

02 82 00 – Asbestos Remediation

I. PROJECT COORDINATION

A. General

1. All Asbestos Abatement Contractors will be licensed general contractors in either the specialty interior, building, unclassified or asbestos categories by the North Carolina-Licensing Board of General Contractors and limited for the bid amount.
2. The Contractor shall be responsible for inspecting the site prior to bidding to confirm the scope of the work. Any quantities listed in the plans, specifications or surveys are done so as approximations. The actual quantities of asbestos-containing material to be encountered are the responsibility of the Contractor.
3. The Contractor shall furnish and is responsible for all costs including, but not limited to: permit fees, containment preparation, labor, materials, services, insurance, bonding and equipment necessary to carry out the abatement operations and disposal of all asbestos material in accordance with the plans and specifications, the EPA and OSHA regulations and any applicable state and local government regulations.
4. The Contractor/Employer has and assumes the responsibility of proceeding in such a manner that he offers his employees a workplace free of recognized hazards causing or likely to cause death or serious injury. The Contractor shall be responsible for performing this abatement and disposal so that airborne asbestos fiber levels do not exceed established levels.
5. The Contractor will be responsible for all costs associated with employee monitoring to meet the OSHA requirements.
6. The Contractor is responsible for all costs, including additional visits, should the Duke University Occupational and Environmental Safety Office (OESO) determine that the contractor failed a final inspection. Notification and scheduling of the final inspection during the project is the responsibility of the Contractor. The Contractor will allow a minimum notice of 48 hours unless a different time frame is agreed upon by OESO and the Contractor.

B. Personnel

1. Supervisor
 - a. All supervisors shall be accredited by the Health Hazards Control Branch (HHCB).

- b. All supervisors on the project shall have two years experience in the administration and supervision of asbestos abatement projects including work practices, protective measures for building and personnel, disposal procedures, etc.
 - c. One supervisor shall be provided for every 10 workers inside the containment. A minimum of one supervisor shall be provided per project.
 - d. The Contractor shall have at least one employee on the job site in either a foreman or supervisor's position that is bilingual in the appropriate languages when employing workers who do not speak fluent English.
 - e. A minimum of one supervisor per company shall have attended a 24 hour respiratory protection course.
2. Worker
 - a. All workers shall be accredited by the HHCB.
3. Competent Person
 - a. A competent person, as defined in the OSHA asbestos standard 29 CFR 1926.1101, employed by the Contractor must be outside the work area at all times to monitor activity, ensure containment security, provide information to visitors and provide access to the work area.
4. Employees
 - a. The Contractor is responsible for the behavior of workers within his employment. If at any time during the contracted work, any of his employees are judged to exhibit behavior unfitting for the area or judged to be a nuisance by the Owner or Project Manager, the Contractor shall remove them immediately from the project.
 - b. The Contractor shall be responsible for compliance with the following concerning employee behavior:
 - 1) Under no circumstances are alcohols, drugs or any other type of controlled substances permitted on Duke University property.
 - 2) Under no circumstances are firearms permitted on Duke University property.
 - 3) All workers are restricted to the construction project site only.
 - 4) All vehicles must be parked in prearranged areas.
 - c. All workers must conform to the following basic dress code when in public areas of the project confines:
 - 1) long pants

- 2) shirts, no tank tops
 - 3) no shorts
 - 4) no bare backs
- d. The Contractor is responsible for disposal of all trash brought on Duke University property by his employees, including drink cans, bottles or other food containers and wrappers.
 - e. Failure to adhere to these rules could result in criminal prosecution and/or removal from the University property.

C. Meetings

1. Pre-bid conference
 - a. A pre-bid conference will be held by the Duke Project Manager. All Contractors submitting a bid are encouraged to attend, visit the site and ask questions concerning the plans and specifications.
 - b. The Project Manager, with the collaboration of OESO, will review the plans and specifications, present required techniques and safeguards for the removal of the asbestos and identify locations of water, electrical sources, etc.
 - c. Any minutes, new points or clarifications raised during the meeting will be issued by the Project Manager in an addendum no less than seven days prior to bids.

D. Pre-Job Submittals

1. Submit three complete, bound sets of pre-job submittals to the Project Manager at least 10 days prior to the start of work. Work is prohibited until submittal package has been reviewed and approved by OESO. A copy of the approved submittals shall be kept in a three-ring binder (project log) by the Contractor at the project site in the clean room or in the on-site office of the Contractor.
2. Notifications: Provide copies of Asbestos Permit Application and Notification for Demolition/Renovation (DEHNR 3768), which provide written notice to all required agencies, including North Carolina HHCB.
3. Employee List: Provide copies of lists of supervisors and workers, along with their accreditation and Social Security numbers, to be utilized on the project.
4. Permits: Provide copies of approval of a waste disposal site in compliance with 40 CFR 61.154.
5. Medical: Provide copies of N.C. Dusty Trade cards. Include individually signed and notarized forms by each worker to be utilized on the project documenting that each is actively involved in a company employee medical surveillance program.

