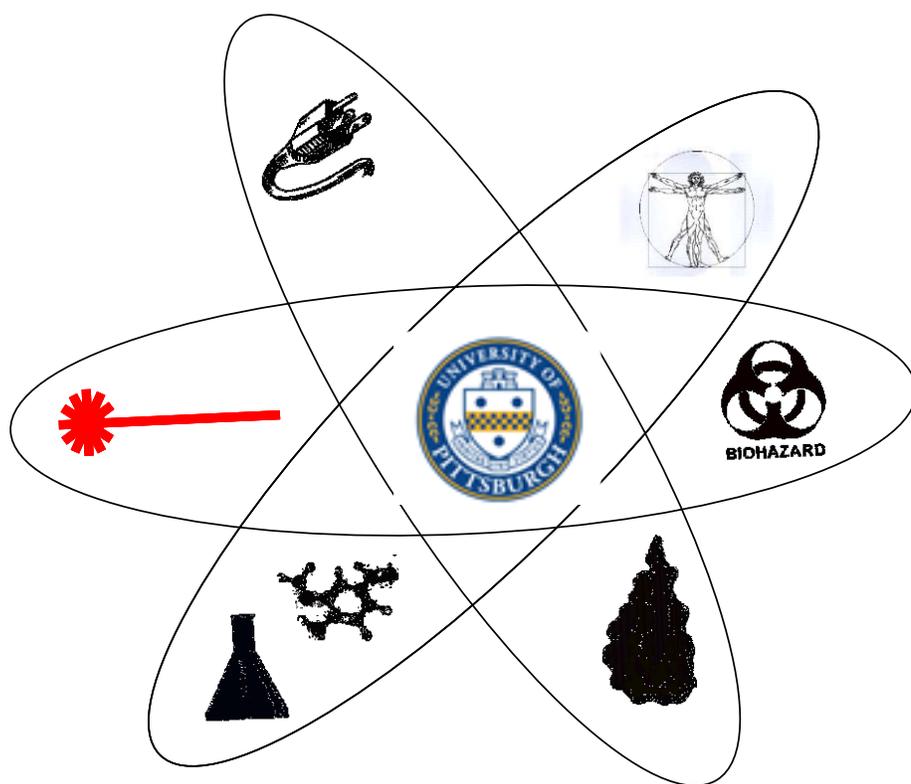


# UNIVERSITY OF PITTSBURGH MAINTENANCE SAFETY MANUAL



Department of Environmental Health and Safety

2019

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<https://www.ehs.pitt.edu/manual>

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## **Shops and Maintenance Safety**

This Manual was designed to provide an overview of available programs that could impact maintenance activities performed by University employees. It was designed to provide information on some of the more potentially hazardous activities. As conditions change, these programs may also change. The programs included in this Manual do not include attachments or appendices. The most up-to-date changes, along with attachments and appendices, can be viewed on our website ([www.ehs.pitt.edu](http://www.ehs.pitt.edu)) or you can request a copy through our office. There are additional safety programs available on the website, that are not included as part of this manual.

### **A. General Shop Safety**

Good housekeeping practices in shop areas are important for providing a safe workplace. University employees should observe the following guidelines in shop areas:

- Aisles and passageways should be kept clear.
- Fire exits and exit pathways must be kept clear at all times. Fire doors must not be propped open. Storage of any kind is not permitted in stairwells. Do not block the visibility of any fire protection, detection, or notification device;
- Nails, bolts, and screws should be removed from stock materials or pounded flush with the surface;
- Trash and other waste materials should be kept in proper containers and limited to the capacity of those containers;
- Contact the Department of Environmental Health and Safety for guidance in the proper handling, storage, and disposal of potentially regulated waste materials. These may include but are not limited to:
  - ⇒ Lead-containing materials;
  - ⇒ Waste chemicals, oils, solvents, lubricants or fuels;
  - ⇒ Insulation or other products/materials which may contain asbestos;
  - ⇒ Contaminated materials including soil, water, oil dry, rags;
- Keep areas around machinery or equipment clear of materials which could interfere with the equipment or operator;
- Compressed air is not permitted to be used for cleaning purposes.

### **B. Use of Personal Protective Equipment in Shop Areas**

Personal protective equipment should never be substituted for safe working practices, or engineering controls (e.g. design, guarding). All University employees, under the direction of their foreman or supervisor, should continually evaluate the risks of their work areas to ensure that they are using the appropriate personal protective equipment. Due to the various hazards and types of available PPE, the General Safety portion of the University Safety Manual has dedicated an entire section to the proper selection, use, care, and maintenance of personal protective equipment.

It is the responsibility of the foreman or supervisor to ensure that the proper PPE is provided, maintained, and used in their areas of responsibility. Any question on the use of PPE should be directed to the Department of Environmental Health and Safety.

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### C. Hand Tools

Hand tools are defined as tools that do not require external power for operation. The majority of accidents involving hand tools are the result of improper use or a lack of maintenance. Using the proper tool for the job will help to eliminate accidents.

- All hand tools must be visually inspected before each use to identify damage;
- It is the ultimate responsibility of the user to ensure that a tool is in good working condition, to use the correct tool for the task, and to use the tool in a safe manner;
- The supervisor is responsible for ensuring that all tools and equipment used by employees under their responsibility are in good condition and repair, and that any damaged or worn equipment has been identified and removed from service.
- All hand tools should be stored in appropriate racks, tool boxes, or drawers to prevent damage and not create a hazard to other shop users;
- Workers should always use carrying bags, boxes, or work belts for temporary storage of hand tools while working on location. This is especially true while working from heights to prevent the tools from being dropped.

### D. Power Tools

Power tools are defined as any tools requiring external power for operation. Power tools are typically powered by electricity but can also be pneumatic. The primary concerns regarding the safe use of power tools are:

- **“The proper tool for the job”**: always use the appropriate type and size of power tool for the task. It is dangerous to use large or high powered tools on low strength materials;
- Adequate personal protective equipment for the anticipated hazards should always be utilized with power tools. This may include protective eyewear, gloves, foot protection, and/or head protection; Do not wear loose fitting clothing and secure long hair when working around rotating equipment.
- All electric powered tools must be double insulated or be energized through a ground fault circuit interrupter (GFCI).

### E. Machine Guarding

It is imperative that all original equipment and machine guards, interlocks, and other protective devices remain in place and are not removed or otherwise defeated. Almost all major accidents involving machinery are caused by the absence of proper guarding or by defeating the guards and interlocks provided by the manufacturer.

Guarding is required on:

- Points of operation:
  - ⇒ Blades;
  - ⇒ Knives;
  - ⇒ Power presses;
  - ⇒ Cutting Heads;
  - ⇒ Drills;

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- Power transmission devices:
  - ⇒ Belts;
  - ⇒ Pulleys;
  - ⇒ Shaft;
  - ⇒ Gears;
  - ⇒ Drums;
- Top, bottom and backside exposures from the extended travel of the blade, drill, etc.

The intentional modification of any equipment from the original manufacturers' design or retrofit, in order to remove or otherwise defeat a guard, interlock, shield or other safety device, for ANY REASON outside of equipment maintenance and or repair is **STRICTLY PROHIBITED**.

## F. Ladders and Scaffolding

The University has developed rules essential to ensuring a useful working life of ladders and scaffold equipment and the safety of the user. The most common ladder equipment utilized at the University of Pittsburgh are wooden and metal portable ladders.

### 1. Portable Wood Ladders

**Type I** - Industrial stepladder, 3 to 20 feet long for heavy duty, such as utilities, contractors, and industrial use;

**Type II**- Commercial stepladder, 3 to 12 feet long for medium duty, such as painters, offices, and light industrial use;

**Type III** - Household stepladder, 3 to 6 feet long for light duty, such as household use.

#### a. Care of Wood Ladders

- All wood parts must be sound and free from sharp edges and splinters and free from shake, compression failures, decay, or other irregularities. Low density wood must not be used;
- Ladders must be maintained in good condition at all times. The joint between the rungs and side rails of the ladder should be tight, all hardware and fittings securely attached, and the movable parts must operate freely without binding or undue play;
- Metal bearings of locks, wheels, pulleys, etc., must be frequently lubricated;
- Frayed or badly worn rope must be replaced;
- Safety feet and other auxiliary equipment must be in good condition;
- Ladders shall be inspected frequently and those which have developed defects must be withdrawn from service for repair or destruction and tagged as "Dangerous, Do Not Use";
- Rungs should be kept free of grease and oil.

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## **b. Safe Use of Wood Ladders**

- Wood stepladders longer than 20 feet are prohibited from use at the University;
- Portable rung and cleat ladders should, where possible, be used at such a pitch that the horizontal distance from the top support to the foot of the ladder is one-quarter of the working length of the ladder (the length along the ladder between the foot and the top support). The wood ladder should be placed to prevent slipping, lashed or held in position. Wood ladders are not to be used in a horizontal position as platforms, runways, or scaffolds;
- Ladders should not be used by more than one person at a time nor with ladder jacks and scaffold planks where use by more than one person is anticipated. In such cases, specially designed ladders with larger dimensions should be used;
- Portable ladders should be placed so that the side rails have a secure footing. The top rest for portable rung and cleat ladders should be reasonably rigid and have ample strength to support the applied load;
- Ladders are not to be placed in front of doors opening toward the ladder unless the door is propped open, locked, or guarded;
- Ladders must not be placed on boxes, barrels, or other unstable bases to obtain additional height;
- Ladders with broken or missing steps, rungs, or cleats, broken side rails, or other faulty equipment must be removed from service.
- Short ladders must not be spliced together to provide long sections;
- Ladders made by fastening cleats across a single rail are not permitted;
- Ladders are not to be used as guys, braces, or skids, or for other than their intended purposes;
- Tops of stepladders are not to be used as steps;
- Portable rung ladders with reinforced rails are to be used only with metal reinforcement on the under side;
- No ladder should be used to gain access to a roof unless the top of the ladder extends at least 3 feet above the point of support, at eave, gutter, or roof line;
- Top sections of sectional ladders should not be used for bottom section unless the user equips them with non-slip safety shoes;
- The user should equip all portable rung ladders with non-slip bases when there is a hazard of slipping. Non-slip bases are not intended as a substitute for care in safely placing, lashing, or holding a ladder that is being used upon oily, metal, concrete, or slippery surfaces;
- The bracing on the back legs of step ladders is designed solely for increasing stability and not for climbing.

## **2. Portable Metal Ladders**

The University has rules and minimum requirements for the care and use of portable metal ladders:

- Rungs and steps must be corrugated, knurled, dimpled, coated with skid-resistant material, or otherwise treated to minimize the possibility of slipping;
- The length of single metal ladders or individual sections of ladders are not permitted to exceed 30 feet. Two-section metal ladders are not permitted to exceed 48 feet in length
- Extension ladders are to be equipped with positive stops which will ensure the required overlap;
- Metal stepladders are not permitted to exceed 20 feet in length;
- The bottoms of the four rails of a metal stepladder are to be supplied with insulating non-slip material;

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- A metal spreader or locking device of sufficient size and strength to securely hold the front and back sections in the open position must be a component of each metal stepladder. The spreader shall have all sharp points or edges covered or removed;
- Trestle ladders or extension sections or base sections of extension trestle ladders are not permitted to be not more than 20 feet in length;
- The length of a platform ladder is not permitted to exceed 20 feet. The length of a platform ladder is measured along the front rail from the floor to the platform.

**a. Care of Metal Ladders**

- Portable metal ladders must be maintained in good usable condition at all times;
- If a metal ladder is involved in any of the following incidents, immediate inspection is necessary:
  - ⇒ If ladders tip over, inspect ladder for side rail dents or bends, or excessively dented rungs; check all rung-to-side-rail connections; check hardware connections; and check rivets for shear;
  - ⇒ If ladders are exposed to oil and grease, equipment should be cleaned of oil, grease, or slippery materials. This can easily be done with solvent or steam cleaning;
  - ⇒ Ladders having defects are to be marked and immediately taken out of service until repaired.

**b. Safe Use of Metal Ladders**

- A simple rule for setting up a metal ladder at the proper angle is to place the base a distance from the vertical wall equal to one-fourth the working length of the ladder;
- Portable metal ladders are designed as a one-man working ladder based on a 200-pound load;
- The ladder base section must be placed with a secure footing;
- The top of the ladder must be placed with the two rails supported, unless equipped with a single support attachment;
- When ascending or descending, the climber must face the ladder;
- Ladders must not be tied or fastened together to provide longer sections. They must be equipped with the hardware fittings necessary if the manufacturer endorses the use of extensions;
- Ladders should not be used as a brace, skid, guy or gin pole, gangway, or for other uses than that for which they were intended, unless specifically recommended for use by the manufacturer;
- Metal ladders should not be used when work is performed on or near electric circuits.

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### 3. Scaffolding

The University provides general requirements for all types of scaffolds as well as specific requirements for individual types of scaffold equipment. University employees should observe the following general requirements for all scaffolds:

- The footing or anchorage for scaffolds must be sound, rigid, and capable of carrying the maximum intended load without settling or displacement. Unstable objects such as barrels, boxes, loose brick, or concrete blocks are not permitted to be used to support scaffolds or planks;
- Scaffolds and their components must be capable of supporting without failure at least four times the maximum intended load;
- Do not move scaffolds horizontally or alter scaffolds while they are in use or occupied;
- Immediately repair any scaffold that was damaged or weakened from any cause. This equipment must not be used until repairs have been completed;
- Do not load scaffolds in excess of the working load for which they are intended;
- All load-carrying timber members of scaffold framing shall be a minimum of 1,500 f. (Stress Grade) construction grade lumber. All planking shall be Scaffold Grade as recognized by grading rules for the species of wood used.
- Bolts used in the construction of scaffolds must be of adequate size and in sufficient numbers at each connection to develop the designed strength of the scaffold.
- Overlap all planking or platforms (minimum 12 inches) or secure them from movement;
- An access ladder or equivalent safe access must be provided;
- Scaffold planks must extend over their end supports not less than 6 inches nor more than 18 inches;
- The poles, legs, or uprights of scaffolds must be plumb, and securely and rigidly braced to prevent swaying and displacement;
- Materials being hoisted onto a scaffold must have a tag line;
- Overhead protection must be provided for employees on a scaffold that are exposed to overhead hazards;
- Scaffolds must be provided with a screen between the toeboard and the guardrail, extending along the entire opening, consisting of No. 18 gauge U.S. Standard Wire one-half-inch mesh or the equivalent, where persons are required to work or pass under the scaffolds;
- Employees are not permitted to work on scaffolds during storms or high winds;
- Employees are not permitted to work on scaffolds which are covered with ice or snow, unless all ice or snow is removed and planking sanded to prevent slipping;
- Tools, materials, and debris are not allowed to accumulate in quantities which will cause a hazard;
- Only treated or protected fiber rope is permitted for use for or near any work involving the use of corrosive substances or chemicals;
- The use of shore scaffolds or lean-to scaffolds is prohibited;
- Scaffolds must be secured to permanent structures, through the use of anchor bolts, reveal bolts, or other equivalent means. Window cleaners' anchor bolts are not permitted;
- Special precautions must be taken to protect scaffold members, including any wire or fiber ropes, when using a heat-producing process.

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## **G. Hot Work Program**

All hot work can create conditions with high probability for fire related injury or property loss. Hot work includes but is not limited to: brazing, cutting, grinding, soldering, torch-applied roofing and welding. Each type of hot work presents specific hazards depending on the methods used, the materials used, and the environment involved.

The objective of this Hot Work Program is to reduce injury, fire and/or explosion resulting from the performance of hot work. The procedures contained in this Program are applicable to all University employees. The Department of Environmental Health and Safety provides oversight for this Program.

### **PART I General Welding and Cutting Guidelines**

University employees should observe the following general safety guidelines when performing Hot Work operations:

- Welding areas need to be kept clean and free of any excess materials, especially combustibles;
- Do not perform Hot Work operations in a building when sprinkler protection is inoperable or off-line for repairs, without permission from the Department of Environmental Health and Safety; { phone: 4-9505, Off-Shift (412)917-0173 }
- Only authorized employees who have been properly trained shall be permitted to perform welding or cutting.
- Employees performing cutting or welding must wear the personal protective equipment required for the job. Clothing shall be free of excessive grease and oil.
- Fire extinguishers shall be readily available wherever cutting or welding is being done.
- Only perform work in an area that restricts entry by unauthorized personnel.

## **EQUIPMENT**

### **Cylinders**

Oily or greasy substances shall be kept away from cylinders, cylinder valves, couplings, regulators, hose and other equipment. Any equipment that has been subject to oil and grease shall be thoroughly cleaned before being placed back into service

Fittings shall never be lubricated. Only approved materials shall be used on oxygen equipment.

Contents of cylinders shall be identified by commonly accepted names legibly marked on the cylinder. Do not rely on color codes because there are no standard codes for cylinders. Report any unlabeled cylinder to your foreman/supervisor.

All cylinders shall be provided with approved pressure relief devices. No repairs of any kind are to be attempted on any cylinder or valve. Safety devices on cylinders or apparatus shall not be tampered with or removed.

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Oxygen cylinders shall not be stored in the same compartment with cylinders of acetylene or other fuel gas. Unless well separated (minimum of twenty (20) feet), there shall be a fire resistant partition between oxygen cylinders and acetylene or fuel gas cylinders.

During storage and transportation, cylinders shall always be stored in an upright position and properly secured. Provisions should be made to prevent their falling over or being struck by other objects.

Cylinders shall not be stored in locations where they might be exposed to excessive heat. All empty cylinders shall be marked ('MT') and returned to their proper storage compartments with valves tightly closed and caps replaced.

When oxygen and acetylene cylinders are mounted together on a cart, a partition of steel or other non-combustible material shall be installed between the cylinders. Do not place cylinders where they might become part of an electric circuit. When cylinders are used in proximity to electric welding, precautions must be taken to protect the cylinders against accidental grounding.

A cap shall protect cylinder valves when the cylinders are not in use or are being transported. If the valve cannot be opened by hand, the cylinder shall be tagged and exchanged for a new one.

Fuel gas leaks can generally be identified by odor and the location determined by applying soapy water. If a leak is discovered in a cylinder, it shall immediately be removed to fresh air (away from any source or ignition), the valve opened slightly and the contents allowed to escape to a safe location.

### **Pressure Reducing Equipment and Torches**

Oxygen, acetylene and other compressed gases shall never be used from a cylinder without reducing the pressure through a pressure-reducing regulator bearing an Underwriter Laboratory (UL) or Factory Mutual (FM) approval.

Oxygen regulators shall be used only on oxygen cylinders and fuel gas regulators on fuel gas cylinders. Oxygen regulators are provided with national standard right hand threads and fuel gas regulators with left hand threads.

Handle all pressure regulating equipment with care to avoid damage to the mechanism.

Never use oil or grease on cutting or welding equipment for any purpose. Regulators in need of repair shall be returned to the supplier or a person authorized to do such work shall make repairs. Inspect regulating equipment and torch prior to every use. Remove unsafe equipment from service.

Always stand to the side of regulators when opening or closing valves and making adjustments.

When a regulator is not in use, the pressure adjusting screw shall be released and the cylinder valve closed. A cylinder valve shall never be opened until the pressure adjustment screw on the regulator is fully released.

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When burning or welding overhead, the regulators on the cylinders shall be properly protected to prevent sparks and objects from falling on them.

Regulators shall be removed from cylinders before cylinders are moved from one location to another unless they are in a carrier specifically designed for transporting.

## **Hose**

All units should be equipped with back-flow prevention and flash back arrestors.

Examine all hoses for defects before use. Defective hose shall not be used. New hose should be tested for leaks before use.

Oxygen and acetylene hose shall be fastened together with tape or approved clamps at intervals of three to four feet along the hose. Care must be exercised to prevent hose from being damaged.

Hose shall be fastened to the regulators and torches by approved fittings only. It is important that all connections be kept tight.

Use hose and connections made especially for gas welding and cutting. Red colored hose shall be used for acetylene or other fuel gas and green colored hose for oxygen.

Care shall be taken that the hose does not become kinked or tangled. Place the hose so that it will not be trampled on, run over or present a tripping hazard.

## **OPERATION**

### ***Hot work is prohibited:***

- On partitions, walls, ceilings or roofs with combustible coverings or cores (e.g., expanded plastic insulation, sandwich panels).
- In areas containing unprotected flammable liquids, vapors or gases, combustible dusts or combustible metals.
- On or in rubber lined equipment.
- In oxygen enriched atmosphere.
- In storage and handling areas for oxidizing materials or explosives.
- In other areas where hot work cannot be performed safely.

University personnel may only conduct hot work outside of designated hot work areas if specifically authorized by the foreman or supervisor and the following conditions are verified:

1. No other suitable non-hot work means can be found to produce the desired result;
2. No other safe location can be found to do the hot work; and
3. The designated person(s) involved with authorizing and conducting the hot work have complied with all hot work permitting process requirements, including all precautions and required follow-up actions. Contractors hired to do work potentially involving hot work must comply with all requirements of the hot work permitting process and will be overseen by a designated University employee.

