopy," Amer. Ind. Hyg. Assoc. J., 43, 505-515 (1982).
[5] Baron, P. and G. Deye, "Electrostatic Effects in Asbestos Sampling," Parts I and II Amer. Ind. Hyg. Assoc. J., 51, 51-69 (1990).
[6] Johnston, A. M., A. D. Jones, and J. H. Vincent. "The Influence of External Aerodynamic Factors on the Measurement of the Airborne Concentration of Asbestos Fibers by the Membrane Filter Method," Ann. Occup. Hyg., 25, 309-316 (1982).
[7] Beckett, S.T., "The Effects of Sampling Practice on the Measured Concentration of Airborne Asbestos," Ann. Occup. Hyg., 21, 259-272 (1980).
[8] Jankovic, J. T., W. Jones, and J. Clere. "Field Techniques for Clearing Cellulose Ester Filters Used in Asbestos Sampling," Appl. Ind. Hyg., 1, 145-147 (1986).
[9] Crawford, N. P., H. L. Thorpe, and W. Alexander. "A Comparison of the Effects of Different Counting Rules and Aspect Ratios on the Level and Reproducibility of Asbestos Fiber Counts," Part I: Effects on Level (Report No. TM/82/23), Part II: Effects on Reproducibility (Report No. TM/82/24), Institute of Occupational Medicine, Edinburgh, Scotland (December, 1982).
[10] NIOSH Manual of Analytical Methods, 2nd ed., Vol. 1., P&CAM 239, U.S. Department of Health, Education, and Welfare, Publ. (NIOSH) 77-157-A (1977).
[11] Revised Recommended Asbestos Standard, U.S. Department of Health, Education, and Welfare, Publ. (NIOSH) 77-169 (1976); as amended in NIOSH statement at OSHA Public Hearing, June 21, 1984.
[12] Asbestos International Association, AIA Health and Safety Recommended Technical Method #1 (RTMI). "Airborne Asbestos Fiber Concentrations at Workplaces by Light Microscopy" (Membrane Filter Method), London (1979).
[13] Abell, M., S. Shulman and P. Baron. The Quality of Fiber Count Data, Appl. Ind. Hyg., 4, 273-285

(1989).
[14] "A Study of the Empirical Precision of Airborne Asbestos Concentration Measurements in the Workplace by the Membrane Filter Method," Asbestos Information Association, Air Monitoring Committee Report, Arlington, VA (June, 1983).
[15] McCrone, W., L. McCrone and J. Delly, "Polarized Light Microscopy," Ann Arbor Science (1978).
[16] Ogden, T. L. "The Reproducibility of Fiber Counts," Health and Safety Executive Research Paper 18 (1982).
[17] Schlecht, P. C. and S. A. Schulman. "Performance of Asbestos Fiber Counting Laboratories in the NIOSH Proficiency Analytical Testing (PAT) Program," Am. Ind. Hyg. Assoc. J., 47, 259-266 (1986).
[18] Chatfield, E. J. Measurement of Asbestos Fiber Concentrations in Workplace Atmospheres, Royal Commission on Matters of Health and Safety Arising from the Use of Asbestos in Ontario, Study No. 9, 180 Dundas Street West, 22nd Floor, Toronto, Ontario, CANADA M5G 1Z8.
[19] Walton, W. H. "The Nature, Hazards, and Assessment of Occupational Exposure to Airborne Asbestos Dust: A Review," Ann. Occup. Hyg., 25, 115-247 (1982).
[20] Cherrie, J., A.D. Jones, and A.M. Johnston. "The Influence of Fiber Density on the Assessment of Fiber Concentration Using the membrane filter Method." Am. Ind. Hyg. Assoc. J., 47(8), 465-74 (1986).
[21] Baron, P. A. and S. Shulman. "Evaluation of the Magiscan Image Analyzer for Asbestos Fiber Counting." Am. Ind. Hyg. Assoc. J., (In press).
[22] Taylor, D. G., P. A. Baron, S. A. Shulman and J. W. Carter. "Identification and Counting of Asbestos Fibers," Am. Ind. Hyg. Assoc. J. 45(2), 84-88 (1984).
[23] "Potential Health Hazards of Video Display Terminals," NIOSH Research Report, June 1981.
[24] "Reference Methods for Measuring Airborne Man-Made Mineral Fibers (MMMF)," WHO/EURO Technical Committee for Monitoring an Evaluating Airborne MMMF, World Health Organization, Copenhagen (1985).
[25] Criteria for a Recommended Standard...Occupational Exposure to Fibrous Glass, U.S. Department of Health, Education, and Welfare, Publ. (NIOSH) 77-152 (1977).

METHOD WRITTEN BY:

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APPENDIX A: CALIBRATION OF THE WALTON-BECKETT GRATICULE:

Before ordering the Walton-Beckett graticule, the following calibration must be done to obtain a counting area (D) 100 µm in diameter at the image plane. The diameter, d_c (mm), of the circular counting area and the disc diameter must be specified when ordering the graticule.

1. Insert any available graticule into the eyepiece and focus so that the graticule lines are sharp and clear.
2. Set the appropriate interpupillary distance and, if applicable, reset the binocular head adjustment so that the magnification remains constant.
3. Install the 40 to 45X phase objective.
4. Place a stage micrometer on the microscope object stage and focus the microscope on the graduated lines.
5. Measure the magnified grid length of the graticule, L_o (µm), using the stage micrometer.
6. Remove the graticule from the microscope and measure its actual grid length, L_a (mm). This can best be accomplished by using a stage fitted with verniers.
7. Calculate the circle diameter, d_c (mm), for the Walton-Beckett graticule:

$$d_c = \frac{L_a}{L_o} \times D. \qquad (5)$$

Example: If L_o = 112 µm, L_a = 4.5 mm and D = 100 µm, then d_c = 4.02 mm.

8. Check the field diameter, D (acceptable range 100 µm ± 2 µm) with a stage micrometer upon receipt of the graticule from the manufacturer. Determine field area (acceptable range 0.00754 mm^2 to 0.00817 mm^2).

APPENDIX B: COMPARISON OF COUNTING RULES:

Figure 2 shows a Walton-Beckett graticule as seen through the microscope. The rules will be discussed as they apply to the labeled objects in the figure.

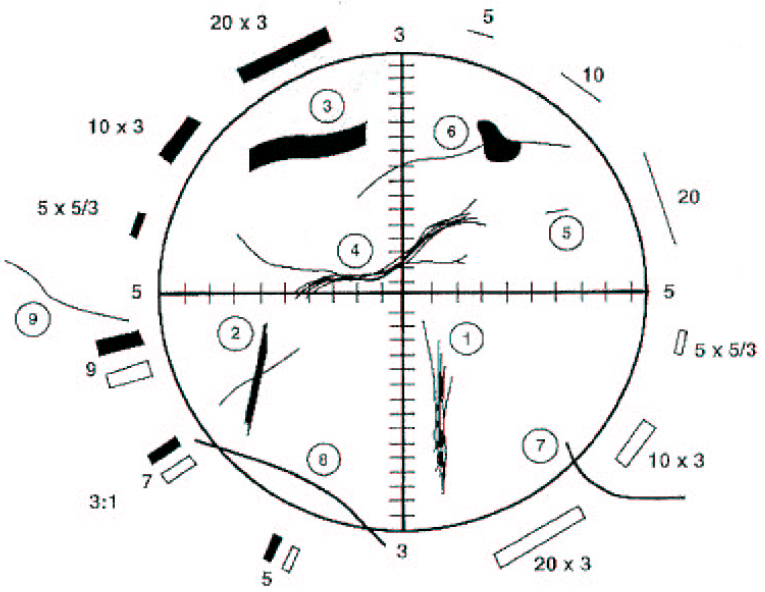

Figure 2. Walton-Beckett graticule with fibers.

These rules are sometimes referred to as the "A" rules.

FIBER COUNT

Object	Count	DISCUSSION
1	1 fiber	Optically observable asbestos fibers are actually bundles of fine fibrils. If the fibrils seem to be from the same bundle the object is counted as a single fiber. Note, however, that all objects meeting length and aspect ratio criteria are counted whether or not they appear to be asbestos.
2	2 fiber	If fibers meeting the length and aspect ratio criteria (length >5 µm and length-to-width ratio >3 to 1) overlap, but do not seem to be part of the same bundle, they are counted as separate fibers.
3	1 fiber	Although the object has a relatively large diameter (>3 µm), it is counted as fiber under the rules. There is no upper limit on the fiber diameter in the counting rules. Note that fiber width is measured at the widest compact section of the object.
4	1 fiber	Although long fine fibrils may extend from the body of a fiber, these fibrils are considered part of the fiber if they seem to have originally been part of the bundle.
5	Do not count	If the object is ≤5 µm long, it is not counted.
6	1 fiber	A fiber partially obscured by a particle is counted as one fiber. If the fiber ends emanating from a particle do not seem to be from the same fiber and each end meets the length and aspect ratio criteria, they are counted as separate fibers.
7	1/2 fiber	A fiber which crosses into the graticule area one time is counted as 1/2 fiber.
8	Do not count	Ignore fibers that cross the graticulate boundary more than once. count
9	Do not count	Ignore fibers that lie outside the graticule boundary.

APPENDIX C. ALTERNATE COUNTING RULES FOR NON-ASBESTOS FIBERS

Other counting rules may be more appropriate for measurement of specific non-asbestos fiber types, such as fibrous glass. These include the "B" rules given below (from NIOSH Method 7400, Revision #2, dated 8/15/87), the World Health Organization reference method for man-made mineral fiber [24], and the NIOSH fibrous glass criteria document method [25]. The upper diameter limit in these methods prevents measurements of non-thoracic fibers. It is important to note that the aspect ratio limits included in these methods vary. NIOSH recommends the use of the 3:1 aspect ratio in counting fibers.

It is emphasized that hybridization of different sets of counting rules is not permitted. Report specifically which set of counting rules are used with the analytical results.

"B" COUNTING RULES:

1. Count only ends of fibers. Each fiber must be longer than 5 µm and less than 3 µm diameter.
2. Count only ends of fibers with a length-to-width ratio equal to or greater than 5:1.
3. Count each fiber end which falls within the graticule area as one end, provided that the fiber meets rules 1 and 2 above. Add split ends to the count as appropriate if the split fiber segment also meets the criteria of rules 1 and 2 above.
4. Count visibly free ends which meet rules 1 and 2 above when the fiber appears to be attached to another particle, regardless of the size of the other particle. Count the end of a fiber obscured by another particle if the particle covering the fiber end is less than 3 µm in diameter.
5. Count free ends of fibers emanating from large clumps and bundles up to a maximum of 10 ends (5 fibers), provided that each segment meets rules 1 and 2 above.
6. Count enough graticule fields to yield 200 ends. Count a minimum of 20 graticule fields. Stop at 100 graticule fields, regardless of count.
7. Divide total end count by 2 to yield fiber count.

APPENDIX D. EQUIVALENT LIMITS OF DETECTION AND QUANTITATION

	fiber density on filter*		fiber concentration in air, f/cc	
	fibers per 100 fields	fibers/mm^2	400-L air sample	1000-L air sample
	200	255	0.25	0.10
	100	127	0.125	0.05
LOQ	80	102	0.10	0.04
	50	64	0.0625	0.025
	25	32	0.03	0.0125
	20	25	0.025	0.010
	10	12.7	0.0125	0.005
	8	10.2	0.010	0.004
LOD	5.5	7	0.00675	0.0027

* Assumes 385 mm^2 effective filter collection area, and field area = 0.00785 mm^2, for relatively "clean" (little particulate aside from fibers) filters.

METHOD 7402

ASBESTOS by TEM 7402

FORMULA: Various MW: Various CAS: Various RTECS: Various

METHOD: 7402 **EVALUATION: PARTIAL** **Issue 1: 15 May 1989**
Issue 2: 15 August 1994

OSHA : 0.1 asbestos fibers (>5 µm long)/cc; 1 f/cc/30 min excursion; carcinogen
MSHA: 2 asbestos fibers/cc
NIOSH: 0.1 f/cc (fibers > 5 µm long)/400 L; carcinogen
ACGIH: 0.2 crocidolite; 0.5 amosite; 2 chrysotile and other asbestos, fibers/cc; carcinogen

PROPERTIES: solid, fibrous, crystalline, anistropic

SYNONYMS [CAS#]: actinolite [77536-66-4] or ferroactinolite [15669-07-5]; amosite [12172-73-5]; anthophyllite [77536-67-5]; chrysotile [12001-29-5]; serpentine [18786-24-8]; crocidolite [12001-28-4]; tremolite [77536-68-6]; amphibole asbestos [1332-21-4].