6. Respirator Training: Provide copies of most recent fit testing records, individually signed for each worker to be utilized on the project.
7. Project Schedule: Time schedule for the project, outlining the proposed start, setup, clearances, etc. for the various phases of the project.
8. Initial Exposure Assessment: Provide if based on historical data for similar work, as required by the OSHA construction asbestos standard 29 CFR 1926.1101.

E. Post-Job Submittals

1. Submit three complete, bound sets of post job submittals to the Project Manager following the final completion of the work. Requests for final payment will not be approved until the submittal package has been reviewed and approved by the Project Manager.
2. Affidavits: Contractor's affidavit of payment of debts and claims, affidavit of release of liens, and consent of Surety Company to final payment.
3. Manifest: North Carolina Asbestos Waste Shipment Record (DEHNR 3787) receipt from landfill operator which acknowledges the contractor's delivery(s) of waste material. Include date, quantity of material delivered and signature of authorized representative of landfill. Also, include name of waste transporter.
4. Daily Log: A notarized copy of all daily logs showing the following: name, date, entering and leaving time, company or agency represented, reason for entry for all persons entering the work area, employee's daily air monitoring data as required by the OSHA standard and written comments by inspectors, industrial hygienists, Project Managers and visitors.
5. Medical: Copies of N.C. Dusty Trade cards, worker release forms, asbestos training certification forms and respirator training documentation of all new employees hired during the project.
6. Special Reports: All documents generated under Section I.F - Special Reports.

F. Special Reports

1. General
 - a. Except as otherwise indicated, submit special reports to OESO within one day of occurrence requiring special report, with copies to others affected by occurrence. Also keep a copy in the project log book.
2. Reporting Unusual Events
 - a. When an event of unusual and significant nature occurs at site (examples: failure of negative pressure system, rupture of temporary enclosures), prepare and

submit a special report to the Project Manager immediately, listing chain of events, persons participating, response by contractor's personnel, evaluation of results or effects, and similar pertinent information. When such events are known or predictable in advance, advise Project Manager in advance at earliest possible date.

3. Reporting Accidents

- a. Prepare and submit reports of significant accidents, at site and anywhere else work is in progress. Record and document date and actions; comply with industry standards for reporting accidents. For this purpose, a significant accident is defined to include events where personal injury is sustained, or property loss of substance is sustained, or where the event posed a significant threat of loss or personal injury.

G. Contingency Plan

1. Prepare a contingency plan for emergencies including fire, accident, power failure, negative pressure system failure, supplied air system failure (if applicable), evacuation of injured persons for both life threatening and non-life threatening, or any other event that may require modification or abridgment of decontamination or work area isolation procedures. Include in plan specific procedures for decontamination or work area isolation. Note that nothing in this specification should impede safe exiting or providing of adequate medical attention in the event of an emergency. Keep these plans in the on-site office.
2. Post outside of clean room of Personnel Decontamination Unit:
 - a. Telephone numbers and locations of emergency services.
 - b. A copy of Material Safety Data Sheets (MSDS) for any chemicals used during the asbestos project.
 - c. The contractor shall post asbestos signs in each appropriate language as per the OSHA 29 CFR 1926.1101 standard.

II. **CODES AND REGULATIONS**

A. Reference Specifications

1. The contractor shall assume full responsibility and liability for compliance with all applicable federal, state and local regulations pertaining to work practices, hauling, disposal and protection of workers, visitors to the site and persons occupying areas adjacent to the site.

2. Unless modified by these project specifications, all specifications for stripping, removal, repair and disposal work shall conform to the following specifications and standards, as applicable, as if completely reproduced herein:
 - a. The following regulations published by the **Environmental Protection Agency (EPA)**:
 - 1) "National Emissions Standards for Hazardous Air Pollutants Asbestos," 40 CFR Part 61, Subpart M.
 - 2) "General Provisions," 40 CFR Part 61, Subpart A.
 - 3) "Guidance for Controlling Asbestos-Containing Materials in Buildings" June 1985. (EPA # 560/5-85-024).
 - 4) "Asbestos-Containing Materials in Schools," 40 CFR Part 763, Subpart including appendices.
 - b. The following regulations published by the **U.S. Department of Labor and OSHA**:
 - 1) "Occupational Exposure to Asbestos, Tremolite, Anthophyllite, and Actinolite; Final Rules," Title 29, Part 1910, Section 1001 and Part 1926, Section 1101 of the Code of Federal Regulations.
 - 2) "Respiratory Protection," Title 29, Part 1910, Section 134 of the Code of Federal Regulations.
 - 3) Construction Industry, Title 29, Part 1926, of the Code of Federal Regulations.
 - 4) "Access to Employee Exposure and Medical Records" Title 29, Part 1910, Section 20 of the Code of Federal Regulations.
 - 5) "Hazard Communication," Title 29, Part 1926, Section 59 of the Code of Federal Regulations.
 - 6) "Specifications for Accident Prevention Signs and Tags," Title 29, Part 1910, Section 145 of the Code of Federal Regulations.
 - c. The following regulations published by **North Carolina State Agencies**:
 - 1) North Carolina Asbestos Hazard Management Program Rules as adopted by 15A NCAC 19C.0600.
 - 2) "North Carolina Occupational Safety and Health Standards for the Construction Industry," 29 CFR Part 1926 as adopted by T13 NCAC 07F .0201, and shipyard T13:07F.0500.
 - 3) North Carolina General Statutes, Chapter 95, 97, 130.
 - d. The following documents published by the **American National Standards Institute (ANSI)**:
 - 1) "Fundamentals Governing the Design and Operation of Local Exhaust Systems," Z9.2-1979.