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Do not perform any welding or cutting operations in any area where there is danger of fire unless you have received permission to do so from your foreman. Provisions for Hot Work authorization shall be made and a fire watch provided to properly safeguard the area.

### **Attaching Regulator to Cylinder**

- Keep hands and gloves free of oil and grease.
- Stand to one side when opening valve
- Open discharge valves slowly:
- With the cylinder secured in place upright, and the outlet valve pointed away from the operator, the valve shall then be opened sufficiently to blow any dirt out before attaching the regulator.
- Close the valve and tightly attach the regulator to prevent leaks. The pressure adjusting screw shall be fully released before slowly opening the cylinder valve. Do not stand in front of the outlet.

### **Use of Cylinder Valves, Regulators and Torch Valves**

After equipment has been assembled and connected for use, the following procedure shall be employed before putting the equipment in service:

- Oxygen cylinder valve shall be opened slowly so that the needle on the high pressure gauge rises slowly. The valve shall then be opened as far as possible. Regulate desired oxygen pressure. Wrenches shall not be used on oxygen valves.
- Acetylene cylinder valve shall be opened one and one quarter turns with the "T" handle wrench, which is supplied for the cylinder. This wrench shall be kept on the valve while equipment is in use. Regulate desired gas pressure, which shall never exceed 15 pounds per square inch.
- Purge each hose before lighting the torch.
- Use only a friction lighter to ignite torch. Matches or other flames are prohibited.
- Always stand to the side of regulators when opening valves.
- Light acetylene, adjust flame, then adjust oxygen.

In the case of a "backfire", (which is the flame going out with a loud snap) the torch may relight itself. If the torch does not relight itself, the oxygen valve must be shut off quickly; then close the gas valve. After a moment relight in the regular manner. If a "flash-back" (which is the flame flashing back inside the torch, and which may extend to the hose and regulators) occurs, the torch oxygen valve shall be closed quickly, then the acetylene valve and the valves of both cylinders shall be closed. All torches and regulators must be provided with reverse flow check valves and flashback arrestors on both oxygen and fuel gas connections to reduce the possibility of "backfires".

When finished with the torch, the fuel gas shall be turned off at the torch and then the oxygen. Gas shall not be kept burning on the end of the tip as a pilot. This practice will carbon up the torch and render it dangerous. Keep torch tips clear of all foreign material.

When through using or moving the equipment, employees must insure that cylinders valves are closed and the pressure on regulators relieved.

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The regulator thumbscrews shall be backed off and the pressure released from the low pressure gauges, unless the operator will be using the outfit again within a few minutes.

Do not shut off cylinder valves and leave outfit with regulator thumb screws turned in. If creeping is noted on the working pressure gauge hands, this is an indication that the regulator is faulty and must be repaired.

The valves on the torch and all connections shall be examined daily for leaks before lighting the torch. If leakage is noted around the valve stems, tighten the packing nuts and if this does not correct the situation, have proper repairs made by an authorized person.

Use great care not to allow the oxygen pressure to fall below the working pressure of the acetylene regulator. Fuel gas may flow back into the oxygen cylinder, forming an explosive mixture, which is highly dangerous.

## **ARC WELDING AND CUTTING**

### **Electrical Connections**

Before starting operations:

- Make certain all electric lead welding connections are secure.
- Firmly attach the ground connection as close to the work as possible.
- Work leads shall be as short as possible.
- The welding machine frame shall be grounded.

### **Electric Shock**

It is important to take precautions to avoid electric shock. The following are especially important precautions to be taken:

- Clothing, shoes, gloves and other protective equipment shall be kept as dry as possible.
- Always wear approved hand protection and never permit the metal part of an electrode or holder to touch your body.
- Electrodes shall be removed from the holder when not in use. Electrode holders when not in use shall be placed so they cannot make electrical contact with persons or conductive objects. Be careful to avoid shock when changing electrodes.
- Check equipment regularly to see that electrical connections and cable are in good condition. Be particularly alert that the electrode holder cable connection is in good condition and secure. Only approved ground connecting devices and rod holders shall be used.
- All welding lines and connections shall be insulated.
- Welding machines shall be shut off when work is stopped.
- Only authorized employees shall make repairs on welding machines.

## **WELDING OR CUTTING IN CONFINED SPACES**

When welding or cutting in any confined space, such as a tank, boiler, pipeline or compartment, the space shall be cleaned, tested and ventilated during the welding operation. All Confined Space requirements as outlined in the University Program must be followed.

When entering a confined space through a manhole or other small opening, means shall be provided for quickly removing employee in case of an emergency.

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When arc welding in a confined space is to be suspended for any substantial period of time all electrodes shall be removed from the holders and the machine shut off.

When gas welding or cutting in a confined space is to be stopped for any substantial period of time the torch valves shall be closed and the gas and oxygen supply to the torch positively shut off at some point outside the confined area. The torch and hose shall be removed from the confined space or disconnected from the gas supply during such times. Atmospheric tests shall be made before re-entering.

Do not allow unlighted gas or oxygen to escape and exercise extreme care that hoses and connections are free from leaks. The torch shall be lighted outside and passed with care to the employee inside.

Ventilation shall be provided to keep the space purged of any possible accumulation of flammable gas or vapors. If welding or burning is done on the outside of the structure and there is any possibility of flammable gases accumulating, the interior shall be properly purged to prevent any fire or explosion.

Welding or cutting is not to be done on or in any tank, pipeline, compartment or container which has contained flammable material until it has been thoroughly purged, cleaned and proved to be free from explosive vapors or any danger of explosion, by means of gas detector.

### **MISCELLANEOUS**

Under ordinary conditions, no artificial ventilation is necessary when welding in large or well-ventilated areas. However, special materials such as brass, galvanized or stainless materials may necessitate the use of portable exhaust fans or respiratory protection. Consult with EH&S for approved respiratory protection.

When welding is done in a space screened off on all sides, the screens shall be so arranged that no serious restriction of ventilation exists. Screens should be mounted approximately one foot above the floor

Where, because of the nature of the work or other reasons it is not possible to sufficiently ventilate an area, welders shall wear approved respiratory protective equipment. Respirator wearers must comply with the requirements of the University Respiratory Protection Program, managed by EH&S.

Electric/gas welding or cutting shall not be permitted over or in close proximity to a manhole without first testing with gas-detecting instrument.

If the object to be welded or cutting cannot be moved, combustible materials in the vicinity shall be removed to a safe place. If the object to be welded or burned cannot be moved and if the combustible materials near that object cannot be removed, then the combustible materials must be protected from heat, sparks and slag. A fire watch shall be provided and maintained.

Flammable materials in the area where burning and welding operations are to be performed shall be removed or protected from heat, sparks and molten metal.

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Plasma torch cutting or inert gas shielded arc welding are specialized processes requiring that the manufacturer's recommendations with regard to safety procedures and personal protective equipment be followed.

Do not perform any welding or cutting operations on a concrete floor. Keep the work at least 12" above the floor.

## **PART II Hot Work Permit Procedures**

### **Definitions**

*Fire Watch:* A person trained in the use of fire extinguishers shall be designated to observe the area surrounding the hot work and be prepared to extinguish any fire that may be ignited. A properly maintained fire extinguisher of the appropriate hazard class is required in any area where appreciable combustible or flammable materials are within 35 feet of the hot work.

*Hot work:* Any temporary or permanent operation involving open flames or producing heat and/or sparks including but not limited to: brazing, cutting, grinding, soldering, torch-applied roofing and welding.

*Hot Work Hazard Area:* Any area where the presence of open flames, sparks or other products of hot work could present a significant fire and/or explosion hazard. These designated areas require a completed Hot Work Approval Form.

*Hot Work Permit:* A written checklist of procedures to be implemented before performing hot work in a hot work hazard area. Signing the completed permit is done to ensure that the proposed work has been reviewed for all applicable safety considerations. Permitted hot work shall be done in accordance with the details spelled out on the permit. If conditions change, the permit must be modified or reissued by the hot work supervisor/foreman. Completed permits shall be maintained in the EH&S Department for one year.

*Hot Work Supervisor/foreman:* A Hot Work Supervisor/foreman is a person with training, experience and judgment to oversee hot work operations and who has the authority to direct changes or stop the work if necessary. The hot work supervisor/foreman shall determine the hazards present or likely to be present at the work location.

### **Permitting Instructions**

- 1) No person shall be allowed to perform hot work operations unless he/she has been trained and authorized by their foreman or supervisor to do so.
- 2) Permits shall be completed and signed by the person responsible for the hot work.
- 3) All applicable precautions on the permit shall be followed.
- 4) Permits shall be posted at the worksite and sent to the Department of Environmental Health and Safety at the completion of work.
- 5) Permits are only good for a single turn on a single day as conditions at the work site may change from day to day.

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- 6) When completing the PRECAUTIONS section of the Approval Form, an “X “ in the appropriate column indicates that this particular precaution is required or N/A to indicate that the precaution is not applicable. The exact precautions will be left to the determination of the foreman based upon the hazards present and the extent and type of hot work.

### **Fire Watch**

A Fire watch is required for any job requiring a permit and whenever welding or cutting is performed in locations where any of the following conditions exist:

- Appreciable combustible materials, ignitable by sparks or slag, are closer than 35 feet to the point of operation;
- Wall or floor openings within a 35 feet radius expose combustible materials in adjacent areas including concealed spaces in walls or floors;
- Combustible materials are adjacent to the opposite side of metal partitions, walls, ceilings or roofs and are likely to be ignited by conduction or radiation.

Fire watches:

- Must be trained in the use of fire extinguishing equipment.
- Shall be familiar with facilities for sounding an alarm in the event of a fire.
- Shall watch for fires in all exposed areas, sound the alarm if necessary, and try to extinguish them only when obviously within the capability of the equipment available.
- Shall have no other primary function.
- Shall be maintained for 1 hour after completion of the work and during breaks and lunches to detect smoldering fires.
- Shall know the location of the nearest phone and the Pittsburgh Campus emergency number (412-624-2121).

For hot work in areas requiring a permit follow the guidelines listed above with the addition of:

- Explosive or flammable atmospheres shall be eliminated and periodic tests shall be conducted using LEL meters and recorded on the permit.
- Enclosed equipment shall be thoroughly cleaned and purged of combustible and flammable materials or sufficiently inerted.
- A fire watch shall be posted and supplied with suitable fire extinguishing equipment (extinguisher, water hose, fire hose...)

Hot work may be performed without a permit in the following locations:

- Departmental Shops;
- Any outdoor location free of combustibles and away from pedestrians or by standers.

For hot work in areas that do not require a permit, the following general fire safety guidelines must be followed:

- Hot work equipment shall be in good repair.
- If combustible materials are found in the area where hot work is planned the work should be moved to a location free from combustibles. If the work cannot be moved, have the combustibles moved to a safe distance from the work (at least 35 feet) or have the

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combustibles properly protected. If combustibles cannot be moved or protected, a fire watch must be provided.

- Combustible floors shall be wet down or covered with flame retardant covers.
- Cover all wall, floor or ceiling openings that may cause a fire to start in an adjacent area.
- Ensure that walls and ceilings are not combustible, cover or wet as necessary.
- Ducts, fans or conveyor systems that might carry sparks to distant combustibles shall be suitably protected or shut down;
- For overhead work, position flame retardant tarp to contain sparks and slag. The higher the work, the larger the area that must be protected from falling sparks and slag.
- If welding is to be done on a metal wall, partition, ceiling or roof, precautions shall be taken to prevent ignition of combustibles on the other side, due to conduction or radiation, preferably by relocating combustibles.

All other applicable University safety procedures shall be followed including but not be limited to personal protective equipment, confined space entry, compressed gas safety, lockout/tagout...

Suitable fire extinguishing equipment shall be maintained ready for use while hot work is being performed.

## H. Electrical Safety

### 1. Personal Protective Equipment for Electrical-Related Work Activities

Employees that work in areas where there are potential electrical hazards are provided with, and must use, electrical protective equipment that is appropriate for the specific part of the body to be protected and for the work to be performed.

- **Head Protection:** Employees must wear nonconductive head protection wherever there is a danger of head injury from electric shock or burns due to contact with exposed electrical parts;
- **Eye and Face Protection:** Employees must wear protective equipment for the eyes or face wherever there is a danger of injury to the eyes or face from electric arcs, flashing, or from flying objects resulting from explosion;
- **Electrical Protective Devices** such as insulating blankets, matting, covers, line hose, gloves, and sleeves are required when...
- **Arc Flash Suit or flame retardant clothing** is required wherever there is a danger of injury from electric arcs, flashing, or from flying objects resulting from electrical explosion.

### 2. General Protective Equipment and Tools

When working near exposed energized conductors or circuit parts, employees must use insulated tools or insulated tool-handling equipment if a possibility exists for making contact with the energized conductors or parts.

- Fuse handling equipment, properly insulated for the circuit voltage, must be used to remove or install fuses when the fuse terminals are energized;
- Ropes and handlines near exposed energized parts must be nonconductive;

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- Protective shields, protective barriers, or insulating materials must be used to protect employees from shock, burns, or other electrical-related injuries while the employees are working near exposed energized parts which might be accidentally contacted or where dangerous electric heating or arcing might occur. When normally enclosed live parts are exposed for maintenance or repair, they must be guarded to protect unqualified persons from contact with the live or energized parts.

### **3. Alerting Techniques for Electrical Hazards**

- Safety signs, safety symbols, or accident prevention tags must be used where necessary to warn employees about electrical hazards which may endanger them;
- Barricades must be used in conjunction with safety signs where it is necessary to prevent or limit employee access to work areas exposing employees to uninsulated energized conductors or circuit parts. Conductive barricades may not be used where they may cause an electrical contact hazard;
- If signs and barricades do not provide sufficient warning and protection from electrical hazards, an attendant must be stationed.

## **I. Control of Hazardous Energy (Lockout/Tagout)**

### **I. SCOPE**

This Program outlines the purpose, authorization, rules, responsibilities and techniques to be followed by University of Pittsburgh employees to guard against the unexpected energizing, start-up, or release of stored energy that could cause injury. Supervisors shall ensure that employees under their supervision receive training in the contents of this Program and ensure compliance with the Program contents.

This Program does not apply to work on cord and plug connected electrical equipment where exposure to the hazards of unexpected energization or start-up of the equipment is controlled by the unplugging of the equipment from the energy source and by the plug being under the exclusive control of the employee performing the servicing or maintenance.

### **II. PURPOSE**

The purpose of this Program is to establish procedures for the lockout/tagout of energy isolating devices whenever maintenance or servicing is done on machines or equipment. These procedures shall be used to ensure that the machine or equipment is stopped, isolated from all potentially hazardous energy sources and locked out before employees perform any servicing or maintenance where the unexpected energizing or start-up of the machine or equipment or release of stored energy could cause injury.

### **III. DEFINITIONS**

The following definitions are included in this program to ensure all employees know and understand the meaning and concept of the terms as they apply to this program. All definitions are consistent with *OSHA 29 CFR part 1910.147* and can be used as a reference by all employees.

**Affected Employees** are persons whose job requires him/her to operate or use a machine or equipment on which servicing or maintenance is being performed under lockout or tagout, or whose job requires

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him/her to work in an area in which such servicing or maintenance is being performed. The affected employees for the University of Pittsburgh Lockout/Tagout Program are those employees who meet above guidelines.

**Authorized Employees** are persons who physically lock out or tag out machines or equipment in order for servicing or maintenance to be performed. The authorized employees for the University of Pittsburgh Lockout/Tagout Program are Building Engineers, Tradesmen, and Facilities Management Construction Managers. All authorized employees are responsible for implementing a lockout procedure, which meets the minimum requirements established by the University of Pittsburgh and *OSHA 29 CFR part 1910.147*.

**Capable of Being Locked Out** means an energy-isolating device that has a hasp or other means of attachment to which, or through which, a lock can be affixed, or it has a locking mechanism built into it. Other energy isolating devices are capable of being locked out if lockout can be achieved without the need to dismantle, rebuild, or replace the energy-isolating device or permanently alter its energy control capability.

**Energy Isolating Device** is a mechanical device that physically prevents the transmission or release of energy, including but not limited to the following: A manually operated switch by which the conductors of a circuit can be disconnected from all ungrounded supply conductors and, in addition, no pole can be operated independently; a line valve; a block; and any similar device used to block or isolate energy. Push buttons, selector switches and other control circuit type devices are not energy isolating devices.

**Energy Source** is any source of electrical, mechanical, hydraulic, pneumatic, chemical, thermal or other energy.

**Hot Tap** is a procedure used in the repair, maintenance and services activities, which involves welding on a piece of equipment (pipelines, vessels or tanks) under pressure, in order to install connections or appurtenances. It is commonly used to replace or add sections of pipeline without the interruption of service for air, gas, water, steam, and petrochemical distribution systems.

**Lockout** is the placement of a lockout device on an energy-isolating device, in accordance with an established procedure, ensuring that the energy isolating device and the equipment being controlled cannot be operated until the lockout device is removed.

**Lockout Device** is a device that utilizes a positive means such as a lock, either key or combination type, to hold an energy-isolating device in the safe position and prevent the energizing of a machine or equipment. Included are blank flanges and bolted slip blinds.

**Normal Production Operations** is the utilization of a machine or piece of equipment to perform its intended production function.

**Servicing and/or Maintenance** is workplace activities such as constructing, installing, setting up, adjusting, inspecting, modifying, and maintaining and/or servicing machines or equipment. These activities include lubrication, cleaning or unjamming of machines or equipment and making

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adjustments or tool changes, where the employee may be exposed to the unexpected energization or start-up of the equipment or release of hazardous energy.

**Setting Up** is any work performed to prepare a machine or equipment to perform its normal production operation.

**Tagout** is the placement of a tagout device on an energy-isolating device, in accordance with an established procedure, to indicate that the energy isolating device and the equipment being controlled may not be operated until the tagout device is removed.

#### IV. AUTHORIZATION

An **authorized employee** is a person who physically locks out or tags out machines or equipment for servicing or and who has been properly trained in lockout/tagout procedures.

The authorized employees for the University of Pittsburgh Lockout/Tagout Program are Building Engineers, Tradesmen, and Facilities Management Construction/Project Managers providing contractor oversight.

An **affected employee** is an individual whose job requires him/her to operate or use a machine or equipment on which servicing or maintenance is being performed under lockout or tagout, or whose job requires him/her to work in an area in which such servicing or maintenance is being performed.

An affected employee becomes an authorized employee when that employee's duties include performing servicing or maintenance.

#### V. BASIC RULES

Each department utilizing the University of Pittsburgh program for the control of hazardous energy shall establish and document site-specific procedures for energy isolation. Specialized lockout devices shall be obtained and kept within the department for its use.

If an energy-isolating device is capable of being locked out, the authorized employee shall utilize lockout, unless the department head can demonstrate that utilization of a tagout system will provide full employee protection. When a tagout device is used on an energy-isolating device, which is capable of being locked out, the tagout device shall be attached at the same location that the lockout device would have been attached.

Lockout/tagout devices used for the implementation of this program shall be standardized, singularly identified and not used for any other purpose. Tagout device attachment means shall be of a non-reusable type, self-locking with a minimum unlocking strength of no less than 50 pounds.

Locks, tags and any other equipment required for energy control (chains, blocks, pins, hasps, etc.) will be provided by the University of Pittsburgh.

Only University electricians will service electrical circuits and University equipment unless specifically authorized by the Electrical Foreman. Lockouts of such circuits will only be performed in the presence of and with authorization of the Electrical Department.

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The Department of Environmental Health and Safety shall conduct periodic inspections of the lockout program at least annually to ensure that the procedures and requirements of this program are being followed. This process will be documented by identifying machines and equipment checked, the employees audited, and the date and the name of the person performing the audit.

## VI. COMPLIANCE

All University employees are required to comply with the restrictions and limitations imposed upon them during the use of lockout or tagout. Upon observing a machine or piece of equipment, which is locked out or tagged for servicing or maintenance, employees shall not attempt to start, energize or use that machine or equipment. Failure to comply with the restrictions and limitations of the lockout/tagout Program could result in disciplinary actions up to and including immediate termination of employment from the University of Pittsburgh.

## VII. PRE-LOCKOUT EVALUATION

In instances where a documented lockout procedure is not available, a pre-lockout evaluation will be conducted by authorized employees on any machine or piece of equipment, which needs maintenance, service, or repair. Upon completion, the pre-lockout evaluation form (found in Appendix B) will be kept on file by the department safety officers, supervisors or foreman with a copy sent to EH&S.:

The pre-lock out evaluation need not document the required procedure for a particular machine or piece of equipment, when **ALL** of the following elements exist:

1. The machine or equipment has no potential for stored or residual energy or reaccumulation of stored energy after shut down which could endanger employees.
2. The machine or equipment has a single energy source, which can be readily identified and isolated.
3. The isolation and locking out of that energy source will completely deenergize and deactivate the machine or equipment.
4. The machine or equipment is isolated from that energy source and locked out during servicing or maintenance.
5. A single lockout device will achieve a locked out condition.
6. The lockout device is under the exclusive control of the authorized employee performing the servicing or maintenance.
7. The servicing or maintenance does not create hazards for other employees.
8. There have been no accidents involving the unexpected activation or re-energization of the machine or equipment during servicing or maintenance.