SAMPLING

SAMPLER: FILTER (0.45- to 1.2-µm cellulose ester membrane, 25-mm diameter; conductive cassette)

FLOW RATE: 0.5 to 16 L/min

VOL-MIN*: 400 L @ 0.1 fiber/cc
-MAX*: (step 4, sampling)
*Adjust for 100 to 1300 fibers/mm^2

SHIPMENT: routine (pack to reduce shock)

SAMPLE STABILITY: stable

BLANKS: 2 to 10 field blanks per set

ACCURACY

RANGE STUDIED: 80 to 100 fibers counted

BIAS: not determined

OVERALL PRECISION ($\hat{S}_{rT}$): see EVALUATION OF METHOD

ACCURACY: not determined

MEASUREMENT

TECHNIQUE: MICROSCOPY, TRANSMISSION ELECTRON (TEM)

ANALYTE: asbestos fibers

SAMPLE PREPARATION: modified Jaffe wick

EQUIPMENT: transmission electron microscope; energy dispersive X-ray system (EDX) analyzer

CALIBRATION: qualitative electron diffraction; calibration of TEM magnification and EDX system

RANGE: 100 to 1300 fibers/mm^2 filter area [1]

ESTIMATED LOD: 1 confirmed asbestos fiber above 95% of expected mean blank value

PRECISION ($\hat{S}_r$): 0.28 when 65% of fibers are asbestos; 0.20 when adjusted fiber count is applied to PCM count [2].

APPLICABILITY: The quantitative working range is 0.04 to 0.5 fiber/cc for a 1000-L air sample. The LOD depends on sample volume and quantity of interfering dust, and is <0.01 fiber/cc for atmospheres free of interferences. This method is used to determine asbestos fibers in the optically visible range and is intended to complement the results obtained by phase contrast microscopy (Method 7400).

INTERFERENCES: Other amphibole particles that have aspect ratios greater than 3:1 and elemental compositions similar to the asbestos minerals may interfere in the TEM analysis. Some non-amphibole minerals may give electron diffraction patterns similar to amphiboles. High concentrations of background dust interfere with fiber identification. Some non-asbestos amphibole minerals may give electron diffraction patterns similar to asbestos amphiboles.

OTHER METHODS: This method is designed for use with Method 7400 (phase contrast microscopy).

REAGENTS:

1. Acetone. (See SPECIAL PRECAUTIONS.)

EQUIPMENT:

1. Sampler: field monitor, 25-mm, three-piece cassette with ca. 50-mm electrically-conductive extension cowl, cellulose ester membrane filter, 0.45- to 1.2-µm pore size, and backup pad.
   NOTE 1: Analyze representative filters for fiber background before use. Discard the filter lot if mean count is >5 fibers/100 fields. These are defined as laboratory blanks.
   NOTE 2: Use an electrically-conductive extension cowl to reduce electrostatic effects on fiber sampling and during sample shipment. Ground the cowl when possible during sampling.
   NOTE 3: 0.8-µm pore size filters are recommended for personal sampling. 0.45-µm filters are recommended for sampling when performing TEM analysis on the samples because the particles deposit closer to the filter surface. However, the higher pressure drop through these filters normally preclude their use with personal sampling pumps.
2. Personal sampling pump, 0.5 to 16 L/min, with flexible connecting tubing.
3. Microscope, transmission electron, operated at ca. 100 kV, with electron diffraction and energy-dispersive X-ray capabilities, and having a fluorescent screen with inscribed or overlaid calibrated scale (Step 15).
   NOTE: The scale is most efficient if it consists of a series of lines inscribed on the screen or partial circles every 2 cm distant from the center.
4. Diffraction grating replica with known number of lines/mm.
5. Slides, glass, pre-cleaned, 25- x 75-mm.
6. Knife, surgical steel, curved-blade.
7. Tweezers.
8. Grids, 200-mesh TEM copper, (optional: carbon-coated).
9. Petri dishes, 15-mm depth. The top and bottom of the petri dish must fit snugly together. To assure a tight fit, grind the top and bottom pieces together with an abrasive such as carborundum to produce a ground-glass contact surface.
10. Foam, clean polyurethane, spongy, 12-mm thick.
11. Filters, Whatman No. 1 qualitative paper or equivalent, or lens paper.
12. Vacuum evaporator.
13. Cork borer, (about 8-mm).
14. Pen, waterproof, marking.
15. Reinforcement, page, gummed.
16. Asbestos standard bulk materials for reference; e.g. SRM #1866, available from the National Institute of Standards and Technology.
17. Carbon rods, sharpened to 1 mm x 8 mm.
18. Microscope, light, phase contrast (PCM), with Walton-Beckett graticule (see method 7400).
19. Grounding wire, 22-gauge, multi-strand.
20. Tape, shrink- or adhesive-.

SPECIAL PRECAUTIONS: Acetone is extremely flammable (flash point = 0 °F). Take precautions not to ignite it. Heating of acetone must be done in a fume hood using a flameless, spark-free heat source. Asbestos is a confirmed human carcinogen. Handle only in a well-ventilated fume hood.

SAMPLING:

1. Calibrate each personal sampling pump with a representative sampler in line.
2. For personal sampling, fasten sampler to worker's lapel near worker's mouth. Remove the top cover from cowl extension ("open-face") and orient sampler face down. Wrap joint between extender and monitor body with tape to help hold the cassette together and provide a marking surface to identify the cassette. Where possible, especially at low %RH, attach sampler to electrical ground to reduce electrostatic effects during sampling.
3. Submit at least two field blanks (or 10% of the total samples, whichever is greater) for each set of samples. Remove top covers from the field blank cassettes and store top covers and cassettes in a clean area (e.g., closed bag or box) during sampling. Replace top covers when sampling is completed.
4. Sample at 0.5 to 16 L/min [3]. Adjust sampling rate, Q (L/min), and time, t (min), to produce fiber density, E, of 100 to 1300 fibers/mm ^{2} [$3.85 \cdot 10^4$ to $5 \cdot 10^5$ fibers per 25-mm filter with effective collection area (A_c = 385 mm^2)] for optimum accuracy. Do not exceed ca. 0.5 mg total dust loading on the filter. These variables are related to the action level (one-half the current standard), L (fibers/cc), of the fibrous aerosol being sampled by:

$$t = \frac{A_c \cdot E}{Q \cdot L \cdot 10^3}, \text{ min.}$$

   NOTE: The purpose of adjusting sampling times is to obtain optimum fiber loading on the filter. A sampling rate of 1 to 4 L/min for 8 h (700 to 2800 L) is appropriate in atmospheres containing ca. 0.1 fiber/cc in the absence of significant amounts of non-asbestos dust. Dusty atmospheres require smaller sample volumes (≤400 L) to obtain countable samples. In such cases take short, consecutive samples and average the results over the total collection time. For documenting episodic exposures, use high rates (7 to 16 L/min) over shorter sampling times. In relatively clean atmospheres, where targeted fiber concentrations are much less than 0.1 fiber/cc, use larger sample volumes (3000 to 10000 L) to achieve quantifiable loadings. Take care, however, not to overload the filter with background dust [3].
5. At the end of sampling, replace top cover and small end caps.
6. Ship samples upright with conductive cowl attached in a rigid container with packing material to prevent jostling or damage.
   NOTE: Do not use untreated polystyrene foam in the shipping container because electrostatic forces may cause fiber loss from sample filter.

SAMPLE PREPARATION:

7. Remove circular sections from any of three quadrants of each sample and blank filter using a cork borer [4]. The use of three grid preparations reduces the effect of local variations in dust deposit on the filter.
8. Affix the circular filter sections to a clean glass slide with a gummed page reinforcement. Label the slide with a waterproof marking pen.
   NOTE: Up to eight filter sections may be attached to the same slide.
9. Place the slide in a petri dish which contains several paper filters soaked with 2 to 3 mL acetone. Cover the dish. Wait 2 to 4 min for the sample filter(s) to fuse and clear.
   NOTE: The "hot block" clearing technique [5] of Method 7400 or the DMF clearing technique [6] may be used instead of steps 8 and 9.
10. Transfer the slide to a rotating stage inside the bell jar of a vacuum evaporator. Evaporate a 1-by 5-mm section of a graphite rod onto the cleared filter(s). Remove the slide to a clean, dry, covered petri dish [4].
11. Prepare a second petri dish as a Jaffe wick washer with the wicking substrate prepared from filter or lens paper placed on top of a 12-mm thick disk of clean, spongy polyurethane foam [7].

Cut a V-notch on the edge of the foam and filter paper. Use the V-notch as a reservoir for adding solvent.

NOTE: The wicking substrate should be thin enough to fit into the petri dish without touching the lid.

12. Place the TEM grid on the filter or lens paper. Label the grids by marking with a pencil on the filter paper or by putting registration marks on the petri dish halves and marking with a waterproof marker on the dish lid. In a fume hood, fill the dish with acetone until the wicking substrate is saturated.

NOTE: The level of acetone should be just high enough to saturate the filter paper without creating puddles.

13. Remove about a quarter section of the carbon-coated filter from the glass slide using a surgical knife and tweezers. Carefully place the excised filter, carbon side down, on the appropriately-labeled grid in the acetone-saturated petri dish. When all filter sections have been transferred, slowly add more solvent to the wedge-shaped trough to raise the acetone level as high as possible without disturbing the sample preparations. Cover the petri dish. Elevate one side of the petri dish by placing a slide under it (allowing drops of condensed acetone to form near the edge rather than in the center where they would drip onto the grid preparation).

CALIBRATION AND QUALITY CONTROL:

14. Determine the TEM magnification on the fluorescent screen:
    a. Define a field of view on the fluorescent screen either by markings or physical boundaries.
       NOTE: The field of view must be measurable or previously inscribed with a scale or concentric circles (all scales should be metric) [7].
    b. Insert a diffraction grating replica into the specimen holder and place into the microscope. Orient the replica so that the grating lines fall perpendicular to the scale on the TEM fluorescent screen. Ensure that goniometer stage tilt is zero.
    c. Adjust microscope magnification to 10,000X. Measure the distance (mm) between the same relative positions (e.g., between left edges) of two widely-separated lines on the grating replica. Count the number of spaces between the lines.
       NOTE: On most microscopes the magnification is substantially constant only within the central 8- to 10-cm diameter region of the fluorescent screen.
    d. Calculate the true magnification (M) on the fluorescent screen:

$$m = \frac{X \cdot G}{Y}$$

       where: X = total distance (mm) between the two grating lines;
       G = calibration constant of the grating replica (lines/mm);
       Y = number of grating replica spaces counted
    e. After calibration, note the apparent sizes of 0.25 and 5.0 µm on the fluorescent screen. (These dimensions are the boundary limits for counting asbestos fibers by phase contrast microscopy.)
15. Measure 20 grid openings at random on a 200-mesh copper grid by placing a grid on a glass slide and examining it under the PCM. Use the Walton-Beckett graticule to measure the grid opening dimensions. Calculate an average graticule field dimension from the data and use this number to calculate the graticule field area for an average grid opening.

NOTE: A grid opening is considered as one graticule field.

16. Obtain reference selected area electron diffraction (SAED) or microdiffraction patterns from standard asbestos materials prepared for TEM analysis.

NOTE: This is a visual reference technique. No quantitative SAED analysis is required [7]. Microdiffraction may produce clearer patterns on very small fibers or fibers partially obscured by other material.

    a. Set the specimen holder at zero tilt.

b. Center a fiber, focus, and center the smallest field-limiting aperture on the fiber. Obtain a diffraction pattern. Photograph each distinctive pattern and keep the photo for comparison to unknowns.

NOTE: Not all fibers will present diffraction patterns. The objective lens current may need adjustment to give optimum pattern visibility. There are many more amphiboles which give diffraction patterns similar to the analytes named on p. 7402-1. Some, but not all, of these can be eliminated by chemical separations. Also, some non-amphiboles (e.g., pyroxenes, some talc fibers) may interfere.

17. Acquire energy-dispersive X-ray (EDX) spectra on approximately 5 fibers having diameters between 0.25 and 0.5 µm of each asbestos variety obtained from standard reference materials [7].

NOTE: The sample may require tilting to obtain adequate signal. Use same tilt angle for all spectra.

a. Prepare TEM grids of all asbestos varieties.
b. Use acquisition times (at least 100 sec) sufficient to show a silicon peak at least 75% of the monitor screen height at a vertical scale of ≥500 counts per channel.
c. Estimate the elemental peak heights visually as follows:
   (1) Normalize all peaks to silicon (assigned an arbitrary value of 10).
   (2) Visually interpret all other peaks present and assign values relative to the silicon peak.
   (3) Determine an elemental profile for the fiber using the elements Na, Mg, Si, Ca, and Fe. Example: 0-4-10-3-<1 [7].
      NOTE: In fibers other than asbestos, determination of Al, K, Ti, S, P, and F may also be required for fiber characterization.
   (4) Determine a typical range of profiles for each asbestos variety and record the profiles for comparison to unknowns.

MEASUREMENT:

18. Perform a diffraction pattern inspection on all sample fibers counted under the TEM, using the procedures given in step 17. Assign the diffraction pattern to one of the following structures:
   a. chrysotile;
   b. amphibole;
   c. ambiguous;
   d. none.

NOTE: There are some crystalline substances which exhibit diffraction patterns similar to those of asbestos fibers. Many of these, (brucite, halloysite, etc.) can be eliminated from consideration by chemistry. There are, however, several minerals (e.g., pyroxenes, massive amphiboles, and talc fibers) which are chemically similar to asbestos and can be considered interferences. The presence of these substances may warrant the use of more powerful diffraction pattern analysis before positive identification can be made. If interferences are suspected, morphology can play an important role in making positive identification.