- 2) "American National Standard for Respiratory Protection Respiratory Use - Physical Qualifications for Personnel," 288.6-1984.
- 3) Practices for Respiratory Protection," 288.2-1992.

B. Notices

1. The contractor shall notify the following offices in writing within the time frame specified by the NESHAP regulations prior to beginning any asbestos removal operations.
 - a. State Agencies:
 - b. Health Hazards Control Branch Occupational & Environmental Epidemiology Section N.C. DEHNR
 - c. Emergency Departments:
 - 1) The Contractor shall notify the local emergency medical services, police and fire department in writing of the type and scope of work being performed and request these departments make an inspection prior to beginning the work.
 - d. Licenses:
 - 1) Maintain current licenses for contractor and accreditation for workers and supervisors as required by applicable State or local jurisdictions for the removal, transporting, disposal or other regulated activity relative to the work of this contract.

III. AIR MONITORING

A. General

1. OESO shall be responsible for the coordination of ambient air monitoring services.
2. Contractor shall be responsible for monitoring worker exposure levels.
3. Employees of the HHCB shall have right of entry into the project. The HHCB's SAM shall have final authority over the performance of the contractor on the project.

B. Description of Work

1. OESO shall offer expertise to the Duke Project Manager and Contractor, but is not directly responsible for the performance of the job.
2. At the job site, OESO will observe and comment on general work site conditions and activities as they relate to the specifications and profession of industrial hygiene and make recommendations to the Duke Project Manager and Contractor.

3. OESO is responsible for overseeing the protection of the environment from contamination, protection of persons in adjacent areas and assurance that the areas are acceptable for occupancy.
4. OESO has the authority to direct the contractor relative to safety and environmental concerns. This includes stopping the work if necessary.
5. OESO shall review and make comments to the Project Manager on the submittals listed in Section I - Project Coordination.
6. Contractor shall provide OESO notification of any change in contractor's respiratory protection with supporting documentation.

C. Air Monitoring

1. Ambient Air Monitoring - The purpose of ambient air monitoring by OESO will be to detect discrepancies in the work area isolation such as:
 - a. Contamination of the building outside of the work area with airborne asbestos fibers.
 - b. Failure of filtration or rupture in the negative pressure system.
 - c. Confirm the work practices established by the contractor and respiratory protection provided for employees are adequate.
2. Work Area Airborne Fiber Levels - The purpose of work area monitoring is primarily to demonstrate compliance with OSHA Permissible Exposure Levels (PEL's), both time-weighted averages (TWA's) as well as Short-term Exposure Limits (STEL's). Monitoring is also done to detect airborne fiber levels which may challenge the ability of the work area isolation procedures to protect the balance of the building or outside of the building from contamination by airborne fibers.
 - a. Contractor must follow all OSHA requirements for initial and periodic monitoring.
 - b. Contractor shall share all monitoring results with OESO within 24 hours of receipt.
3. Work Area Clearance - To determine if the elevated airborne fiber levels encountered during abatement operations have been reduced to an acceptable level, the OESO will sample and analyze air per Section XI – Work Area Clearance.
4. Supplemental air monitoring may be conducted inside and outside the work area by the HHCB. This supplemental sampling does not fulfill air monitoring responsibilities required by OSHA, EPA or this contract.

IV. TEMPORARY FACILITIES

A. General

1. Provide temporary connection to existing building utilities or provide temporary facilities as required herein or as necessary to carry out the work.
2. Use qualified tradesmen for installation of temporary services and facilities. Locate, modify and extend temporary services and facilities where they will serve the project adequately and result in minimum interference with the performance of the work.
3. In occupied buildings, the Owner's maintenance personnel shall lock and tag out all electrical and HVAC equipment in the asbestos abatement area. The Contractor shall verify that the power and HVAC have been locked and tagged out prior to beginning work.
4. In unoccupied buildings, the Contractor is responsible for the lock and tag out of all power sources and HVAC equipment.
5. The Owner shall move all furniture, books, computers, records, equipment, etc. prior to the Contractor's arrival date as specified.

B. Water Service

1. Owner shall supply a source of water. Contractor bears all expense of heating and getting water to the work and decontamination areas.
2. Supply hot and cold water to the decontamination unit in accordance with Section IX – Decontamination Units. Hot water shall be supplied at a minimum temperature of 100°F.
3. After completion of use, connections and fittings shall be removed without damage or alteration to existing water piping and equipment.