## VIII. LOCKOUT PROCEDURES

Only authorized employees shall perform implementation of the lockout or tagout program. The application of lockout/tagout shall be done in the following sequence:

1. **Notification:** All affected employees shall be informed that servicing or maintenance is required on a machine or equipment and that the machine or equipment must be shut down and locked out to perform the servicing or maintenance.
2. **Preparation for shutdown:** The authorized employee shall refer to the University procedure (if available) to identify the type and magnitude of the energy that the machine or equipment utilizes, shall understand the hazards of the energy, and shall know the methods to control the energy. The procedure is available from the department safety officer, supervisor or foreman

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3. **Machine or equipment shutdown:** If the machine or equipment is operating, an orderly shutdown must be utilized to avoid any additional or increased hazard(s) to employees as a result of de-energization.
4. **Machine or equipment isolation:** Physically locate and de-activate the energy isolating device(s) so that the machine or equipment is isolated from the energy source(s).
5. **Lockout/tagout device application:** Each authorized employee shall affix lockout or tagout devices to each energy-isolating device. Lockout devices shall be affixed in a manner that will hold the energy in a "safe" or "off" position. Tagout devices shall be affixed in such a manner as will clearly indicate that the operation or movement of energy isolating devices from the "Safe" or "off" position is prohibited.
6. **Stored Energy:** Stored or residual energy (such as that in capacitors, springs, elevated machine members, rotating flywheels, hydraulic systems, and air, gas, steam or water pressure, etc.) must be dissipated or restrained by methods such as grounding, repositioning, bleeding down, blocking etc.
7. **Verification of isolation:** Ensure that the equipment is disconnected from the energy source(s) by first checking that no personnel are exposed, and then verify the isolation of the equipment by operating the push button or other normal operating control(s).

**//// CAUTION ////**

**Return operating control(s) to "NEUTRAL" or "OFF" position after verifying the isolation of the equipment.**

## **IX. RELEASE FROM LOCKOUT OR TAGOUT**

Before lockout or tagout devices are removed and energy restored to the machine or equipment, procedures shall be followed by the authorized employee(s) to ensure the following:

- 1) The work area shall be inspected to ensure that nonessential items have been removed and that machine or equipment components are operationally intact.
- 2) The work area shall be checked to ensure that all employees have been safely positioned or removed. Before lockout or tagout devices are removed and before machines or equipment are energized, affected employees shall be notified.
- 3) Verify that the controls are in the "OFF" or "NEUTRAL" position.
- 4) Remove the lockout devices and tags.
- 5) Re-start the machine or equipment

## **X. TESTING OF EQUIPMENT**

In situations where energy-neutralizing devices are locked out and there is need to test or position the equipment, these procedures will be followed:

1. Clear all personnel to safety.
2. Clear away tools and materials from equipment.
3. Remove lockout devices and re-energize the controls, following the established safety procedures.
4. Proceed with try out or testing of equipment.
5. Neutralize all energy sources once again; purge all systems and re-lockout prior to continuing work.

## **XI. GROUP LOCKOUT OR TAGOUT**

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When servicing and/or maintenance is performed by a crew or department, they shall utilize a procedure which affords the employees a level of protection equivalent to that provided by the implementation of a personal lockout or tagout device. This shall be accomplished by:

- The application of a multi-lock accepting device by the primary authorized employee to the energy-isolating device.
- Each authorized employee shall affix a personal lockout or tagout device when they begin work, and shall remove those devices when they stop working on the machine or equipment.
- The primary authorized employee will remove his/her lock and the multi-lock accepting device when all service or maintenance has been completed.

## **XII. NEW MACHINERY AND EQUIPMENT**

All new machinery and equipment shall incorporate provisions for lockout. Equipment mounted disconnects are recommended. All valves used to hold equipment out of service or for sectionalizing lines should be designed to enable lockout. Bleeder valves should be installed where dissipation of pressure, draining lines, purging, or similar activities are required. All equipment which is extensively modified or which undergoes major repair shall be fitted with energy isolating devices.

## **XIII. LOCKOUT CONTINUITY DURING SHIFT CHANGES**

To ensure continuity of lockout protection in the event that a problem arises after the standard 7:30 a.m. to 4:00 p.m. shift, the following procedures shall be followed:

1. The person who applied the lockout shall remove locks at the end of each shift after appropriate safety checks.
2. If there is an oncoming authorized employee he/she will immediately apply his/her lock and tag to each point of lockout, and recheck for the effectiveness of the lockout.

## **XIV. LOCK REMOVAL**

Locks or tags must not be removed by anyone other than the authorized employee who installed it, with one exception.

If an emergency takes place which calls for re-energizing a machine or piece of equipment, the authorized employee's supervisor may remove his/her lock or tag under the following conditions:

1. The supervisor or foreman will make every practical attempt to contact the employee whose lock and tag are in question and determine the safety involved in removing his/her lockout device(s).
2. The supervisor or foreman will conduct a lockout removal review with all affected parties. The purpose of the review is to ensure that removal of the lock will not jeopardize the safety or health of any individual.
3. When it has been determined that it is safe to do so, the employee's supervisor or foreman may then remove the lock and tag.
4. In the event the employee was unable to be contacted, his/her supervisor or foreman shall notify him/her that his/her lock and tag have been removed as soon as possible.

## **XV. CONTRACTORS**

Whenever outside contractors are to be engaged in activities covered by the scope and application of this program, the University of Pittsburgh representative and the outside contractor representative shall

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discuss hazardous energy sources involved in the work and de-energization procedures. The procedures employed by the contractor must meet the requirements established in 29CFR1910.147.

In situations where contractor and University employees will be working on the same equipment or machinery, the responsible University Project Manager will coordinate the de-energization and lockout/tagout of the appropriate devices.

## **XVI. EXEMPTED EQUIPMENT AND OPERATIONS**

1. **Cord and Plug Equipment:** Cord and plug connected electrical equipment is not covered by this program, if the unexpected energizing of the equipment is controlled by the unplugging of the equipment. The plug must be under the exclusive control of the employee performing the work, such that it is within reach at all times.
2. **Hot-Tap Operations:** Hot-tapping is not covered by this program if the following conditions are met:
  - a. Service continuity is essential.
  - b. It is impractical to shut the service down.
  - c. There are documented procedures that ensure effective employee protection and those procedures are followed.
  - d. Special equipment, if necessary, is used.

## **XVII. EMPLOYEE TRAINING**

All **authorized employees** must be knowledgeable and understand the hazards associated with the unexpected release of energy by machines, equipment, pipelines, and electrical circuits.

Training for authorized employees shall include:

1. Recognition of hazardous energy sources.
2. Identification of the types and magnitude of energy sources in the workplace.
3. Explanation of the methods and means for isolation and control of hazardous energy.

Affected employees shall be instructed on the purpose and use of the lockout/tagout procedures.

Other employees working in an energy-control area shall be instructed on the lockout/tagout procedures, but not their use; and shall be informed of prohibitions on tampering with energy isolating devices.

In certain situations, it may be impossible for a machine or piece of equipment to be locked out and consequently, tagout will be the only form of energy isolation possible. Employees shall be trained on the following limitations posed by the use of tags only:

1. Tags do not provide a physical restraint.
2. Tags are little more than warning devices and may evoke a false sense of security unless their meaning is clearly understood.
3. Tags must be legible and understandable by all employees.
4. Both tags and their means of attachment must be able to withstand hostile environmental conditions encountered in the workplace and must be securely attached so they cannot be inadvertently or accidentally detached.

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5. Tags are not to be removed, bypassed, ignored or otherwise invalidated without proper authorization.

Employee retraining will take place whenever there is a change in job assignments or a change in equipment, machines or processes that presents a new hazard. Retraining will also be conducted when program audits indicate non-compliance or a lack of knowledge about the program.

## **J. Fall Protection**

Employees on walking/working surface must be protected from falls when:

- Working at a height of six feet or more or: near wall, floor, hole or skylight openings and near excavations that exposes employees to a fall hazard of six feet or more.
- Working on sloped roofs.
- Working above dangerous equipment or facilities, regardless of height.
- Working within six feet of the edge of flat roofs or leading edges on construction.
- Working on moving scaffolds, lifts or buckets.

A fall protection system is required if a worker could fall from an elevated position.

Fall protection systems include; **guardrails, warning lines, safety nets or personal fall arrest systems**. As a general rule, a fall protection system must be used anytime a working height of six feet or more is reached. Working height is the distance from the walking/working surface to a grade or lower level.

### **Guardrail System:**

A barrier erected to prevent employees from falling to lower levels. It consists of stanchions, mid rail and top rail. Guardrail systems must be capable of withstanding a force, without failure, of 200 pounds applied in any direction.

### **Warning Line System:**

A barrier erected on a roof to warn employees that they are approaching an unprotected roof side or edge, and which designates an area in which roofing work may take place without the use of guardrail, fall arrest, or safety net system to protect employees in the area. In lieu of a warning line system a **safety-monitoring system** in which a competent person is responsible for recognizing and warning employees of fall hazards may be used.

### **Safety Nets:**

Where the use of scaffolds, platforms, guardrails, warning lines, or fall arrest systems is impractical, safety nets shall be provided when workplaces are more than 20 feet above the ground.

### **Fall Arrest System:**

Fall arrest systems shall be designed in accordance with OSHA and ANSI standards. The components of this system include: full-body harnesses with a shock-absorbing lanyard or a retractable lifeline, anchor point and connector. A full-body harness distributes the forces throughout the body, and the shock-absorbing lanyard decreases the total fall arresting forces.

### **Anchorage:**

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A secure point of attachment for lifelines, lanyards or deceleration devices. Anchorage points must be attached only to main structural framing members (columns, beams, trusses etc.) No attachments are to be made to non-structural members (pipes, conduits, mechanical equipment, electrical equipment, handrails, etc.). Attachments to secondary structural members (roof and wall purlins, cross bracing, architectural walls, sheeting and concrete members) must not be made until verification of the appropriate load carrying capacity.

**Attachment of harness to anchorage point:**

Anchorage used for attachment of personal fall arrest equipment shall be rigged such that an employee can neither free fall more than six feet nor contact any lower level. The anchorage point must be capable of supporting 5400 pounds per person attached. A lanyard is a flexible line of rope, wire rope, or strap, which generally has a connector at each end for connecting the body belt or body harness to a deceleration device, lifeline, or anchorage. Lanyards may not be tied off to an anchorage point on itself (i.e. looped over a beam) unless specifically approved for that application. A **cross arm strap** should be utilized when tying off to a beam. A lanyard must never be knotted in an attempt to shorten it. Anchorage points generally must be above the employee’s head to prevent free fall from exceeding six feet.

**Inspection and Maintenance:**

- The employee shall inspect the fall protection equipment before each use. Inspect for shock loading, rips, tears or abrasion, damaged eyelets, rivets, buckles, D-rings and connectors. Any damaged equipment must be reported to the foreman and must be destroyed.
- Equipment that has been used to arrest a fall shall be immediately removed from service and destroyed.
- Nylon lanyards and harnesses should not be exposed to extreme heat or chemicals. These may damage and weaken the fibers.

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### **Training:**

Training is required for employees who might be exposed to fall hazards.

- Employee training must include:
  - The nature of fall hazards in the work area.
  - The correct procedures for erecting, maintaining, disassembling, operating and inspecting fall protection systems.
  - An overview of OSHA's Fall Protection Standard.

### **Responsibility:**

- The employee is responsible for; inspection and proper use of equipment, and reporting any falls to foreman/supervisor and EH&S.
- The foreman/supervisor is responsible for; insuring that any employee potentially exposed to a fall hazard as defined in these guidelines is properly trained and protected.
- The Department of Environmental Health and Safety (EH&S) is responsible for; training, recommending appropriate fall protection systems when consulted, auditing for compliance with these guidelines, and annual inspection of fall protection equipment.

### **Roof Work;**

Roof construction, repair, and other maintenance operations often require manual labor at dangerous heights and on steeply pitched working surfaces. Roofing work includes the hoisting, storage, application, and removal of roofing materials and equipment, including related insulation, sheet metal, and vapor barrier work, but not including the construction of the roof deck. The possibility of lost footing, decreased stability, and objects falling from such heights is great; appropriate employee safeguards shall be present. When employees of the University of Pittsburgh are involved in such operations, the following minimum safety guidelines shall be followed.

Prior to walking or placing objects onto roofs, the structural integrity of the roof must be assured.

Each employee engaged in roofing activities on low-slope roofs (slope less than or equal to 4 in 12), with unprotected sides and edges 6 feet or more above lower level shall be protected from falling by:

- Guardrail systems,
- Safety net systems,
- Personal fall arrest systems,
- Combination of warning line system and guardrail system, warning line system and personal fall arrest system, or warning line system and safety monitoring system.

On roofs 50 feet or less in width, the use of a safety monitoring system alone (i.e., without the warning line system) is permitted.

Each employee on a steep roof (slope greater than 4 in 12) with unprotected sides and edges 6 feet or more above lower levels shall be protected from falling by guardrail systems with toeboards, safety net systems, or personal fall arrest systems.

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## **K. Confined Space Entry**

### **I. POLICY**

The University of Pittsburgh endeavors to protect its employees and others involved in confined space work by implementing this Permit Required Confined Space Entry Program. The University intends to limit the entry of employees into areas posing special dangers due to their configuration or other features and achieve acceptable environmental conditions for individuals working in such areas.

The University recognizes that confined space entry may pose a variety of hazards to its employees. The procedures developed within this program shall be followed by all employees to ensure these hazards are adequately controlled.

Employees should recognize the hazards associated with confined space entry and should never trust their senses to determine if an area is hazard free. Whenever an employee feels a hazard may be present he/she shall immediately leave the area and notify his/her supervisor or foreman.

As a general rule, the University of Pittsburgh does not intend to have its employees enter permit required confined spaces and every effort will be made to eliminate the hazards and declassify the spaces accordingly.

When appropriate, the University will utilize alternate procedures specified by OSHA's Standard 1910.146(5)(c)(ii) for entering a permit space when:

- A. Demonstration that the only hazard posed by the permit space is an actual or potential hazardous atmosphere.
- B. Continuous forced ventilation alone is sufficient to maintain the space safe for entry and monitoring data documents that a safe entry condition exists.
- C. Periodic monitoring supports that the forced ventilation is preventing accumulations of hazardous atmospheres.

### **II. PURPOSE**

The purpose of this program is to develop, implement, and maintain practices and procedures to protect employees from hazards associated with permit required confined spaces. The program was designed to comply with Code of Federal Regulations (CFR) Title 29 Labor (OSHA) part 1910.146 - Permit-required confined spaces.

### **III. SCOPE AND APPLICATION**

This program covers all work done by, at the request of, or for the University of Pittsburgh including any of its entities and representatives. Confined space entry guidelines used by any of the aforementioned persons must, at a minimum, meet the requirements of this program.

### **IV. DEFINITIONS**

"Acceptable entry conditions"- the conditions that must exist in a permit space to allow entry and to ensure that employees involved with a permit-required confined space entry can safely enter into and work within the space.

"Attendant" - an individual stationed outside one or more permit spaces who monitors the authorized entrants and who performs all attendant's duties assigned in the employer's permit space program.

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"Authorized entrant" - an employee who is authorized by the employer to enter a permit space.

"Blanking or blinding" - the absolute closure of a pipe, line, or duct by the fastening of a solid plate (such as a spectacle blind or a skillet blind) that completely covers the bore and that is capable of withstanding the maximum pressure of the pipe, line, or duct with no leakage beyond the plate.

"Confined space"-a space that:

- (1) It is large enough and so configured that an employee can bodily enter and perform assigned work; and;
- (2) Has limited or restricted means for entry or exit (for example, tanks, vessels, silos, storage bins, hoppers, vaults, and pits are spaces that may have limited means of entry.) and;
- (3) Is not designed for continuous employee occupancy.

Some examples of confined spaces are: Manholes, storage tanks, utility vaults, pits, boilers, furnaces, pipe tunnels, sewers...

"Double block and bleed"- the closure of a line, duct, or pipe by closing and locking or tagging two in-line valves and by opening and locking or tagging a drain or vent valve in the line between the two closed valves.

"Emergency" - any occurrence (including any failure of hazard control or monitoring equipment) or event internal or external to the permit space that could endanger entrants.

"Engulfment" - the surrounding and effective capture of a person by a liquid or finely divided (with flowing, liquid-like properties) solid substance that can be aspirated to cause death by filling or plugging the respiratory system or that can exert enough force on the body to cause death by strangulation, constriction, or crushing.

"Entry" - the action by which a person passes through an opening into a permit-required confined space. Entry includes ensuing work activities in that space and is considered to have occurred as soon as any part of the entrant's body breaks the plane of an opening into the space.

"Entry permit (permit)" - the written or printed document that is provided by the employer to allow and control entry into a permit space and that contains the information specific to that location for safe entry.

"Entry supervisor" - the person (such as the employer, foreman, or crew chief) responsible for determining if acceptable entry conditions are present at a permit space where entry is planned, for authorizing entry and overseeing entry operations, and for terminating entry as required by this section.

NOTE: An entry supervisor also may serve as an attendant or as an authorized entrant, as long as that person is trained and equipped as required by this section for each role he or she fills. Also, the duties of entry supervisor may be passed from one individual to another during the course of an entry operation.

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"Hazardous atmosphere" - an atmosphere that may expose employees to the risk of death, incapacitation, impairment of ability to self-rescue (that is, escape unaided from a permit space), injury, or acute illness from one or more of the following causes:

- (1) Flammable gas, vapor, or mist in excess of 10 percent of its lower flammable limit (LFL);
- (2) Airborne combustible dust at a concentration that meets or exceeds its LFL;  
NOTE: This concentration may be approximated as a condition in which the dust obscures vision at a distance of 5 feet (1.52 m) or less.
- (3) Atmospheric oxygen concentration below 19.5 percent or above 23.5 percent;
- (4) Atmospheric concentration of any substance for which a dose or a permissible exposure limit is published in 29 CFR Subpart G, Occupational Health and Environmental Control, or in 29 CFR Subpart Z, Toxic and Hazardous Substances, of this Part and which could result in employee exposure in excess of its dose or permissible exposure limit;

NOTE: An atmospheric concentration of any substance that is not capable of causing death, incapacitation, impairment of ability to self-rescue, injury, or acute illness due to its health effects is not covered by this provision.

For air contaminants for which OSHA has not determined a dose or permissible exposure limit, other sources of information, such as Material Safety Data Sheets that comply with the Hazard Communication Standard, section 1910.1200 of this Part, published information, and internal documents can provide guidance in establishing acceptable atmospheric conditions.

"Hot work permit" -the employer's written authorization to perform operations (for example, riveting, welding, cutting, burning, and heating) capable of providing a source of ignition.

"Immediately dangerous to life or health (IDLH)" - any condition that poses an immediate or delayed threat to life or that would cause irreversible adverse health effects or that would interfere with an individual's ability to escape unaided from a permit space.

"Inerting" - the displacement of the atmosphere in a permit space by a noncombustible gas (such as nitrogen) to such an extent that the resulting atmosphere is noncombustible.

NOTE: This procedure produces an IDLH oxygen-deficient atmosphere.

"Isolation" - the process by which a permit space is removed from service and completely protected against the release of energy and material into the space by such means as: blanking or blinding; misaligning or removing sections of lines, pipes, or ducts; a double block and bleed system; lockout or tagout of all sources of energy; or blocking or disconnecting all mechanical linkages.

"Line breaking" - the intentional opening of a pipe, line, or duct that is or has been carrying flammable, corrosive, or toxic material, an inert gas, or any fluid at a volume, pressure, or temperature capable of causing injury.

"Non-permit confined space" - a confined space that does not contain or, with respect to atmospheric hazards, have the potential to contain any hazard capable of causing death or serious physical harm.

"Oxygen deficient atmosphere"- an atmosphere containing less than 19.5 percent oxygen by volume.

"Oxygen enriched atmosphere" - an atmosphere containing more than 23.5 percent oxygen by volume.

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"Permit-required confined space (permit space)" - a confined space that has one or more of the following characteristics:

- (1) Contains or has a potential to contain a hazardous atmosphere;
- (2) Contains a material that has the potential for engulfing an entrant;
- (3) Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor which slopes downward and tapers to a smaller cross-section; or
- (4) Contains any other recognized serious safety or health hazard. "Permit-required confined space program (permit space program)" means the employer's overall program for controlling, and, where appropriate, for protecting employees from, permit space hazards and for regulating employee entry into permit spaces.

"Permit system" - the employer's written procedure for preparing and issuing permits for entry and for returning the permit space to service following termination of entry.

"Pre-Entry / Entry Checklist" - the form used to determine the safety of a confined space. This form referred to as the 'checklist' is to be used to reclassify a permit space to a Non-Permit.

"Prohibited condition" - any condition in a permit space that is not allowed by the permit during the period when entry is authorized.

"Rescue service" - the personnel designated to rescue employees from permit spaces.