19. Obtain EDX spectra in either the TEM or STEM modes from fibers on field samples using the procedure of step 18. Using the diffraction pattern and EDX spectrum, classify the fiber:
   a. For a chrysotile structure, obtain EDX spectra on the first five fibers and one out of ten thereafter. Label the range profiles from 0-5-10-0-0 to 0-10-10-0-0 as "chrysotile."
   b. For an amphibole structure, obtain EDX spectra on the first 10 fibers and one out of ten thereafter. Label profiles ca. 0-2-10-0-7 as "possible amosite"; profiles ca. 1-1-10-0-6 as "possible crocidolite"; profiles ca. 0-4-10-3-<1 as "possible tremolite"; and profiles ca. 0-3-10-0-1 as "possible anthophyllite."
      NOTE: The range of profiles for the amphiboles will vary up to ± 1 unit for each of the elements present according to the relative detector efficiency of the spectrometer.
   c. For an ambiguous structure, obtain EDX spectra on all fibers. Label profiles similar to the chrysotile profile as "possible chrysotile." Label profiles similar to the various amphiboles as "possible amphiboles." Label all others as "unknown" or "non-asbestos."

20. Counting and Sizing:

a. Insert the sample grid into the specimen grid holder and scan the grid at zero tilt at low magnification (ca. 300 to 500X). Ensure that the carbon film is intact and unbroken over ca. 75% of the grid openings.

b. In order to determine how the grids should be sampled, estimate the number of fibers per grid opening during a low-magnification scan (500 to 1000X). This will allow the analyst to cover most of the area of the grids during the fiber count and analysis. Use the following rules when picking grid openings to count [7,8]:
   (1) Light loading (<5 fibers per grid opening): count total of 40 grid openings.
   (2) Moderate loading (5 to 25 fibers per grid opening): count minimum of 40 grid openings or 100 fibers.
   (3) Heavy loading (>25 fibers per opening): count a minimum of 100 fibers and at least 6 grid openings.

   Note that these grid openings should be selected approximately equally among the three grid preparations and as randomly as possible from each grid.

c. Count only grid openings that have the carbon film intact. At 500 to 1000X magnification, begin counting at one end of the grid and systematically traverse the grid by rows, reversing direction at row ends. Select the number of fields per traverse based on the loading indicated in the initial scan. Count at least 2 field blanks per sample set to document possible contamination of the samples. Count fibers using the following rules:
   (1) Count all particles with diameter greater than 0.25 µm that meet the definition of a fiber (aspect ratio ≥3:1, longer than 5 µm). Use the guideline of counting all fibers that would have been counted under phase contrast light microscopy (Method 7400). Use higher magnification (10000X) to determine fiber dimensions and countability under the acceptance criteria. Analyze a minimum of 10% of the fibers, and at least 3 asbestos fibers, by EDX and SAED to confirm the presence of asbestos. Fibers of similar morphology under high magnification can be identified as asbestos without SAED. Particles which are of questionable morphology should be analyzed by SAED and EDX to aid in identification.
   (2) Count fibers which are partially obscured by the grid as half fibers.
      NOTE: If a fiber is partially obscured by the grid bar at the edge of the field of view, count it as a half fiber only if more than 2.5 µm of fiber is visible.
   (3) Size each fiber as it is counted and record the diameter and length:
      (a) Move the fiber to the center of the screen. Read the length of the fiber directly from the scale on the screen.
         NOTE 1: Data can be recorded directly off the screen in µm and later converted to µm by computer.
         NOTE 2: For fibers which extend beyond the field of view, the fiber must be moved and superimposed upon the scale until its entire length has been measured.
      (b) When a fiber has been sized, return to the lower magnification and continue the traverse of the grid area to the next fiber.

d. Record the following fiber counts:
   (1) f_s, f_b = number of asbestos fibers in the grid openings analyzed on the sample filter and corresponding field blank, respectively.
   (2) F_s, F_b = number of fibers, regardless of identification, in the grid openings analyzed on the sample filter and corresponding field blank, respectively.

CALCULATIONS:

21. Calculate and report the fraction of optically visible asbestos fibers on the filter, $(f_s - f_b)/(F_s - F_b)$. Apply this fraction to fiber counts obtained by PCM on the same filter or on other filters for which the TEM sample is representative. The final result is an asbestos fiber count. The type of asbestos present should also be reported.
22. As an integral part of the report, give the model and manufacturer of the TEM as well as the model and manufacturer of the EDX system.

EVALUATION OF METHOD:

The TEM method, using the direct count of asbestos fibers, has been shown to have a precision of 0.275 (s_r) in an evaluation of mixed amosite and wollastonite fibers. The estimate of the asbestos fraction, however, had a precision of 0.11 (s_r). When this fraction was applied to the PCM count, the overall precision of the combined analysis was 0.20 [2].

REFERENCES:

[1] Walton, W. H. "The Nature, Hazards, and Assessment of Occupational Exposure to Airborne Asbestos Dust: A Review," Ann. Occup. Hyg., 25, 115-247 (1982).
[2] Taylor, D. G., P. A. Baron, S. A. Shulman and J. W. Carter. "Identification and Counting of Asbestos Fibers," Am. Ind. Hyg. Assoc. J. 45(2), 84-88 (1984).
[3] Johnston, A. M., A. D. Jones, and J. H. Vincent. "The Influence of External Aerodynamic Factors on the Measurement of the Airborne Concentration of Asbestos Fibers by the Membrane Filter Method," Ann. Occup. Hyg., 25, 309-316 (1982).
[4] Zumwalde, R. D. and J. M. Dement. Review and Evaluation of Analytical Methods for Environmental Studies of Fibrous Particulate Exposures, NIOSH Technical Information Bulletin #77-204 (1977).
[5] Baron, P. A. and G. C. Pickford. "An Asbestos Sample Filter Clearing Procedure," Appl. Ind. Hyg., 1:169-171,199 (1986).
[6] LeGuen, J. M. and S. Galvin "Clearing and Mounting Techniques for the Evaluation of Asbestos Fibers by the Membrane Filter Method" Ann. Occup. Hyg. 24, 273-280 (1981).
[7] Yamate, G., S. A. Agarwal, and R. D. Gibbons. "Methodology for the Measurement of Airborne Asbestos by Electron Microscopy," EPA Contract No. 68-02-3266 (in press).
[8] Steel, E. B. and J. A. Small. "Accuracy of Transmission Electron Microcopy for the Analysis of Asbestos in Ambient Environments," Anal. Chem., 57, 209-213 (1985).

METHOD REVISED BY:

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APPENDIX E: DEFINITIONS

Definitions

1. Abatement: Process of removing, enclosing, or encapsulating ACM.

2. Adequately Wet: A term as defined in 40 CFR 61, Subpart M and EPA 340/1-90-019 that means to sufficiently mix or penetrate with liquid to prevent the release of particulates. If visible emissions are observed coming from ACM, then that material has not been adequately wetted. However, the absence of visible emissions is not sufficient evidence of being adequately wetted.

3. Amended Water: Water containing a wetting agent or surfactant with a maximum surface tension of 29 dynes per square centimeter when tested in accordance with ASTM D 1331.

4. Asbestos-Containing Material (ACM): Any material containing more than one (1) [insert *more* stringent state requirement, if applicable] percent asbestos as determined using the method specified in 40 CFR 763, Appendix A, Subpart F. For purposes of this document, the term "ACM" also includes "PACM" (presumed asbestos-containing material) (See paragraph) and assumed ACM (e.g. fire doors) as referenced by 40 CFR Part 763, Subpart E.

5. Asbestos Containing Building Material (ACBM): Surfacing ACM, thermal system insulation (TSI) ACM, or miscellaneous ACM that is found in or on interior structural members or other parts of a building.

6. Certified Industrial Hygienist (CIH): An Industrial Hygienist certified in the comprehensive practice of industrial hygiene by the American Board of Industrial Hygiene.

7. Mil: A unit of length equal to one thousandth of an inch or 0.024 millimeters.

8. OSHA Class I Asbestos Work: Activities involving the removal of TSI and surfacing ACM.

9. OSHA Class II Asbestos Work: Activities involving the removal of ACM that is not TSI or surfacing material. This includes, but is not limited to, the removal of asbestos-containing wallboard, floor tile and sheeting, siding shingles, and construction mastic.

10. OSHA Class III Asbestos Work: Repair and maintenance operations where ACM, including TSI and surfacing ACM, is likely to be disturbed. Operations may include drilling, abrading, cutting a hole, cable pulling, crawling through tunnels or attics and spaces above the ceiling, where asbestos or asbestos-containing debris is actively disturbed. Removal of small amounts of ACM that would fit into a single 60 inch by 60 inch glovebag or disposal bag may be classified as an OSHA Class III job.

11. OSHA Class IV Asbestos Work: Maintenance and custodial construction activities during which employees contact but do not disturb ACM and activities to clean up dust, waste and debris resulting from OSHA Class I, II, and III activities. This may include dusting surfaces where ACM waste and debris and accompanying dust exists and cleaning up loose ACM debris from TSI or surfacing ACM following construction.

12. Critical Barrier: One or more layers of polyethylene sheeting taped in place over openings into a work area. Openings to be covered include doors, windows, diffusers, and any other opening that could allow outside air into a work area.

13. Excursion Limit (EL): See permissible exposure limit.

14. Friable ACM: Any material containing more than one (1) *[insert more stringent state requirement, if applicable]* percent asbestos as determined using the method specified in 40 CFR 763, Appendix A, Subpart F, that when dry, can be crumbled, pulverized, or reduced to powder by hand pressure.

15. High Efficiency Particulate Air (HEPA) Filter: A filter capable of trapping and retaining at least 99.97 percent of all mono-dispersed particles of 0.3 micrometers in diameter.

16. Non-Friable ACM : Any material containing more than one (1) *[insert more stringent state requirement, if applicable]* percent asbestos as determined using the method specified in Appendix A, Subpart F, 40 CFR 763 that when dry, cannot be crumbled, pulverized, or reduced to powder by hand pressure.

→ Category I Non-friable ACM: Asbestos-containing packings, gaskets, resilient floor coverings, and asphalt roofing products containing more than one (1) *[insert more stringent state requirement, if applicable]* percent asbestos as determined using the method specified in 40 CFR 763, Appendix A, Subpart F.

→ Category II Non-friable ACM: Any material, excluding Category I non-friable ACM, containing more than 1 *[insert more stringent state requirement, if applicable]* percent asbestos as determined using the method specified in 40 CFR 763, Appendix A, Subpart F that, when dry, cannot be crumbled, pulverized, or reduced to powder by hand pressure.

17. Non-Scheduled Renovation Operation: A renovation operation necessitated by the routine failure of equipment, which is expected to occur within a given period based on past operating experience, but for which an exact date cannot be predicted.

18. Presumed Asbestos-Containing Material (PACM): TSI and surfacing material found in buildings constructed before 1981. For the purposes of this Plan, PACM may also include other types of materials (such as flooring, roofing, siding, and transite) determined by the Facility Asbestos Coordinator (FAC) as having the potential to contain asbestos.

19. Permissible Exposure Limit (PEL) : OSHA PELs are worker exposure limits regulating the amount or concentration of a substance in air that shall not be exceeded. (1) An airborne concentration of asbestos of 0.1 fibers per cubic centimeter of air (f/cc) as an eight-(8) hour time weighted average (TWA). (2) An airborne concentration of asbestos of 1.0 f/cc as averaged over a sampling period of thirty (30) minutes (Excursion Limit).

20. Regulated Area: An area established to demarcate areas where airborne concentrations of asbestos exceed, or can reasonably be expected to exceed, permissible exposure limits. The regulated area may take the form of temporary negative pressure enclosures or an area demarcated in any manner that minimizes the number of employees exposed to asbestos.

21. Regulated Asbestos-Containing Material (RACM): (1) Friable ACM. (2) Category I Non-friable ACM that has become friable. (3) Category I Non-friable ACM that will be or has been subjected to sanding, grinding, cutting, or abrading. (4) Category II Non-friable ACM that has a high probability of becoming or has become crumbled, pulverized, or reduced to powder by the forces expected to act on the material in the course of demolition or renovation operations regulated under Subpart M, 40 CFR Part 61.

22. Time-Weighted Average (TWA): The TWA is an 8-hour time weighted average concentration of airborne asbestos fibers (longer than 5 micrometers) per cubic centimeter of air that represents the employee's 8-hour workday as determined by Appendix A of 29 CFR 1926.1101.

APPENDIX F: REFERENCES

REFERENCES

References: The current version of referenced publications shall be used. Where conflicts exist between documents, the most stringent requirements shall apply.