C. Electrical Service

1. General:
 - a. Comply with applicable NEMA, NEC and UL standards and governing state and local regulations for materials and layout of temporary electric service.
2. Ground Fault Protection:
 - a. Provide receptacle outlets equipped with ground fault circuit interrupters, reset button and pilot light for plug-in connection of power tools and equipment.
 - b. Provide a weatherproof, grounded, temporary electric power service and distribution system of sufficient size, capacity and power characteristics to accommodate performance of work during the construction period.

3. Install temporary lighting adequate to provide sufficient illumination for safe work and traffic conditions in every area of work.
4. Provide services of an electrician, on a standby basis, to service electrical needs during the abatement process.
5. Provide additional power service and distribution service, consisting of individual dedicated 15 amp, 120 volt circuits to electrical drops with receptacle outlets equipped with ground fault interrupt protection, color coded for the exclusive use of the industrial hygiene firm.

D. First Aid

1. A minimum of one first aid kit shall be located in the clean room. Additional first aid kits as the Contractor feels is adequate or is required by law shall be located throughout the work area.

E. Fire Extinguishers

1. Comply with the applicable recommendations of NFPA Standard 10 - "Standard for Portable Fire Extinguishers." Locate fire extinguishers where they are most convenient and effective for their intended purpose but provide not less than one extinguisher in each work area equipment room and one in the clean room of the personnel decontamination unit.

F. Toilet Facilities

1. Provide temporary toilet facilities to be used by Contractor's employees. Use of the Owner's existing toilet facilities will be at Owner's discretion and these privileges may be revoked at any time.

G. Parking

1. Park only in areas designated by the Owner.

H. Building Security

1. Maintain personnel on-site at all times for any portion of the work areas that are open or not properly secured. Secure work areas completely at the end of each day.

I. Storage

1. Supply temporary storage required for storage of equipment and materials for duration of project. Trailer and storage dumpsters will be maintained in areas designated by the Owner.

V. NEGATIVE PRESSURE SYSTEM

A. General

1. High efficiency particulate air (HEPA) filter exhaust systems equipped with new HEPA filters for each project shall be used. Exhaust equipment and systems shall comply with ANSI Z9.2-79 and used according to manufacturer's recommendations.
2. A system of HEPA-equipped air filtration devices shall be configured so that a pressure differential is established between the work area and the surrounding area (-0.02 to -0.04 inch water column). A continuous chart-recorded manometer shall be used to confirm this condition. For projects with containments higher than 25 feet, an additional continuous recording manometer shall be placed at the top of the enclosure.
3. Additional air filtration devices shall be provided inside the work area for emergency standby as well as for circulation of dead air spaces.
4. The pressure differential is maintained at all times after preparation is complete and until the final visual inspection and air tests confirm the area is clean and acceptable for occupancy. Also, the Project Manager confirms verbally with written follow up to discontinue the use of the negative pressure system.
5. Air shall be exhausted outside the building. Any variations must be approved by OESO.
6. The Contractor shall check daily for leaks and log his checks in the bound log book. This includes checks internal to air-moving devices.
7. There shall be a minimum of four air changes per hour in any containment.

VI. WORK AREA PREPARATION

A. General

1. Before work begins in an area, a decontamination unit must be in operation as outlined in Section IX – Decontamination Units.
2. Completely isolate the work area from other parts of the building so as to prevent contamination beyond the isolated area.
3. Temporary facilities shall be addressed as outlined in Section IV – Temporary Facilities.
4. The Contractor shall set up a work area, load out and decontamination area as shown in the plans and specifications. Any variations must be approved by the Project Manager. The decontamination facility outside of the work area shall consist

- of a change room, shower room and equipment room as described in Section IX – Decontamination Units.
5. The Contractor shall wet clean and/or HEPA vacuum all items and equipment in the work area suspected of being contaminated with asbestos but not in direct contact with the asbestos material and either secures these items in place with polyethylene sheeting or has them removed from the work area.
 6. Critical Barriers: The Contractor shall thoroughly seal the work area for the duration of the work by completely sealing off all individual openings and fixtures in the work area, including, but not limited to, heating and ventilation ducts, doorways, corridors, windows, skylights and lighting, with polyethylene sheeting taped securely in place. If the contractor is using sealant materials to fill in small holes or cracks, the material shall have appropriate fire ratings.
 7. Floors (if required): Apply one or more layers of 6 mil (minimum) polyethylene plastic sheeting with joints overlapped 24 inches and taped securely. Plastic shall be carried up walls a minimum of 12 inches and secured.
 8. Walls (if required): Apply one or more layers of 4 mil (minimum) polyethylene plastic sheeting with joints lapped 24 inches and taped securely. Plastic shall be lapped over floor coverings and taped securely.
 9. Floors and walls shall be installed in such a manner that they may be removed independently of the critical barriers.
 10. Entrances and exits from the work area will have triple barriers of polyethylene plastic sheeting so that the work area is always closed off by one barrier when workers enter or exit.
 11. Integrity of these seals shall be regularly checked and maintained by the Contractor.
 12. No water may be left standing on the floor at the end of the work day.
 13. Floor surfaces, walls, finishes or coverings, etc., that in the contractor's opinion will likely be damaged by water or that may become contaminated with asbestos, shall have additional protective preparation as the Contractor sees appropriate, at his cost, to protect the original condition of the surfaces.
 14. Any costs associated with physical damage caused by water or securing polyethylene sheeting to areas inside or outside the abatement area shall be the Contractor's responsibility.
 15. The Contractor shall establish and mark emergency and fire exits from the work area. Emergency procedures shall have priority over established decontamination entry and exit procedures. Audible and visible fire and emergency evacuation alarms shall be installed so as to be heard and seen throughout the entire work area.