"Retrieval system" - the equipment (including a retrieval line, chest or full-body harness, wristlets, if appropriate, and a lifting device or anchor) used for non-entry rescue of persons from permit spaces.

"Testing" - the process by which the hazards that may confront entrants of a permit space are identified and evaluated. Testing includes specifying the tests that are to be performed in the permit space.

## **V. EMPLOYEE TRAINING AND DUTIES**

### **A. Authorized Entrants**

All employees who work as authorized entrants will be trained to perform the following duties:

#### **1. Hazard recognition**

Authorized entrants will be trained to know the hazards they may confront, to recognize the effects of those hazards and to understand the consequences of exposure to those hazards.

#### **2. Communication**

Authorized entrants will be instructed on both the methods that will be used to maintain contact with the attendant and the means of notifying the attendant of their intent to self-initiate an evacuation.

#### **3. Protective equipment**

Authorized entrants will be made aware of the personal protective equipment, such as respirators, harnesses and lifelines, needed for safe entry and exit. They will be provided with the necessary personal protective equipment and instructed on its proper use. Entrants will be made aware of the

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external barriers needed to protect themselves from external hazards and instructed on the proper use of the barriers.

#### **4. Self-rescue**

Authorized entrants will be trained to exit a permit space without assistance (self-rescue) whenever it is physically possible to do so. Entrants will be trained to exit a permit space, if possible, when the attendant orders evacuation, an automatic alarm sounds or if they perceive they are in danger.

#### **B. Authorized Attendant**

An authorized attendant shall be stationed and remain outside the permit space at all times during entry operations. Attendants will be trained to perform the following duties:

##### **1. Accountability**

Attendants shall be instructed to know, at all times during the entry, how many persons are in the permit space so that no one is accidentally left in the space when it is returned to service.

##### **2. Hazard recognition**

Attendants will be trained to know and recognize potential permit space hazards and the effects of the hazards. Attendants will also be trained to monitor activities inside and outside the permit space to ensure that no hazards exist.

##### **3. Communication**

Attendants shall be instructed to maintain continuous and effective contact with authorized entrants.

##### **4. Evacuation**

Attendants shall be instructed to immediately evacuate authorized entrants from the permit space when:

- A condition arises that is prohibited in the entry permit;
- Behavioral effects of hazard exposure are detected;
- A situation outside the permit space, which could endanger the entrants, is detected;
- An uncontrolled hazard within the permit space is detected;
- If the attendant is monitoring entry in more than one permit space and he/she must focus attention on the rescue of entrants in one of those spaces; or
- The attendant must leave the work station.

##### **5. Unauthorized Persons**

The attendants shall be trained to take the following action when unauthorized persons approach or enter a permit space while entry is underway:

- Warn the unauthorized person away from the space,
- Request the unauthorized person to immediately exit if they have entered the permit space,
- Inform the authorized entrants and any other designated persons if unauthorized persons have entered the permit space.

##### **6. Rescue**

The attendants shall be trained to summon rescue and other emergency services as soon as they determine that authorized entrants need to escape from permit space hazards.

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Attendants shall be instructed not to enter the permit space to attempt rescue of entrants.

Attendants will be trained to perform all other assigned rescue and emergency duties without entering the permit space.

### **7. Protective Equipment**

Attendants shall be trained to properly use all rescue equipment provided for their use.

Attendants will be made aware of the external barriers needed to protect authorized entrants from external hazards and instructed on the proper use of the barriers.

### **C. Individuals Authorizing or in Charge of Entry**

The individuals who authorize or are in charge of entries will be trained in respect to administrative, technical and managerial aspects of confined space entry and will be empowered to terminate the entry whenever unacceptable conditions are present. They will be trained to be able to determine if the permit contains all requisite information and be able to assure that relevant procedures, practices and equipment are in place before allowing entry. They will be trained to perform follow-up audits during the entry to assure that conditions remain consistent with the terms of the permit.

NOTE: Authorized attendants and individuals who authorize or are in charge of entries may enter a permit space only if they have received proper training.

Employee training in Confined Space requirements is available through the Environmental Health and Safety Department.

## **VI. ENTRY PROCEDURES**

### **RECLASSIFICATION OF PERMIT REQUIRED CONFINED SPACES**

Spaces that meet the definition of a confined space must be entered under the procedures for Permit Required Confined Spaces unless they can be reclassified as non-permit confined spaces under the following procedures:

1. If the permit space poses no actual or potential atmospheric hazard and if all hazards within the space are eliminated without entry into the space, the permit space may be reclassified as a non-permit confined space as long as the non-atmospheric hazards remain eliminated.
2. In order for a space to be permanently reclassified as a "non-permit confined space" its potential hazards must be properly evaluated. This should include developing monitoring and inspection data. There must be a signed document permanently declassifying each space, and it must be available to employees assigned to enter the space. Continuous atmospheric monitoring must be utilized in all declassified confined spaces that have any "potential" for atmospheric contamination. Also, no single employee may be assigned to enter a confined space even if it has been classified as a "non-permit confined space".  
(i.e. If it meets the definition of a confined space, there must be more than one employee assigned. )

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3. If it is necessary to enter the space to eliminate hazards, such entry shall be performed under the "Permit System" part of this Program. If testing and inspection during that entry demonstrate that the hazards within the space have been eliminated, the permit space may be reclassified as a non-permit confined space for as long as the hazards remain eliminated.
4. The supervisor or foreman must verify that all hazards in the permit space have been eliminated, by utilizing the Pre-Entry Checklist. The Checklist section must be completed and indicate the date and location of the space. The Checklist must be made available to each employee entering the space.
5. If hazards arise within a permit space that has been reclassified to a non-permit space, each employee in the space shall exit the space. The entry supervisor or foreman and crew members shall then reevaluate the space and determine whether it must be reclassified as a permit space.

The following procedures are to be followed by all employees who are involved with the entry of permit spaces:

1. The supervisor or foreman from the, department which needs to enter a permit space for maintenance or service, shall prepare the permit space for entry by completing the following safety precautions and documenting the information on an entry permit.
  - a) Identify all possible hazards in the permit space.
  - b) Notify affected departments of service interruption.
  - c) Lock out and/or tag out all isolating devices in compliance with established University procedures.
  - d) Clean, drain, wash and purge the area.
  - e) Provide necessary ventilation system(s).
  - f) Assure emergency response team is available.
  - g) Inform employees of specific permit space hazards.
  - h) Review procedures with each employee.
  - i) Determine if hot work is necessary.
  - j) Determine what safety equipment (respirators, communication aid, etc.) is required for entry and work, specify it, and provide it for the employees (who must be trained in its use.)
  - k) List all authorized entrants, authorized attendants and individuals eligible to be in charge of the entry.
  - l) Post signs near the permit space to notify employees what hazards may be present and that only authorized entrants may enter the permit space.
  - m) Place barriers, where necessary, in order to protect entrants against external hazards and to protect bystanders from an accidental fall through, or inadvertent entry into the opening.
  - n) Take all other precautions necessary for safe entry.
2. The Supervisor or Foreman shall inform the Department of Environmental Health and Safety that permit space entry is required and that he/she has taken all necessary precautions to ensure safe entry. A University designated employee will conduct the proper atmospheric testing in the permit space and document the results on the entry Permit provided by the supervisor or foreman.
3. After the trained tester completes the atmospheric testing, he/she shall return the entry permit to the respective Supervisor or Foreman.

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4. The Supervisor or Foreman shall take the entry permit to Environmental Health and Safety Department for authorization. (This step may be eliminated if Supervisors or Foremen have authorization approval).
5. The individual authorizing the entry permit shall complete the section of the entry permit listed as "AUTHORIZATION" after he/she determines all necessary precautions have been taken to ensure safe entry and all requisite information is on the entry permit.
6. The permit is limited to the date and time identified on the permit or checklist. Permits are good for one 8 hour shift only. They can be extended to a maximum of 16 hours, if the same crew continues on the job and then only after an atmospheric check. A new permit must be completed for each space on each day.
7. After the entry permit is authorized, work in the permit space can begin. All specifications of the entry permit for that permit space must be followed.  
The individual authorizing the entry permit or the person in charge of entry (supervisor or foreman) can cancel the entry authorization and terminate entry whenever they determine entry operations are not consistent with the terms of the permit and/or acceptable entry conditions are not present
8. Testing of the atmospheric conditions in the permit space shall take place in compliance with the guidelines established in Section VIII. of this program.
9. The entry permit shall be canceled by the individual who authorized it, after entry is completed, and all entrants have exited the permit space.
10. The individual who authorized the entry permit shall keep a copy of it on file and send the original entry permit to the Department of Environmental Health and Safety.

## ***VII. ATMOSPHERIC TESTING***

The "Sentinel 4 Personal Gas Monitor" (available through the Department of Environmental Health and Safety) or a similar approved device shall be used to test the atmospheric conditions of permit spaces. When testing for atmospheric hazards, first test for oxygen (>19.5% and<23%), then for combustible gases or vapors (<10%), and then for toxic gases and vapors (< established TWA or PEL).

Atmospheric testing will be performed:

- Prior to an employee entering a permit space.
- Continuously when welding, cutting, brazing, painting, or degreasing is being performed in the permit space.
- Prior to an employee re-entering the permit space after any break.
- Any time it is perceived necessary in order to ensure acceptable atmospheric conditions.

Testing shall be performed at various levels of the permit space (top, middle and bottom), If testing reveals an unacceptable atmospheric condition, the permit space must be ventilated and re-tested before an employee can enter. If ventilation is not possible and entry is necessary, entrants must have appropriate respiratory protection.

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## **VIII. EQUIPMENT**

Personal protective equipment such as respirators, lifelines, safety harnesses, communication equipment, ventilation equipment, protective clothing, hearing and eye protection, signs and barriers, and all other equipment necessary to protect the well being of the authorized entrants will be provided and maintained by University of Pittsburgh.

All employees who will be using such equipment will be properly trained on its use. In specific situations such as respirator use, employees will be given complete physicals, fit tests and all other necessities as required by law. All portable electric tools and lighting used in a confined space must be powered through a GFCI.

All equipment must be approved by the individual authorizing the entry permit in order to be used during the entry. If the equipment has not been approved, it cannot be used.

## **IX. RESCUE**

In the event that rescue of an entrant becomes necessary, the authorized attendant will immediately contact the Campus Police at 412 624-2121 to request an outside rescue team. The services of the City of Pittsburgh Fire Department will be utilized for the rescue of entrants and for any other emergency situation that arises (i.e., explosion, etc.).

The authorized attendant will NOT enter the permit space to attempt rescue unless he/she is properly trained to do so, is equipped to perform the rescue without endangering themselves or others involved, and has been relieved by another equipped and trained attendant. Rescue from outside the space with available equipment such as a tripod and winch with attached lifeline and harness is permitted.

Personnel from the City of Pittsburgh who may be involved in rescue of an entrant or involved in an emergency situation will be informed of the potential hazards they may confront when called in to perform service by the authorized attendant.

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## L. Excavation and Trenching Guidelines

The primary hazard associated with excavation and trenching activities is cave-in. A cave-in may result in entrapment and eventual suffocation of workers in an unprotected excavation. Associated hazards include falls, falling loads, mobile equipment, water accumulation, hazardous atmospheres, and access and egress obstructions. These guidelines are intended to protect University employees who work in and around excavations and trenches.

### ***General Program Requirements:***

- Employees who work in or around excavations must be provided training according to their work.
- Protection against cave-ins using sloping, benching systems or support systems must be provided in excavations greater than four feet in depth.
- Traffic around the site must be controlled using barricades, signs, and/or flag persons as needed to control both vehicular and pedestrian traffic.
- Utilities on the site must be protected and suitable precautions must be taken if any utility will be disturbed by the work.
- Employees must use required personal protective equipment (PPE).
- An initial inspection to evaluate site hazards must be conducted by a competent person. Additional inspections must be conducted daily or as conditions occur that may affect or create hazards.
- Each department covered by this program must appoint one or more competent person(s) to ensure compliance with these guidelines.

Excavation work may involve safety hazards not addressed by this program including:

- Work conducted on or around electrical systems [addressed in the Electrical Safety Program];
- Work that may impact existing utilities and may require implementation of the Lockout/Tagout Program;
- Work conducted in areas where hazardous atmospheres or gases could accumulate (e.g. gas distribution lines, or hazardous materials storage locations) requiring implementation of the Confined Space Program;

Fall hazards covered under the Fall Protection Program.

### **Definitions:**

*Aluminum hydraulic shoring* - An engineered shoring system comprised of aluminum hydraulic cylinders (cross braces), used in conjunction with vertical rails (uprights) or horizontal rails (wales). Such a system is designed specifically to support the sidewalls of an excavation and prevent cave-ins.

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*Benching* - A method of protecting employees from cave-ins by excavating in a manner which forms one or a series of horizontal levels or steps, usually with vertical or near-vertical surfaces between levels.

*Cave-in* - The separation of a mass of soil or rock material from the side of an excavation, or the loss of soil from under a trench shield or support system, and its sudden movement into the excavation, either by falling or sliding, in sufficient quantity so that it could entrap, bury, or otherwise injure and immobilize a person.

*Competent person* - One who is capable of identifying existing and predictable hazards in the surroundings or work environment that are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures. A competent person should be able to demonstrate the following:

1. Training, experience, and knowledge of:

- soil analysis,
- protective systems, and
- requirements of 29 CFR 1926 Subpart P and these Guidelines.

2. Ability to detect:

- conditions that could result in cave-ins,
- failures in protective systems,
- hazardous atmospheres, and
- other hazards.

3. Authority to take prompt corrective measures to eliminate existing and predictable hazards and to stop work when required.

*Excavation* - Any man-made cut, cavity, trench, or depression in an earth surface, formed by earth removal.

*Shield* - A structure that is able to withstand the forces imposed on it by a cave-in and thereby protect employees with the structure. Shields can be permanent structure or can be designed to be portable and moved along as work progresses. Also known as trench box or trench shield.

*Shoring* - A structure such as a metal hydraulic or mechanical shoring system that supports the sides of an excavation and which is designed to prevent cave-ins.

*Sloping* - A method of protecting employees from cave-ins by excavating in a manner which forms sides that are inclined away from the excavation so as to prevent cave-ins. The angle of incline varies with differences in such factors as the soil type, environmental conditions of exposure, and application of surcharge loads.

*Soil Type* –

Type A - Most stable: clay, silty clay, and hardpan (resists penetration). No soil is Type A if it is fissured, is subject to vibration of any type, has previously been disturbed, or has seeping water.

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Type B - Medium stability: silt, sandy loam, medium clay and unstable dry rock; previously disturbed soils unless otherwise classified as Type C; soils that meet the requirements of Type A soil but are fissured or subject to vibration.

Type C - Least stable: gravel, loamy sand, soft clay, submerged soil or dense, heavy unstable rock, and soil from which water is freely seeping.

Layered geological strata (where soils are configured in layers) - The soil must be classified on the basis of the soil classification of the weakest soil layer. Each layer may be classified individually if a more stable layer lies below a less stable layer, i.e. where a Type C soil rests on top of stable rock.

Trench - A narrow excavation (in relation to its length) made below the surface of the ground. In general, the depth is greater than the width, but the width of a trench is not greater than 15 feet.

### **Training:**

All personnel involved in excavation work must be trained in accordance with these guidelines. Training must be provided before the employee is assigned duties.

### Site Worker:

Personnel who conduct work within or in the vicinity of excavations must receive training prior to beginning work at the site. The training must include:

- Requirements of the OSHA Excavations standard;
- Requirements of University of Pittsburgh Excavation and Trenching Guidelines;
- Work practices;
- Hazards relating to excavation work;
- Methods of protection for excavation hazards;
- Use of Personal Protective Equipment;
- Procedures regarding hazardous atmospheres;
- Emergency and non-entry rescue procedures.

### Competent Person

In addition to site worker training, a departmental competent person must also receive training to include:

- Methods of evaluating the site and conducting inspections according to this program;
- Evaluation and selection of protection methods;
- Ensuring compliance with this program;
- Requirements under additional applicable programs such as Confined Space and Fall Protection.

### **Compliance:**

In order to comply with this program:

1. An initial inspection to evaluate site hazards must be conducted by a competent person.
2. All hazards must be eliminated, controlled, or employees must be provided appropriate personal protective equipment.
3. Protection must be provided against potential cave-ins using either sloping or benching systems or support systems.

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4. Inspections must be conducted daily or as conditions occur that may affect or create hazards.

**Hazards:**

Surface Encumbrances-All equipment, materials, supplies, permanent installations (e.g. buildings, roadways), trees, brush, boulders, and other objects at the surface that could present a hazard to employees working in the excavation must be removed or supported, as necessary, to protect employees.

Underground Installations- The location of sewer, telephone, fuel, electric, and water lines as well as any other underground installations that may be encountered during excavation work must be located and marked prior to opening the excavation. The Competent Person must make arrangements as necessary with the appropriate utility agency for the protection, removal, shutdown, or relocation of underground installations.

If it is not possible to establish the exact location of underground installations, the work may proceed with caution provided detection equipment or other safe and acceptable means (e.g. using hand tools) are used to locate the utility as the excavation is opened and each underground installation is approached.

Excavation work will be conducted in a manner that does not endanger underground installations or employees engaged in the work. Barricades, shoring, suspension, or other means as necessary to protect employees must protect utilities left in place.

Access and Egress-Stairs, ladders, or ramps must be provided where employees are required to enter trench excavations four feet or more in depth. The maximum distance of travel in an excavation to a means of egress shall not exceed 25 feet. Ladders must be secured and extend a minimum of 36 inches above the landing.

Vehicular Traffic -Employees exposed to vehicular traffic must be provided with, and will wear, warning vests or other suitable garments marked with or made of reflectorized or high-visibility material.

Falling Loads- No employee will be permitted underneath loads handled by lifting or digging equipment. Employees will be required to stand away from any vehicle being loaded or unloaded.

Mobile Equipment-When mobile equipment is operated adjacent to the edge of an excavation; a warning system will be used when the operator does not have a clear and direct view of the edge of the excavation. The warning system must consist of barricades, hand or mechanical signals, or stop logs. If possible, the surface grade will slope away from the excavation.

Hazardous Atmospheres- Atmospheric testing must be conducted in excavations over four feet deep where hazardous atmospheres could reasonably be expected to exist (e.g. landfill areas, near hazardous substance storage, gas pipelines).

Adequate precautions will be taken to prevent employee exposure to atmospheres containing less than 19.5 percent oxygen or other hazardous atmospheres. These precautions include providing appropriate respiratory protection or forced ventilation. Forced ventilation or other effective means will be used to prevent exposure to an atmosphere containing a flammable gas in excess of 10 percent of the lower

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flammable limit. Where needed, respiratory protection will be used in accordance with the University Respiratory Protection Program.

Water Accumulation-Employees will not work in excavations that contain or are accumulating significant water unless precautions have been taken to protect employees from hazards posed by water accumulation. Precautions will also be taken to provide adequate drainage of the area adjacent to the excavation. The competent person must reinspect excavations subject to runoff from heavy rains.

Adjacent Structures-Support systems (such as shoring, bracing, or underpinning) will be used to assure the stability of structures and the protection of employees where excavation operations could affect the stability of adjoining buildings, walls, or other structures.

Excavation below the level of the base or footing of any foundation or retaining wall that could be reasonably expected to pose a hazard to employees will not be permitted except when:

- A support system, such as underpinning, is provided to ensure the safety of employees and the stability of the structure; or
- The excavation is in stable rock; or
- A registered professional engineer has approved the determination that the structure is sufficiently removed from the excavation so as to be unaffected by the excavation activity; or
- A registered professional engineer has approved the determination that such excavation work will not pose a hazard to employees.

Sidewalks, pavements and appurtenant structures will not be undermined unless a support system or other method of protection is provided to protect employees from the possible collapse of such structures.

Where review or approval of a support system by a registered professional engineer is required, the Department will secure this review and approval in writing before the work is begun. A copy of this approval must be provided to EH&S.

Loose Rock or Soil-Adequate protection must be provided to protect employees from loose rock or soil that could pose a hazard by falling or rolling from an excavation face. Such protection will consist of:

- Scaling to remove loose material;
- Installation of protective barricades, such as wire mesh or timber, at appropriate intervals on the face of the slope to stop and contain falling material; or
- Benching sufficient to contain falling material.

Excavation personnel will not be permitted to work above one another where the danger of falling rock or earth exists.

Employees must be protected from excavated materials (spoil), equipment or other materials that could pose a hazard by falling or rolling into excavations.

- Protection will be provided by keeping such materials or equipment at least 2 feet from the edge of excavations, by the use of restraining devices that are sufficient to prevent materials or equipment from falling or rolling into excavations, or by a combination of both if necessary.

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- Materials and equipment may, as determined by the competent person, need to be stored further than 2 feet from the edge of the excavation if a hazardous loading condition is created on the face of the excavation.
- Spoil should be placed so that it channels rainwater and other run-off water away from the excavation. Spoil should be placed so that it cannot accidentally run, slide, or fall back into the excavation.
- Materials piled, grouped or stacked near the edge of an excavation must be stable and self-supporting.