Occupational Safety and Health Administration (OSHA)

→29 CFR 1926.1101, Asbestos in Construction
→29 CFR 1910.1001, Asbestos in General Industry
→29 CFR 1910.1020, Access to Employee Exposure and Medical Records
→29 CFR 1910.134, Respiratory Protection
→42 CFR Part 84 (NIOSH), Respiratory Protective Devices

United States Environmental Protection Agency

→40 CFR Part 61, Subpart M, National Emission Standard for Hazardous Air Pollutants
→40 CFR Part 763, Subpart E, Asbestos-Containing Materials in Schools (AHERA)
→40 CFR Part 763, Subpart C, Asbestos School Hazard Abatement Reauthorization Act (ASHARA)
→Managing Asbestos in Place, A Building Owner's Guide to Operations and Maintenance Programs for Asbestos-Containing Materials, Office of Pesticides and Toxic Substances, 2OT-2003, July 1990

State of New Jersey and/or local Asbestos Regulations

→N.J.A.C. Chapter 12:120
→N.J.A.C. Chapter 8
→New Jersey Department of Environmental Protection

APPENDIX G: Stockton University Facility Specific Respiratory Protection Program

INTRODUCTION

SUMMARY OF RESPIRATORY PROTECTION PROGRAM REQUIREMENTS

Stockton University Respiratory Protection Program, through the requirements described in this manual, establishes a program for the use of respirators. The criteria is designed for those personnel who, during their normal duties, are or could be exposed to hazardous substances or atmospheres that may affect their health or well being, or that may otherwise be detrimental to their safety.

The program includes:

- Efforts to prevent atmospheric contamination. This shall be accomplished as far as feasible by accepted engineering control measures. However, when not feasible or while such measures are being instituted or evaluated, the program provides appropriate respiratory protection to personnel who might be exposed to unhealthy or unusual conditions.
- Provisions for the proper selection and fitting of respiratory protection equipment and for the training of Stockton's personnel in the proper use of such equipment.
- Establishment of requirements and controls for those employees who must use respirators and for their supervisors.
- Provisions for proper respiratory protection equipment for emergency use when loss of life is at stake.

AUTHORITY

Occupational Safety and Health Administration 29 CFR 1910.134, Respiratory Protection.

Basic Program Elements for Federal Employee Occupational Safety and Health Programs, 29 CFR 1960, as revised.

American National Standards Institute, Z88.2-1992, Guidelines for Respiratory Protection Use

National Institute for Occupational Safety and Health, Guide to Industrial Respiratory Protection

National Institute for Occupational Safety and Health, Selection and Use of Particulate Respirators, 42 CFR 84

SUMMARY OF CONTENTS

DEFINITIONS

1.0 RESPIRATORY PROTECTION PROGRAM

2.0 RESPONSIBILITIES

3.0 AUTHORIZATION FOR USE

4.0 REQUIREMENTS FOR FITTING AND TESTING

5.0 OPERATING PROCEDURES FOR RESPIRATORY PROTECTION EQUIPMENT

6.0 EMERGENCY USE OF RESPIRATORY PROTECTION EQUIPMENT

6.1 Emergency Situations
6.2 Emergency Equipment

7.0 MAINTENANCE AND CARE OF RESPIRATORS

7.1 Inspection and Repair
7.2 Cleaning and Sanitizing
7.3 Storage
7.4 Employee Responsibility
7.5 Safety and Health Responsibility

8.0 PROGRAM EVALUATION

8.1 Wearer Acceptance
8.2 Inspection of Respirator Program Implementation

TABLES:

1. Air Purifying Respirator Chemical Cartridge Types

ATTACHMENTS:

1. Voluntary Respirator User Form
2. Self-Contained Breathing Apparatus Inspection - MSA AirHawk MMR with Ultra Elite Facepiece
3. Stockton's SCBA Regulator Overhaul Schedule
4. OSHA Medical Evaluation Questionnaire
5. Supplemental Information for the Physician or Other Licensed Health Care Professional (PLHCP)

DEFINITIONS

- **Adequate warning properties -** An airborne contaminant has "adequate warning properties" when its presence can be detected by odor or irritation of the mucous membranes (e.g., ammonia) at a safe level of exposure.

- **Aerosol** - A system consisting of particles, solid, or liquid, suspended in air.

- **Approved** - Tested and listed as satisfactory jointly by the Mine Safety and Health Administration (MSHA) and the National Institute for Occupational Safety and Health (NIOSH).

- **Cartridge** - A container filled with sorbents and catalysts that remove gases and vapors from air drawn through the unit.

- **Confined Space** - An enclosure such as a storage tank, process vessel, boiler, silo, tank car, pipeline, tube, duct, sewer, underground utility vault, tunnel, or pit that has limited means of egress and poor natural ventilation and that may contain hazardous contaminants or be oxygen deficient.

- **Contaminant** - A harmful irritating, or nuisance material that is foreign to the normal atmosphere.

- **Competent person -** A person who has demonstrated the knowledge and skills necessary to administer certain Respiratory Protection Program procedures such as fit testing, training, hazard assessments, etc.

- **Dust -** Solid particles mechanically generated by handling, crushing, grinding, sawing, rapid impact or detonation of organic or inorganic materials such as metal, coal, wood, and dirt.

- **Engineering controls -** Methods of controlling employee exposures to toxic materials by modifying the source or reducing the quantity of contaminants released into the workroom environment.

- **Exhalation Valve** - A device that allows exhaled air to leave a respiratory device and prevents outside air from entering through the valve.

- **Face piece** - That portion of a respirator that covers the wearer's nose, mouth and eyes in a full face piece. It is designed to make a gas-tight fit with the face and includes the headbands, exhalation valve(s), and connections for an air purifying device.

- **Filter** - A fibrous medium used in respirators to remove solid or liquid particles from the airstream entering the respiratory enclosure.

- **Fit Factor -** The quantitative measurement of the fit of a respirator on an individual. Fit factor is determined by the ratio of the ambient airborne concentration of a test material outside the respirator face piece to the concentration of the test material inside the respirator face piece.

- **Fume -** Airborne particulate formed by the evaporation of solid materials, e.g., metal fume emitted during welding (usually less than 1 micron in diameter).

- **Hazard assessment -** An industrial hygiene evaluation of the health hazards posed by a specific operation or task.

- **High-Efficiency Particulate Aerosol (HEPA) Filter** - A filter designed to remove 99.97% of specific type particle material from air.

- **IDLH Atmosphere** - An atmosphere immediately dangerous to life or health (IDLH). An IDLH atmosphere poses an immediate hazard to life, such as being oxygen deficient (containing less than 19.5% oxygen), or produces an irreversible debilitating effect on health.

- **Inhalation Valve** - A device that allows respirable air to enter the face piece and prevents exhaled air from leaving the face piece through the intake opening.

- **Mine Safety and Health Administration (MSHA)** - A Federal agency that tests, approves, and certifies respiratory protection equipment.

- **Mist -** Suspended liquid droplets generated by condensation or by breaking up of a liquid into a dispersed state, such as by splashing, foaming or atomizing. Mist is formed when finely divided liquid is suspended in air.

- **Particulate Matter** - A suspension of fine solid or liquid particles in air, such as dust, fog, fume, mist, smoke, or sprays. Particulate matter suspended in air is commonly known as an aerosol.

- **Permissible Exposure Limit (PEL) -** The airborne concentration of a substance that, even on repeated daily exposure, will pose no adverse health effects to nearly all workers. PEL's are published and enforced by the Occupational Safety and Health Administration as a legal standard.

- **Pesticide** - For the purpose of this manual, the terms pesticide and pesticide chemical are synonymous with economic poison, as defined under the United States Department of Agriculture's Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA).

- **Pneumoconiosis** - Producing Dust - Dust that, when inhaled, deposited, and retained in the lungs, may produce signs, symptoms, and findings of pulmonary disease.

- **Poison** - Substances and mixtures of substances intended for defoliating plants, regulating plant growth or for preventing, destroying, repelling or mitigating any and all plant pests.

- **Protection Factor (PF)** - The overall protection afford by a certain type of respirator. For example, if a half-mask respirator has a protection factor of 10, it may be used for protection in atmospheres with a contaminant concentration up to 10 times the permissible exposure limit. A full face piece respirator provides a minimum protection factor of 50, and a powered air-purifying respirator provides a minimum protection factor of 100.

- **Qualitative Fit Test** - A test procedure to determine the effectiveness of the seal between the face mask and the wearer's face, usually performed during the fitting process.

- **Quantitative Fit Test** - The measurement of the effectiveness of a respirator seal in the ambient atmosphere. This test, using a *PORTACOUNT* or similar measuring device, is performed by dividing the measured concentration of the dust particles in the ambient atmosphere by the measured concentration of the particles inside the respirator face piece.

- **Resistance** – Opposition of the flow of air, as through a canister, cartridge, or particulate filter.

- **Respirator** - A device designed to protect the wearer from inhalation of harmful chemical, biological, or radioactive contaminants.

- **Self-Contained Breathing Apparatus (SCBA)** - For the purpose of this manual, a unit designed to provide to the wearer a respirable atmosphere independent of the ambient air. A supply of approved Type 1 Grade D compressed air contained in a gas cylinder is carried by the wearer. SCBA units are generally restricted to types equipped with pressure-demand regulators that maintain positive pressure in a full face mask.

- **Supplied-Air Respirator** - For the purpose of this manual, a hose-mask respirator equipped with a face piece, breathing tube, safety harness and safety line. The respirable air is supplied through an air hose connected to a compressed-air cylinder or air compressor.
- **Test Subject** - A person wearing a respirator for quantitative fit testing.

- **Threshold Limit Value (TLV)** - A list published yearly by the American Conference of Governmental Industrial Hygienists as a guide for exposure concentrations that a healthy individual normally can tolerate for 8 hours a day, five days a week, without harmful effects. Airborne particulate concentrations are generally listed

as milligrams per cubic meter of air (mg/m3), and gaseous concentrations are listed as parts per million (ppm) by volume.

- **Vapor** -The gaseous state of a substance that is solid or liquid at ordinary temperature and pressure.

1.0 RESPIRATORY PROTECTION PROGRAM

1.1 General

The EHS Office develops, implements, and manages safety and health programs for the Stockton's employees. The control of safety and health hazards at Stockton is primarily through the implementation of engineering, work practice and administrative controls. Personal Protective Equipment (PPE) is used to supplement these controls or whenever the controls are not feasible or are in the process of being implemented. PPE is also recommended whenever exposures to chemical, physical or biological agents can be prevented or reduced by its use.

This respiratory protection program is established to coordinate the use and maintenance of respiratory protective equipment when such equipment is used to reduce employee exposure to potentially hazardous agents or work environments. An effective comprehensive respiratory protection program is essential to assure that personnel using such equipment are adequately protected. All employee activities involving the use of respiratory protection equipment, as defined in this written program, shall be conducted in compliance with the Occupational Safety and Health Administration's (OSHA's) standard for respiratory protection 29 CFR 1910.134.

When respiratory protection is to be used it is critical that: (1) the correct type of equipment is chosen; (2) it is clean and in good working order; (3) a good fit is obtained; and (4) the user is adequately trained in the use, care and limitations of the protective device. This written program establishes the procedures and requirements necessary to meet established standards and federal regulations for use of respiratory protection equipment and to provide the necessary health and safety protection to those falling within the jurisdiction of the program.

Requirements outlined in this program are mandatory in nature where the word "SHALL" is used, and are advisory in nature where the word "SHOULD" is used.

1.2 Respiratory Protection Program Execution

The Respiratory Protection Program is administered by the Stockton's EHS Office. The EHS Office provides a centralized facility for purchasing, supplying, fitting, and evaluating on-site respiratory protection equipment and for training University personnel in its use.

1.3 Who Must Wear Respiratory Protection Equipment

Respiratory protection devices shall be used:

- For activities that cannot be safely controlled by engineering methods, such as for pesticide applications required by the EPA Worker Protection Standard or hazardous exposures to carcinogenic, mutagenic, teratogenic or other highly toxic materials.
- When the working atmosphere is or may be oxygen deficient. If so, supplied air respirators shall be used.
- When working in confined spaces where toxic (above 1ppm unknown VOC's) or hazardous atmospheres (oxygen deficient) are present.
- When airborne radioactive or toxic materials could exceed recommended exposure limits.
- For emergency use when loss of life or serious property loss or damage may be involved.

1.4 How to Obtain Respiratory Protection Equipment

- Each employee whose duties require the use of a respirator must contact the EHS Office to verify the requirement and verify the type of protection needed. Contact the EHS Office to request additional equipment or for vendor information for ordering supplies.

- Cartridge or Filter Media Change-out Schedule - Contact the EHS Office for area and chemical specific cartridge or filter media change out schedules based on the exposure concentration and duration.

1.5 Voluntary Use of Respirators

If employees choose to use respirators voluntarily, the requirements of 29 CFR 1910.134 (c) must be adhered to. This includes the following:

- Ensuring that the employee is medically qualified by a licensed healthcare professional to wear the assigned respirator.

- Providing the employee with the information contained in 29 CFR 1910.134, Appendix D.

- Ensuring that the respirator is cleaned, stored, and maintained so that it does not present a health hazard to the employee.