16. After work area preparation, the Contractor shall notify the Project Manager verbally with written follow-up that he is ready for a pre-work inspection.

VII. WORKER PROTECTION

A. General

1. Provide worker protection as required by OSHA, state and local standards applicable to the work. Contractor is solely responsible for enforcing worker protection requirements at least equal to those specified in this Section.
2. Each time the work area is entered, the Contractor shall require all persons to remove all street clothes in the changing room of the personnel decontamination unit and put on new disposable coverall, new head cover and a clean respirator. Proceed through shower room to equipment room and put on work boots.
3. Workers shall not eat, drink, smoke, chew gum or chew tobacco in the work area, the equipment room, the load out area or the clean room.

B. Worker Training

1. Train all workers in accordance with 29 CFR 1926 and North Carolina State regulations regarding the dangers inherent in handling asbestos, breathing asbestos dust, proper work procedures and personal and area protective measures.

C. Medical Examinations

1. Provide medical examinations for all workers. Examination shall as a minimum meet OSHA requirements as set forth in 29 CFR 1926 and N.C. Workmen's Compensation Act Dusty Trades Examination Record (DEHNR Form 2796).

D. Protective Clothing

1. Provide disposable full-body coveralls and disposable head covers and require that they be worn by all workers in the work area. Provide a sufficient number for all required changes, for all workers in the work area.
2. Boots: Provide work boots with non-skid soles and where required by OSHA, foot protection for all workers.
3. Gloves: Provide work gloves to all workers and require that they be worn at the appropriate times. Do not remove gloves from work area. Dispose of work gloves as asbestos-contaminated waste at the completion of the project.

E. Additional Protective Equipment

1. Type 'C' respirators, disposable coveralls, head covers and footwear covers shall be provided by the Contractor for the Owner, the Project Manager, OESO and other authorized representatives who may inspect the job site.

F. Decontamination Procedures

1. Require that all workers use the following decontamination procedure as a minimum requirement whenever leaving the work area:
 - a. Remove disposable coveralls, disposable head covers and disposable footwear covers or boots in the equipment room.
 - b. Still wearing respirators, proceed to showers. Showering is mandatory. Care must be taken to follow reasonable procedures in removing the respirator to avoid asbestos fibers while showering. The following procedure is required as a minimum:
 - 1) Thoroughly wet body including hair and face.
 - 2) With respirator still in place thoroughly wash body, hair, respirator face piece, and all exterior parts of the respirator.
 - 3) Take a deep breath. Hold it and/or exhale slowly, completely wet hair, face and respirator. While still holding breath, remove respirator and hold it away from face before starting to breathe.
 - 4) Carefully wash face piece of respirator inside and out.
 - 5) Shower completely with soap and water; rinse thoroughly.
 - 6) Rinse shower room walls and floor prior to exit.
 - 7) Proceed from shower to changing (clean) room and change into street clothes or new disposable work items.
 - c. After showering, each employee shall inspect, clean and repair his respirator as needed. The respirator shall be dried, placed in a suitable storage bag and properly stored.

VIII. RESPIRATORY PROTECTION

A. Description of Work

1. Instruct and train each worker involved in asbestos abatement in proper respirator use and require that each worker always wear a respirator, properly fitted on the face, in the work area from the start of any operation which may cause airborne asbestos fibers until the work area is completely decontaminated. Use respiratory protection appropriate for the fiber level encountered in the workplace or as required for other toxic or oxygen deficient situations encountered.