Fall Protection-Barricades, walkways, lighting and posting must be provided as necessary prior to the start of excavation operations.

Guardrails, fences, or barricades must be provided on excavations adjacent to walkways, driveways, and other pedestrian or vehicle thoroughfares. Use of barricade tape alone is not considered a sufficient method of isolation when the excavation is unattended. Warning lights or other illumination must be maintained as necessary for the safety of the public and employees from sunset to sunrise. Wells, holes, pits, shafts, and all similar excavations must be effectively barricaded or covered and posted as necessary to prevent unauthorized access. All temporary excavations of this type will be backfilled as soon as possible.

Walkways or bridges, at least 20 inches wide, protected by standard guardrails must be provided where employees and the general public are permitted to cross over excavations. Where workers in the excavation may pass under these walkways or bridges, a standard guardrail and toeboard must be used.

Vehicle crossings- Must be designed by and installed under the supervision of a registered professional engineer.

### **Protection:**

Each employee in an excavation shall be protected from cave-ins by using adequate sloping, benching system or other adequate support or protective system.

Exceptions to this are limited to:

- Excavations made in stable rock; or
- Excavations less than four feet in depth where examination of the ground by a Competent Person provides no indication of a potential cave-in.

Protective systems shall be capable of resisting all loads that could reasonably be expected to be applied to the system.

If the excavation is between 4 and 20 feet deep, a protection system must be installed and utilized in all occupied areas of the excavation.

If the excavation is greater than 20 feet, a protection system designed by a registered engineer must be installed and utilized in all occupied areas of the excavation.

Sloping - The slope and configuration of sloping shall be selected and constructed by the Competent Person. Maximum allowable slopes for excavations less than 20' based on soil type and angle to the horizontal are as follows:

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### Maximum Allowable Slopes for Excavations Less Than 20 Feet

Soil or Rock Type	Maximum Slope (H:V)	Maximum Slope (Degrees)
Stable Rock	Vertical	90
Type A	.75:1	53
Type B	1:1	45
Type C	1.5:1	34

For example: A 10-foot-deep trench in Type B soil would have to be sloped to a 45-degree angle, or sloped 10 feet back in both directions. Total distance across a 10-foot-deep trench would be 20 feet, plus the width of the bottom of the trench itself. In Type C soil, the trench would be sloped at a 34-degree angle, or 15 feet back in both directions for at least 30 feet across, plus the width of the bottom of the trench itself.

Employees shall not be permitted to work above other employees on the faces of sloped systems except when employees at the lower levels are protected from the hazard of falling, rolling, or sliding material or equipment.

*Benching* – There are two basic types of benching, single and multiple, which can be used in conjunction with sloping. In Type B soil, the vertical height of the benches must not exceed 4 feet. Benches must be below the maximum allowable slope for that soil type. In other words, a 10-foot deep trench in Type B soil must be benched back 10 feet in each direction, with the maximum of a 45-degree angle. ***Benching is not allowed in Type C soil.***

Support Systems- Support systems, shield systems, shoring and other protective systems shall be selected and designed by the Competent Person.

1. *Shielding*: Trench boxes or trench shields are intended to protect workers from cave-ins and similar incidents. The shield is lowered into the excavation and workers enter the protected area within the shield. The use is limited to those trenches for which the shield is certified (maximum depth and material.) The excavated area between the outside of the trench box and the face of the trench should be as small as possible. The space between the trench box and the excavation side should be backfilled to prevent lateral movement of the box. Trench boxes may be used in combination with sloping and benching. The box must extend at least 18” above the surrounding area if there is sloping toward the excavation. Shields may be placed two feet above the bottom of the excavation, provided there is no caving under or behind the shield. Workers may not remain in the shielded area while it is being moved.

2. *Shoring*: **University employees shall not use timber shoring unless approved in writing by the Competent Person and a Professional Engineer.** Hydraulic shoring must:

- Be installed from outside the trench.
- Be gauge-regulated.
- Ensure even distribution of pressure along the trench line and be adaptable to various trench depths and widths.
- Be installed from the top down and removed from the bottom up.
- Be inspected every shift.
- Have the top cylinder of the hydraulic shoring no more than eighteen inches from the top of the excavation.
- Have the bottom of the cylinder no higher than four feet from the bottom of the excavation.

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- Consist of three vertical shores, evenly spaced to form a system.
- Have wales installed no more than two feet from the top, no more than four feet from the bottom, and no more than four feet apart vertically.

## **M. OPERATIONS AND MAINTENANCE PROGRAM FOR ASBESTOS CONTAINING MATERIALS**

### **I. INTRODUCTION**

The inhalation of asbestos fibers in excess amounts is believed to cause chronic lung disease including asbestosis, lung cancer and mesothelioma. Much of our knowledge of these health effects comes from studies of workers exposed routinely to high concentrations of airborne asbestos fibers on their jobs. These injured workers used asbestos containing materials (ACM) that were sprayed on, cut, disturbed or damaged without proper controls in place resulting in elevated airborne fiber exposures. At the University of Pittsburgh, asbestos is found as installed pipe and tank insulation, acoustical plaster, fireproofing, floor tile, transite sheeting, lab hoods and bench tops, mastics and roofing products.

While asbestos materials can pose a health hazard when, due to damage, deterioration or disturbance, high concentrations of asbestos fibers are released into the air, intact and undisturbed asbestos materials do not pose a health risk. The presence of asbestos in a facility does not mean that the health of building occupants is endangered. ACM, that is in good condition and is not subjected to damage or disturbance, is not likely to release asbestos fibers into the air. Rarely does a small disturbance of ACM constitute a significant exposure risk. When ACM is properly managed through a comprehensive Operation and Maintenance (O&M) Program, the release of asbestos fibers into the air is prevented and the risk of asbestos-related disease is negligible.

### **II. OBJECTIVES OF THE O&M PROGRAM**

The principle objective of the University of Pittsburgh's O&M Program is to minimize the potential exposure of all faculty, students and staff to airborne asbestos fibers. To accomplish this objective, the O&M program includes specific work practices and training to:

- Maintain asbestos containing materials (ACM) in good condition;
- Ensure proper clean-up of asbestos fibers previously released;
- Prevent further damage and release of asbestos fibers;
- Develop procedures for the proper removal, repair and disposal of ACM;
- Monitor the condition of ACM periodically.

Another objective of the program is to assure compliance with all federal, state and local regulations dealing with asbestos abatement, employee training, worker licensing and waste disposal. This O&M Program encompasses all types of ACM present in University of Pittsburgh facilities. ACM can be

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classified into three categories: surfacing materials, thermal system insulation and miscellaneous materials as described in the following bullets.

- **Surfacing Materials:** ACM sprayed or trowel onto surfaces, such as decorative plaster ceilings, acoustical ACM applied to the underside of concrete slabs or fireproofing materials sprayed on floor decking and structural members.
- **Thermal System Insulation:** ACM applied to boilers, tanks, pipes, ducts and other mechanical equipment to prevent heat loss, or gain, and condensation.
- **Miscellaneous ACM:** ACM floor or ceiling tiles, textiles, gaskets and other building components such as transite lab hood panels, lab bench tops and roofing materials.

The Department of Environmental Health and Safety maintains an inventory of ACM identified at various University of Pittsburgh building locations.

### III. O&M PROGRAM RESPONSIBILITIES

The University of Pittsburgh is committed to implementing a comprehensive O&M program that will remain in effect until all ACM is removed from University of Pittsburgh building locations. The Asbestos Program Manager, appointed by the University of Pittsburgh EH&S, will administer the O&M Program. The Asbestos Program Manager will have the responsibility to oversee asbestos-related activities on campus, including building inspections, O&M projects and contractor abatement actions. The Asbestos Program Manager will be qualified, through training and experience, to be actively involved in asbestos control activities.

The current Asbestos Program Manager for the University of Pittsburgh is:

**Name:** Sarmed S. Shareef, CIH, CSP  
**Department:** Department of Environmental Health and Safety  
**Office Phone:** (412) 624-9505

The O&M program's success at the University of Pittsburgh is contingent upon key Facilities Management and Housing personnel understanding the O&M Program and committing themselves to implementing it effectively.

#### A. Duties of Asbestos Program Manager

The Asbestos Program Manager is responsible for implementing and maintaining the Operations & Maintenance Program. The Asbestos Program Manager with the assistance of Facilities Management and Housing will:

- Inform affected building occupants, contractors, and maintenance/custodial workers about the location of ACM and caution them against disturbing or damaging this material. Occupants, employees and subcontractors will also inform about asbestos hazards in their work areas if there is potential for disturbance during renovation.

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- Require containments and safety precautions to be in place before authorizing construction and maintenance work involving ACM; (see Figures 3& 4)
- Ensure that required programs for medical surveillance, respiratory protection, personnel training and air monitoring are instituted;
- Require asbestos to be disposed of properly and obtain waste shipment manifests/records from the landfill where waste materials were delivered;
- Ensure that applicable records are maintained.

When notified about renovation projects, except those where contact with ACM is unlikely, the Asbestos Program Manager (or designee) will verify the work to be performed and ensure that any potential for asbestos disturbance has been addressed. The need for qualified University of Pittsburgh maintenance personnel or outside abatement contractors will be decided at this time.

On jobs where disturbance of ACM is intended or likely, the Asbestos Program Manager will make periodic inspections of the site for the project's duration. These observations will be reported on a Work Evaluation Form. Any deviation from required work practices shall be corrected immediately. This form will be included with any reports received from the abatement contractor or air-monitoring firm for future reference.

Upon completion of abatement work, project documents submitted by FM, EH&S, the contractors or asbestos laboratories will be maintained in a numbered asbestos file in the EH&S office.

#### **IV. O&M PROGRAM ELEMENTS**

This O&M Program has been developed to be site specific for the **Pittsburgh Campus**. The fundamental program elements include:

##### **A. Identification, Labeling, and Notification**

Identification, labeling, and notification is sometimes required by this O&M Program to inform workers contractors and building occupants where ACM is located, how to identify it, how to avoid exposure, and whom to notify in the event of a problem.

##### **B. Training**

The University of Pittsburgh conducts the level of training appropriate for building maintenance personnel, management, and other facility occupants as required by OSHA, USEPA, Pennsylvania Department of Labor & Industry, and Allegheny County Health Department (ACHD) regulations.

##### **C. Work Permit System**

The ACHD Work Permit System and the University's O&M Program provide notification and written documentation to obtain permission and to implement control activities on projects that might disturb ACM. OSHA required negative exposure assessment documentation are also facilitated under the O&M permit system.

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#### **D. Work Practices**

O&M Program Work Practices are written procedures designed to avoid asbestos disturbance or to minimize fiber release during activities affecting ACM.

#### **E. Worker Protection**

The O&M Program provides elements of worker protection such as medical surveillance and personnel protective equipment programs as necessary to protect workers and comply with regulations.

#### **F. Periodic Surveillance**

The O&M Program provides guidelines for regular reassessment of ACM to observe and document any changes in condition.

#### **G. Emergency Plan**

The O&M Program provides procedures for responding to and documenting fiber release episodes.

#### **H. Record keeping**

Proper record keeping is required to document O&M Program activities in compliance with OSHA requirements.

### **V. INFORMATION, NOTIFICATION, LABELING**

The Departments of Environmental Health and Safety, Facilities Management, or Housing Administration will inform University of Pittsburgh workers, contractors and other building occupants about the presence of asbestos containing materials (ACM) in the various buildings on campus as necessary. The notice will be accomplished by correspondence to affected persons that informs them of:

- The existence of the asbestos containing materials in their work area and the precautions necessary to avoid disturbing this material;
- The University's plan to prevent asbestos exposures to building occupants during facility renovation, physical plant improvement, and building maintenance activities;
- The long term goals of the University's O&M Program to evaluate and maintain remaining asbestos containing materials in a safe condition until it's eventual removal;
- The established work rules and safety procedures to be followed by campus personnel who come in contact with asbestos containing material;
- How to obtain information about asbestos concerns at the University and the contents of the O&M Program.

A sample asbestos information letter to campus employees and contractors is shown in **Figure 1**. A letter or e-mail of this type should be sent or given to employees, contractors and other facility occupants as needed to alert them of potential asbestos concerns in their area in advance of maintenance or renovation activity.

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In addition, signs should be posted at the entrance to mechanical rooms, crawl spaces or other areas containing asbestos thermal system insulation and surfacing materials where practical to identify the presence of these materials and work practices necessary to avoid disturbance.

The inventory and labeling of ACM is a requirement of the OSHA Asbestos Standard for Construction (*OSHA 29 CFR part 1926.1101*). The University will install OSHA designated warning labels to installed products and waste containers of asbestos when feasible. Labeling is **NOT** required if the asbestos fibers have been modified with a bonding agent, coating, binder or some other agent to prevent airborne fiber release. Most exposed pipe insulation at the University meets these criteria. During asbestos abatement work, building occupants and maintenance workers are advised of hazardous materials per the OSHA Hazard Communication Standard (*OSHA 29 CFR part 1910.1200*) and the OSHA Asbestos Standard which require active asbestos abatement areas be posted with designated warning signs.

ACM labels and identification signs to be used at the University of Pittsburgh shall be worded as follows to comply with the OSHA regulations

**ACM SIGNS**

**ACM LABEL**

<p><b>Danger Asbestos May Cause Cancer Cases Damage to Lungs Authorized Personnel Only</b></p> <p><i>(If in a regulated abatement area, add)</i></p> <p><b>Wear Respiratory Protection and Protective Clothing in this Area</b></p>	<p><b>Danger Contains Asbestos Fibers</b></p> <p><b>May Cause Cancer Causes Damage to Lungs Do Not Breathe Dust Avoid Creating Dust</b></p>
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The Department of Environmental Health and Safety has maintained a file of ACM identified in University owned buildings since 1979. Removal of ACM by contractors and University employees has been documented since 1984. As required by OSHA regulations, all suspect ACM found on campus is presumed to contain asbestos until it is verified by testing by an analytical laboratory (PLM microscopy) or existing records to be non-ACM (1% or less). Provisions are in place to notify EH&S prior to the start of renovation or construction work that could involve asbestos disturbance.

**VI. WORKER TRAINING**

Training of maintenance, custodial, and housekeeping personnel serves to establish awareness and understanding of potential asbestos hazards, and outlines the work practices that are vital to a successful program. All training reflects the likelihood that an individual has for potential exposure to airborne asbestos fibers. Three levels of employee training are available:

**A. LEVEL 1: General Awareness Training (Awareness)**

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Operations, maintenance and custodial staff involved in cleaning or repair tasks where ACM may be accidentally disturbed shall attend an online training course presented by EH&S. Other employees may attend on a voluntary or on an as-needed basis. Level 1 Training will include:

- Background information on asbestos regarding its various uses and types;
- Health effects associated with asbestos exposure;
- Location and type of ACM identified at a facility;
- Action taken by the EH&S Department to control employee exposure;
- Recognition of ACM damage and deterioration;
- O&M program elements involving long term maintenance and control of ACM;
- Proper response to fiber release episodes.

**B. LEVEL 2: Special O&M Training (Operation & Maintenance)**

This level of training (16 hours) is intended for University of Pittsburgh's maintenance employees involved in the removal, repair or clean-up of small quantities of ACM.

Level 2 training involves:

- More detailed discussion of General Awareness Training topics;
- Federal, State and Local asbestos regulations;
- Description of proper asbestos handling methods and waste disposal;
- Respirator use, care and fit testing;
- Hands-on exercises involving glove bag removal and HEPA vacuum use;
- Worker protection and decontamination procedures.

**C. LEVEL 3: Abatement Worker or Supervisor Training (L&I Abatement)**

This training is intended for University of Pittsburgh employees and their supervisors who may conduct small-scale asbestos abatement projects. This program is equivalent to the EPA AHERA training (32-40 hours). Level 3 training involves:

- Detailed Level 1 and Level 2 training topics;

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- Pre-asbestos abatement work activities;
- Work area containment preparation;
- Establishing decontamination units;
- Personnel protective equipment including respirators and protective clothing;
- Worker decontamination procedures;
- Safety considerations in the abatement work area;
- Practical hands on exercises for glove bags and containment construction;
- Proper handling and disposal of ACM waste.

The above training will be provided prior to initial assignment as necessary. Thereafter refresher training will be provided annually to designated personnel. Attendance at training courses will be documented by completing and filing an Attendance Roster with the Asbestos Program Manager.

The level of required training should be predicated on information submitted by Facilities Management and Housing. Personnel that have minimal exposures to friable or non-friable ACM are instructed that they are prohibited from performing any operations (sanding, grinding, cutting, abrading or drilling) involving ACM. The training programs will be evaluated on an annual basis by the Asbestos Program Manager to assess their adequacy for the personnel involved and determine their effectiveness.

The Asbestos Program Manager, because of his overall management responsibility for the program, will be properly licensed by the Pennsylvania Department of Labor and Industry as an Asbestos Project Designer, Management Planner, and Building Inspector having attended at a minimum, the 24-hour Project Designer and 40-hour Building Inspector/Management Planner training seminars prior to assignment and annual refresher courses thereafter.

## **VII. MEDICAL SURVEILLANCE**

Persons who are trained to do asbestos clean up or abatement work that requires the use of a respirator must be included in the University's Respiratory Protection and Medical Surveillance Programs. The purpose of the Medical Surveillance Program is to establish an employee's fitness to wear a negative pressure respirator and to detect any health changes over time that may be related to working with asbestos. The content of the medical exam specified by the OSHA Asbestos Standards (1910.1001 and 1926.1101) and Respiratory Protection Standard (1910.134) requires completion of a medical history questionnaire, the physical exam, a pulmonary function test, and a chest X-ray at the direction of a physician. This asbestos exam is repeated annually, while the respirator evaluation is done initially and whenever a health status change occurs.

## **VIII. WORK PERMIT SYSTEM**

A permit system has been developed for all work involving the potential disturbance of ACM such as renovations, equipment maintenance or small-scale removal. This permit system is coordinated

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through the Asbestos Program Manager. The permit or "Job Request Form" must list all ACM in the area where work is to be performed and the Program Manager may conduct a pre- and post-work site inspection depending on the scope of the project. All asbestos related work must be deferred until the asbestos hazard can be removed or abated by "appropriate" personnel, or it is determined that no ACM will be adversely impacted by the work. When this determination is made, the Asbestos Program Manager authorizing the work and specifying precautions that must be taken completes a second form (Maintenance Work Approval Form). Copy of these two forms are included at the end of this section as Figures 3 and 4.

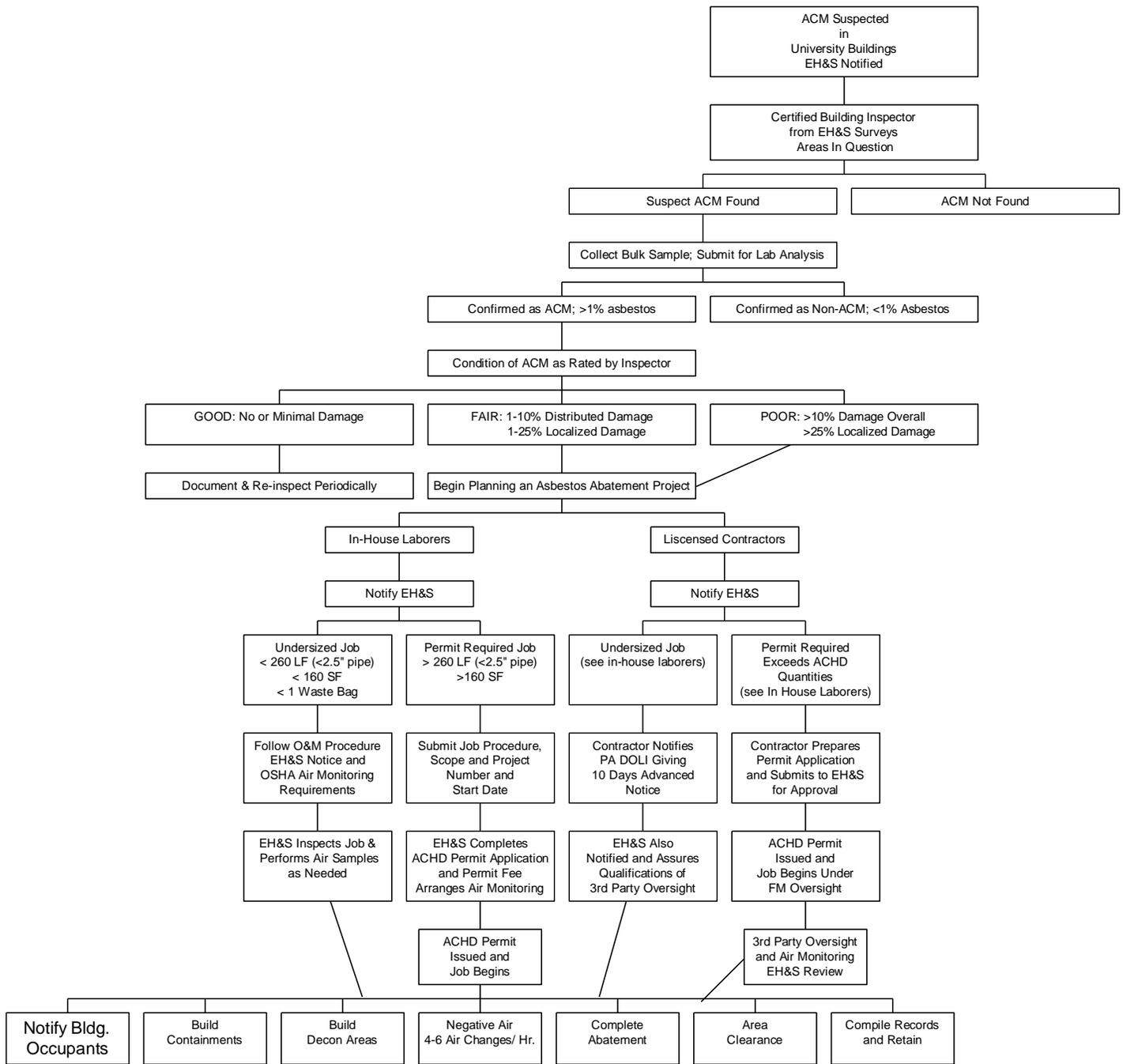
Small-scale asbestos jobs done by in-house abatement workers can be completed upon notification and approval by the EH&S Department on the designated forms. Outside abatement contractors cannot perform ACM work at the University without first notifying EH&S and obtaining the EH&S Director's, Construction Safety Manager, or Asbestos Program Manager's signature on the ACHD and Pennsylvania Department of Environmental Protection notification forms. A ten-day waiting period is usually required for all abatement works done at the University by outside contractors, unless an emergency condition can be demonstrated. In-house abatement workers can legally do emergency asbestos abatement at any time with subsequent follow-up to ACHD as required.