- Maintaining a completed copy of the Voluntary Respirator User Form for each employee/contractor voluntarily using a respirator. See Attachment 1

2.0 RESPONSIBILITIES

2.1 Supervisor

Each person in charge of a research project, maintenance, service or renovation, or other activity where respiratory protection equipment may be or is required is responsible for:

- Identifying, with the assistance of the EHS Office, those employees that may need respiratory protection equipment and scheduling them for fitting and training in the proper use and maintenance of the equipment.
- Requesting assistance from the EHS Office in evaluating new operations that may present health and safety hazards.
- Coordinating with the EHS Office in obtaining approval from the Occupational Health Physician before assigning known or suspected medically restricted employees to jobs requiring the use of respirators.
- Enforcing the use of respiratory protection equipment and other requirements when applicable.
- Keeping the department chairperson or director informed of any actions proposed or taken regarding the Respiratory Protection Program.
- Be cognizant of the Respiratory Protection Program requirements and ensure their employees comply with them.
- Support the Respiratory Protection Program as it relates to the needs of their employees.
- Support the EHS Office in identifying the need for hazard evaluations.

2.2 Employee

Any Stockton employee or contractor, who is required under the Respiratory Protection Program to wear respiratory equipment, or who participates in the Respiratory Protection Program, is responsible for:

- Utilizing the issued respiratory protection equipment in accordance with instruction and training provided by EHS Office personnel. This includes maintaining the respirator in a clean condition and ready to use at all times.
- Restricting the use of an assigned respirator to his or her's exclusive use.
- Informing his/her supervisor of any personal health problems that could be aggravated by the use of respiratory equipment.

2.3 EHS Office

The EHS Office is responsible for performing the following functions:

- Develops and administers the Respiratory Protection Program.
- Perform Hazard Evaluations.
- Reviewing and approving all purchases of respiratory protection equipment.
- Providing instruction on the need for respiratory protection, criteria for selecting respirators, and respirator fitting, use, and maintenance.
- Issuing the approved respiratory protection equipment, maintaining facilities for the reconditioning and maintenance of equipment, and providing the following additional services:

- Conducting initial, annual, and other required fit tests for employees who utilize respiratory protection equipment.
- Coordinating with a local occupational physician to provide and assist with the Stockton's medical surveillance program for respiratory protection.
- Answers specific questions, provides guidance, and responds to new projects or workplace hazards pertaining to (or may require the use of) respiratory protection.
- Perform periodic program evaluation.

2.4 Outside Contractors

Contractor personnel are responsible for the health and safety of their personnel while working at Stockton as well as the following program items:

- Provide, manage, and implement their own respiratory protection program.
- Contractor respiratory protection program shall comply with all Occupational Safety and Health Administration (OSHA) regulations as well as with Stockton's RPP.

3.0 AUTHORIZATION FOR USE

3.1 Authorization for Use of Respiratory Protection Equipment – Job Site Health Hazard Evaluation

Only those persons who have been designated by the supervisor or EHS Office as being required to utilize respiratory protection equipment and who have been properly fitted and trained in its use shall utilize such equipment.

HAZARD ASSESSMENT

Before the selection and assignment of a respirator, the EHS or a competent person under the supervision EHS, shall perform a hazard evaluation of the task that may require respiratory protection. The evaluation shall include the nature of the hazard, expected or actual levels of exposure, and the length of time the respiratory protection is required.

Whenever possible, air contaminants shall be controlled by accepted engineering control measures (e.g., enclosure, ventilation, wet methods, and substitution of less toxic materials). When effective engineering controls are not feasible, or while they are being instituted, appropriate respirators shall be used.

3.2 Evaluation of Required Respiratory Protection Equipment

The EHS Office shall evaluate and approve the purchase of all respiratory protection equipment before it is used. This selection is, of course, subject to change as new and improved equipment is available.

Approved Respirators - An approved respirator is one that has been certified jointly by NIOSH and the Mine Safety and Health Administration (MSHA) under the provisions of 42 CFR Part 84.

3.3 Instruction, Selection, Fitting, Training, and Maintenance

The EHS Office shall provide instruction on the need for respiratory protection, shall develop criteria for the selection and fitting of respirators, and shall provide training in the proper use and maintenance of respirators.

3.4 Procurement of Respirators

Initial half and full face mask respirators are available to the employee through the EHS Office after a job site hazard evaluation has deemed it necessary. Emergency needs shall be individually processed through the EHS Office. The organization utilizing the protective equipment will purchase replacement or additional equipment, depending on their use and needs requirements. This procedure gives added assurance that tasks involving the use

of this type of respiratory protection are properly evaluated. Some special applications not mentioned above are listed below:

1. Full-face respirators, fitted with corrective lens.
2. Air-supplied sandblast hoods.
3. Air-supplied plastic downdraft hoods.
4. Powered air-purifying respirators.
5. Welding hoods with filtering lenses.
6. Air line respirators with 5 minute escape bottles

The EHS Office will stock appropriate maintenance free NIOSH/MSHA approved respirators that provide needed protection. Each respirator is capable of being equipped with a filter and/or cartridges for the specific hazard to be protected against. The selection of proper respiratory equipment by EHS Office personnel is performed with the guidance of the NIOSH Guide to Industrial Respiratory Protection, and supplemental reference and support materials.

3.5 Education and Training

Education and training of employees in the use of respirators shall include a complete description of equipment issued, and the care, maintenance, purpose, and function of all parts thereof. Each employee will be instructed in proper wearing of the respirator approved for his or her use. Training will also include discussion of pertinent federal regulations, safety and health standards and EHS policies.

Training program

The EHS Office shall provide training for each employee who is required to wear a respirator.
Training shall be conducted by the EHS Office or a competent person designated by the EHS prior to use. Written records shall be kept for the duration of employment and shall include names, training dates, and subject areas covered. The subjects covered by the training shall include:

- The respiratory hazards to which an employee may be exposed
- The operation, limitations, and capabilities of the selected respirator
- Inspection, donning, and doffing of the respirator, including checking the fit and seals during respirator use
- Maintenance and storage of the respirator
- Respirator malfunctions
- The written Respiratory Protection Program
- The training will also include sufficient practice to enable the employee to become confident in the use of the respirator.

All supervisors of employees required to wear respirators shall also be trained in respirator selection, use, and maintenance. Respiratory protection training for non-voluntary users and supervisors is required annually.

3.6 Medical Evaluation and Medical Surveillance

Each employee whose duties require the use of a respirator will initially complete the OSHA 29 CFR 1910.134 Appendix C Medical Questionnaire prior to the medical exam and fit test (*see Attachment 2*). This form must be submitted to the EHS Office in a sealed envelope labeled with the employee name. The medical questionnaire is confidential and will be forwarded to the health services company used by Stockton. The EHS Office will provide the PLHCP with the following: type/weight of respirator to be worn, duration/frequency of respirator use, expected physical work effort, additional protective clothing/equipment to be worn, temperature/humidity extremes and copy of the written respiratory protection program (*see Attachment 3*). A follow-up medical examination shall be provided for an employee who gives a positive response to any of the questions among questions 1 through 8 in Section 2, Part A of Appendix C or whose initial examination demonstrates the need for a follow-up medical examination.

Additional medical evaluation shall be provided if the following occurs: (1) an employee reports signs or symptoms that are related to the ability to wear a respirator, (2) a PLHCP, supervisor or respirator program administrator

informs the employer that an employee needs a reevaluation, (3) information gathered during fit testing or program evaluation indicate a need to reevaluate, (4) a change occurs in the workplace that may result in a substantial increase in burden placed on an employee.

4.0 REQUIREMENTS FOR FITTING AND TESTING

4.1 Qualitative and Quantitative Fit Testing Requirements

All personnel required to utilize respiratory protection equipment must be qualitatively and/or quantitatively fit tested prior to use of the equipment and annually thereafter. The fitting of respirators will be facilitated by having multiple sizes and a variety of interchangeable cartridges. After the selection of the proper respirator has been made the user shall wear the proposed respirator for five minutes prior to the initiation of a qualitative or quantitative fit test.

4.2 Qualitative Fit Test

A qualitative fit test shall be performed in the following manner:

- **Positive-pressure check**: With the exhaust port(s) blocked, the positive pressure of slight exhalation should remain constant for several seconds.
- **Negative-pressure check**: With the intake port(s) blocked, the negative pressure of slight inhalation should remain constant for several seconds.
- **Stannous Chloride Irritant Smoke Test**: Once a satisfactory fit is obtained on the negative or positive pressure checks, the quality of the facial seal is verified by the use of stannous chloride irritant smoke. The high efficiency particulate filter cartridges are attached to the respirator for this test. The employee will be instructed to close his/her eyes and to breathe normally during the test. The irritant smoke is puffed around the entire face seal and cartridge seal, slowly at first and with increasing smoke density if the wearer experiences no irritation.

4.3 Quantitative Fit Test

A quantitative fit test instrument, *PORTACOUNT PLUS*, a continuous-flow condensation nucleus counter, is used in determining the particle concentration outside the mask and inside the mask. This ratio is known as the fit factor. A fit factor of 100 is considered passing the test for a half-mask, and 500 for the full face mask (10 x protection factor). The test subject shall perform the following exercises for each independent test:

- Normal Breathing (NB) In the normal standing position, without talking, the subject shall breathe normally for at least one minute.
- Deep Breathing (DB) In the normal standing position the subject performs deep breathing for at least one minute, pausing so as not to hyperventilate.
- Turning Head Side To Side (SS) Standing up, the subject shall slowly turn his/her head from side to side between the extreme positions to each side. The head shall be held at each extreme position for at least 5 seconds.
- Moving Head Up and Down (UD) Standing up, the subject shall slowly move his/her head up and down between the extreme position straight up and the extreme position straight down. The head shall be held at each extreme position for at least 5 seconds.
- Jaw Movements (JM) The subject will be asked to read the “rainbow passage” aloud during this test.
- Grimacing facial movements.
- Bending and touching the toes.
- Normal Breathing (NB) In the normal standing position, without talking, the subject shall breathe normally for at least one minute.

Additional exercises will be required for employees to be tested with SCBA. Respirator restraining straps may not be over-tightened for testing. The straps shall be adjusted by the wearer to give a reasonably comfortable fit typical of normal use. The employee shall use their personal respirator during the fit testing procedures. Employees who wear eyeglasses shall be tested while wearing them (half-mask respirators only).

4.4 Restrictions

The employee shall not be permitted to wear a half-mask or full face mask air purifying respirator if the minimum protection factor of 100 or 500, respectively, cannot be obtained. The test shall not be conducted if there is any hair growth between the skin and the face mask sealing surface. If an employee exhibits difficulty in breathing during the test, the test shall be cancelled, and a second attempt performed. If the second attempt fails, the information shall be provided to his/her supervisor, and the supervisor or employee contact the occupational physician to determine whether the employee is capable of utilizing respiratory protection while performing his or her duties.

4.5 Annual Quantitative/Qualitative Fit Testing Requirement

Quantitative fit testing will be performed at least annually. In addition, because the seal of the respirator may be affected, the quantitative fit testing shall be repeated immediately if the test subject has:

- A weight change of 20 pounds or more.
- Significant facial scarring in the area of the face piece seal
- Significant dental changes, i.e., multiple extraction without prosthesis, or dentures.
- Reconstructive or cosmetic surgery.
- Any other condition that may interfere with face piece sealing.

Qualitative fit testing shall be conducted at least annually on all SCBA mask users.

4.6 Records

A record shall be made of each fittest and will be filed in the EHS Office. After fitting has been completed, each employee shall be issued a copy of the fittest results indicating:

- Brand, type, and size of respirator to be used by the employee.
- Employee work location and job title
- Date tested. (Note: This certification must be updated annually).
- Results for each individual test
- Final Fit Factor result

5.0 OPERATING PROCEDURES FOR RESPIRATORY PROTECTION EQUIPMENT

This section contains operating instructions for each of the respiratory protective equipment routinely used at Stockton and instruction on their limitations for use.

5.1 Disposable Paper Dust Masks

Disposable paper dust respirators are **not** a recognized form of respiratory protection at Stockton and shall **not** be used at any time on it's controlled premises. This is a violation of the Respiratory Protection Program. Contact the EHS Office concerning respiratory protection, cartridge, or filter selection questions.

Limitations - Dust masks provide no protection against gases and vapors and, as they supply no oxygen, they cannot be used in oxygen deficient areas. Neither can they be worn for protection when facial hair extends under the face piece sealing area. The disposable dust masks offer very little protection due to poor sealing characteristics.

5.2 Air-Purifying Half-Mask Respirators

Availability and Types for Use - Half-mask respirators are the most widely used types of respirators. Several brands of this type are provided by EH&S to assure employees satisfactory fit. Each half-mask face piece is equipped with cartridges which purify the air as the wearer breathes. Different types of cartridges are available for filtering various air contaminants (See Table 1). For example, HEPA cartridges protect against low concentrations of radioactive/toxic particulates, nuisance dust, and asbestos fibers.

Limitations - Since this type of respirator does not supply air, it cannot be used in oxygen-deficient atmospheres or IDLH atmospheres. It can only be used for protection against the contaminants listed on the cartridge. It cannot be

used against natural gas or vapors with poor olfactory warning properties. The wearer should leave an area immediately if the smell of gas or vapor is detected inside the mask or if the breathing resistance increases. The half-mask respirator shall not be worn when facial hair extends under the face-mask sealing area.