B. General

1. Provide workers with personally issued and marked respiratory equipment approved by NIOSH and MSHA and suitable for the asbestos exposure level in the work areas according to OSHA Standard 29 CFR 1926.1101 and other possible contaminants employees might be exposed to during the project.
2. Provide respiratory protection from the time the first operation involved in the project requires contact with asbestos-containing materials (including construction of decontamination units, construction of airtight barriers/barricades and placing of plastic sheeting on walls) until acceptance of final air clearance test results by the industrial hygiene firm.
3. The minimum respiratory protection for the project during gross removal shall be powered air purifying respirators (PAPR).
4. During gross removal of sprayed-on asbestos fireproofing, the contractor shall stay in Type-'C' supplied air respirators as described in 29 CFR 1926.1101 until all gross asbestos materials have been removed.
5. If supplied air respirators are used, the Contractor shall provide a minimum of Grade 'D' breathing air as set forth in the Compressed Gas Association's "Commodity Specifications for Air," G-7.1. The Contractor shall test for Grade 'D' breathing air initially and daily thereafter. Daily testing is not needed if the Contractor has an air purification system which has CO and organic purging capabilities as well as a continuous CO monitor and alarm calibrated at 10 ppm. The system must be calibrated at least once a week or when it is moved.
6. Provide emergency backup air supply, egress SCBA or egress HEPA filters for each worker in work area at all times when Type-'C' (supplied air) respirators are required. Breathing air system shall provide one hour of reserve air, calculated for maximum crew size for emergency evacuation.
7. Where Type 'C' respirators are utilized, the Contractor is required to have an employee in the vicinity of the source of air. The Contractor shall take into account the location of the fresh air intake to ensure no pollutant source is in the vicinity. The audible alarm shall be located where the employees inside and outside containment can hear the alarm.
8. Do not allow the use of single-use, disposable or quarter-face respirators for any purpose.

IX. DECONTAMINATION UNITS

A. Description of Work

1. Provide separate personnel and equipment/load-out decontamination facilities. Require that the personnel decontamination unit be the only means of ingress and egress for the work area require that all materials exit the work area through the equipment/load-out decontamination unit. Contractor shall comply with 29 CFR 1926.1101, specifically paragraph (j) Hygiene facilities and practices for employees.

B. General

1. Provide separate personnel decontamination units and equipment/load-out decontamination units when practical.

C. Personnel Decontamination Unit

1. Provide a Personnel Decontamination Unit consisting of a serial arrangement of connected rooms or spaces including changing room, shower room, equipment room. Each shall be separated by a minimum of three curtain doorways. Require all persons without exception to pass through this decontamination unit for entry into and exiting from the work area for any purpose. Do not allow parallel routes for entry or exit. Do not remove equipment or materials through Personnel Decontamination Unit.
2. Provide temporary lighting within decontamination units as necessary to reach an adequate lighting level.
3. Maintain floor of changing room dry and clean at all times. Do not allow the overflow water from the shower to escape the shower room.
4. Damp wipe all surfaces twice after each shift change with a disinfectant solution.
5. Provide hot and cold water, drainage and standard fixtures including an elevated shower head as necessary for a complete and operable shower. A water hose and bucket is not an acceptable shower. At least one shower stall shall be provided for each group of 10 workers (or fraction thereof).
6. Arrange water shut off and drain pump operation controls so that a single individual can shower without assistance from either inside or outside of the work area.
7. Pump shower waste water to drain. Provide 20 micron and 5 micron waste water filters in line to drain. Change filters daily or more often if necessary.
8. If the decontamination area is located within an area containing friable asbestos on overhead ceilings, ducts, piping, etc., provide the area with a minimum 3/8 inch plywood "ceiling" with two layers of polyethylene sheeting covering the top of the "ceiling."

9. Visual Barrier: Where the decontamination areas are immediately adjacent to and within view of occupied areas, provide a visual barrier of opaque plastic sheeting so that worker privacy is maintained and work procedures are not visible to building occupants. Where the area adjacent to the decontamination area is accessible to the public, construct a solid barrier on the public side of the sheeting to protect the sheeting. Construct barrier with wood or metal studs, max. 16 inches on center, covered with minimum 3/8 inch plywood.

D. Equipment Decontamination Unit

1. Provide an equipment decontamination unit consisting of a serial arrangement of rooms including clean room, holding area, and washroom, each room separated by a minimum of three curtain doorways, for removal of equipment and material from work area. Do not allow personnel to enter or exit work area through equipment decontamination unit.
2. Washroom: Provide washroom for cleaning of bagged or drummed asbestos-containing waste materials passed from the work area.
3. Holding Area: Provide holding area as a drop location for sealed drums and bagged asbestos-containing materials passed from the washroom.
4. Clean Room: Provide clean room to isolate the holding area from the building exterior or occupied areas.
5. Equipment or Material: Obtain all equipment or material from the work area through the equipment decontamination unit according to the following procedure:
 - a. When passing contaminated equipment, sealed plastic bags, drums or containers into the washroom, close all doorways of the equipment decontamination unit, other than the doorway between the work area and the washroom. Keep all outside personnel clear of the equipment decontamination unit.
 - b. Once inside the washroom, wet-clean the bags and/or equipment.
 - c. When cleaning is complete, insert bagged material into a clean bag/drum during the pass between the washroom and holding area. Close all doorways except the doorway between the washroom and holding area.
 - d. Workers from the building exterior enter the clean room then the holding area to remove decontaminated equipment and/or containers for disposal. Require these workers to wear full protective clothing and respiratory protection as described in Section VIII – Respiratory Protection.

E. Use of Elevators

1. If elevators are used for transport of material, it shall be prepared with two layers of 6 mil polyethylene plastic sheeting that meets the approval of the Project Manager. The elevator shall be cleaned daily after each use.