An ACHD "Asbestos Abatement Permit" is required on all large asbestos abatement projects. This permit application must be submitted when the quantity of ACM (friable or non-friable) exceeds the ACHD designated quantity of 160 square feet. EPA NESHAPS quantities (260 linear feet or 160 square feet) do not apply for permit determination in Allegheny County. A full description of the project and the work practices must be designated on the Job Request Form and the ACHD Permit Application. Permit Applications can be filled out by EH&S, by the Project Manager or by the asbestos abatement contractor, performing the work. All applications must be reviewed and signed by the University's Asbestos Program Manager or the Director of Environmental Health & Safety.

A flow chart shown in Table 1 outlines the steps necessary when suspect asbestos containing material (ACM) is found in a University Building. Persons finding suspect ACM should contact EH&S to identify the materials asbestos content and the steps necessary prior to disturbing the material.

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**TABLE 1  
ASBESTOS ACTIVITY FLOW CHART**



**IX. SPECIAL CLEANING PRACTICES**

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Special cleaning practices are important in areas where friable asbestos containing materials (ACM) are present. Without them, general cleaning or other maintenance activities may re-suspend previously settled dust and raises the level of asbestos fibers in the air. Special cleaning practices will help reduce the possibility of accidentally disturbing ACM in a work area.

#### **A. Prohibited Activities in Areas Containing ACM**

- Do not dust ACM containing surfaces with a brush or dry cloth;
- Do not dry sweep or buff floors at high speed (>300rpm);
- Do not use an ordinary vacuum to clean up asbestos debris. Special HEPA filter vacuums must be used;
- Do not sand or grind ACM;
- Do not drill holes in ACM;
- Do not remove or shake ventilation system filters.

#### **B. Special Cleaning Practices for Areas with Friable ACM**

- All dusting and mopping of suspect ACM should be conducted using wet cleaning techniques (mops or cloths dampened with water or a dust suppressant), or with vacuum cleaners equipped with High Efficiency Particulate Air (HEPA) filters;
- All valves, gratings, equipment, upholstered furniture, carpets, and other irregular surfaces should be vacuumed with a HEPA vacuum as often as necessary to remove asbestos contamination;
- In buildings where asbestos surfacing materials or friable ACM is present, all non-carpeted floors should be wet mopped, and all other horizontal surfaces such as the tops of light fixtures and file cabinets should be wiped with damp clothes on a monthly basis to remove any asbestos contamination. Alternatively, these surfaces can be HEPA vacuumed;
- Spray (mist) bottles of water should be used to keep the mops and cloths damp. Alternatively, a dust suppressant can be used on mops or brooms;
- Cleaning materials (mop heads, cloths, and HEPA filters) should be washed after cleaning, changed frequently, and discarded as asbestos waste. The materials should be placed in 6 mil plastic bags, the bags sealed and labeled:

<p><b>Danger</b> <b>Contains Asbestos Fibers</b></p>
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**May Cause Cancer  
Causes Damage to Lungs  
Do Not Breathe Dust  
Avoid Creating Dust**

- All asbestos waste bags must contain an **ORM-C** (other regulated material-) label, which is regulated by the U.S. Department of Transportation (DOT) for hazardous or special waste. The bags must be removed from the campus by a licensed waste hauler and then be deposited in a landfill approved by the State to accept asbestos. Small amounts of waste can be stored in a labeled 55 gallon drum (or other durable containers) in a secure area on site for a maximum period of six (6) months;
- HEPA filters should be removed from vacuum cleaners with care. Consult manufacturer's instructions on filter removal. Workers should wear at least NIOSH/MSHA approved air purifying respirators and should mist the filters with water as they are removed;
- Ladders, mops, buckets, vacuum cleaners, and all cleaning equipment should be washed or wiped with damp cloths when the cleaning is finished. Used cleaning cloths should be discarded as described above.

The above cleaning may be initially conducted to remove any asbestos containing debris, which may exist in campus facilities or buildings at the present time. Special cleaning shall be repeated on an annual basis to insure that the miscellaneous asbestos debris is removed from work areas.

## **X. WORK PRACTICES FOR MAINTENANCE ACTIVITIES**

Routine maintenance activities in buildings containing asbestos materials have the potential to disturb ACM and raise the level of airborne asbestos fibers. Maintenance workers are cautioned against conducting any work in a manner that may disturb ACM. The management permit system for maintenance work shall be instituted to ensure that proper procedures are employed whenever there is a possibility of disturbing ACM or releasing asbestos fibers.

When maintenance is performed in parts of the building that are free of ACM, no special precautions are necessary. An exception would be work that causes vibrations at a distant location where ACM may be present (e.g., jack hammering on a level above ACM.) In this case, assure that work area containment, respirators, protective clothing, and HEPA vacuums are available if needed.

As shown in Table 2, all maintenance activities involving ACM disturbance must be reviewed and approved by the Asbestos Program Manager. A **Job Request Form** must be submitted with the Asbestos Program Manager and a copy of a **Maintenance Work Approval Form** returned prior to the commencement of the proposed project.

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### **A. Maintenance Activities Involving Non-friable ACM**

Miscellaneous types of non-friable ACM can be found in many buildings at the University of Pittsburgh including vinyl asbestos floor tile, transite, and gasket materials. Disturbance of these materials should be avoided. Cutting, drilling, grinding, or sanding of non-friable ACM is prohibited unless performed with tools equipped with HEPA-filtered vacuum systems (per OSHA requirements). Most University of Pittsburgh maintenance personnel are not trained to perform this work; it should be conducted only by certified in-house asbestos workers or licensed abatement contractors.

### **B. Special Maintenance Work Activities Involving Friable ACM**

The requirements for special maintenance work practices involving Friable ACM are designed to reflect the potential for disturbing the ACM or for releasing asbestos fibers. University employees and contractors should observe the requirements of the following scenarios for maintenance work activities involving ACM:

- **Where ACM is present but contact with the material is unlikely:**  
(Repair work in an area where ACM is present such as pipe insulation or acoustical ceiling plasters that is not directly involved in the maintenance activity.)
  - ⇒ assure the availability of protective clothing and clean-up equipment should an asbestos release occur due to unintentional damage.
- **Where accidental disturbance or contact with ACM is possible:**  
(Maintenance activity not intended to involve ACM but done so close to pipes or ceilings that disturbance through accidental contact or vibration may occur.)
  - ⇒ **Obtain a Job Request Form and a Maintenance Work Approval Form which** will outline procedures to be followed as if disturbances were going to be intentional.
  - ⇒ Use personal protective equipment, control access to the area, notify occupants and wet the ACM likely to be disturbed.
  - ⇒ The Asbestos Program Manager will consider using a licensed asbestos worker or an abatement contractor to perform the work if appropriate.
- **Where disturbance of ACM is intended or likely:** Disturbing small amount of ACM (less than three square feet or three linear feet) constitutes most O&M abatement at the University. Disturbing larger amounts of ACM (more than three square or linear feet) may require notification of ACHD and PA. DoLI and other regulatory compliance actions prior to removal:
  - ⇒ Use qualified University of Pittsburgh maintenance personnel, the University's designated O&M contractor (BLT, Bristol.) or another licensed asbestos abatement contractor to perform all necessary work in the area.
  - ⇒ All work involving ACM removal or disturbance should be done inside an asbestos containment enclosure or mini containment kept under negative pressure as required by OSHA and ACHD.

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- ⇒ Post appropriate signs at work area entrance to keep unauthorized personnel from entering the area.
- ⇒ Personnel performing abatement of ACM will wear disposable coveralls with hoods and shoe covers and NIOSH approved respirators.
- ⇒ All friable ACM shall be wetted prior to removal and placed immediately into labeled 6-mil waste disposal bags to minimize fiber release.
- ⇒ Equipment shall be wet cleaned after ACM removal and the work area HEPA vacuumed to complete abatement.
- ⇒ Asbestos Program Manager will perform personnel or area air monitoring as necessary to clear containment prior to release of area.

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**TABLE 2**  
**SUMMARY OF SPECIAL PRACTICES FOR MAINTENANCE WORK**  
**AT THE UNIVERSITY OF PITTSBURGH**

<b>LIKELIHOOD OF ACM DISTURBANCE AND PROPER ACTION</b>				
<b>REQUIREMENTS</b>	<b>CONTACT UNLIKELY</b>	<b>ACCIDENTAL DISTURBANCE POSSIBLE</b>	<b>DISTURBANCE INTENDED OR LIKELY</b>	
			<b>SMALL</b>	<b>LARGE</b>
<b>Approval Needed</b>	No	Yes	Yes	Yes
<b>Scheduling Access Control</b>	No	Yes	Yes	Yes
<b>Supervision Needed</b>	No	Initial	Yes	Yes
<b>Modify HVAC System</b>	None	If possible	Shutdown	Shutdown
<b>Containment</b>	None	Drop Cloths	Glove-bag or Mini-Containment.	Full Containment
<b>Respiratory Protection</b>	Available	As needed	Yes	Yes
<b>Protective Clothing</b>	Not Required	As needed	Yes	Yes
<b>Wet Methods</b>	Not Required	As needed	Yes	Yes
<b>HEPA Vacuums</b>	Available	As needed	Yes	Yes
<b>Personal Decontamination</b>	Not Required	Vacuum	Shower	Shower
<b>Abatement Contractor / Qualified In-house Employee</b>	Not Required	Possible	Yes	Yes

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## **XI. WORK PRACTICES FOR RENOVATION AND REMODELING**

### **A. Renovation**

Building renovation or facility equipment replacement can cause a major disturbance of ACM. Demolishing walls and replacing utility systems can involve breaking into, cutting or otherwise disturbing ACM that may be present. Removal of all potentially affected ACM is recommended in these situations. Asbestos removal may be required under ACHD, EPA and PA DEP facility demolition regulations if the amount of ACM likely to be disturbed is greater than the threshold amounts (160 square feet or 260 linear feet). All procedures and precautions for asbestos removal required by OSHA or EPA, State, and County regulations must be employed.

When considering a building renovation project, the first step should be to check on the location and type of ACM that may be affected. An ACM evaluation of the renovation area should be obtained from the Asbestos Program Manager before serious project planning is begun. This site evaluation initiates by submitting a Maintenance Job Request Form (**Figure 3**) to EH&S well in advance of work.

### **B. Remodeling**

Remodeling or redecorating building interiors implies less dramatic structural alteration. However, disturbance of ACM or materials containing asbestos fibers is still possible. Where the remodeling involves direct contact with ACM (e.g., replacement of floor tile) all of the procedures and precautions required by EPA, DEP, ACHD and OSHA asbestos regulations for removal must be followed.

## **XII. PROCEDURES FOR FIBER RELEASE EPISODES**

As long as ACM remains in the facility, a fiber release episode could occur. Fiber release episodes most often occur during maintenance or renovation projects. Building occupants, custodial and maintenance workers must report the presence of asbestos debris, evidence of water or physical damage to ACM, or any evidence of a possible asbestos fiber release to the Project Manager or Building Coordinator as soon as possible. The Project Manager or Facility Manager in turn should notify the Asbestos Program Manager and contact qualified in house asbestos workers or licensed asbestos contractors to clean up debris or to make repairs. When the University of Pittsburgh relies on outside contractors for asbestos abatement work, a pre-qualified company should be selected and retained under contract for quick response action.

BLT has been included on our O&M Plan to assist in rapid clean-up of an asbestos fiber release. Each fiber release episode shall be assessed and documented. The following procedures form the basis for response actions to fiber release episodes:

- The area shall be isolated as soon as possible after the ACM debris is discovered. Where doors can seal the area, they must be locked from the outside (exit doors and corridors must remain in operation) and have signs posted to prevent unauthorized personnel from entering the work area. ("DANGER ASBESTOS; May Cause Cancer; Causes Damage to Lungs; AUTHORIZED PERSONNEL ONLY; Wear Respiratory Protection and Protective Clothing in this Area").

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- The HVAC system shall be shut off or temporarily modified to prevent the distribution of asbestos fibers from the work area to other areas of the building. If possible doors, windows, registers, diffusers, etc. shall be sealed with 6-mil polyethylene sheeting and duct tape.
- Each fiber release episode shall be documented by completing the ***Fiber Release Episode Report Form***. This form must be filed with the Asbestos Program Manager as soon as possible after the incident.

### **XIII. AIR MONITORING**

OSHA asbestos regulations for construction (***29 CFR part 1926.1101***) require that employers conduct air monitoring of employees who may be exposed to asbestos during construction or maintenance activity. (See Appendix A of the OSHA Construction Standard for Asbestos)

#### **A. Initial Air Monitoring**

Under the O&M Program, personnel air monitoring should be conducted at the initiation of each asbestos project or maintenance job that may expose workers to asbestos fibers (i.e. valve replacement, changing gaskets, special annual cleaning, etc.). This initial monitoring is intended to accurately determine the representative 8-hour time weighted average exposures associated with each routine maintenance operation. Additional monitoring requirements are based on the results of the initial monitoring or on changes to the routine for maintenance operations.

#### **B. Periodic Air Monitoring**

The O&M Program also requires employers to conduct daily air monitoring that is representative of each workers asbestos exposure when inside regulated asbestos areas or working with asbestos outside containment. The requirement for daily air monitoring can be eliminated if workers wear supplied air respirators operated in the positive pressure mode. Air supplied respirators are typically not worn during asbestos abatement work at the University so periodic air monitoring is required to document exposures.

#### **C. Termination of Air Monitoring**

If periodic air monitoring reveals that employee exposures are statistically below the OSHA 8-hour Time Weighted Average (TWA) or below the Excursion Level of 1.0 f/cc for a 30-minute period, monitoring may be discontinued for those employees.

#### **D. Method of Air Monitoring**

All asbestos air sample results used for exposure evaluations must be personal samples collected following procedures specified in Appendix A, of the OSHA Construction Standard (29 CFR 1926.1101), included in Appendix B of this O&M Program.

#### **E. Employee Notification of Air Monitoring Results**

- The EH&S Department shall notify affected employees of their exposure results as soon as possible following receipt of the air monitoring test results.

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- This notification will be made verbally to the individual or in writing to his department supervisor who in turn informs the individual.

#### **XIV. PERIODIC SURVEILLANCE**

##### **A. Re-inspection**

With more than 150 buildings covered under this program, many knowledgeable groups perform re-inspection of asbestos containing materials. Facility Managers, Building Superintendents, building engineers, custodians, mechanics and tradesmen from Facilities Management, and Housing Administration have received “Asbestos Awareness” training to recognize asbestos materials in their buildings, to avoid disturbing them and to report damaged materials to EH&S. Department of Environmental Health and Safety personnel continually monitor for damaged ACM and frequently conduct a re-inspection of known ACM present on the campus (both friable and non-friable).

When requested or deemed necessary, formal ACM re-inspections will be conducted by a PA DoLI accredited inspector and will include the following:

- A visual inspection of materials previously considered ACM, also touching the material to determine whether it has become friable since the last inspection.
- Verifying the general condition of the material for damage either man-made or by acts of nature.
- Verification of ACM removal since the last inspection.
- Requalification of the remaining ACM.
- If additional bulk sampling of suspect ACM is done, it should be conducted according to a written bulk sample procedure similar to that shown in Appendix B.
- Collection of ambient air samples to determine the asbestos concentration in areas where asbestos exists within the Facility. Only qualified personnel should conduct air monitoring.
- Following a formal re-inspection, data will be recorded on the ***Reassessment of Asbestos-containing Materials Form (FIGURE 7)*** and submitted to the Asbestos Program Manager for inclusion in the management plan within 30 days of the re-inspection. Data shall include:
  - ⇒ Date of the re-inspection.
  - ⇒ Name(s) and signature(s) of person(s) making re-inspection, collecting samples, and making assessments.
  - ⇒ Any changes in condition of known or assumed ACM.
  - ⇒ Locations where bulk samples were collected (if any) during the re-inspection.

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⇒ Air monitoring results received from the analyzing laboratory.

## **XV. RECORDEEPIING**

Some basic points relative to O&M program record keeping must be emphasized. The Asbestos Program Manager will be responsible for maintaining the following materials:

- A copy of the University of Pittsburgh's written O&M Program;
- Facility and building plans or drawings indicating the location Of ACM;
- A copy of the Asbestos Assessment Report(s);
- Copies of Employee Notification Letters;
- Description, times dates and attendees at training programs;
- A written Respiratory Protection Program;
- Medical Surveillance Program;
- Completed Job Request Forms;
- Maintenance Work Approval Forms;
- Fiber Release Episode Forms;
- Work Evaluation Forms;
- Reassessment of Asbestos-Containing Materials Forms;

The Department of Environmental Health and Safety first developed this University of Pittsburgh Operations and Maintenance program in 1994 for the Pittsburgh Campus. The Asbestos Program Manager implements the Plan, reviews it annually and maintains pertinent asbestos records. This O&M Program will remain in place until all ACM is removed from campus.

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## XVI. ASBESTOS DISPOSAL

University employees and contractors shall observe the following guidelines regarding the disposal of ACM:

- All asbestos-containing material and asbestos contaminated waste is packed in double 6 mil polyethylene disposal bags that are labeled as required by applicable regulations before being removed from the work area; transite sheets or ACM lined equipment is double wrapped in 6-mil poly. Some ACM waste is placed in poly drums for storage and transport.
- All double-bagged asbestos waste is carefully loaded onto an enclosed box truck or other approved vehicle for transport. Care is exercise before and during transport to insure that no unauthorized persons have access to the waste material;
- Both the disposal bags and drums shall be labeled as required **40 CFR part 61.152 (b)(1)(iv)**;
- Waste disposal must occur at a Pa DER authorized landfill in accordance with applicable regulations;
- A licensed carrier shall transport all waste directly from the work site to the disposal site. Temporary storage of asbestos waste at a location other than the generation site is not recommended. Waste can be kept on-site in sealed containers for a maximum period of six months;
- Waste shall be transported only in enclosed vehicles. The cargo area of the enclosed vehicle shall be free from debris and lined with 6 mil polyethylene sheeting;
- There shall be no visible emission of asbestos dust during the transport of asbestos waste;
- Any debris or residue observed on containerized waste or surfaces outside of the work area resulting from clean-up or disposal activities shall be immediately cleaned up using a HEPA vacuum and wet methods;
- Do not transport containerized waste material on open trucks. Label drums with same warning labels as bags. Treat drums that have been contaminated as asbestos-containing waste and dispose of them in accordance with this section;
- Advise the landfill operator at least twenty-four hours in advance of transport as to the quantity of material to be delivered;
- At the landfill site, sealed containers shall be carefully removed from the truck and placed on the ground. Containers shall not be dumped or thrown from the truck;
- Waste shipment records for ACM disposed of at the landfill shall be retained in the permanent asbestos file at EH&S.

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## **N. Lead Exposure**

Operations that may potentially expose workers to lead include iron work; demolition work; lead-based paint abatement; plumbing, heating, and air-conditioning work; electrical work; and carpentry/renovation/remodeling. The primary lead exposure pathway is by inhalation of dust, fumes, or mists containing lead. The Department of Environmental Health and Safety is available to; perform sampling for lead content in paints and coatings, recommend personal protective equipment, and conduct exposure monitoring.

## **O. Safe Use of Cranes, Hoists and Slings**

These Guidelines define the work practices and inspection procedures to help ensure that the operators of the overhead cranes are protected from potential hazards associated with the movement of equipment and material; and to comply with the OSHA standards entitled “Overhead Cranes” (29CFR 1910.179, 1926.550) and American National Standards Institute standards (ANSI B30).