Procedure - To put on and adjust a half-mask:

- Use the mask approved for use, as specified during the fitting session.
- Hold the mask so the narrow nose-cup points upward.
- Grasp both lower mask straps and hook them behind the neck and place the top cradle straps on the top and behind the head.
- Adjust the straps so the fit is snug but comfortable.
- Check for leaks when possible by covering the filter inlet opening with the palms of the hands and inhaling gently. If the mask pulls in toward the face, the fit is good. This is known as a negative pressure fit check.
- Check for leaks when possible by covering the exhalation valve and blowing out gently. The mask should hold a slight positive pressure. This is known as a positive pressure fit check.

5.3 Air-Purifying Full Face-Mask Respirators

Availability and Types for Use - Full facemask respirators provide more protection than half-masks because their shape allows a better mask-to-face seal. They also protect the eyes from irritating chemicals or particulate atmospheres. Full facemasks come equipped with selective types of air-purifying canisters/cartridges, dependent upon the protection required. Additionally, full facemasks are available with air-supplied systems such as airlines or SCBA units. Special arrangements must be coordinated in advance if this type of protection is required.

Limitations- Air-purifying full facemasks have the same limitations for use as half-mask respirators. Additionally, standard eyeglasses interfere with the mask-to-face seal; therefore, respirator wearers should obtain an additional pair of glasses through their department for installation into a mask. Limitations for use of full face mask with air-supplied systems is covered under subsection 4.14 SCBA.

Procedure - To don a full face-mask:

- Loosen all straps, pull the harness over the head, and place the chin in the chin cup.
- Pull the head harness well down on the back of the head.
- Tighten the harness gently, starting with the bottom straps and then the middle and top straps.
- Check the fit by closing off the air hose or canister opening with the palm of the hand and inhaling gently. The user should then hold his/her breath for a few seconds. A good fit is indicated if the mask remains collapsed toward the face during this time.
- A positive fit check should also be conducted.

5.4 Powered Air Purifying Respirators (PAPR)

Availability and Types For Use - PAPR units are belt-mounted battery-powered blower respirators. Contaminated air, containing moderate concentrations of particulates are passed through the HEPA cartridge(s) and a constant supply of purified air is supplied to a face piece, helmet, or hood. Since the blower has rechargeable batteries, it can be reused with the addition of a freshly charged battery or after the batteries have been recharged. A PAPR unit with a helmet or a hood can be worn by an employee with a beard, since this unit does not require a good seal between the face and the respirator.

Limitations - A PAPR with a belt-mounted blower and HEPA cartridges cannot be used in an oxygen-deficient atmosphere or in IDLH atmospheres or for protection against gases or vapors or asbestos. The batteries should be fully charged before using the blower.

Procedure - To use a powered air purifier:

- Check the unit to ensure that the HEPA cartridge(s) are securely attached.
- Mount the unit on your waist and adjust the belt until it is comfortable.
- Don the face mask, helmet or hood.

- Turn the blower on. Air will flow into the mask.

5.5 Self Contained Breathing Apparatus (SCBA)

Availability and Types For Use

SCBA units provide the user with a pure supply of breathing air regardless of ambient air contamination. They may be used in atmospheres unsuitable for air-purifying respirators. This includes use in IDLH atmospheres, in confined spaces, and for emergencies where breathing hazards may exist. Organizations required to utilize SCBA units must purchase their own equipment as approved by the EHS Office. SCBA units may be used in IDLH atmospheres only in conjunction with a positive-pressure full face-mask. All employees using SCBA must receive training and be fit tested.

Limitations - The air supply in a standard SCBA cylinder is normally rated for a 30-minute duration; however, heavy exertion and stress will increase breathing rates and deplete the air in less than 30 minutes. When the alarm bell on the unit sounds, the wearer has about 5 minutes of air remaining and should leave the area immediately. No one should work alone in hazardous atmospheres (IDLH); a standby with SCBA and proper communications equipment should always be nearby. The positive-pressure full face mask used with the SCBA unit cannot be worn when facial air extends under the face piece sealing area of the mask.

All breathing air used to fill bottles for SCBA's or cylinders used to service an airline respirator shall be certified by the supplier as meeting the minimum specifications of Type 1 Grade D Breathing Air as indicated in CGA-P-1-1965, ANSI Z88.2-1992, and 29 CFR 1910.134(d)(1). Couplings for breathing air lines shall be incompatible with other air cylinders or bottled gases. Breathing air cylinders shall be hydrostatically tested according to the Department of Transportation specifications for shipping containers (49 CFR 173). Breathing air cylinders shall be marked in accordance with ANSI 248.1 / CGA C-4-1978. Any cylinder, which the hydrostatic testing date has lapsed, shall be removed from service until retested. Cylinders must be retested by an authorized and experienced vendor every 3 years.
SCBA's are refilled at the SJTA Fire Department as necessary.

Procedure - Remove the unit from its case or cabinet and inspect it to ensure that it is operating properly before donning it.
Follow the instructions specified by the SCBA manufacturer for air cylinder operation.

- Check cylinder gauge for a "full" indication.
- Check the connection between the cylinder and high pressure hose to assure that it is snug.
- Don the SCBA unit and adjust harness.
- Stretch hose, and check overall condition of mask (straps, lens, etc.).
- Don mask and adjust, starting with bottom straps, then temple straps, and finally top strap (pull top strap snug, not tight).
- Place palm over end of hose and inhale slowly until mask is drawn toward face; hold breath for 10 seconds to see whether there is any leakage in the face piece-to-face seal.
- With palm still over the end of the hose, exhale, noting whether there is any leakage around the face piece. (This step also clears the exhalation valve).
- Connect breathing hose to regulator.
- Always switch regulator to positive-pressure mode (up) before entry into hostile atmosphere.
- A monthly inspection of the SCBA units will be performed by the EHS Office or other competent/designated individual to ensure proper operation for emergency use (Appendix F).

Pressure-Demand Regulator - the pressure-demand regulator minimizes any chance of contaminants leaking into the mask during inhalation, because the entire face mask is kept at positive pressure in relation to the ambient atmosphere. A special full face-mask equipped with a positive-pressure exhalation valve is held closed by air pressure to prevent contaminants from leaking into the face piece during inhalation.

Because proper performance of the pressure demand regulator is essential to the wearer's protection, any problems with the regulator must be immediately reported to the EHS Office.

5.6 Supplied Air Respirator/Compressed Breathing Air Requirements

A supplied air respirator or airline respirator is an atmosphere supplying respirator for which the source of breathing air is not designed to be carried by the user. An air compressor or breathing air cylinder is placed in a non-hazardous environment in close proximity to the area where the respirator is needed. An airline hose is then connected to the compressor or breathing air cylinder and also attached to the respirator mask. An example of use for this type of respirator would be inside a paint spray booth. The compressor would be placed outside the paint spray booth. Only full-face masks shall be used with supplied air respirators.

Compressed Breathing Air Requirements

Compressed breathing air shall meet at least the requirements for Type 1-Grade D breathing air described in ANSI/Compressed Gas Association Commodity Specification for Air, G-7.1-1989, to include:

1. Oxygen content (v/v) of 19.5-23.5%;

2. Hydrocarbon (condensed) content of 5 milligrams per cubic meter of air or less;

3. Carbon monoxide (CO) content of 10 ppm or less;

4. Carbon dioxide content of 1,000 ppm or less; and

5. Lack of noticeable odor.

6. Ensure that compressed oxygen is never used in atmosphere supplying respirators. Only breathing air shall be used.

7. At no time shall inert gas, or any other gas except breathing air, be introduced into breathing air lines or compressed air systems.

8. Ensuring that cylinders used to supply breathing air to respirators meet the following requirements:

(a) Cylinders are tested and maintained as prescribed in the Shipping Container Specification Regulations of the Department of Transportation (49 CFR part 173 and part 178);

(b) Cylinders of purchased breathing air have a certificate of analysis from the supplier that the breathing air meets the requirements for Type 1 -- Grade D breathing air; and

(c) The moisture content in the cylinder does not exceed a dew point of -50 deg.F (-45.6 degrees C) at 1 atmosphere pressure.

9. Ensuring that compressors used to supply breathing air to respirators are constructed and situated so as to:

(a) Prevent entry of contaminated air into the air-supply system;

(b) Minimize moisture content so that the dew point at 1 atmosphere pressure is 10 degrees F (5.56 deg.C) below the ambient temperature;

(c) Have suitable in-line air-purifying sorbent beds and filters to further ensure breathing air quality. Sorbent beds and filters shall be maintained and replaced or refurbished periodically following the manufacturer's instructions.

(d) Have a tag containing the most recent change date and the signature of the person authorized by the employer to perform the change. The tag shall be maintained at the compressor.

10. Compressors that are not oil-lubricated, the employer shall ensure that carbon monoxide levels in the breathing air do not exceed 10 ppm.

11. For oil-lubricated compressors, the employer shall use a high-temperature or carbon monoxide alarm, or both, to monitor carbon monoxide levels. If only high-temperature alarms are used, the air supply shall be monitored at intervals sufficient to prevent carbon monoxide in the breathing air from exceeding 10 ppm.

12. The employer shall ensure that breathing air couplings are incompatible with outlets for nonrespirable worksite air or other gas systems. **No asphyxiating substance shall be introduced into breathing air lines.**

13. The employer shall use breathing gas containers marked in accordance with the NIOSH respirator certification standard, 42 CFR part 84.

5.7 Specialized Respiratory Protection Equipment

Use of a pressure-demand, airline system may be permitted in an IDLH atmosphere under certain conditions. For example, if protection is required over an extended period of time, it would be impractical to use SCBA because of frequent bottle-changing requirements. Should the above type protective equipment or other specialized equipment be required, contact the EHS Office for a needs assessment.

5.8 Warning Signs of Respirator Failure

Particulate Air-Purifying – When breathing difficulty is encountered with a filter respirator the filter must be replaced.

Gas or Vapor Air-Purifying – When using a gas or vapor respirator (chemical cartridge or canister) and any of the warning properties (i.e. odor, taste, eye/respiratory irritation or end of service life indicator) occur promptly leave the area and check the following: (1) proper face seal, (2) damaged or missing respirator parts, (3) saturated or inappropriate cartridge or canister. If no discrepancies are observed, replace the cartridge or canister. If any of the warning properties appear again, the concentration of the contaminants may have exceeded the design specification.

5.9 Cartridge Change-out Schedule

For those organic vapor air purifying cartridges used that do not have an end of service life indicator, a schedule of cartridge change-out has been established and can be found in the standard operating procedures developed for each specific work area as applicable.

6.0 EMERGENCY USE OF RESPIRATORS

This procedure limits the type of respirators to use during emergencies where breathing hazards may exist.

6.1 Emergency Situations

An emergency can be defined as "an unforeseen combination of circumstances that calls for immediate action." Respiratory hazards often occur during emergencies when fire fighters or other emergency service personnel need immediate entry into a fire, hazardous materials emergency or accident scene.

Other types of breathing hazards may occur when personnel are exposed to hazardous substances while trapped by an accident or escaping from the scene of a fire or accident, or when they are exposed to hazardous spills; an unforeseen chemical reaction may also result in an overexposure to hazardous substances.

6.2 Emergency Respiratory Equipment

Each respiratory protection device has a limited ability to protect health. During emergency entry, when there is usually neither time nor opportunity to evaluate the degree of exposure, only SCBA's operating in the pressure-demand mode should be used. SCBA's are approved for use in IDLH atmospheres. After the type and degree of breathing hazards are evaluated, other respiratory equipment may be recommended.

6.3 Emergency 5-minute Escape Apparatuses

An escape respirator shall be available for each worker when the potential for releases of unknown chemicals exist.

7.0 MAINTENANCE AND CARE OF RESPIRATORS

7.1 Inspection and Repair

Respirators must be inspected for defects. OSHA requires that "all respirators be inspected routinely before and after each use" with the exception of those respirators used as emergency escape and rescue devices that "shall be inspected after each use and at least monthly." It is extremely important that the exhalation valve system of the respirator be in perfect operating condition. A defective valve system may allow contaminated air to leak into the facepiece.

Although inspection procedures will vary depending on the type of respiratory device being inspected, these general items should be looked for during the inspection:

- Facepiece - The facepiece should be examined for: excessive dirt; cracks, tears, holes or physical distortion; cracked or broken connectors or plugs; cracked or badly scratched lenses in full facepiece respirators; properly sealed lenses in full facepieces; all screws and nuts tightened; missing or defective inhalation valves and missing or damaged exhalation valves.

- Suspension or Headgear - Examine the suspension or headgear for: cuts or cracks in rubber, plastic; loss of elasticity; broken or malfunctioning buckles, loops, or hooks; secure attachment to facepiece via yoke, harness, or buckle; excessively worn serrations of rubber headbands that might permit slippage.

- Exhalation Valve - Remove the exhalation valve cover and examine the exhalation valve for: foreign matter, e.g. dirt, hair, etc. that may be between the valve and the valve seat; cracks, tears or distortion in the valve material (valve should be flush with the valve seat); cracks, breaks, or chips in valve seat; improper insertion of valve seat into facepiece; missing or defective valve cover.

- Powered air purifying, and supplied air respirators all require specific inspections procedures depending on the type of equipment being used. Consult the manufacturer's manual for inspection recommendations. Regulators, reducing or admission valves, and alarms shall be returned to the manufacturer for repair.