F. Decontamination Unit Contamination

1. If the air quality in the decontamination unit exceeds 0.01 fibers per cc analyzed by PCM or 70 structures per mm squared analyzed by TEM or its integrity is diminished through use, no employee shall use the unit until corrective steps are taken and approved by the Duke Project Manager and OESO.

X. PROJECT DECONTAMINATION

A. General

1. Carry out a first cleaning of all surfaces of the work area including plastic sheeting, tools, scaffolding and/or staging by use of damp-cleaning and mopping and/or a high efficiency particulate air (HEPA) filter vacuum until there is no visible debris from removed materials or residue on plastic sheeting or other surfaces. Do not perform dry-dusting or dry-sweeping.
2. Equipment shall be cleaned and all contaminated materials removed before removing polyethylene from the walls and floors.
3. The Contractor shall replace all pre-filters and clean the inside and outside of the HEPA exhaust units.
4. After polyethylene sheets have been removed from walls and floors, but are still remaining on all windows, doors and the critical components, the Contractor shall clean all surfaces in the work area, including ducts, electrical conduits, steel beams, roof deck, etc., with amended water and/or HEPA-filtered vacuum.
5. After cleaning the work area, the Contractor shall allow the area to thoroughly dry and then wet-clean and/or HEPA vacuum all surfaces in work area again.
6. At the completion of the cleaning operation, the Contractor's supervisor shall perform a complete visual inspection of the work area to ensure that the work area is dust- and fiber-free. If the supervisor believes he is ready for a final project decontamination inspection, he shall notify OESO.
7. Final project decontamination inspection includes the visual inspection and air monitoring clearance.
8. Visual inspection for acceptance shall be performed after all areas are dry.

9. OESO shall perform the final visual inspection and conduct the final air clearance. Any discrepancies found shall be documented in the form of a punch list.
10. Final air sampling shall not commence until the visual inspection is completed and passed.
11. If OESO finds that the work area has not been adequately decontaminated, cleaning and/or air monitoring shall be repeated at the Contractor's expense until the work area is in compliance.
12. After the work area is found to be in compliance, all entrances and exits shall be unsealed and the plastic sheeting, tape and any other trash and debris shall be disposed of in sealable plastic bags (6 mil minimum) and disposed of as outlined in Section XIII – Disposal of Asbestos Waste Material.
13. All HEPA unit intakes and exhausts shall be wrapped with six mil polyethylene before leaving the work area.
14. Any residual asbestos that may be present after removing critical barriers that in OESO's judgment should have been cleaned during the pre-cleaning phase prior to installing critical barriers, shall be cleaned and cleared at the Contractor's expense.
15. There shall be appropriate seals totally enclosing the inspection area to keep it separate from clean areas or other areas where abatement is or will be in progress. Once an area has been accepted and passed air tests, loss of the critical barrier integrity or escape of asbestos into an already clean area shall void previous acceptance and tests. Additional visual and final air clearance sampling shall be required at the Contractor's expense.

XI. WORK AREA CLEARANCE

A. General

1. Notification and scheduling of the final inspection during the project is the responsibility of the Contractor.

B. Final Clearance Testing

1. After the second cleaning operation and after the area is completely dry, the following procedure test shall be performed:
 - a. A final visual inspection shall be conducted by OESO. The inspection shall be conducted following the guidelines set forth in the American Society for Testing and Materials, Standard Practices for Visual Inspection of Asbestos Abatement Projects, Designation: E1368.90. If the work area is found visibly clean, air samples will be collected by OESO.

- b. During the air testing, the accredited air monitor shall cause disruptive air currents as described in the EPA-AHERA regulations (40 CFR Part 763, Subpart E, Appendix A).
- c. If samples are to be analyzed using PCM (minimum of five samples using NIOSH 7400 method), then the maximum flow rate is 12 liters per minute, with a minimum sample size of 2000 liters for each sample. Clearance criteria shall be less than 0.01 F/cc for all samples analyzed.
- d. If samples are to be analyzed using TEM, the Mandatory Transmission Electron Microscopy Method described in 40 CFR Part 763, Subpart E, 'Appendix F shall be used. Clearance criteria shall be an arithmetic mean less than or equal to 70 structures per square millimeter or a z-test less than or equal to 1.65.
- e. Final clearance criteria shall be in accordance with AHMB Program Rules. (in this section OESO shall clearly define which areas will be cleared by PCM or MW
- f. OESO shall promptly report the final air sampling clearance results to the contractor and Duke project manager
- g. The use of the negative pressure system may be discontinued after OESO instructs the Contractor that he has passed the final project decontamination inspection.

XII. ASBESTOS REMOVAL

A. General

1. Prior to starting asbestos removal, the Contractor's equipment, work area and decontamination units will be inspected and approved by the Project Manager.
2. All loose asbestos material removed in the work area shall be adequately wet, bagged, sealed and labeled properly before personnel breaks or end of shift.
3. All plastic sheeting, tape, cleaning material, clothing and all other disposable material or items used in the work area shall be packed into sealable plastic bags (6 mil minimum) and treated as contaminated material.
4. All material shall be double-bagged.
5. All excess water (except shower water) shall be combined with removed material or other absorptive material and properly disposed of as per EPA regulations. Contractor shall not place water in storm drains, onto lawns or into ditches, creeks, streams, rivers or oceans.