By OSHA definition, a crane is a machine for lifting and lowering a load and moving it horizontally, with the hoisting mechanism an integral part of the machine. Cranes can be driven manually or by power.

These guidelines also include information on the safe operation and inspection procedures for small portable overhead hoists, chains, and slings, which are also regulated by OSHA and ANSI.

The provisions of this Guideline shall apply to all employees who operate and use overhead cranes, portable hoists, chains and slings and they shall attend training on these requirements and the appropriate inspection procedures for chains, slings and hoists. The Environmental Health and Safety Department (EH&S) will provide technical assistance regarding cranes, slings, and hoists.

### **1. General Requirements**

- 1.1. When a crane or hoist is installed, the user department must notify EH&S of its location prior to initial use. The crane or hoist must be inspected by EH&S or another qualified person prior to initial use. All operators must be trained on the particular crane or hoist prior to initial use.
- 1.2. Any unsafe condition noted during an inspection shall be corrected before the equipment is used.
- 1.3. Operators shall comply with the manufacturer's specifications and limitations applicable to the operation of the equipment. Operators shall follow safe work practices when operating a crane or hoist, and when rigging with slings.
- 1.4. Where manufacturer's specifications are not available, the limitations assigned to the equipment shall be based on the determinations of a qualified engineer competent in this field. All such determinations will be appropriately documented, recorded and retained by the user.

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## 2. Training

**2.1.** Training of crane and hoist operators will consist of classroom instruction and hands-on training. Hands-on training and hands-on evaluation portions of the training can be conducted by a foreman, chief engineer or designated employee in the department who is experienced and competent with the equipment. Training shall include:

- 2.1.1.** Characteristics of safe crane and hoist operation
- 2.1.2.** Inspection procedures
- 2.1.3.** Basic load handling considerations
- 2.1.4.** Operator responsibilities
- 2.1.5.** Communication used during crane and hoist operation
- 2.1.6.** Hands-on equipment training

**2.2.** Refresher training in relevant topics will be provided to a crane or hoist operator when any of the following occur:

- 2.2.1.** The operator has been observed using the equipment in an unsafe manner.
- 2.2.2.** The operator has been involved in an accident or a near-miss incident.
- 2.2.3.** The operator is assigned to operate a different type of equipment.
- 2.2.4.** A condition in the workplace changes in a manner that could affect safe operation of the equipment.

## 3. Inspections

The user department is responsible for ensuring that the following inspections are conducted:

### 3.1. Pre-Use Inspection

- 3.1.1.** Prior to each use, the operator shall visually inspect the crane, hoist and/or slings for defects and for identification of conditions that could affect the safe use of the equipment.
  - 3.1.2.** Operators must immediately report any unsafe crane conditions to their supervisor. The supervisor is then responsible for ensuring the necessary arrangements are made for repair.
  - 3.1.3.** If any unsafe conditions exist, equipment shall be removed from service which includes locking and tagging it out to prevent use.
  - 3.1.4.** Only personnel authorized by the manufacturer shall perform repairs and adjustments.
- 3.2.** A documented monthly inspection of all cranes shall be performed. These inspections must be performed by a designated person trained as a crane/hoist operator and is compliant with monthly crane/hoist inspection training.
- 3.3.** A documented annual inspection of all cranes shall be performed by a qualified third party, and all cranes and hoists shall be labeled or marked to show date of last annual inspection.
- 3.4.** A documented annual inspection of all slings shall be performed by a designated person or qualified third party who has gone through sling inspection training.
- 3.5.** Preventive maintenance shall be performed as prescribed by the manufacturer and detailed in the owner's manual.
- 3.6.** Each department is responsible for maintaining the equipment's inspection and repair records.

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#### **4. Safe Work Practices**

- 4.1.** A personal protective equipment (PPE) hazard assessment must be performed for the task. PPE considerations should include a hardhat, safety glasses and safety shoes.
- 4.2.** Rated load capacities, recommended operating speeds, special hazard warnings and/or instructions shall be conspicuously posted on all equipment. Instructions or warnings shall be visible to operators while they are at their control stations.
- 4.3.** Do not exceed the rated load capacity of the crane, hoist, slings, or other components. Keep in mind that the hoist may be higher rated than the rail/beam, or vice versa.
- 4.4.** Belts, gears, shafts, pulleys, sprockets, spindles, drums, fly wheels, chains, or other reciprocating, rotating, or other moving parts or equipment shall be guarded if such parts are exposed to contact by employees, or otherwise create a hazard.
- 4.5.** No modifications or additions which affect the capacity or safe operation of the equipment shall be made without the manufacturer's written approval. If such modifications or changes are made, the capacity, operation, and maintenance instruction plates, tags, or decals, shall be changed accordingly. In no case shall the original safety factor of the equipment be reduced.
- 4.6.** Never operate a hoist or crane that in your opinion is UNSAFE TO OPERATE.
- 4.7.** If a lift requires removal of any section of protective barriers, then appropriate steps must be taken to protect the operator. (For example, if a section of railing must be removed for a lift, the operator must wear fall protection equipment and be properly tied off BEFORE removing the railing).

#### **4.8. Engaging the Load**

- 4.8.1.** The sling or other device shall be properly seated and secured in the base of the hook.
- 4.8.2.** The load shall not be applied to the point of the hook or the hook latch.
- 4.8.3.** Before moving the load, the operator shall be sure chains and wire rope are not kinked or twisted, and that multiple part chains or ropes are not twisted about each other.
- 4.8.4.** The rope or chain must be properly seated on the drum, sheaves, or sprockets before the lift takes place.
- 4.8.5.** Remove slack from the sling, chain, or cable before lifting a load.
- 4.8.6.** The hoist must be centered over the load.
- 4.8.7.** The operator shall not pick up a load in excess of the rated load of the hoist or crane.
- 4.8.8.** Specific attention should be given to balancing of the load to prevent slipping.

#### **4.9. Moving the load**

- 4.9.1.** The operator shall not engage in any activity that will divert his/her attention from the task.
- 4.9.2.** The operator shall respond to signals from a designated person only. However, the operator shall obey a stop signal at all times, no matter who gives it.
- 4.9.3.** The operator shall make sure the load and hoist will clear all obstacles before moving or rotating the load.

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- 4.9.4.** A person shall be designated to observe clearance of the equipment and give timely warning for all operations where it is difficult for the operator to maintain the desired clearance by visual means.
- 4.9.5.** The operator shall inch powered hoists and cranes slowly in engagement with a load, but should avoid unnecessary inching and quick reversals of direction.
- 4.9.6.** A load shall not be lifted more than a few inches until it is well balanced in the sling or lifting device.
- 4.9.7.** When lifting loads at or near capacity, brake action shall be tested by lifting the load a few inches off the surface to verify that the brakes are holding.
- 4.9.8.** On rope hoists, the load shall not be lowered below the point where less than two wraps of rope remain on each anchorage of the hoist drum, unless a lower limit device is provided. In this case no less than one wrap may remain on each anchorage of the hoist drum.
- 4.9.9.** Loads shall not be suspended over personnel. Under no circumstances may anyone ride the hook.
- 4.9.10.** Directional movement should be made smoothly and deliberately to avoid swing.
- 4.9.11.** Never pull a hoist by the controller cable.
- 4.9.12.** The operator shall not use the upper (or lower, if provided) limit device(s) as a normal means of stopping the hoist. These are emergency devices only.

#### 4.10. Placing the Load

- 4.10.1.** Never leave the controls unattended while a load is suspended. If it becomes necessary to leave the controls, lower the load to the floor.
- 4.10.2.** The load block should be positioned above head level when the hoist is not in use.
- 4.10.3.**

#### 5. Slings

- 5.1.** Slings shall not be shortened with knots or bolts or other makeshift devices.
- 5.2.** Sling legs shall not be loaded in excess of their rated capacities.
- 5.3.** Slings used in a basket hitch shall have the loads balanced to prevent slippage.
- 5.4.** Slings shall be securely attached to their loads.
- 5.5.** Slings shall be padded or protected from sharp edges of their loads.
- 5.6.** Suspended loads shall be kept clear of all obstructions.
- 5.7.** Hands and fingers shall not be placed between the sling and its load while the sling is being tightened around the load.
- 5.8.** Shock loading is prohibited (abrupt starting or stopping of the load).
- 5.9.** A sling shall not be pulled from under a load when the load is resting on the sling.

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**5.10.** Slings shall be properly stored when not in use so that they are not subject to mechanical damage, moisture, corrosives, extreme temperature or kinking.

**5.11.** Care shall be exercised when removing a sling from under a landed and blocked load.

6. Cranes not in regular use

Any crane which has been idle for a period of 1 month or more, must be thoroughly inspected before being placed back in service. This inspection shall be documented.

<b>Pre-Use Crane &amp; Hoist Inspection Guidelines</b>	<b>YES</b>	<b>NO</b>	<b>N/A</b>
Load rating marked on each side of the crane.			
Load rating of the hoist marked on the hoist or its load block and legible from the ground? (If the crane has more than one hoisting unit, each hoist shall have its rated load marked on it or its loading block and this marking shall be clearly legible from the ground.)			
At least 3 inches of overhead clearance and 2 inches laterally between crane and obstructions.			
All controller functions labeled and legible.			
All operational controls and functional operating mechanisms working properly, properly adjusted and no unusual sounds.			
Upper limit switch operating properly. It shall be tested with no load on the hook. Extreme care shall be exercised; the block shall be "inched" into the limit device or run in at slow speed.			
Excessive wear of components on any functional operating mechanisms.			
Deterioration or leakage in lines, tanks, valves, drain pumps, and other parts of the air or hydraulic system.			
Excessive dirt, grease, or foreign matter.			
Deformation and/or cracking of the hook, load block, drums and/or sheaves.			
Safety latch on crane/hoist load block that automatically closes.			

<b>Pre-Use Sling Inspection Guidelines</b>	<b>YES</b>	<b>NO</b>	<b>N/A</b>
<b><i>Chain Slings:</i></b>			
Nicks, cracks, breaks, stretches, distortions, twists, gouges, bends, heat damage, discoloration, worn or damaged links			
In ability of the chain or components move freely,			
Pitting, corrosion or weld splatter,			
Missing or illegible sling identifications,			
Other defects			
<b><i>Wire Rope Slings:</i></b>			
Broken wires,			
Pitting or corrosion,			
Localized wear (shiny worn spots), abrasion or scrapes,			
Damage or displacement of end fittings, hooks, rings, links, or collars,			
Distortions, kinks, bird caging, crushing, or other evidence of damage to wire rope structure,			
Missing or illegible sling identifications,			
Other defects			
<b><i>Synthetic Fiber Rope / Synthetic Webbing Slings:</i></b>			
Melting, charring or burning of any part of the surface,			

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Snags, punctures, tears, cuts, fraying, broken or worn stitches,			
Change in diameter,			
Discoloration,			
Hard or stiff areas,			
Wear or elongation exceeding the amount recommended by the manufacturer,			
Distortion of fittings,			
Missing or illegible sling identifications,			
Other defects			
<b><i>Metal Mesh Slings:</i></b>			
Broken weld or brazed joints,			
Broken wire in any part of the mesh,			
Abrasion, corrosion, distortion, pitting, twisting, bending, cracking, gouging of any component,			
Lack of flexibility,			
Missing or illegible sling identifications,			
Other defects			

## P. ROOF SAFETY

The use of roofs on University buildings is prohibited for social and personal purposes. This guideline does not prohibit the use of roof areas for research, teaching, or maintenance purposes provided that adequate safeguards are taken. Persons wishing to arrange for the use of roof areas for teaching and research purposes must contact Facilities Management or Housing and also obtain approval of Environmental Health and Safety (EH&S).

University employees and contractor employees are often required to access building roofs for tasks such as routine maintenance, equipment inspection, and minor roof repair. Less frequently, work may require employees or contractors to be on roofs for extended periods of time, such as when re-roofing or installing ventilation systems.

### 1. Fall Prevention

University and contractor employees that maintain mechanical and electrical equipment mounted on roofs are exposed to fall hazards. According to the Occupational Safety and Health Administration (OSHA); anyone working at heights of six feet or more above another surface needs to be protected by guardrails, safety nets, or personal fall protection systems. These regulations also apply to skylights and other roof openings. The use of safety nets is not a viable option.

- 1.1.** The following provisions do not apply when employees are making an inspection, investigation, or assessment of work-place conditions prior to the actual start of work and the roof is flat, safe to walk on in all weather conditions, and the area being accessed is not within 6' of the roofs outer edge.
- 1.2.** If a roof has parapet walls or railings at least 36" high, no other safeguards are required.
- 1.3.** Steep pitched roofs (>4 in 12 slope) with no inherent fall protection shall only be accessed after receiving permission from the department manager, who will define specific precautions for the particular task. Under no circumstance should anyone be on such roofs in inclement weather such as rain, snow, ice or high winds.
- 1.4.** Work on low sloped roofs with no inherent fall protection will require two individuals unless a personal fall protection system is available.

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- 1.5. When working alone on a flat roof with no parapet or railing, the work area must be at least 25' from the roof edge (daylight) or 50' (night with limited illumination). Distances less than those will require either a personal fall protection system or monitor system.
- 1.6. Areas which require a worker to climb over walls or pipelines should have a walkway with handrail installed over the impediments.
- 1.7. Where ladders are necessary to climb from one level to another, the ladder must be fixed/secured and extend 3' above the point being accessed.
- 1.8. When working within 10' of an unprotected edge, a harness, lifeline and anchorage point or installation of temporary railing (which requires fall protection to install) must be provided.
- 1.9. Warning lines consisting of a rope, wire, or chain, and supporting stanchions shall be erected around all sides of the work area. The warning lines shall be erected not less than six from the roof edge, be readily visible, and be capable of withstanding a 16 pound force applied horizontally against the stanchion. This is typically for flat roofs and low pitched roofs only.

## 2. Fall Protection Options

- a) A personal fall protection system which includes a properly inspected and fitted full body harness, lanyard, and anchorage point. This system must be designed to withstand 5,000 pounds of force including anchorage point. The lanyard must be selected to minimize free fall to 6 feet, preferably less. Retractable lanyards are strongly recommended. In some cases, horizontal lifelines may need to be installed.
- b) Temporary railing systems, which do not penetrate the roof surface, are commercially available. These railing systems must be capable of withstanding a 200 pound force exerted in any direction.
- c) Safety-monitoring system is a safety system in which a person monitors the safety of all employees on a roof, and warns them when it appears that they are unaware of the hazard or are acting in an unsafe manner. The monitoring person shall have no other duties and must be on the same roof within visual sighting distance of all employees. The monitoring person must be close enough to verbally communicate with the employees.

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## GROUNDS MAINTENANCE SAFETY GUIDELINES

The University of Pittsburgh spends considerable time, effort, and money on grounds maintenance. From flower care, to lawn care, tree trimming, snow plowing and leaf blowing, Pitt employees are responsible for safely maintaining the grounds on campus. Gardening tools and mechanical lawn care devices, such as lawn mowers, power blowers, and chain saws, present special safety concerns for grounds maintenance personnel.

Common landscaping accidents include the following:

- Cuts, lacerations, or amputations from whirling mower blades.
- Bruises or broken bones from flying projectiles.
- Burns from hot equipment parts
- Electrical shock from faulty grounding or defective electrical cords
- Back strain from improper equipment usage
- Slips, trips, and falls

Regardless of the type of landscape equipment you use, follow these basic guidelines to ensure optimum safety:

- Read the equipment owner's manual.
  - Use the right equipment for the job at hand.
  - Inspect the equipment before each use.
  - Know how to control and stop the equipment quickly.
- Wear personal protection equipment, as necessary:
  - Eye protection
  - Hearing protection
  - Long pants
  - Sturdy shoes
  - Work gloves
- Apply sunscreen to exposed areas of skin.
- Be careful to avoid fatigue and heat stress in the summer and cold stress and frostbite in the winter
- Drink plenty of water to stay hydrated in the hot weather
- Do not operate powered equipment if you are tired, sick, or taking medication that could result in drowsiness or coordination problems.
- Take special precautions when working with electrical equipment. If you are using an extension cord, take care not to accidentally cut it. All extension cords must be protected by a ground fault circuit interrupter(GFCI)
- Do not smoke around gas powered equipment. Allow hot equipment to cool before refueling.
- Make sure that all guards are in place and in good condition.

### IMPORTANT

Keep pedestrians and bystanders at least 30 feet away when using power equipment.

### Hand Tools

Although garden hand tools tend to be safer than powered equipment, common gardening tools, such as rakes, shovels, and hoes cause thousands of injuries each year. Follow these guidelines for using garden hand tools.

- Keep hand tools in good condition. Replace split or rotten handles. Keep blades sharp.
- Use appropriate tools that fit your needs and your build. For example, if you are tall, choose tools with handles that are long enough to prevent you from stooping over your work.
- Never leave a rake, shovel, or hoe on the ground facing up. Foot injuries from exposed metal and head injuries from handles that pop up unexpectedly are the main hazards associated with these tools.

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## Gasoline

- Approved metal or plastic cans will always be used for gasoline storage. Self-closing, pressure venting, approved gas containers with spark arresting screens need to be used for fueling – after fueling equipment move gas containers away from machines before restarting.
- Do not allow the can to sit in the direct sunlight. Use a bonding wire and clip for pouring liquids from one metal container to another. Can must be shut tightly when not in use, this includes the dispensing spout.
- Make sure container is properly labeled as “gasoline” or “gas”.
- Power equipment shall not be refueled while running or while hot.

## Mower Safety

Mowers are the most common type of lawn care equipment. To avoid injury with power mower equipment, you must pay close attention to your surroundings. Whether you use a riding mower or a walk-behind mower, follow these guidelines for lawn mower safety:

- Always conduct your daily mower inspections on a hard, flat surface away from the mowing area. Open the hood and check the mower’s oil level. Check the hydraulic system for the appropriate level of fluid. Inspect the cooling system to make sure there is enough coolant in the radiator. Clean any debris off the screen and front of the radiator. Check the condition of your air-restriction indicator or the condition of your air cleaner and empty any debris found. Ensure that all parts such as belts, pulleys, catchers and guards are in proper working order. Also, check the tire pressure and refer to your operator’s manual for step-by-step start-up procedures and daily machine inspections.
- Keep hands and feet away from moving blades.
- Fill the tank with gas before beginning work. (By filling the tank initially, you can avoid having to fill the tank later when it is hot.)
- Replace loud or faulty mufflers.
- Shut off the engine before unclogging, servicing, or adjusting the mower and before removing the grass bag. For added protection, remove the ignition wire before working on the machine.
- **Be extra careful on slopes.** Riding mowers are unstable on steep inclines. So unlike with walk-behind mowers, with which you cut **across** an incline, with riding mowers you mow up and down slope. Decrease your speed when mowing down slopes or around sharp corners to help prevent tipping. Maintain minimal ground speed and make wide gradual turns. Avoid sudden starts, stops, and turns.
- Also, check the safety guards and devices to ensure that they are in proper working condition. Never operate your mower if your safety guards and devices are not in place.
- Never leave a running mower unattended. Before leaving the seat, park the mower on a flat area, disengage the mower blades and remove the ignition key.

## Riding Lawn Mowers

In addition to the general guidelines for mower safety, follow these guidelines for riding lawn mower safety:

- Before starting the engine, make sure the transmission is out of gear and the mower blade clutch is disengaged.
- Never allow extra riders on the lawn mower.
- Always look behind you before backing.
- If you hit a large rock or stump, stop the mower and inspect the blades and shaft. Replace damaged blades.
- Never leave a running lawn mower unattended. Before leaving the seat, park the mower on a flat area, disengage the mower blades, and remove the ignition key.

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### Walk-Behind Mowers

In addition to the general guidelines for mower safety, follow these guidelines for walk-behind mower safety:

- Wear sturdy shoes with good traction. Never wear sandals around walk-behind mowers.
- Do not bypass the safety device that stops the blade when the operator releases his/her grip on the handle.
- Mow across slopes rather than up and down slopes.
- Work slowly and patiently when mowing tall grass or tough weeds. Forcing the mower may cause repeated clogs and engine stalls.
- Never leave a running mower unattended. If you stop momentarily, cut the throttle to idle and make sure the mower will not roll away.