- OSHA states that "replacement or repairs shall be done only be experienced persons with parts designed for that respirator. No attempt shall be made to replace components or to make adjustment or repairs beyond the manufacturer's recommendations."

- Any questionable part found during inspection should be replaced or repaired before the respirator is returned to service. For parts such as those used on Pressure Demand Respirators, consult applicable instructions for further details. Do not attempt to repair any parts when there are no repair procedures listed in the instruction manual. Do not use parts from a different manufacturer on a respirator. This voids the respirator warranty and may affect proper functioning of the respirator.

The manufacturer’s manual shall be consulted prior to any repair of respiratory protection.

7.2 Cleaning and Sanitizing

A respirator issued for other than continuous use by a particular worker shall be cleaned and sanitized after each use. Respirators assigned to specific workers shall be cleaned as necessary. Cleaning procedures shall be in accordance with the manufacturer’s manual.

Other possible respiratory protective equipment cleaning procedures:

a). Benzylconium chloride antiseptic individual respirator wipe pads (alcohol free).

b). Hypochlorite solution (approximately 50 ppm chlorine) - Add two tablespoons of household bleach (Clorox or equivalent) to 1 gallon water. This solution effectively kills many bacteria and viral organisms, including hepatitis, AIDS and influenza (Centers for Disease Control).

c). Iodine solution (approximately 50 ppm iodine) - Add one teaspoon tincture of Iodine to 1 gallon water. The facepieces should be immersed in the disinfectant for two minutes after cleaning.

d). Respirators must be rinsed thoroughly to remove the disinfectant. Dermatitis of the face could result from improperly rinsed facepieces. Thoroughly dry respirators prior to storage or use.

7.3 Storage

The purpose of proper storage is to ensure any respirator will function as designed. A poor, but unfortunately common, practice is to store respirators in a tool box or storage cabinet used for other goods. Not only will this keep the respirator unclean, but it will distort the facepiece and components, which could result in a defective respirator. After cleaning, inspection and repair, respirators must be stored in a clean, dry place. This protects them from dust and dirt, sunlight, extreme temperatures, excessive moisture, damaging chemicals, and physical distortion.

Storage shall be in accordance with the following requirements:

- Storage shall protect respirators against dust, sunlight, heat, extreme cold, excessive moisture, or damaging chemicals.
- Respirators shall be stored to prevent distortions of rubber or other elastomeric parts.
- Respirators shall not be stored in lockers or toolboxes, unless, they are protected from contamination, distortion, or damage.
- Nothing shall ever be stored on top of a respirator.
- Respirator facepieces shall be thoroughly dried prior to storage and placed in plastic bags or equivalent.

The manufacturer's manual shall be consulted to ensure proper storage.

7.4 Employee (User) Responsibility

Primary responsibility for maintaining the respirator in proper and clean condition rests with the employee wearing the respirator.

A respirator should be returned to the EHS Office if any of the following conditions are met:

- It becomes too difficult to breathe through the respirator and changing the cartridges does not alleviate the problem.
- A proper fit cannot be obtained.
- If the user experiences significant discomfort during use.

The cartridges should be replaced according to a cartridge change-out schedule (see shop specific standard operating procedure) obtained from air sampling data during monitored working conditions.

- Using breakthrough, detection of any odor or taste is detected or it becomes difficult to breathe through the respirator is not acceptable to determine the need for filter replacement.
- After each use, thoroughly clean and dry the respirator.
- Store respirator in the original bag or similar protective means as provided.

7.5 Safety and Health Responsibility

- Ensure that respirator users disinfect and clean respirators.
- Inspect valves, head straps and other parts. Provide new parts and replace if defective.
- If a maintenance free respirator, discard old respirator and provide

- Provide replacement filter/cartridge(s) per users request or per site evaluations and inspections.
- Inspect respirator use and storage areas to ensure respirators are being properly used and located in plastic bags or other appropriate areas.
- Reissue reconditioned respirators after repair, if necessary or applicable.
- Conduct a monthly survey of all SCBA and escape units.
- Conduct annual training classes on respirator inspection and training requirements for personnel.
- Assist with coordination of medical surveillance annual physicals and conduct annual fittesting for employee's personal respirators.
- It malfunctions or is damaged.

8.0 Program Evaluation

The EHS Office shall evaluate the effectiveness of the respirator program on an annual basis. During the evaluation, respirator program participants and their immediate supervisors may be interviewed. The interviews will be used to evaluate wearer acceptance of the respirator program (as to respirator selection, training, donning and fit, maintenance, storage, medical aspects and use) and to appraise the protection afforded based on monitoring data. In addition, random inspections shall be conducted to ensure compliance with the program.

Inspections/audits shall be conducted periodically to evaluate the effectiveness of the respiratory protection program. The immediate supervisor may be required to assist the EHS Office in the evaluation procedure. Respiratory protection program evaluations shall consist of the following elements:

8.1 Wearer Acceptance

Respirator users shall be consulted periodically on their acceptance of respiratory protection. This is a key element of any evaluation since respiratory protection is only as effective as the employee's willingness to use it properly. Factors which may affect acceptance include:

- Comfort
- Resistance to breathing
- Fatigue
- Interference with vision
- Interference with communication
- Restriction of movement
- Interference with job performance
- Confidence in the effectiveness of the respirator to provide adequate protection

8.2 Inspection of Respirator Program Operation

Inspections of the respiratory protection program shall be conducted. Inspections shall evaluate the effectiveness of the program:

- Selection of respiratory protection
- Training
- Use of respiratory protection
- Operating condition of respiratory protection
- Respirator storage
- Work area surveillance
- Medical surveillance program

Table 1
Air Purifying Respirator Chemical Cartridge Types

Atmospheric Contaminants to be Protected Against	Colors Assigned
ACID GASES	WHITE
HYDROCYANIC ACID GAS	WHITE W/GREEN STRIPE
CHLORINE GAS	WHITE W/YELLOW STRIPE
ORGANIC VAPORS	BLACK
AMMONIA GAS	GREEN
ACID GAS AND AMMONIA GAS	GREEN W/WHITE STRIPE
CARBON MONOXIDE	BLUE
ACID GASES AND ORGANIC VAPORS	YELLOW
HYDROCYANIC ACID GAS AND CHLOROPICRIN VAPOR	YELLOW W/BLUE STRIPE
ACID GASES, ORGANIC VAPORS, AND AMMONIA GASES	BROWN
RADIOACTIVE MATERIALS, EXCEPTING TRITIUM AND NOBLE GASES	PURPLE
PARTICULATES (DUSTS, FUMES, MISTS, FOGS, OR SMOKES) IN COMBINATION WITH ANY OF THE ABOVE GASES OR VAPORS	CANISTER FOR CONTAMINANT AS STATED ABOVE W/GRAY STRIPE
ALL OF THE ABOVE ATMOSPHERIC CONTAMINANTS	RED W/GRAY STRIPE

Attachment 1

Voluntary Respirator User Form

Licensed Healthcare Professional Section

_____ is medically able to wear the following type of respirator _____

_____ is not medically able to wear the following type of respirator _____

Comments:_____
_____
_____

Licensed Healthcare Professional Name_____

Licensed Healthcare Professional *Signature*_____**Date**_____

Respirator User Section

I have received a copy of 29 CFR 1910.134 Appendix D, *Information for Employees Using Respirators when not Required under the Standard*

Name_____**Organization**_____**Phone**_____
Signature_____**Date**_____

I have received the following type of respirator:

Type of Respirator_____

Name_____**Organization**_____**Phone**_____
Signature_____**Date**_____

Respirator Provider Section

_____ was provided with the above mentioned respirator.

Name_____ **Organization**_____**Phone**_____

Signature_____**Date**_____

ATTACHMENT 2

Stockton's
Respiratory Protection Program

OSHA Medical Evaluation Questionnaire

Each employee whose duties require the use of a respirator, and who has not received an annual occupational medical examination for respirator use, must complete the OSHA 29 CFR 1910.134 Appendix C Medical Qualification Form. This questionnaire will be submitted by the EHS Office to the Examining Physician or Other Licensed Healthcare Professional (PLHCP) at the health services company providing annual medical exams for qualifying Stockton employees. After completing the questionnaire, to maintain confidentiality, please submit it in a sealed envelope to the EHS Office to the attention of:

Amber Berry
The EHS Office
Bldg. 70 Plant Building

Additional medical evaluation shall be provided if the following occurs: (1) an employee reports signs or symptoms that are related to the ability to wear a respirator, (2) a PLHCP, supervisor or respirator program administrator informs the employer that an employee needs a re-evaluation, (3) information gathered during fit testing or program evaluation indicate a need to re-evaluate, (4) a change occurs in the workplace that may result in a substantial increase in burden placed on an employee.

Appendix C to Sec. 1910.134: OSHA Respirator Medical Evaluation Questionnaire (Mandatory)

To the employer: Answers to questions in Section 1, and to question 9 in Section 2 of Part A, do not require a medical examination.

To the employee:

Can you read (circle one): Yes/No

Answer this questionnaire during normal working hours, or at a time and place that is convenient to you. To maintain your confidentiality, your answers will not be reviewed by your employer or supervisor.

Part A. Section 1. (Mandatory) The following information must be provided by every employee who has been selected to use any type of respirator (please print).

1. Today's date:_____

2A. Your name:_____

2B. Organization ID:_____ 2C. Supervisor_____

3. Your age (to nearest year):_____

4. Sex (circle one): Male/Female

5. Your height: _____ ft. _____ in.

6. Your weight: _____ lbs.

7. Your job title:_____

8. A phone number where you can be reached by the health care professional who reviews this questionnaire (include the Area Code): _____

9. The best time to phone you at this number: _____

10. Has your employer told you how to contact the health care professional who will review this questionnaire (circle one): Yes/No

11. Check the type of respirator you will use (you can check more than one category):
a. _____ N, R, or P disposable respirator (filter-mask, non- cartridge type only).
b. _____ Other type (for example, half- or full-facepiece type, powered-air purifying, supplied-air, self-contained breathing apparatus).

12. Have you worn a respirator (circle one): Yes/No

If "yes," what type(s):_____
_____

Part A. Section 2. (Mandatory) Questions 1 through 9 below must be answered by every employee who has been selected to use any type of respirator (please circle "yes" or "no").

1. Do you **currently** smoke tobacco, or have you smoked tobacco in the last month: Yes/No

2. Have you **ever had** any of the following conditions?

a. Seizures (fits): Yes/No
b. Diabetes (sugar disease): Yes/No
c. Allergic reactions that interfere with your breathing: Yes/No
d. Claustrophobia (fear of closed-in places): Yes/No
e. Trouble smelling odors: Yes/No

3. Have you **ever had** any of the following pulmonary or lung problems?

a. Asbestosis: Yes/No
b. Asthma: Yes/No
c. Chronic bronchitis: Yes/No
d. Emphysema: Yes/No
e. Pneumonia: Yes/No
f. Tuberculosis: Yes/No
g. Silicosis: Yes/No
h. Pneumothorax (collapsed lung): Yes/No
i. Lung cancer: Yes/No
j. Broken ribs: Yes/No
k. Any chest injuries or surgeries: Yes/No
l. Any other lung problem that you've been told about: Yes/No

4. Do you **currently** have any of the following symptoms of pulmonary or lung illness?

a. Shortness of breath: Yes/No
b. Shortness of breath when walking fast on level ground or walking up a slight hill or incline: Yes/No
c. Shortness of breath when walking with other people at an ordinary pace on level ground: Yes/No
d. Have to stop for breath when walking at your own pace on level ground: Yes/No
e. Shortness of breath when washing or dressing yourself: Yes/No
f. Shortness of breath that interferes with your job: Yes/No
g. Coughing that produces phlegm (thick sputum): Yes/No
h. Coughing that wakes you early in the morning: Yes/No
i. Coughing that occurs mostly when you are lying down: Yes/No
j. Coughing up blood in the last month: Yes/No
k. Wheezing: Yes/No
l. Wheezing that interferes with your job: Yes/No
m. Chest pain when you breathe deeply: Yes/No
n. Any other symptoms that you think may be related to lung problems: Yes/No

5. Have you **ever had** any of the following cardiovascular or heart problems?

a. Heart attack: Yes/No
b. Stroke: Yes/No
c. Angina: Yes/No
d. Heart failure: Yes/No
e. Swelling in your legs or feet (not caused by walking): Yes/No
f. Heart arrhythmia (heart beating irregularly): Yes/No
g. High blood pressure: Yes/No
h. Any other heart problem that you've been told about: Yes/No

6. Have you **ever had** any of the following cardiovascular or heart symptoms?

a. Frequent pain or tightness in your chest: Yes/No
b. Pain or tightness in your chest during physical activity: Yes/No
c. Pain or tightness in your chest that interferes with your job: Yes/No
d. In the past two years, have you noticed your heart skipping or missing a beat: Yes/No
e. Heartburn or indigestion that is not related to eating: Yes/ No
f. Any other symptoms that you think may be related to heart or circulation problems: Yes/No

7. Do you **currently** take medication for any of the following problems?

a. Breathing or lung problems: Yes/No
b. Heart trouble: Yes/No
c. Blood pressure: Yes/No
d. Seizures (fits): Yes/No

8. If you've used a respirator, have you **ever had** any of the following problems? (If you've never used a respirator, check the following space and go to question 9:)

a. Eye irritation: Yes/No
b. Skin allergies or rashes: Yes/No
c. Anxiety: Yes/No
d. General weakness or fatigue: Yes/No
e. Any other problem that interferes with your use of a respirator: Yes/No

9. Would you like to talk to the health care professional who will review this questionnaire about your answers to this questionnaire: Yes/No

Questions 10 to 15 below must be answered by every employee who has been selected to use either a full-facepiece respirator or a self-contained breathing apparatus (SCBA). For employees who have been selected to use other types of respirators, answering these questions is voluntary.