B. ACM Products to be Removed

1. Roofing Materials:

- a. The Contractor will meet the requirements listed under the OSHA standard 29 CFR 1926.1101 for roofing.
 - b. Contact the HHCB concerning the need for permit, fees and accredited roofing workers and supervisors when removing regulated roofing material.
 - c. The Roofing Contractor shall use the state's Waste Shipment Record for a waste manifest and shall include a copy of the manifest to the Project Manager before final payment.
 - d. Transport materials to a permitted landfill approved to accept asbestos, in a covered truck. Materials will be disposed of as asbestos-containing construction waste. Landfills must be notified in advance when such materials are to be disposed.
2. Asbestos Floor Tile and Mastic:
- a. The Project Manager may elect to design the removal using non-traditional, non-regulated methods such as the infrared heat machine, etc. If these methods are used the Project Manager shall require the Contractor to provide documentation showing that his employees have been thoroughly trained in how to use the equipment and provide a copy of personnel air monitoring data from previous jobs to document fiber exposure levels.
 - b. When removing asbestos-containing mastic from the floor surface, the Contractor shall use a product that meets the following criteria:
 - 1) The product shall not create a hazardous waste as a byproduct.
 - 2) The product shall be "low to no odor."
 - 3) The product shall not contain any carcinogenic or chlorinated hydrocarbons.
 - c. When the Contractor is using a mastic remover, they shall protect the walls and any adjacent areas. They shall be responsible for any damage that occurs and for the complete repair of the damage.
 - d. When the Contractor is collecting the asbestos solution, they shall add cat litter, oil-sorb or equivalent so that no free standing liquid will be left in the asbestos bag.
 - e. After the Contractor completes the asbestos mastic removal, the contractor shall use a cleaning solution to neutralize the mastic remover and mop and rinse the floor so that no residue of the product may be left on the floor surface. This cleanser shall be compatible with any new adhesive to be installed.
 - f. Potential health problems associated with the mastic remover in buildings that are occupied by the general public shall be addressed. A negative pressure

enclosure with a specified number of air changes per hour or some other means may be needed because of vapor concentrations or odor considerations.

3. Contaminated Crawl Space:
 - a. The goal is to "render safe" the contaminated crawl space from obvious asbestos and contaminated debris. It may not be possible to totally remove the asbestos hazard from the crawl space.
 - b. The Duke Project Manager, in collaboration with OESO, will clearly state how to remove the asbestos hazard from the crawl space and to what degree.
4. Insulation on Hot Water and Live Steam Lines:
 - a. The Contractor shall not conduct asbestos removal on any hot water pipe that exceeds 130°F or which exceeds the manufacturer's requirements for heat resistant polyethylene or glove bags.
 - b. The Contractor shall not conduct asbestos removal on live steam lines.
 - c. The Owner shall maintain the heat on hot water pipes below 130°F until the Contractor completes the project.
 - d. The Owner shall turn off and purge all live steam lines prior to the Contractor's arrival to start preparation.
 - e. In either event of a. or b., the Owner shall provide a letter documenting that the temperature in the hot water pipes has been reduced below 130°F and/or that the live steam lines have been turned off and purged.
5. TSI Glovebag/Glovebox:
 - a. The negative pressure glovebag/glovebox system shall follow 29 CFR 1926.1101.

XIII. DISPOSAL OF ASBESTOS WASTE MATERIAL

A. General

1. All asbestos materials and miscellaneous contaminated debris shall be properly sealed and protected, and the load-out vehicle/dumpster shall be locked, while located on the facility site and then transported to a pre-designated disposal site in accordance with 40 CFR 61.150 and DOT 49 CFR Parts 100-399.
2. An enclosed vehicle will be used to haul waste material to the disposal site. No rental vehicles or trailers shall be used. Vehicle selection, vehicle covers and work practices shall assure that no asbestos becomes airborne during the loading,

- transport and unloading activity and that material is placed in the waste site without breaking any seals.
3. Waste disposal polyethylene bags (6 mil) and containers, non-porous (steel/plastic) drums or equivalent, with labels, appropriate for storing asbestos waste during transportation to the disposal site shall be used. In addition to the OSHA labeling requirements, all containers shall be labeled with the name of the waste generator and the location at which the waste was generated.
 4. The Contractor shall transport the containers and bags of waste material to the approved waste disposal site. The sealed plastic bags shall be placed into the burial site unless the bags have been broken or damaged. Upon the landfill's approval damaged bags shall be left in the non-porous containers and the entire contaminated package shall be buried. Uncontaminated containers may be reused.
 5. Workers loading and unloading the asbestos will wear respirators and disposable clothing when handling material. Asbestos warning signs shall be posted during loading and unloading of asbestos waste.
 6. The Contractor shall use the HHCB's Waste Shipment Record for disposal records as per 40 CFR 61.150 and distribute a copy of all waste shipment records to the Project Manager after the completion of the project.