### Chain Saw Safety

Chain saws are ideal for trimming trees and cutting fallen limbs into smaller pieces. Unfortunately, chain saws are associated with many serious injuries each year. Common chain saw hazards include the following:

- Chain cuts
- Falling trees and limbs
- Strains and sprains
- Burns

To avoid injury, you must respect chain saw hazards and handle chain saws skillfully. In addition to general lawn safety guidelines, follow these instructions for safely using chain saws:

- Hearing protection and safety glasses or goggles are required when operating a chain saw.
- Stay alert while sawing. Most injuries occur below the waist when the operator is not paying attention.
- Do not use a chain saw alone. Have someone else stand nearby in case of an emergency.
- Choose and inspect your chain saw carefully:
  - Use the correct size chain saw for the job at hand.
  - Ensure that the chain is sharp and the tension is taut.
  - Ensure that smaller chain saws have a safety tip to prevent kickbacks. (Kickbacks cause one third of all chain saw injuries.)
- Wear a hard hat to protect you from falling limbs.
- Always operate a chain saw with two hands.
- Limbs that are at shoulder height or higher present a special safety problem. Use a ladder so that the saw is at a lower and safer position relative to your body.
- Never allow the tip of a running chain saw to touch the ground. This could cause a serious kickback injury.
- To avoid kickback injuries; stand to the side of a running chain saw. Do not stand directly behind it.
- Move brush and limbs as you work to maintain a clear operating area.
- Never force a chain saw through a limb.
- Never stand on a log or limb while cutting it.
- When loading or hauling brush, safety glasses/goggles are to be worn.
- Canvas gloves are to be worn when handling brush; chaps are recommended.

### Power Blower

- Because power leaf blowers produce air gusts up to 200 mph, you must follow all manufacturers' safety precautions.
- Always wear safety glasses and hearing protection
- Always walk towards your work when using a power leaf blower.
- Do not back away from your work.
- Never blow material toward an on coming pedestrian.

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## Trimming Equipment

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Follow these safety guidelines for trimming equipment such as hedge trimmers, string trimmers, grass shears, and edgers:

- Avoid touching rocks, debris, and gravel with trimming equipment. These items could cause a serious injury if a kickback occurs.
- Make sure all screws and chains are tight. Vibrating equipment can cause screws to loosen.
- Walk towards your work. Do not back away from your work when using a trimmer.
- Always wear eye and ear protection
- Street work safety procedures shall be followed when working near streets. Areas below trees shall be roped off or posted to warn the public.

## Tree Trimming

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- This section covers removal of trees taller than 12' and removal of limbs, which cannot be reached from the ground.
- All employees shall be trained in safe tree trimming operations. The tree shall be evaluated and checked for rot damage and electrical lines running through it or near it.
- Hard hats, safety shoes, hearing protection and eye protection are always required.
- All climbing equipment and ropes shall be inspected prior to use. Only approved climbing ropes shall be used.

## Poisonous Plants

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Many native and exotic plants are poisonous to humans when ingested. However, the most common problems with poisonous plants arise from contact with the sap oil of several ever-present native plants that cause an allergic skin reaction—poison ivy, poison oak, and poison sumac.

Poison ivy, poison oak, and poison sumac release an oil, urushiol, when the leaf or other plant parts are bruised, damaged, or burned. When the oil gets on the skin an allergic reaction, referred to as contact dermatitis, occurs in most exposed people as an itchy red rash with bumps or blisters.

Workers can prevent contact with poisonous plants by taking these steps:

- Wear long sleeves, long pants, boots, and gloves.
- Wash exposed clothing separately in hot water with detergent.
- Barrier skin creams, such as a lotion containing bentoquatam, may offer some protection before contact.
- Barrier creams should be washed off and reapplied twice a day
- After use, clean tools with rubbing alcohol (isopropanol or isopropyl alcohol) or soap and lots of water
- Wear disposable gloves during this process.
- Be careful handling tarps or burlap that might have contacted poison ivy. Urushiol can remain active on the surface of objects for up to 5 years.

Workers who have come in contact with poisonous plants should:

- Immediately rinse skin with rubbing alcohol, specialized poison plant washes, degreasing soap (such as dishwashing soap) or detergent, and lots of water.
- Rinse frequently so that wash solutions do not dry on the skin and further spread the urushiol.
- Scrub under nails with a brush.

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## **Pesticide Chemical Safety**

Pesticides are chemicals that protect crops and livestock from rodents, insects, disease, or weeds. They also control pests that endanger human health. Because pesticides are poisonous, they can be extremely dangerous to humans. Before applying commercial pesticides, always ensure your safety, the safety of others, and the safety of the environment. Pesticides can only be applied under the direction of a PA Department of Agriculture Certified Applicator

There are several government agencies that **regulate** the use of commercial pesticides. For more information on pesticide usage, contact one or more of the following groups: Pennsylvania Department of Agriculture, Pennsylvania Department of Environmental Protection (DEP), or the Environmental Protection Agency (EPA).

### **General Pesticide Safety**

The following sections provide general or specific guidelines for handling pesticides. To help reduce the hazards associated with them:

- Do not transport, mix, or use agricultural chemicals unless you can summon help, if needed.
- Keep an ample supply of water nearby to flush exposed areas, if a spill occurs.
- Check all pesticide equipment before you use it to ensure proper working condition.
- Read pesticide labels carefully. Follow the label directions when mixing, applying, storing, or disposing of pesticides.
- Wear personal protective equipment to prevent dermal, inhalation, and mucous membrane exposure.
- Do not eat, drink, or smoke when handling pesticides.
- Launder clothing and bathe after working with pesticides to ensure that all chemicals are removed from clothing and skin.
- Observe assigned reentry intervals.
- Always handle pesticides downhill from wells, cisterns, sink holes, ditches, or standing water.
- Do not apply pesticides when rain is imminent or if wind could affect the spraying area.
- Triple-rinse spray equipment and empty containers. Apply the rinse water to the treated field.
- Properly dispose of empty containers.

### **Preparing to Apply Pesticides**

Preparation is essential for chemical safety. Follow these steps to properly prepare for pesticide application:  
Plan Ahead

Always read chemical labels before attempting to work with pesticides. Prepare for a possible emergency by maintaining a personal decontamination site, a chemical spill kit, and by knowing the proper first aid procedures associated with your pesticide.

### **Move Pesticides Safely**

Careless chemical transportation can cause spills and contamination. Do not carry pesticides in an enclosed area, such as a car. Be sure to secure the pesticides to prevent shifting or bouncing. In addition, never leave your vehicle unattended when transporting chemicals.

#### Select Appropriate Personal Protective Equipment

Regardless of the pesticide's toxicity, always wear a long-sleeve shirt and pants when working with pesticides. Wear additional protective equipment, as necessary.

#### Select Application Equipment

Choose suitable equipment to properly apply pesticides. Before using the equipment, inspect it for good working order.

### **Provide Prior Notification**

Before applying pesticides, inform all people in or around the application area. Notification allows people to

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protect themselves from harmful chemicals. Check PA Hypersensitivity registry for potentially affected individuals.

### **Mixing Pesticides**

Always read and carefully follow label directions when mixing pesticides. Even if you are familiar with a particular chemical, reread the label to ensure that you have the latest safety information. In addition, follow these guidelines for mixing pesticides:

### **Wear Personal Protective Equipment**

Respirators and protective clothing will be worn if there is a possibility that airborne concentrations of pesticides will exceed safe limits or if required by label (applicator and auxiliary helper).

Always wear protective gear when handling hazardous chemicals.

### **Work in a Safe Area**

The pesticide mixing and loading area should be well ventilated, well lighted, and downhill from any water sources. Concrete slabs are ideal for mixing chemicals since they allow for easy cleanup.

### **Measure Chemicals Correctly**

Measure and mix pesticides carefully. Never mix different pesticides except as directed by the label or chemical manufacturer. Do not use more chemical than prescribed by the pesticide label. The overuse of pesticides is illegal, and may result in the following:

- Higher pest control costs
- Pesticide residue in food
- Groundwater pollution
- Pesticide resistance

### **Pour Pesticides Carefully**

Always wear a face shield and take care not to splash chemicals when pouring pesticides. Never use your mouth to siphon pesticides.

### **Applying Pesticides**

When you apply pesticides, you are responsible for protecting yourself, other people, and the environment. Follow these guidelines when applying pesticides:

#### **Minimize Exposure**

Even mildly toxic chemicals can harm you if you use them daily. Take care to minimize your exposure to any chemical. Avoid working in pesticide spray, mist, or runoff. Always work with another person when working with hazardous chemicals.

#### **Avoid Applying Pesticides in Sensitive Areas**

Avoid spraying pesticides sensitive areas that such as Falk school, Child Development Center, playgrounds and hospitals. If you must apply pesticides in sensitive areas, do so when the weather is calm and when people are not around.

#### **Avoid Pesticide Drift, Runoff, and Spills**

Pesticides that fall outside the targeted application area can be very hazardous. Choose weather conditions, equipment, and chemicals that do not lend themselves to these hazards.

#### **Avoid Equipment Accidents**

Equipment accidents are often caused by poor maintenance and improper work habits. Avoid equipment accidents by following all operating instructions.

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### **Pesticide Storage and Disposal**

Always try to use all the pesticide in your application tank. If pesticides remain, use them on other target locations. After emptying the tank, clean and store the equipment.

The following summary of EPA storage criteria should be followed for pesticides labeled with the signal words DANGER, POISON, or WARNING, or the skull and crossbones symbol. These procedures and criteria are not necessary for the storage of pesticides classed as less toxic (CAUTION word on the label) or for those registered for use in the home or garden.

#### **Site Storage**

- Locate where flooding is unlikely.
- Locate where runoff will not contaminate any water system.

#### **Storage Facility**

- Dry, well ventilated, separate room, building, or covered area with fire protection (e.g., dry chemical fire extinguisher).
- Secured by fence and/or locked doors.
- Signs on rooms/buildings to provide hazard warning (e.g., DANGER, POISON, and PESTICIDE STORAGE).
- Movable pesticide equipment is labeled as contaminated and not removed from the site until decontaminated.
- Provision is available for the decontamination of personnel and equipment; contaminated water disposed of as excess pesticide; contaminated runoff collected and treated as excess pesticide.

#### **Operational Procedures**

- Store pesticide containers in rows with the labels plainly visible.
- Place contents from damaged containers in sound containers.
- If relevant, segregate pesticides by formulation.
- Store rigid containers in an upright position, with tight lids/bungs, off the ground, in a manner to permit access and inspection.
- Maintain a complete inventory indicating the number and identity of containers.
- Check containers regularly for corrosion and leaks.
- Keep suitable absorbent (e.g., vermiculite) on hand in case of spills.
- Safety Precautions:
  - Inspect pesticide containers for leaks before handling them.
  - Do not allow unauthorized personnel in the storage area.
  - Do not store pesticides next to items intended for consumption by animals or humans.
  - Do not eat, drink, smoke, or chew tobacco where pesticides are present.
  - Do not store beverages, food, eating utensils, or smoking material in the storage or loading areas.
  - Wear rubber gloves while handling containers of pesticides.
  - Wash hands immediately after handling pesticides. Remove contaminated protective clothing immediately; extra sets of clean clothing should be nearby.
- Disposal:
  - Unused or outdated pesticides must be disposed as hazardous chemicals.
  - Contact the Department of Environmental Health and Safety for more information.

#### **IMPORTANT**

Never leave pesticide containers at a field site. Be sure to account for every container used, and safely dispose of empty containers.

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**NOTE:**

Store herbicides separately from other pesticides. Some herbicides may volatilize and contaminate the pesticides.

**Pesticide Cleanup**

Always thoroughly clean all pesticide equipment as soon as you are through with it. Leaving pesticide residue in mixing, loading, or application equipment can result in accidental injury or death to livestock or people or unwanted contamination of plants or soil.

Clean the inside and outside of pesticide equipment, including nozzles. Dispose of contaminated rinse water as directed on the chemical label.

**IMPORTANT**

Do not allow pesticide rinse water to contaminate water supplies.

**Snow and Ice Removal**

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The following list of precautions should be considered for snow and ice removal safety discussions and inclusion in operating procedures.

To limit the need for snow removal rope off areas that don't need to be used or accessed

- Use footwear which provides good traction, also use non-slip detachable footwear devices if possible.
- Use ergonomically designed equipment and the correct tool for the job.
- Use ice scrapers or ice-melting materials to make the job of ice removal as easy as possible .
- Assure snow and ice is removed from all exits around a building and insure that doors are openable, including remote exits.
- Assure all fire hydrants which need to be cleared of snow are identified and shoveled.
- Be heart smart! Don't smoke before shoveling snow and avoid caffeinated beverages. These are stimulants and may increase heart rate and cause blood vessels to constrict.
- Pace yourself during shoveling activities. Take frequent breaks and drink plenty of water. Snow shoveling is strenuous work and it is important to re-hydrate your body often.
- When grasping the shovel, keep your hands about 12 inches apart to provide greater stability and minimize the chances of injuring your low back. Use gloves which provide a good grip.

**While shoveling:**

- Bend at the hips, not the low back, and push the chest out, pointing forward. Then, bend your knees and lift with your leg muscles, keeping your back straight
- If you must lift a shovel full, grip the shovel with one hand as close to the blade as comfortably possible and the other hand on the handle (handle and arm length will vary the technique)
- Avoid twisting the back to move your object to its new location – always pivot your whole body to face the new direction
- Supervisors should have all operators read the owner's manual and safety precautions should be discussed with field staff

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### **While using snow blower:**

- Keep hands, feet and clothing away from power-driven parts
- Disengage power and stop the motor if leaving the operating position or making any adjustments
- Do not operate machines on slopes or areas where there is a risk of slipping or falling – other more appropriate equipment or shoveling by hand may be needed
- Always direct the discharge away from bystanders so no one can be hit by a hard object (stone) that could be picked up and thrown, and assure no One is near the front of the machine
- Operators should assure the machine is proper working order before use and safety devices are in place
- Self- closing, pressure venting, approved gas containers with spark arresting screens need to be used for fueling – after fueling equipment move gas containers away from machines before restarting .
- Fuel supplies and gas powered equipment needs to be properly stored
- It is critical to allow gas powered equipment to cool before refueling, also be certain to wipe off any fuel spilled on the machine before starting the engine
- When filling gas cans at the pump it is critical to take them off the pickup bed and place them on the ground while filling to prevent fume buildup in the truck bed and static charges which could spark a fire
- If gas powered equipment has problems starting have it repaired, do not attempt to prime the carburetor with gasoline, the engine can backfire and cause a fire

### **Walking and working on snow and ice:**

#### **TO HELP AVOID A FALL WHILE WALKING:**

- Wear flat shoes or boots with deep tread and nonslip soles.
- If possible use detachable nonskid shoe devices.
- If you are aware of ice or snow related problem on areas you need to walk over, report them to Facilities Management for attention
- In winter, additional walk-off mats may be needed to extend the area of protection inside buildings
- If you are aware of an icy or snow covered area that did not get cleared report it to the Building Manager, Facilities Management or the Department of Environment, Health and Safety
- Always use available handrails.
- Adjust how you walk on snow and ice, take small shuffle steps like a penguin to maintain balance and walk flat footed as possible
- Go slow, being in a hurry increases your chances of a fall, if you rush and fall you may be delayed much longer
- Look where you are walking and avoid walking on sheer ice if possible – Stay on cleared paths and snow routes - don't cut corners
- Keep your arms free if possible and use them to help balance yourself
- If sand or salt is readily available for use near a problem site you may want to apply it before walking across an icy area. Salt containers are strategically placed in areas prone to icing.

### **Techniques for preventing back injuries**

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#### **Warm up thoroughly**

Cold, tight muscles are more prone to injury than warmed up, flexible muscles. Do your back a favor by warming up for five to ten minutes before shoveling or any strenuous activity. Get your blood moving with a brisk walk, marching in place, or another full-body activity. Then, stretch your low back and hamstrings (the large muscles in the back of the thigh) with some gentle stretching exercises. Limber up your arms and shoulders with a body hug.

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### **Pace Yourself During Snow Removal**

Removing small amounts of snow frequently is less strenuous than removing a large pile at once. If possible, removing snow over a period of days will lessen the strain on the back and arms. In deep snow, remove a few inches at a time, rather than attempting to shovel the full depth at once. When shoveling, take a break for a minute or two every 10-15 minutes or if you feel overworked at any point. Use this opportunity to stretch your arms, shoulders, and back to keep them warm and flexible.

**Dress for Success!** Consider the weather when choosing outerwear. Dress in layers. Wear clothing that is easy to move in. Wear a hat - a great deal of body heat is lost through the head. If icy cold, consider breathing through a scarf but don't let it obstruct your view. Proper boots are essential for keeping feet warm and dry while appropriate soles provide traction. Good boots can help you maintain your balance! Choose gloves that will keep your hands warm, dry and blister free - consider thicker gloves allowing for a good grip on the shovel's handle.

### **Footwear**

Folks who also need to push or pull carts or machinery over snow and ice (snow throwers and shoveling) face additional challenges to maintaining traction. Boots with deep non-slip tread can help. Today we also have a variety of non-slip detachable ice grip devices which can be used for even better traction. These slip on devices have metal spikes, studs, or coils which dig into the ice and snow for added traction. They are a great idea for everyone who needs to walk outside in the winter months and very helpful for folks whose work requires them to be outside and carry, push, or pull loads. Here is just one example of a non-slip removable device which provides added traction in snow or ice conditions.

### **Pick the right snow shovel**

An ergonomic snow shovel can help take some of the effort out of your snow removal chores. A shovel with a curved handle or an adjustable handle length will minimize bending, requiring you to bend your knees only slightly and arch your back very slightly while keeping the shovel blade on the ground. In addition, a small, lightweight, plastic blade helps reduce the amount of weight that you are moving. If ice needs to be removed a heavy blade ice scraper or ice melting product may do the work faster and with far less physical effort.

### **Lift and Loading Salt Bags**

Follow these tips to avoid compressing the spinal discs or straining your lower back when you are lifting:

- **Keep a wide base of support.** Your feet should be shoulder-width apart, with one foot slightly ahead of the other (karate stance).
- **Squat** down, bending at the hips and knees only. If needed, put one knee to the floor and your other knee in front of you, bent at a right angle (half kneeling).
- **Keep good posture.** Look straight ahead, and keep your back straight, your chest out, and your shoulders back. This helps keep your upper back straight while having a slight arch in your lower back.
- **Slowly lift** by straightening your hips and knees (not your back). Keep your back straight, and don't twist as you lift.
- **Hold** the load as close to your body as possible, at the level of your belly button.
- **Use your feet** to change direction, taking small steps.
- **Lead with your hips** as you change direction. Keep your shoulders in line with your hips as you move.
- **Set down** your load carefully, squatting with the knees and hips only.

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Keep in mind:

- Do not attempt to lift by bending forward. Bend your hips and knees to squat down to your load, keep it close to your body, and straighten your legs to lift.
- Never lift a heavy object above shoulder level.
- Avoid turning or twisting your body while lifting or holding a heavy object

### Best Practices for Most Salt Users

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- Prevent ice by keeping runoff from pooling; keep gutters and storm sewer drains open and clear of leaves, snow and ice. Should pooling occur, contact Facilities Management. They will then assess the situation and take corrective action.
- Don't use salt if you expect below zero temperatures for a prolonged period; use sand instead. Salt works poorly below zero, and doesn't work at all below  $-6^{\circ}\text{F}$ .
- When possible, use fine grain salt instead of rock salt. Large pieces of salt melt ice very inefficiently. You can do the same job with a smaller amount of fine grain salt.
- Salt only walks, streets and parking lots. Don't salt grass or planting beds. Consider salt alternatives.
- Unless you are sure that ice is about to form, don't salt in anticipation of ice. Avoid salting dry pavement that is free of ice.
- Remove snow first; avoid salting snow.
- Use salt as necessary to clear accessible routes and other paths of travel used by people with disabilities. These routes should be given priority.
- Minimize or eliminate salt use if there is a warming trend that will melt ice quickly.
- Minimize or eliminate salt use if sun exposure is likely to melt the ice quickly.
- Use less salt when the surface is level or partially clear, or when packed snow provides safe traction.
- Sweep up any excess or spilled salt. Reuse it or dispose of it in the normal trash; avoid sweeping the excess salt into the street.

### Best Practices for Walkways

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- Early and frequent snow removal is the best practice to minimize salt use. Shoveling prevents ice formation that results from snow packing and the thaw/freeze cycle.
- Please do not use salt as an alternative to timely snow removal and shoveling.
- If time and weather allow, always try to shovel first—before salting alternative chemicals.
- Ramps on an accessible route or those providing access must be totally cleared of snow, handrail to handrail; there cannot be any snow left under the handrail.
- **However, use salt as necessary:**
- When ice is expected because of the weather forecast. For example, salt wet walkways (caused by sun or daytime temperatures) when freezing overnight temperatures are forecasted.
- To prevent ice as an interim measure between snow removals.
- When it snows and no one will be available to clear it.
- To loosen thick ice for future removal. Prompt, complete snow removal is the best way to prevent packed ice. Although packed snow provides good traction for a while, it can soon turn to thick ice, which is very difficult to remove.

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- **Patios and Extra-Wide Walkways and Stairs**
- Not every inch of paved surface on campus needs to be salted or cleared of snow and ice. It is better to do a good job of clearing a narrow path than not having the time to adequately clear a large area. If you wish to close a walk or area during the winter, consider:
  - Building exits must be clear and allow emergency egress.
  - Check with the Building Manager.
  - Cleared paths should be at least four feet wide or, the width of the building entrance, whichever is wider. You may want to clear a wider path for areas with heavy traffic, if it will facilitate snow removal in the future, or if it will prevent ice formation from re-freezing snow melt and run-on.
  - Emergency exits need to remain cleared.