10. Have you **ever lost** vision in either eye (temporarily or permanently): Yes/No
11. Do you **currently** have any of the following vision problems?

a. Wear contact lenses: Yes/No
b. Wear glasses: Yes/No
c. Color blind: Yes/No
d. Any other eye or vision problem: Yes/No

12. Have you **ever had** an injury to your ears, including a broken ear drum: Yes/No
13. Do you **currently** have any of the following hearing problems?

a. Difficulty hearing: Yes/No
b. Wear a hearing aid: Yes/No
c. Any other hearing or ear problem: Yes/No

14. Have you **ever had** a back injury: Yes/No
15. Do you **currently** have any of the following musculoskeletal problems?

a. Weakness in any of your arms, hands, legs, or feet: Yes/No
b. Back pain: Yes/No
c. Difficulty fully moving your arms and legs: Yes/No
d. Pain or stiffness when you lean forward or backward at the waist: Yes/No
e. Difficulty fully moving your head up or down: Yes/No
f. Difficulty fully moving your head side to side: Yes/No
g. Difficulty bending at your knees: Yes/No
h. Difficulty squatting to the ground: Yes/No
i. Climbing a flight of stairs or a ladder carrying more than 25 lbs: Yes/No
j. Any other muscle or skeletal problem that interferes with using a respirator: Yes/No

Part B Any of the following questions, and other questions not listed, may be added to the questionnaire at the discretion of the health care professional who will review the questionnaire.

1. In your present job, are you working at high altitudes (over 5,000 feet) or in a place that has lower than normal amounts of oxygen: Yes/No

If "yes," do you have feelings of dizziness, shortness of breath, pounding in your chest, or other symptoms when you're working under these conditions: Yes/No

2. At work or at home, have you ever been exposed to hazardous solvents, hazardous airborne chemicals (e.g., gases, fumes, or dust), or have you come into skin contact with hazardous chemicals: Yes/No

If "yes," name the chemicals if you know them:_____

_____

_

_____

_

3. Have you ever worked with any of the materials, or under any of the conditions, listed below:

a. Asbestos: Yes/No
b. Silica (**e.g.,** in sandblasting): Yes/No
c. Tungsten/cobalt (e.g., grinding or welding this material): Yes/No
d. Beryllium: Yes/No
e. Aluminum: Yes/No
f. Coal (for example, mining): Yes/No
g. Iron: Yes/No
h. Tin: Yes/No
i. Dusty environments: Yes/No
j. Any other hazardous exposures: Yes/No

If "yes," describe these exposures:_____

_____

_

_____

_

4. List any second jobs or side businesses you have:_____

_____

_

5. List your previous occupations:_____

_____

_

6. List your current and previous hobbies:_____

_____

_

7. Have you been in the military services? Yes/No

If "yes," were you exposed to biological or chemical agents (either in training or combat): Yes/No

8. Have you ever worked on a HAZMAT team? Yes/No

9. Other than medications for breathing and lung problems, heart trouble, blood pressure, and seizures mentioned earlier in this questionnaire, are you taking any other medications for any reason (including over-the-counter medications): Yes/No

If "yes," name the medications if you know them:_____
10. Will you be using any of the following items with your respirator(s)?

a. HEPA Filters: Yes/No
b. Canisters (for example, gas masks): Yes/No
c. Cartridges: Yes/No

11. How often are you expected to use the respirator(s) (circle "yes" or "no" for all answers that apply to you)?:

a. Escape only (no rescue): Yes/No
b. Emergency rescue only: Yes/No
c. Less than 5 hours **per week:** Yes/No
d. Less than 2 hours **per day:** Yes/No
e. 2 to 4 hours per day: Yes/No
f. Over 4 hours per day: Yes/No

12. During the period you are using the respirator(s), is your work effort:

a. **Light** (less than 200 kcal per hour): Yes/No

If "yes," how long does this period last during the average shift:_____hrs._____mins.
Examples of a light work effort are **sitting** while writing, typing, drafting, or performing light assembly work; or **standing** while operating a drill press (1-3 lbs.) or controlling machines.

b. **Moderate** (200 to 350 kcal per hour): Yes/No

If "yes," how long does this period last during the average shift:_____hrs._____mins.
Examples of moderate work effort are **sitting** while nailing or filing; **driving** a truck or bus in urban traffic; **standing** while drilling, nailing, performing assembly work, or transferring a moderate load (about 35 lbs.) at trunk level; **walking** on a level surface about 2 mph or down a 5-degree grade about 3 mph; or **pushing** a wheelbarrow with a heavy load (about 100 lbs.) on a level surface.

c. **Heavy** (above 350 kcal per hour): Yes/No

If "yes," how long does this period last during the average shift:_____hrs._____mins.
Examples of heavy work are **lifting** a heavy load (about 50 lbs.) from the floor to your waist or shoulder; working on a loading dock; **shoveling; standing** while bricklaying or chipping castings; **walking** up an 8-degree grade about 2 mph; climbing stairs with a heavy load (about 50 lbs.).

13. Will you be wearing protective clothing and/or equipment (other than the respirator) when you're using your respirator: Yes/No

If "yes," describe this protective clothing and/or equipment:_____
_____
_

14. Will you be working under hot conditions (temperature exceeding 77 deg. F): Yes/No
15. Will you be working under humid conditions: Yes/No
16. Describe the work you'll be doing while you're using your respirator(s):
_____
_
_____
_

17. Describe any special or hazardous conditions you might encounter when you're using your respirator(s) (for example, confined spaces, life-threatening gases):
_____
_
_____
_

18. Provide the following information, if you know it, for each toxic substance that you'll be exposed to when you're using your respirator(s):
Name of the first toxic substance:_____
Estimated maximum exposure level per shift:_____
Duration of exposure per shift:_____
Name of the second toxic substance:_____
Estimated maximum exposure level per shift:_____
Duration of exposure per shift:_____
Name of the third toxic substance:_____
Estimated maximum exposure level per shift:_____
Duration of exposure per shift:_____
The name of any other toxic substances that you'll be exposed to
while using your respirator:
_____
_____
_____

19. Describe any special responsibilities you'll have while using your respirator(s) that may affect the safety and well-being of others (for example, rescue, security):
_____
_____

[63 FR 1152, Jan. 8, 1998; 63 FR 20098, April 23, 1998]

ATTACHMENT 3

Supplemental Information for the Physician or Other Licensed Health Care Professional (PLHCP)

Employer Name:_____Date: _____

Employee Name:_____

Organization: _____ Supervisor: _____

Type of respirator(s) to be used by the employee:	
[ ] Negative Pressure Air-purifying Full Facepiece [ ] Negative Pressure Air-purifying Half Facepiece [ ] Positive Pressure Air-purifying (powered) [ ] Positive Pressure Continuous-flow airline respirator [ ] Positive Pressure Pressure Demand Self-Contained Breathing Apparatus	
Level of Work Effort:	**Extent of Usage:**
[ ] Light [ ] Moderate [ ] Heavy [ ] Strenuous	[ ] Daily for _____ hours per use [ ] _____ times per week for _____hours per use. [ ] _____ time per month for _____hours per use. [ ] Escape only [ ] Emergency Response – Fire & Rescue [ ] Emergency Response – Chemical/Biological/Radiological Agents [ ] Emergency Response - Confined Space Rescue

The employee has been provided with a copy of the Medical Assessment Form with Respirator Recommendations.

PLHCP Signature: _____ Date:_____

Completed by:_____Date: _____

APPENDIX H: Stockton University Asbestos Abatement Document

Stockton University

ASBESTOS ABATEMENT-BUILDING XXX, ROOM #XXX

1. The Contractor shall remove and dispose of approximately (state dimensions- -lineal feet, square feet, pipe insulation thickness, description of materials, etc. in Building XXX, Room #XXX, or room description).

2. The Contractor shall be a licensed asbestos removal firm in the State of New Jersey. The Contractor shall follow all Federal (including 29 CFR 1926.1101) and State Regulations (including NJAC 5:23 Subchapter 8) during removal, cleanup, and disposal. These requirements include the submittal of the EPA notification and DEP waste manifest to Stockton's EHS Office. As defined by NJAC 5:23-8:11, an "asbestos safety control monitor" shall be utilized for supervising and inspecting all work performed. The Contractor shall provide a copy of his current license at least two (2) weeks before work begins.

3. If floor tile removal- -The Contractor has the option of performing the floor tile/mastic/carpeting removal by hand or machine, utilizing appropriate enclosure procedures to prevent asbestos fiber release. It is recommended that electric heating devices/pry bars (or equivalent) be utilized to remove the floor tile in accordance with the "Recommended Work Practices for the Removal of Resilient Floor Coverings" as stated by the Resilient Floor Covering Institute. If other types of removal, state method (i.e. enclosure, glove bag, etc.).

4. The doors leading to each work area will remain shut and taped during the entire removal project. The Contractor shall utilize two layers of 6-mil polyethylene sheeting for containment of the work area.

5. The Contractor shall HEPA-vacuum each work area after asbestos removal work is completed.

6. The Contractor shall perform personal air monitoring to be conducted in accordance with 29 CFR 1910.1001 of the OSHA Regulations, on behalf of the Contractor's employees. The sampling shall be analyzed by means of Phase Contrast Microscopy (PCM). Results of the monitoring shall be returned within twenty-four (24) hours to the Stockton's EHS' office. If removal work is required to be performed off-hours or weekends, the Contractor shall utilize an "asbestos safety technician" to perform the required personal monitoring and sampling. The Contractor shall provide all qualified personnel and equipment to perform said monitoring.

7. The Contractor shall use a National Voluntary Lab Accreditation Program (NVLAP) lab for analytical work. This laboratory shall be licensed by the State of New Jersey and certified for the analytical procedures performed. Copies of said license shall be provided to Stockton's EHS Office at least two (2) weeks before work begins. The laboratory results shall include the laboratory's accreditation number.

8. If applicable, state reference to any drawings, sketches, which would show location(s) of asbestos, phase plan(s), etc.

9. The abatement project shall be inspected and monitored by Stockton personnel. Stockton's sampling schedule is as follows (analysis by means of "testing method- -PCM or TEM")- -

   State number of samples to be taken for each Work Area…

   All sampling results shall be returned within twenty-four (24) hours. If the results are not satisfactory, re-cleaning shall be performed at no cost to the Stockton. Containment installed for each phase shall not be removed until the sampling results for that area are satisfactory.

10. The Contractor shall submit to Stockton's EHS Office the list of their licensed removal workers to be utilized on this abatement project and copies of their current licenses at least two (2) weeks before work begins. The Contractor shall designate his "asbestos safety technician" with this submittal. At the same time, the Contractor shall also submit an Asbestos Removal and Disposal Plan that addresses use of personal protective equipment with a respirator change out schedule, decon procedures, maintaining negative pressure in the abatement area, coordination for lockout/tagout of HVAC units, and all other requirements in the NJAC Code.

11. The Contractor shall submit to Stockton's EHS Office an abatement schedule at least two (2) weeks before work begins.

12. The Contractor shall obtain Pollution Legal Liability insurance with the minimum limits of $2,000,000 combined single limit and $4,000,000 aggregate. Written evidence should be in the form of a Certificate of Insurance and be forwarded to Stockton's EHS' Office with the submittal requirements listed in Item #11.

OTHER CONDITIONS

1. The Contractor shall perform all work during the hours of 8:00 a.m. to 4:30 p.m., Monday through Friday, excluding Federal Holidays, unless an alternate work schedule is approved in advance by Stockton.

2. The Contractor shall notify the following organizations at least forty-eight (48) hours before work is to begin:

    (a) John Fritsch, Assistant VP Facilities Management and Plant Operations
    Phone: 609-626-6052

    (b) Chris Corea, Associate Director EHS
    Phone: 609-652-4496

    (c) Amber Berry, Manager EHS
    Phone: 609-626-6126

    (d) Skip (Charles) West, Executive Director of Facilities Planning and Construction
    Phone: 609-626-3551

3. Failure to make the proper external regulatory notifications as well as the internal notifications required by this document shall not entitle the Contractor to make claims against Stockton for delays, damages, or additional costs.

4. The Contractor shall perform all work required within XXX (xx) calendar days after receiving notice-to-proceed. The notice-to-proceed shall be issued following the 10-day notification to the DEP. A copy of this notification shall be provided to Stockton's EHS Office at this time.

5. One copy of the EPA Waste Manifest shall be forwarded to Stockton within five (5) calendar days after all work is completed.